**Regional Biodiversity Transition and Corporate Real Earnings Management: Evidence from China's National Park System Reform***

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**Abstract**

We leverage the rollout of China's National Park System reform as a quasi-natural experiment to examine how regional biodiversity conservation efforts influence corporate financial reporting. Using a staggered difference-in-differences design, we find that treated firms engage in significantly greater downward real earnings management following policy implementation—primarily driven by production-based *REM*, with limited reliance on accrual-based methods. Mechanism analysis reveals that mounting government attention and public scrutiny heighten firms' perceived political costs, inducing income suppression to reduce visibility and mitigate regulatory or redistributive pressures. These effects are more pronounced among firms with stronger natural resource dependencies and impacts, as well as those located in biodiversity-rich areas. Overall, our findings suggest that ecological governance reform may unintentionally erode the transparency of financial reporting.

**Keywords:** Biodiversity; Real Earnings Management; Political Cost

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## 1. Introduction

Biodiversity has emerged as a defining pillar of the global sustainability agenda amid escalating ecological risks. The *Kunming–Montreal Global Biodiversity Framework* (*GBF*), adopted at COP15 in December 2022, established four overarching goals and twenty-three measurable targets, underpinned by a pledge to mobilize at least US$200 billion annually from public and private sources. These commitments have translated into growing regulatory and societal expectations, positioning corporations—recognized as key drivers of biodiversity loss (Tilman et al., 2017)—at the center of the global biodiversity transition.[1]

As biodiversity considerations increasingly permeate capital markets, emerging evidence shows that firms with greater biodiversity exposure command higher risk premiums following COP15 (Garel et al., 2024; Giglio et al., 2023). Yet, the reliability of information underlying this pricing remains largely unexplored. Firms may exploit gaps in nascent biodiversity governance frameworks through opportunistic disclosure, thereby weakening market transparency. Understanding these dynamics provides valuable insights for investors who incorporate biodiversity risks into asset pricing and for policymakers seeking to enhance biodiversity governance.

We contribute to this literature by examining whether biodiversity transitions distort the information environment of capital markets through their influence on

[1] Beyond China's NPS reform discussed in this paper, several countries and regions have also introduced biodiversity-related strategies and regulations. For example, the European Union's *2030 Biodiversity Strategy* mandates member states to restore degraded ecosystems and expand the coverage of protected natural areas. In December 2022, Spain approved the *National Strategy for Natural Heritage and Biodiversity to 2030*, which aims to promote ecological restoration and conservation by strengthening biodiversity information systems, monitoring frameworks, and governance mechanisms. Similarly, Colombia has implemented its *National Biodiversity Strategy and Action Plan*, prioritizing the protection of ecosystem services and the alignment of biodiversity goals with corporate green transition efforts.

corporate financial reporting behaviors. According to the political cost hypothesis (Watts and Zimmerman, 1986), managers may suppress earnings to reduce visibility, thereby avoiding litigation and reputational risks that could trigger wealth transfers or threaten firms' going concern.[2] Extending this logic to biodiversity governance, firms exposed to biodiversity conservation mandates may similarly engage in downward earnings management to mitigate rising political costs.

China provides an ideal setting to investigate this question. As the world's second-largest economy and an early signatory to the *Convention on Biological Diversity*, China has demonstrated a sustained policy commitment to biodiversity conservation. The establishment of the unified National Park System (NPS) marks a pivotal reform aimed at protecting ecologically sensitive regions and promoting long-term environmental sustainability. While centrally designed, the NPS is locally implemented, with subnational authorities responsible for tailoring conservation strategies to regional ecological attributes.

The NPS reform heightens corporate political costs through two primary channels: top-down government attention and bottom-up public scrutiny. Facing tight budget constraints, local governments must address legacy environmental degradation, invest in biodiversity infrastructure, and finance costly programs such as ecological resettlement.[3] To fulfill these mandates, they often intensify environmental enforcement and may shift part of the fiscal burden onto firms via stricter compliance

[2] Mounting empirical evidence supports this view, documenting downward earnings management in politically sensitive settings (Boland and Godsell, 2020; Godsell et al., 2017; Jones, 1991; Karpoff and Wittry, 2018; Ramanna and Roychowdhury, 2010).
[3] Details of local government responsibilities under the NPS reform are discussed in Section 3.

inspections, heightened tax scrutiny, or informal expectations to contribute to conservation projects. Meanwhile, the reform has elevated public awareness and institutionalized social oversight through mechanisms such as ecological redlines and the national park legal framework, which provide citizens with clearer legal grounds to monitor and report ecological violations. As biodiversity conservation evolves from a normative goal into a system of public accountability, reputational risks intensify, particularly for firms with significant natural resource dependencies and impacts.

Together, these dual forces amplify firms' political costs and create strong incentives for earnings management. When faced with such scrutiny, managers weigh the trade-off between accrual-based (*AEM*) and real earnings management (*REM*) (Cohen and Zarowin, 2010). Compared with *AEM*, *REM* allows firms to alter reported performance through operational decisions without immediately drawing auditor or regulatory attention (Zang, 2012). Because *REM* is less observable and less likely to provoke external sanctions, it becomes the preferred strategy under heightened monitoring pressure. We therefore hypothesize that firms affected by the NPS reform engage in significantly greater downward real earnings management.

Using a staggered difference-in-differences (DID) design and a panel of Chinese A-share listed firms from 2012 to 2023, we examine the causal effect of regional biodiversity transition on corporate financial reporting behaviors. We find that firms affected by the NPS reform engage in significantly greater downward *REM*, consistent with the notion that biodiversity-related policy pressure elevates firms' perceived political costs, prompting managers to suppress reported profitability to mitigate scrutiny and potential wealth transfers. The evidence further reveals a clear tilt toward real activity manipulation (particularly abnormal production) rather than accrual adjustments, reflecting the greater detectability and enforcement risk of accrual-based management under intensified oversight. These findings are robust to a battery of sensitivity checks, including heterogeneity-robust estimation, alternative variable measures, sample restrictions, placebo tests, and the exclusion of contemporaneous policy shocks.

To shed light on the mechanisms, we examine two channels through which biodiversity transition pressures amplify political cost concerns. First, government attention, measured by local biodiversity-related procurement contracts and public expenditures, captures the fiscal prioritization of conservation, signaling greater regulatory salience and the potential risk of fiscal burden shifting to firms. Second, public scrutiny, proxied by the Baidu Search Index for *National Park* and *Biodiversity*, reflects the degree of civic engagement and enthusiasm for biodiversity oversight at the prefecture level. Increases in either channel significantly strengthen firms' downward *REM*, with the effects more pronounced among firms with higher natural resource dependencies, impacts, as well as those operating in biodiversity-sensitive regions.

This research makes three primary contributions to the literature. First, we provide novel evidence on firms' opportunistic responses toward biodiversity transition policies. Promoting effective corporate participation in biodiversity conservation is crucial for achieving long-term ecological goals. While prior studies largely emphasize compliance and adaptation (Chen et al., 2025), less attention has been given to strategic reporting responses that may undermine policy effectiveness. Leveraging NPS as a quasi-natural experiment, we show that affected firms strategically suppress reported profitability through real activities to manage political visibility. Our findings highlight that as biodiversity risk becomes increasingly priced in capital markets (Garel et al., 2024; Giglio et al., 2023), ensuring the reliability of firm-level information is essential for both effective governance and transparent risk pricing.

Second, we extend the political cost hypothesis (Watts and Zimmerman, 1986) to the domain of biodiversity governance, a setting characterized by spatial heterogeneity and decentralized policy implementation (Nedopil, 2023). We demonstrate that biodiversity transitions elevate firms' perceived political costs through two distinct channels: intensified government attention, reflected in local conservation spending and enforcement efforts, and heightened public scrutiny, proxied by search intensity for biodiversity-related terms. These findings broaden the empirical scope of political cost theory, illustrating how emerging environmental domains create novel forms of social and regulatory monitoring that reshape firms' reporting incentives.

Third, we improve causal inference in both the biodiversity risk and political cost literature. Prior studies on biodiversity risk often rely on textual disclosures, which are prone to managerial discretion and measurement error. At the same time, empirical tests of political cost effects typically draw on firm-initiated or quasi-endogenous events, raising concerns of self-selection bias (Boland and Godsell, 2020). By contrast, the NPS reform assigns national park boundaries exogenously based on ecological criteria rather than firm characteristics or lobbying. By exploiting this feature, we employ a staggered

DID design to estimate dynamic treatment effects while mitigating the endogeneity concerns associated with disclosure-based measures or firm-initiated shocks.

The remainder of the paper is organized as follows. Section 2 discusses the institutional background. Section 3 develops our hypotheses. Section 4 outlines the sample construction, variable definitions, and model specification. Section 5 documents our main results. Section 6 examines the mechanisms, and Section 7 presents cross-sectional tests. Finally, Section 8 concludes.

## 2. Institutional Background

### 2.1 Global Biodiversity Risk

Biodiversity underpins ecosystem resilience and human survival, with nearly half of global GDP moderately to highly dependent on ecosystem services (World Economic Forum, 2022).[4] Yet, since the early 2000s, resource consumption has persistently outpaced the planet's regenerative capacity by more than 56%, driving unprecedented ecosystem degradation. Approximately 75% of terrestrial and 66% of marine environments have been significantly altered (WWF, 2020; IPBES, 2019), while current species extinction rates exceed background levels by a factor of 10 to 100 (Ceballos et al., 2017). Once ecological resilience thresholds are breached, biodiversity loss can trigger irreversible ecosystem collapse, with severe consequences for human welfare (Huggett, 2005).

[4] A growing body of literature has validated the economic value of ecological environments. Xing et al. (2023) document that Beijing's Million Mu Afforestation Project generated approximately RMB 5.5 billion in annual health benefits (equivalent to RMB 412,500 per hectare) and led to a roughly 10% increase in property values within a two-kilometer radius of afforested areas. Similarly, Han et al. (2024) and Li (2023) provide corroborating evidence from Toronto and New York, respectively.

Despite its critical role, biodiversity conservation presents distinct governance challenges. Whereas climate risk arises from diffuse global emissions, biodiversity risk is inherently local and highly heterogeneous across geographies (Nedopil, 2023). This spatial variation complicates standardization, undermines cross-regional comparability (Kennedy et al., 2023), and constrains policy scalability. The public-good nature of biodiversity weakens private incentives, perpetuating a chronic financing gap (Beverdam et al., 2025). Compared with climate finance, biodiversity finance remains fragmented and underdeveloped, lacking mature instruments and institutional infrastructure (Flammer et al., 2025). Governance complexity is further heightened by cross-domain trade-offs—for instance, renewable energy projects may reduce carbon emissions but disrupt habitats and wildlife (Meng et al., 2025).

To address rising ecological risks, the international community has advanced multilateral frameworks to reverse biodiversity loss. The *GBF* outlines 23 global targets centered on the *30×30* goal, aiming to conserve and effectively manage at least 30% of terrestrial, freshwater, and marine ecosystems and restore 30% of degraded areas by 2030.

## 2.2 China's National Park System Reform

Reflecting its commitment to these global initiatives, China launched the NPS reform in 2016 to institutionalize ecological redlines and advance a biodiversity transition at the regional level. By January 2019, ten national parks had been designated across the country (Figure 1), covering approximately 223,000 square kilometers (2.3%

of China's land area) and serving as habitats for 77 species of nationally protected wildlife and numerous rare plants (see Appendix A).

The NPS reform emphasizes preserving ecological integrity and minimizing human disturbance within core conservation zones. Local governments have adopted integrated scientific assessments, cutting-edge monitoring technologies, and multi-agency enforcement mechanisms to deter violations. These initiatives have led to measurable improvements in habitat quality and species abundance (see Appendix B). Beyond ecological protection, the reform aims to align conservation with regional economic development by promoting eco-tourism, environmental education, and ecosystem service monetization.[5] [6]

While the NPS reform supports long-term sustainability, it also amplifies biodiversity transition risks for affected firms through regulatory, technological, and market channels. First, the NPS imposes stringent regional regulations, including land-use controls, water source protection, and restrictions on ecologically sensitive zones. Following the establishment of Sanjiangyuan National Park, Qinghai Province revoked 48 mining and hydropower licenses (20 of which were located within the park) to safeguard headwater ecosystems. Second, Firms are compelled to adopt greener technologies to comply with stricter standards. In Hainan Tropical Rainforest National Park, prosecutors uncovered multiple illegal sewage outlets discharging into protected

[5] In Sanjiangyuan National Park, the *One Household, One Post* program recruits pastoralist households as full-time ecological stewards, while also permitting regulated participation in ecotourism activities to enhance both conservation effectiveness and income stability.

[6] In 2023, a biotech firm in Hainan Province received a RMB 500,000 unsecured green ecosystem product (GEP) loan from a local rural commercial bank, based on the monetized ecosystem service value of its 300 mu land parcel. This valuation, conducted by the Hainan Academy of Environmental Sciences, incorporated water retention, soil conservation, carbon sequestration, and microclimate regulation functions, illustrating how ecosystem services can function as collateral in biodiversity-related lending.

areas, prompting local authorities to upgrade sewage networks and treatment facilities. These enforcement measures translate into substantial compliance and capital costs for local enterprises. Third, the reform also reshapes consumer preferences toward sustainable products. In Wuyishan National Park, authorities promoted eco-friendly tea cultivation—reducing pesticide use, adopting tea-forest and tea-grass systems, and interplanting native trees to enhance both product quality and ecosystem health. These changes have favored producers with ecological certifications while eroding competitiveness among traditional growers (Beyer et al., 2024).

These transition risks ultimately manifest through increasing stakeholder pressures, as governments and the public act as key channels translating biodiversity objectives into concrete constraints in the NPS reform. Active adaptation requires substantial compliance and investment costs, whereas passive avoidance exposes firms to litigation and reputational risks. Firms' strategic choices thus hinge on balancing the costs and benefits of compliance, leading them to adopt accounting policies that minimize overall costs and achieve an efficiency-oriented equilibrium. We next develop our hypotheses on how firms employ financial reporting as a strategic tool to navigate biodiversity-related policy exposure.

## 3. Hypothesis Development

The NPS reform significantly elevates political costs for firms operating within or adjacent to designated conservation areas. Firms anticipating heightened scrutiny from powerful stakeholders may strategically reduce reported profitability to avoid becoming targets of regulatory intervention, redistributive policies, or public backlash—a behavior commonly referred to as *poor-mouthing*. This behavior aligns with the political cost hypothesis (Watts and Zimmerman, 1978; Watts and Zimmerman, 1986), which posits that firms adjust accounting choices in response to institutional and regulatory changes.[7] In the NPS context, political cost pressures are amplified through two interrelated channels: top-down government attention and bottom-up public scrutiny.

Government attention elevates firms' political costs primarily through two mechanisms: intensified regulatory enforcement and risk of fiscal burden shifting. From the regulatory perspective, the NPS reform marks a national shift toward institutionalized biodiversity governance, embedding conservation targets into China's hierarchical administrative apparatus. Central authorities transmit these mandates through performance evaluations, ecological fiscal transfers, and cadre accountability mechanisms, compelling subnational governments to deliver measurable ecological outcomes. In response, local regulators have intensified inspections, tightened compliance thresholds, and reallocated fiscal resources toward conservation infrastructure. As ecological indicators gain weight in official assessments, enforcement efforts have become increasingly visible, with high-profile or high-profit

[7] Early capital markets research emphasizes the value relevance of accounting information for equity pricing (Ball and Brown, 1968), largely abstracting from managerial discretion in financial reporting. Subsequent work reconceptualizes accounting as a governance tool for mitigating agency and political frictions (Armstrong et al., 2010; Ball et al., 2008; Holthausen and Watts, 2001). Within this framework, the political cost hypothesis posits that firms adjust financial reporting to mitigate the risk of wealth transfers resulting from regulatory intervention or public pressure.

firms often singled out as symbolic compliance targets and facing elevated political costs.[8]

In parallel, the NPS reform also imposes substantial fiscal pressures on local governments, many of which face tight budget constraints (Chen et al., 2023).[9] To bridge this fiscal gap, local officials frequently shift part of the financial burden to the corporate sector, either through stricter tax enforcement or by informally recruiting firms to participate in conservation-related public projects (Chen et al., 2022; La Porta et al., 1997; Lin and Tan, 1999).[10] Crucially, this burden-shifting is unlikely to be evenly distributed: firms with higher reported earnings are more readily perceived as capable contributors, whereas low-profit firms are viewed as less suitable policy vehicles (Johnston and Rock, 2005). Anticipating such asymmetric treatment, firms have strong incentives to suppress earnings, thereby lowering their political visibility and reducing the likelihood of becoming targets of regulatory or fiscal intervention (Kong et al., 2024).

Public scrutiny has become an increasingly salient source of political cost under the NPS reform. The reform not only elevates ecological awareness but also institutionalizes citizen participation through legal and digital reporting mechanisms.[11]

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[8] In the Northeast Tiger & Leopard National Park, authorities enforced the closure and ecological restoration of abandoned open-pit mines to meet biodiversity protection metrics, heightening regulatory risk for firms with operations in ecologically sensitive areas.

[9] For example, local governments must remediate legacy environmental damage (e.g., mine backfilling and soil rehabilitation in Hainan Tropical Rainforest National Park), invest in conservation infrastructure (e.g., IoT- and satellite-based "sky–ground" monitoring in Wuyishan National Park), and implement large-scale ecological resettlement programs (e.g., relocation of nearly 100,000 pastoral households in Sanjiangyuan National Park).

[10] The *Opinions on Several Fiscal Policies for Advancing National Park Construction* encourage social donations and corporate participation in ecological public welfare. For example, NIO, in collaboration with WWF under the *Clean Parks* initiative, has supported national park conservation through donations to wildlife monitoring and ecosystem restoration projects.

[11] In China, since the launch of the *Overall Plan for Establishing the National Park System* in 2017, the

Local platforms now allow real-time reporting of ecological violations, often triggering inspections, corrective actions, or public disclosures regardless of the severity of the offense.[12] These institutional changes expand the scope and elevate the standards of corporate environmental legitimacy (Bansal and Clelland, 2004). As most firms lack the experience and technical capacity to manage biodiversity transition risks (as discussed in Section 2.2), public exposure may lead to reputational damage, substantial compliance costs, or even administrative penalties. Even compliant firms may face intensified scrutiny once publicly exposed, creating additional regulatory pressure.

Consequently, firms have a general incentive to reduce political visibility (i.e., suppress earnings), avoiding public scrutiny and the compliance risks it entails. Moreover, high earnings may also directly invite public suspicion of environmental negligence. Prior studies suggest that firms often scale back environmental expenditures to sustain reported earnings, reinforcing the perception of a trade-off between profitability and environmental responsibility (Liu et al., 2021; Thomas et al., 2022). Over time, this behavioral pattern may give rise to a stereotype that financially successful firms achieve their performance at the expense of ecological commitments. As a result, high-profit firms may become targets of public skepticism and scrutiny. Therefore, firms with higher biodiversity exposure have stronger incentives to

central government has strengthened regulatory efforts through measures such as the 2019 revision of the *Regulations on Nature Reserves* and the 2022 issuance of the *Interim Measures for the Administration of National Parks*. On September 10, 2024, the draft *National Park Law* was submitted to the Standing Committee of the National People's Congress, emphasizing specialized governance, enhanced public oversight, and legal rights for citizens and organizations to report violations.

[12] Hunan Province's *One-Code Access* system allows residents to submit environmental complaints via QR codes and offers monetary rewards for verified reports.

moderate reported profitability, thereby preserving environmental legitimacy and mitigating associated political costs (Cahan et al., 1997; Patten and Trompeter, 2003).

Government attention and public scrutiny are mutually reinforcing under the NPS framework. Stricter enforcement encourages public participation, while civic reporting intensifies pressure on regulators to demonstrate visible results. This feedback loop amplifies firms' political visibility, strengthening incentives to suppress reported profitability to mitigate overlapping political costs. Specifically, firms weigh the trade-off between accrual-based earnings management (*AEM*) and real earnings management (*REM*) (Cohen and Zarowin, 2010). *AEM* involves adjustments to accrual components of financial statements and is more susceptible to scrutiny by auditors, regulators, and investors, which increases the risk of litigation and financial restatements (Cohen et al., 2008). In contrast, *REM* affects earnings by altering actual business activities, offering greater concealment and plausibility, and is less likely to be detected by external regulators in the short term (Zang, 2012). Accordingly, we propose the following hypothesis:

***H1:*** *Compared to unaffected firms, firms affected by the National Park System reform exhibit significantly greater downward real earnings management.*

## 4. Research Design

### 4.1 Data and Sample

We construct a sample of Chinese A-share listed firms from 2012 to 2023, ensuring coverage of at least four years before and after the launch of the NPS reform. The sample is refined through the following steps: (1) financial firms are excluded; (2) firms labeled as ST or *ST, indicating financial distress or operational irregularities, are removed; (3) observations with negative net assets are dropped; (4) firms with only a single year of data are excluded; and (5) firm-years with missing values for key variables are eliminated. These filters yield a final sample of 32,377 firm-year observations. All continuous variables are winsorized at the 1st and 99th percentiles to reduce the influence of outliers. The majority of the data is obtained from the CSMAR and CNRDS databases. Additional data are manually collected as described in the relevant sections.

### 4.2 Measuring Real Earnings Management

Following Roychowdhury (2006), we measure real earnings management (*REM*) using three firm-year-level proxies: abnormal production costs (*AbPROD*), abnormal operating cash flows (*AbCFO*), and abnormal discretionary expenses (*AbDISX*). In addition, a composite *REM* index is constructed to capture overall real activity manipulation. Each *REM* component is estimated as the residual from industry-year regressions based on Equations (1)-(3), with industries defined at the two-digit CSRC level. Industry-year cells with fewer than ten observations are excluded.

These three measures reflect the primary channels through which managers adjust real activities to influence earnings. First, production manipulation: firms may reduce output to increase per-unit fixed costs, lowering gross margins and resulting in abnormally low production costs (*AbPROD*). Second, sales manipulation: firms may restrict discounts or tighten credit terms to suppress sales, leading to abnormally high operating cash flows (*AbCFO*). Third, discretionary expense manipulation: managers may cut discretionary spending (e.g., R&D and advertising expenses) to boost current-period earnings, resulting in abnormally high discretionary expenses (*AbDISX*). Consistent with the literature, downward *REM* is reflected by lower *AbPROD*, higher *AbCFO,* and *AbDISX* values. The corresponding regression models are presented below.

$$\frac{PROD_{it}}{TA_{it-1}} = \alpha_0 + \alpha_1\left(\frac{1}{TA_{it-1}}\right) + \alpha_2\left(\frac{Sales_{it}}{TA_{it-1}}\right) + \alpha_3\left(\frac{\Delta Sales_{it}}{TA_{it-1}}\right) + \alpha_4\left(\frac{\Delta Sales_{it-1}}{TA_{it-1}}\right) + \varepsilon_{it} \quad (1)$$

$$\frac{CFO_{it}}{TA_{it-1}} = \alpha_0 + \alpha_1\left(\frac{1}{TA_{it-1}}\right) + \alpha_2\left(\frac{Sales_{it}}{TA_{it-1}}\right) + \alpha_3\left(\frac{\Delta Sales_{it}}{TA_{it-1}}\right) + \varepsilon_{it} \quad (2)$$

$$\frac{DISX_{it}}{TA_{it-1}} = \alpha_0 + \alpha_1\left(\frac{1}{TA_{it-1}}\right) + \alpha_2\left(\frac{Sales_{it}}{TA_{it-1}}\right) + \varepsilon_{it} \quad (3)$$

In the equations, subscripts *i* and *t* denote firm and year, respectively. $PROD_{it}$ refers to the cost of goods sold plus the change in inventory for firm *i* in year *t*, representing total production costs. $CFO_{it}$ is the operating cash flow, while $DISX_{it}$ denotes discretionary expenses, measured as the sum of selling and administrative expenses. $Sales_{it}$ is the revenue in year *t*; $\Delta Sales_{it}$ and $\Delta Sales_{it-1}$ represent changes in sales from year *t-1* to *t*, and from *t-2* to *t-1*, respectively. $TA_{it-1}$ is total assets at the beginning of the year, used to scale variables and control for firm size. We further construct a composite *REM* index based on Equation (4) to capture the overall level of manipulation. A firm is considered to engage in downward *REM* if the composite index is significantly negative.

$$REM_{it} = AbPROD_{it} - AbCFO_{it} - AbDISX_{it} \quad (4)$$

### 4.3 Identifying Firms Treated by NPS

Biodiversity conservation frequently extends beyond administrative boundaries, requiring cross-jurisdictional coordination (Bodin, 2017; Kleemann et al., 2020;

Wyborn and Bixler, 2013). Given the continuous and fluid nature of ecological processes (Grumbine, 1994), [13] isolated efforts within single jurisdictions are insufficient to address transboundary ecological risks. Indeed, fragmented governance may undermine ecosystem resilience (DeFries and Nagendra, 2017). For instance, the migratory routes of large mammals and birds frequently span multiple administrative units, requiring spatial coordination to sustain species populations and preserve the structural integrity of ecological networks (Berger, 2004). As a policy instrument aimed at safeguarding ecosystem integrity, the NPS reform is inherently characterized by strong geographic permeability in both its design and implementation.

We identify policy-affected prefecture-level cities using two spatial criteria. First, the influence of the NPS reform extends beyond the core boundaries of national parks to encompass entire cities that are geographically overlapped by park areas. For example, Nanshan National Park spans several counties within Shaoyang City. After the designation, initiatives related to water resource management and biodiversity protection have been extended to the entire jurisdiction of the city. Second, policy effects spill over into neighboring cities that are geographically adjacent to national parks. For instance, Shennongjia National Park shares a border with Yichang City. The ecological policies initiated in Shennongjia, including watershed protection and joint pollution control mechanisms, have been implemented in adjacent areas of Yichang.

[13] Ecological processes refer to the natural mechanisms that sustain ecosystem structure, function, and dynamics. They include hydrological cycles, species migration, and seed dispersal, and are characterized by spatial continuity and cross-boundary flows.

Accordingly, a city is defined as "policy-affected" if it either spatially overlaps with or borders a designated national park.

To operationalize this classification, we employ Geographic Information System (GIS)-based spatial matching techniques. By overlaying national park boundaries on administrative maps of prefecture-level cities, we identify those that satisfy the above spatial criteria. In Figure 1, national park areas are marked in green, policy-affected cities (i.e., treated units) in dark gray, and control group cities in light gray. We then construct a time-varying indicator variable, $Policy_{it}$, which equals one if firm $i$ is headquartered in a policy-affected city in year $t$, and the city was officially included in the pilot reform by that time; otherwise, it is set to zero. This variable captures the dynamic treatment effect of the NPS reform along both spatial and temporal dimensions, consistent with the staggered implementation of pilot programs in 2016, 2017, and 2019. This approach ensures temporal and geographic accuracy in identifying causal effects.

<Insert Figure 1 Here>

### 4.4 Model Specification

We employ a staggered difference-in-differences (DID) framework as the baseline specification to examine the impact of the NPS policy on firms' real earnings management behaviors (H1):

$$REM_{it} = \beta_0 + \beta_1 Policy_{it} + \sum Control_{it} + Firm_{it} + Year_{it} + \varepsilon_{it} \qquad (5)$$

In Equation (5), the dependent variable $REM_{it}$ measures the extent of real earnings management by firm $i$ in year $t$. The key independent variable $Policy_{it}$ is a time-varying treatment indicator equal to one if the firm's registered city is affected by the NPS pilot in year $t$, and zero otherwise (see Section 4.3 for details). Based on H1, the coefficient $\beta_1$ is expected to be significantly negative, suggesting that firms exposed to the NPS pilot engage in greater downward real earnings management relative to their counterparts.

To mitigate omitted variable bias, a set of firm-level control variables, $Control_{it,}$ is included, capturing factors commonly associated with earnings management decisions. First, we control for firm fundamentals, including firm size (*LnSize*), firm age (*LnAge*), and leverage (*Lev*), all of which may influence managerial discretion in operational activities (Franz et al., 2014; Siregar and Utama, 2008). Second, we incorporate corporate governance variables such as board size (*Boardsize*), CEO duality (*Dual*), and managerial ownership (*ManagerHold*). Weak governance structures and high agency costs are associated with stronger incentives and greater latitude for earnings manipulation (Dechow et al., 1996; Xie et al., 2003). Additionally, we control for firm growth (*Growth*), as firms facing high market expectations are more likely to engage in earnings management to meet performance benchmarks (Cohen and Zarowin, 2010). Audit quality (*Big4*) is included as an external monitoring mechanism that may constrain opportunistic reporting behavior (DeFond and Zhang, 2014). Definitions and construction of all variables are provided in Appendix C.

The regression includes city fixed effects ($City_{it}$), firm fixed effects ($Firm_{it}$), and year fixed effects ($Year_{it}$) to account for time-invariant firm heterogeneity and macroeconomic shocks, respectively (Breuer and DeHaan, 2024). Standard errors are clustered at the firm level to address potential serial correlation in the residuals (Abadie et al., 2022; Petersen, 2008).

## 5. Empirical Results

### 5.1 Descriptive Statistics

Table 1 Panel A reports summary statistics of the key variables. The dependent variable *REM* has a mean of 0.002 and a median of 0.021, indicating a mild tendency toward income-increasing *REM* across the sample. The distribution is left-skewed, with a standard deviation of 0.206 and a wide range (-0.743 to 0.553), suggesting substantial cross-sectional variation. The treatment indicator *Policy* equals one if a firm is located in a city affected by the NPS reform in a given year and zero otherwise. Its mean of 0.042 implies that approximately 4.2% of firm-year observations fall into the treated group. Within this subsample (not reported), the average *REM* is marginally negative (-0.001), suggesting a shift toward downward *REM* following policy exposure. Control variables exhibit distributions consistent with prior literature. All continuous variables are winsorized at the 1st and 99th percentiles to mitigate the influence of outliers.

Table 1 Panel B presents the Spearman correlation matrix for the variables used in the baseline regression. Correlations among independent variables are generally modest, alleviating concerns about multicollinearity. This is corroborated by the variance inflation factor (VIF) diagnostics, with an average VIF of 1.2, well below the conventional threshold of 10. Notably, the *REM* variable is negatively correlated with *Policy*, offering preliminary support for H1—that firms exposed to the NPS reform engage in more downward *REM*. This relationship is formally examined in the regression analyses that follow, which include a full set of controls and fixed effects.

<Insert Table 1 Here>

### 5.2 Baseline Results

Table 2 Panel A reports the baseline regression results from the staggered DID model specified in Equation (5). Column (1) includes city, firm, and year fixed effects to account for unobserved firm-level heterogeneity and time-varying macroeconomic shocks. Standard errors are clustered at the firm level to correct for potential serial correlation. The coefficient on the policy indicator (*Policy*) is -0.037 and statistically significant at the 1% level (t = -3.276), indicating that treated firms engage in greater downward *REM* following the NPS reform relative to control firms. Column (2) introduces a full set of control variables. The coefficient on *Policy* remains negative and significant at the 1% level (-0.040; t = -3.534), and the model fit improves, lending additional support to Hypothesis 1. Control variables are generally consistent with expectations.[14] These findings suggest that the NPS reform prompts affected firms to suppress reported earnings through real activity manipulation.

Table 2 Panel B decomposes *REM* into production, sales, and discretionary expense manipulation. The results show that the effect is concentrated in production activities, with a coefficient of -0.020 (t = -3.205), while sales and discretionary expense manipulation exhibit smaller magnitudes (both 0.007) that are only marginally

[14] Firm size (*LnSize*) shows a positive association with REM at the 10% significance level, contrary to the expectation that larger firms, given their higher political visibility, would adopt more conservative reporting practices. A plausible explanation is that larger firms possess greater bargaining power and institutional influence, which may buffer them from regulatory or media scrutiny.

significant at the 10% level. This pattern aligns with the notion that firms facing biodiversity-related risks prioritize supply chain stability and cash flow efficiency, making sales and discretionary expense adjustments less feasible.[15] In contrast, production cuts are easier to justify under ecological protection goals, as lower output increases per-unit fixed costs and reduces reported profits while remaining consistent with environmental compliance expectations. Overall, the evidence suggests that firms affected by the NPS reform primarily employ production manipulation as the main channel of downward *REM*.

<Insert Table 2 Here>

## 5.3 Robustness Tests

### 5.3.1 Heterogeneity-Robust Estimation

To evaluate the robustness of our baseline staggered DID estimates to treatment effect heterogeneity, we implement alternative estimators that explicitly account for variation in treatment timing and dynamic effects. A growing literature cautions that conventional two-way fixed effects (TWFE) models may yield biased estimates when treatment effects vary across cohorts or over time (Athey and Imbens, 2022; Baker et al., 2022; Callaway and Sant'Anna, 2021; De Chaisemartin and D'Haultfoeuille, 2020; Goodman-Bacon, 2021). Specifically, using already-treated units as controls can result in negative weighting and obscure causal interpretations.

[15] Biodiversity-related operational risks can weaken a firm's perceived reliability as a supplier, prompting downstream customers to consider alternative sources. To preserve business relationships, affected firms may offer more favorable trade credit terms (Ersahin et al., 2024; Giannetti et al., 2021).

To address concerns about treatment effect heterogeneity and potential bias from negative weighting, we implement two recent heterogeneity-robust estimators: the DIDM estimator of De Chaisemartin and D'Haultfoeuille (2020) and the CSDID estimator proposed by Callaway and Sant'Anna (2021). Panel A of Figure 2 reports the average treatment effects estimated using the baseline fixed effects model (FE), alongside results from the DIDM and CSDID approaches. The FE estimate is consistent with our main findings, while the DIDM estimator yields an effect size of -0.033, which remains statistically significant at the 5% level after correcting for weighting issues. The CSDID estimator further disaggregates effects by cohort and time, revealing that both cohort-specific and calendar-time average treatment effects are statistically significant. Panels B-D display dynamic treatment effects across the three estimators. All specifications exhibit flat and statistically insignificant pre-treatment trends, lending support to the parallel trends assumption. Following policy implementation, we observe a sharp and persistent increase in downward *REM*, particularly within the first two years, suggesting a rapid and targeted corporate response to the reform. Overall, these results confirm the robustness of our findings to alternative estimation strategies that account for treatment effect heterogeneity.

<Insert Figure 2 Here>

### 5.3.2 Alternative Measures

To address potential measurement concerns, we use alternative definitions of both the dependent and treatment variables. First, we replace our baseline measure of real earnings management (*REM*) with accrual-based earnings management (*AEM*), following Dechow et al. (1995). *AEM* captures earnings manipulation through accrual adjustments rather than real operating decisions. Column (1) of Panel A in Table 3 presents the regression results using *AEM* as the dependent variable. The coefficient on the policy indicator remains negative and statistically significant at the 5% level (-0.009), suggesting that firms also reduce accrual-based earnings in response to the NPS reform. However, the magnitude of the *AEM* effect is substantially smaller than that of *REM*, consistent with the notion that firms are reluctant to rely heavily on accrual manipulation due to its higher detectability by auditors and regulators.

Second, to address potential misclassification of treatment timing, we construct an alternative policy indicator, *Policy-New*, that adjusts for the staggered rollout of the NPS reform. Because several national park pilots were announced in the second half of the year, the associated regulatory and political pressures may not have affected firms' reporting until the following fiscal year. Accordingly, we set *Policy-New* to 1 in the year of implementation only if the policy was announced in the first half of the year; otherwise, the indicator switches to 1 in the subsequent fiscal year. Column (2) of Panel A shows that the coefficient on *Policy-New* remains negative and statistically significant at the 1% level (-0.040), aligning with our main findings.

5.3.3 Alternative Sample Restrictions

To ensure that potential outliers do not drive our findings, we apply alternative sample restrictions to both the treated and control groups. First, we address concerns that Chongqing, one of China's four centrally administered municipalities, may exert disproportionate influence due to its unique political status, large economic scale, and distinct fiscal regime. These features could lead to idiosyncratic policy responses and bias the estimates through an extreme-value effect. To mitigate this concern, we exclude observations from Chongqing and re-estimate the baseline model. As reported in Column (1) of Table 3 Panel B, the coefficient on the policy variable remains negative and statistically significant at the 5% level, indicating that this outlier region does not drive our core findings.

Second, to enhance the comparability between treated and control firms, we limit the control sample to those located in the 15 provinces that host pilot national park zones. This restriction mitigates confounding variation arising from cross-province differences in industrial structure, environmental endowment, and policy intensity. Column (2) of Panel B presents the results based on the restricted sample, showing that the coefficient on the policy variable remains significant at the 1% level. Together, these results suggest that our findings are robust to concerns about sample selection bias.

<Insert Table 3 Here>

### 5.3.4 Placebo Tests

To further verify that the estimated treatment effect is not driven by spurious correlations or unobserved heterogeneity, we conduct placebo tests based on random treatment assignment. Specifically, we randomly designate a subset of firms as placebo-treated while assigning the remaining firms to the control group, then re-estimate the baseline regression. This procedure is repeated 500 times to generate a distribution of placebo coefficients under the null hypothesis of no policy effect.

Figure 3 plots the resulting distribution of estimated placebo coefficients. Most estimates cluster tightly around zero (between -0.01 and 0.01) and are statistically insignificant at conventional levels, indicating that random treatment does not produce systematic effects. By contrast, the actual policy coefficient from the baseline model (-0.040) lies at the extreme left tail of the placebo distribution, well outside the 95% simulated confidence interval. This result provides strong evidence that the observed treatment effect is not due to random variation or endogenous sample selection.

<Insert Figure 3 Here>

#### 5.3.5 Contemporaneous Policy Shocks

To ensure that the estimated effect of the NPS reform is not confounded by concurrent environmental initiatives, we explicitly control for several major national and regional policies implemented during the same period. First, we account for the Central Inspection of Environmental Protection (CIEP), a nationwide campaign launched by the State Council in 2015 and implemented in two rounds (from January 2016 to September 2017 and from July 2019 to June 2022) to evaluate provincial governments' enforcement of environmental regulations. To control for this effect, we include two dummy variables, *CIEP1* and *CIEP2*, corresponding to the first and second inspection rounds.

We also control for the National Key Ecological Function Areas (NKEFA) program, which designates regions with critical ecological functions for protection and development restriction. Because many NPS pilot areas geographically overlap or interact with NKEFA zones, we match NKEFA coverage at the prefecture level to ensure adequate sample representation (the program may generate spillover and deterrence effects beyond county boundaries). A dummy variable is coded as one for firms located in affected jurisdictions. Finally, to account for broader low-carbon policy shocks, we include controls for the Carbon Emission Trading (CET) and Low-Carbon City (LCC) initiatives.

As shown in Table 4, the coefficients on *CIEP1*, *CIEP2*, *NKEFA*, *CET*, and *LCC* are economically small and statistically insignificant, indicating that these concurrent environmental initiatives do not materially affect firms' *REM* behavior. Importantly, the coefficient on *Policy* remains negative and significant at the 1% level across all specifications, confirming that the downward *REM* effect is uniquely attributable to the NPS reform rather than to other contemporaneous environmental interventions.

<Insert Table 4 Here>

#### 5.3.6 Alternative Explanations

Under a resource-based view, the NPS reform could constrain firms' access to natural resources, mechanically reducing output and profitability. As Boland and Godsell (2020) caution, when the source of variation in political costs directly affects firm profitability, it becomes difficult to distinguish accruals reflecting genuine economic effects from those intended to preempt political scrutiny. To rule out this alternative, we proxy firms' economic activity using nighttime luminosity, a granular and non-manipulable indicator of operation dynamics (Bilicka and Seidel, 2022).[16] We

[16] Nighttime luminosity within a firm's registered grid provides an approximate measure of overall firm-level economic activity, as production, operations, sales, and services are typically interconnected. However, it is worth noting that nighttime light intensity may contain measurement errors while firm activities are rarely conducted on a large scale at night (Chen et al., 2023). To further rule out the resource-

obtain daily, atmosphere- and moonlight-corrected NPP/VIIRS data from NASA and match each firm to the corresponding 500 m × 500 m grid cell based on its registered latitude and longitude. For each firm-year, we compute the annual average (*Nighttime Light*) and its year-over-year change ( *ΔNighttime Light*).

Column (1) of Table 5 shows that the NPS reform has no significant impact on firms' nighttime luminosity, suggesting that their overall production remains stable after the policy. Columns (2) and (3) split the sample by *ΔNighttime Light*: firms with positive versus negative year-over-year changes. If the resource-constrained channel were valid, the policy effect on *REM* should be concentrated among firms with declining light intensity. Instead, we find no significant group difference (*Diff P-Value* = 0.128), and the effect is even stronger for firms with positive activity growth (who also tend to exhibit greater visibility). This pattern supports the interpretation that firms engage in active income suppression to manage political exposure, rather than responding mechanically to reduced operational capacity.

<Insert Table 5 Here>

## 6. Mechanism Analysis

The preceding results suggest that the NPS reform induces affected firms to engage in downward *REM* to mitigate political costs. This section investigates the underlying mechanisms through which such costs arise. Within the NPS framework,

based view, we borrow evidence from the cross-sectional tests, which show that the effect remains significant even among firms with *low natural resource dependency*.

firms' political visibility is shaped by both formal government attention and informal public scrutiny. Stronger regulatory commitment increases the likelihood of direct intervention or fiscal burden shifting, whereas institutionalized public oversight amplifies reputational exposure. Together, these forces heighten the perceived costs of earnings visibility, prompting firms to strategically lower reported profitability.

Government attention represents the formal political cost channel through which biodiversity governance intensifies downward *REM* incentives. The reform embeds conservation performance into China's hierarchical administrative system, holding local officials accountable through evaluation, fiscal transfer, and promotion mechanisms. To meet these mandates, local governments expand spending on biodiversity conservation, ecological restoration, and related infrastructure—expenditures that serve as observable signals of enforcement intensity. Firms located in such jurisdictions can anticipate tighter inspection, stricter compliance thresholds, and higher quasi-fiscal obligations, which increase the marginal cost of earnings visibility.

To quantify regional variation in government attention, we construct a proxy using project-level public procurement data that reflects policy execution. Unlike aggregated fiscal reports, procurement records capture actual disbursements with verified contract descriptions, classifications, and payment amounts (Beraja et al., 2023; Chen et al., 2023). We identify biodiversity-related contracts and aggregate their total value at the prefecture level based on firm location.[17] This measure, *NPS Government Attention*,

[17] We identify biodiversity-related procurement contracts from the official government procurement database using project title keywords. These contracts fall into two categories. First, contracts referencing both a national park name (e.g., Sanjiangyuan, Qilian Mountains) and the term *National Park* are classified as national park ecological construction contracts (e.g., *Construction of the Qilian Mountains National Park Scientific Monitoring Center*), yielding 224 observations. Second, contracts mentioning a

captures the local intensity of formal regulatory engagement. Column (1) of Table 6 shows that *Policy × NPS Government Attention* is negative and significant (-0.004, t = -2.371), while the standalone variable is insignificant. These findings indicate that the NPS reform's effect on downward *REM* is stronger where local governments allocate greater resources to ecological initiatives, consistent with the formal political cost channel.[18]

Beyond formal regulation, firms are also subject to informal political pressures arising from public scrutiny, which has become institutionalized through the NPS reform's digital reporting platforms and legal participation channels. These mechanisms transform civic monitoring into a quasi-regulatory force. Although public sentiment lacks coercive authority, reputational sanctions and follow-up administrative responses can meaningfully influence firm behavior (Jia et al., 2016; Tang and Tang, 2016). Firms operating near conservation areas face heightened exposure to media attention and public reporting, and perceived ecological negligence can lead to reputational damage and regulatory intervention. To avoid such visibility, firms may strategically reduce reported profitability.

To measure regional variation in public scrutiny, we use Baidu Index data that capture online search activity reflecting public engagement. Specifically, we calculate

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park name alongside biodiversity-related terms (e.g., biodiversity, endangered species, wildlife, ecological protection) are classified as biodiversity conservation contracts (e.g., *Biodiversity Monitoring under the Qinghai Qilian Mountains Ecological Protection Project*), yielding 748 observations. The data are aggregated at the prefecture-year level and matched to firms based on their registered prefecture.

[18] While government procurement contracts *directly* reflect fiscal investments in biodiversity conservation and national park construction, they only *indirectly* capture environmental enforcement behavior or fiscal burden shifting. As an additional test, we proxy enforcement intensity using prefecture-level environmental penalty amounts and fiscal transfer pressure using local tax enforcement data, yielding consistent results (not tabulated).

the average annual search frequency for the terms *National Park* and *Biodiversity* at the prefecture level and mean-center the variable. This proxy, *NPS Public Scrutiny*, reflects both public awareness and the institutionalized capacity for civic oversight under the NPS regime. Column (2) of Table 6 shows that *Policy* × *NPS Public Scrutiny* is negative and significant (-0.022, t = -2.039), while the main policy effect remains significant at the 1% level. These results support the informal political cost mechanism: firms in regions with stronger public engagement suppress earnings more aggressively to preempt reputational or regulatory repercussions.

Column (3) incorporates both channels jointly. The coefficients on *Policy* × *NPS Government Attention* (-0.003, t = -1.688) and *Policy* × *NPS Public Scrutiny* (-0.021, t = -1.818) remain negative but smaller in magnitude and significance compared with their standalone specifications. This attenuation suggests that government attention and public scrutiny operate as interrelated and partially overlapping mechanisms. Regions demonstrating stronger fiscal commitment to ecological governance also tend to exhibit greater public engagement, jointly amplifying the political cost pressures that drive firms toward downward *REM*.

<Insert Table 6 Here>

## 7. Cross-Sectional Tests

Firms' responses to the NPS reform are expected to vary with their exposure to biodiversity-related risks. Firms with stronger natural resource dependencies or impacts are more visible under the NPS framework, as their operations directly affect ecosystem integrity and conservation outcomes.[19] Following Giglio et al. (2023), we measure *Natural Resource Dependency* using industry classifications, defining biodiversity-sensitive industries as those with direct exposure to ecological resources, including but not limited to agriculture, forestry, fishing, and mining. To capture *Natural Resource Impact*, we use firms' pollution emission intensity (Hsu et al., 2023), reflecting the extent to which their operations impose pressure on natural ecosystems. Panel A of Table 7 presents the results. Columns (1)-(2) show that firms in high-dependency industries exhibit a larger decline in *REM* (-0.059, $t$ = -3.001) than those in low-dependency industries (-0.027, $t$ = -2.014), with a Fisher permutation *Diff P-Value* of 0.078, indicating a statistically meaningful difference. Columns (3)-(4) show a similar pattern when biodiversity exposure is measured by ecological impact: the coefficient for high-impact firms is -0.037 ($t$ = -2.049), compared with -0.024 ($t$ = -1.474) for low-impact firms, and the difference is significant at the 1% level (*Diff P-Value* = 0.008). Overall, these results suggest that firms with higher biodiversity exposure engage more actively in downward *REM* to mitigate political costs.

Next, we assess whether the local ecological context further shapes firms' responses. Regions with greater biodiversity richness provide more ecosystem services and, when degraded, impose larger negative externalities. Consequently, environmental enforcement and public accountability may be more stringent in these areas. To capture this variation, we construct a proxy for local ecological salience based on prefecture-level bird species counts, sourced from the China Birdwatching Records Center (Meng

[19] Both dimensions are central to TNFD's recommended metrics for identifying and reporting nature-related risks.

et al., 2025). Firms are then split into high- and low-biodiversity groups based on the median species count. Panel B of Table 7 presents the results. In high-biodiversity regions, the estimated treatment effect is -0.042 (t = -3.227), while the corresponding estimate for low-biodiversity regions is -0.023 (t = -1.485). A Fisher permutation test produces a *Diff P-Value* of 0.096, indicating a statistically significant difference across groups. These findings suggest that firms operating in ecologically rich environments face greater informal and formal pressures, and therefore respond more strongly to the NPS reform through downward *REM*.

Taken together, these cross-sectional analyses provide converging evidence that both firm-level biodiversity visibility and regional biodiversity endowments shape the intensity of firms' *REM* following the NPS reform.

<Insert Table 7 Here>

## 8. Conclusion

We exploit the staggered rollout of China's National Park System reform as an exogenous shock to examine how firms adjust earnings management strategies amid regional biodiversity transitions. Defining treated areas as cities overlapping or adjacent to national parks, we document a significant increase in *downward real earnings management* (particularly through production manipulation) among exposed firms following policy implementation. This response is driven by heightened political costs, stemming from both formal government attention and informal public scrutiny. The effect is more pronounced for firms with greater biodiversity exposures and those operating in ecologically sensitive areas.

These findings carry several policy implications. First, firms' strategic use of *REM* to reduce political exposure distorts earnings quality and impairs information efficiency, potentially disrupting asset pricing and undermining the effective allocation of fiscal resources in transition zones. Strengthened audit oversight and disclosure requirements are therefore essential to preserve market integrity. Second, while public oversight mechanisms mark progress in participatory governance, firms respond strategically to evade scrutiny. This mirrors prior evidence of governmental window dressing and highlights a parallel tendency among firms (Liu et al., 2022). Future reforms should enhance the credibility and enforcement strength of public supervision to ensure transparency translates into real accountability. Third, the evidence reveals a disconnect between regulatory intent and corporate response: anticipating political burdens, firms suppress profits rather than improve compliance, weakening policy effectiveness. Future biodiversity initiatives should establish incentive-compatible enforcement tools to align corporate behavior with environmental goals.

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## Appendix A: Information on the National Park System Policy

| No. | Name | Start-up Time | Representative species | Area/km$^2$ | Main practices |
|---|---|---|---|---|---|
| 1 | Three-River-Source | 2016.3 | *Snow leopard; Tibetan Antelope* | 123,100 | Integrate management and law enforcement agencies to enhance ecological governance; develop green eco-industries in neighboring cities. |
| 2 | Shennongjia | 2016.5 | *Snub-nosed monkey* | 1,170 | Regional cooperation; Transform ecologically harmful industries. |
| 3 | Qiantang-River Source | 2016.6 | *Black fronted Muntjac;Abies beshanzuensis M. H. Wu* | 252 | Promote inter-provincial protection policies. |
| 4 | Wuyi Mountain | 2016.6 | *Cabot's Tragopan* | 1,001 | Build eco-tea industry, eco-tourism, and other public wealthy industries; Collaborative governance between the national park authorities and local governments. |
| 5 | Potatso | 2016.6 | *Black-necked Crane* | 602 | Took the lead in piloting the franchise system for national park operations. |
| 6 | Nanshan | 2016.7 | *Fea's Muntjac; Abies ziyuanensis L. K. Fu & S. L. Mo* | 636 | Established a comprehensive ecological compensation mechanism to incentivize conservation behavior. |
| 7 | Giant Panda | 2017.1 | *Giant Panda* | 27,134 | Wide participation of residents in conservation activities; Strict implementation of ecological compensation policies such as returning farmland to forests. |
| 8 | Northeast Tiger & Leopard | 2017.1 | *Amur Tige; Amur Leopard* | 14,612 | Guide local communities to shift toward sustainable production and lifestyles. |
| 9 | Qilianshan | 2017.9 | *Snow leopard* | 50,237 | Close polluting industries such as mining to restore ecosystems. |
| 10 | Hainan Tropical Rainforest | 2019.7 | *Hainan Gibbon* | 4,403 | Develop green industries in national parks and adjacent areas in accordance with local conditions. |

## Appendix B: Representative Ecological Achievements of the National Park System Policy

| Achievements | National Park | Specific Reflection |
|---|---|---|
| Ecosystem services remain stable or have been improved | Qilianshan | Above-ground vegetation in grassland ecosystems increased. |
| | Three-River-Source | Wetland ecosystems and the amount of water conservation in them increase by more than 6 percent per year on average. |
| | Qiantang-River Source | The air quality index exceeds 98.2% and the water quality index is 100%. |
| Illegal acts and damages have been effectively curbed | Northeast Tiger & Leopard | The degree of human interference has been significantly reduced, especially illegal activities such as logging and poaching. |
| | Qilianshan | Illegal and criminal activities have been severely cracked down on, and the number of vandalism cases has dropped significantly. |
| | Wuyi Mountain | Rectification of illegal tea plantation 3.11 square kilometers. |
| Species populations have increased, or their habitats have been restored | Northeast Tiger & Leopard | There are 10 newly bred tiger cubs and 7 leopard cubs, and the distribution range is gradually expanding. |
| | Qilianshan | Snow leopards have been observed to expand their range and move down into coniferous forests. |
| | Giant Panda | The area of suitable habitat for giant pandas increased by 1.6%, nine giant panda corridors and seven wildlife corridors were completed, and 128.5 km² of vegetation was restored. |
| | Three-River-Source | The disturbance of human activities has decreased significantly, the Tibetan antelope population has recovered, and the traces of rare and endangered wild animals have increased. |
| | Shennongjia | According to the migration ability of different types of species, 25 wildlife passages in 3 categories have been built, effectively alleviating the isolation impact of highways on wild animals such as golden monkeys. |
| New species are discovered, and new distributions are recorded | Hainan Tropical Rainforest | 19 new species were discovered. |
| | Potatso | The range of black-necked cranes expanded from Bita Sea to Shendu Lake and Miritang, and the stable population increased from 28 to 38 (2016-2019). The distribution of Buxbaumiapunctata, a rare and endangered moss, was detected for the first time |
| | Nanshan | Two new species of plants and four new species of animals were found. 447 species of vascular plants and 68 species of vertebrates were recorded |

## Appendix C: Variable Definitions

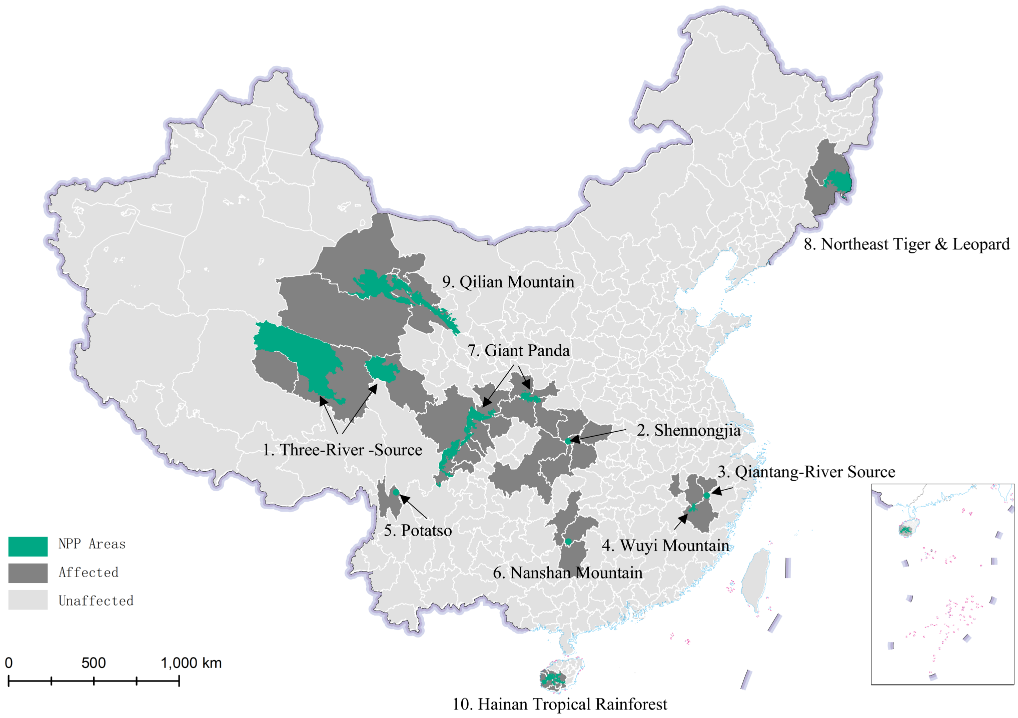
| Variables | Definitions |
|---|---|
| *Outcomes:* | |
| *REM* | Real earnings management, comprising abnormal production, sales, and discretionary expenses, computed based on Equation (4). |
| *AbPROD* | Abnormal production costs, measured as the residuals from Equation (1). |
| *AbCFO* | Abnormal cash flow from operations, measured as the residuals from Equation (2). |
| *AbDISX* | Abnormal discretionary expenses, measured as the residuals from Equation (3). |
| *AEM* | Accrual-based earnings management, estimated using the modified Jones model (Dechow et al., 1995). |
| *Treatments:* | |
| *Policy* | A dummy variable used to distinguish whether firm *i* is affected by the National Park System policy in year *t*. Specifically, if the city of a firm's headquarters location is within or directly adjacent to the NPS pilot area in year *t*, this firm is affected by NPS policy in year *t*, and its *Policy* equals 1 and thereafter, 0 otherwise. |
| *Policy-New* | A dummy variable used to distinguish whether firm *i* is affected by the NPS policy in year *t*. Specifically, if the NPS policy is implemented before June 30th of year *t*, *Policy-New* equals 1 from year *t* onwards and thereafter; if implemented after June 30th of year *t*, *Policy-New* equals 0 for the current year and 1 for the following years. |
| *Controls:* | |
| *LnSize* | Firm size, measured as the natural logarithm of total assets. |
| *LnAge* | Firm age, measured as the natural logarithm of the number of years since establishment in the current year. |
| *Lev* | Financial leverage, measured as total debt divided by total assets. |
| *Boardsize* | Board size, measured as the total number of board members. |
| *Dual* | CEO-chair duality equals 1 if the CEO and board chair roles are held by the same individual, and 0 otherwise. |
| *ManagerHold* | Managerial ownership, defined as the percentage of shares held by directors and senior executives. |
| *Growth* | Revenue growth, calculated as (current revenue − prior year revenue) divided by prior year revenue. |
| *Big4* | Audit quality dummy, equals 1 if the firm is audited by one of the Big Four accounting firms in the current year, and 0 otherwise. |

**Appendix C - Continued**

| | |
|---|---|
| *Others*： | |
| *Nighttime Light* | Annual average of corrected nighttime luminosity (obtained from NASA's NPP/VIIRS dataset) within the 500 m × 500 m grid cell corresponding to the firm's registered location, serving as a proxy for local economic activity. Δ*Nighttime Light* is the year-over-year change in nighttime luminosity for each firm's grid cell. |
| *NPS Government Attention* | Government attention to biodiversity governance, measured by the total value of biodiversity-related procurement contracts identified from the China Government Procurement Network (https://www.ccgp.gov.cn/). These include (1) national park ecological construction contracts referencing park names and *National Park*, and (2) biodiversity conservation contracts referencing park names and biodiversity-related terms (e.g., endangered species, wildlife, ecological protection), aggregated at the prefecture-year level by firm location. |
| *NPS Public Scrutiny* | Public attention to biodiversity governance, proxied by the Baidu Index (https://index.baidu.com/) for the keywords *National Park* (translated as *Guojiagongyuan*) and *Biodiversity* (translated as *Shengwuduoyangxing*). The index reflects online search intensity and media salience, aggregated at the prefecture-year level. |
| *Natural Resource Dependency* | Industry sensitivity to biodiversity, coded as 1 if the firm operates in sectors with high biodiversity exposure, identified by industry codes beginning with A, B, E, M, N, or C26, C27, C28; 0 otherwise. |
| *Natural Resource Impact* | Firms' pollution intensity, calculated based on emissions of four major industrial pollutants: chemical oxygen demand (COD) and ammonia nitrogen in wastewater, and sulfur dioxide ($SO_2$) and nitrogen oxides ($NO_x$) in waste gas. Following the *Administrative Measures for the Collection Standards of Pollution Discharge Fees*, these pollutants are converted into standardized pollution equivalents, summed across pollutants, and log-transformed after adding one. |
| *Regional Biodiversity* | Local biodiversity, proxied by the average number of bird species recorded in all birdwatching observations within a prefecture-level city in a given year. Bird observation data sourced from www.birdreport.cn. |

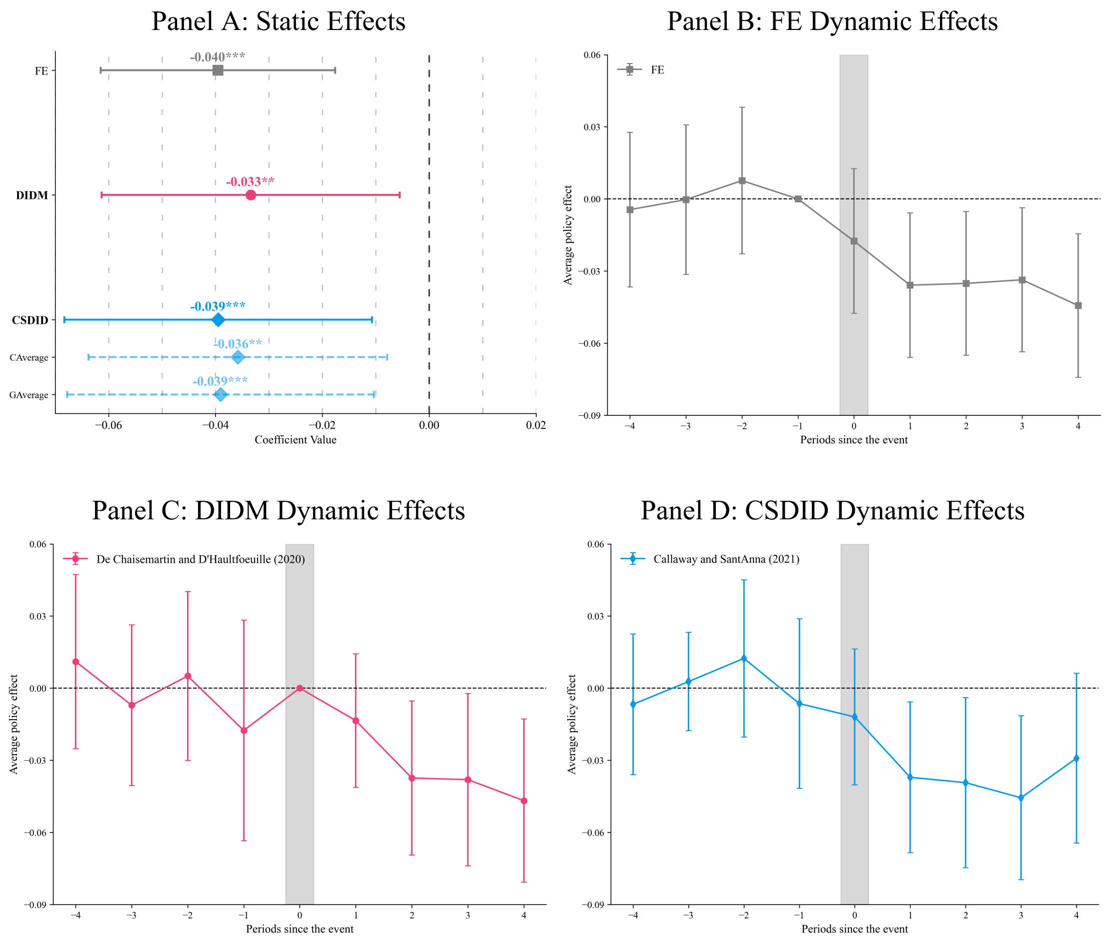
**Figure 1. Distribution of Cities Affected by the National Park System Reform**

*Notes.* This figure presents the distribution of cities affected by the NPS reform. Specifically, the green area represents the geographical scope of each NPS pilot, while the gray area represents the neighboring prefecture-level cities affected by the NPS pilots.



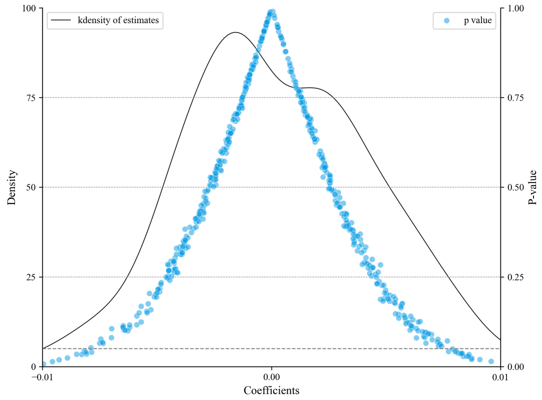
## Figure 2. Heterogeneity-Robust Estimation

*Notes.* This figure presents heterogeneity-robust static and dynamic effects based on a staggered difference-in-differences (DID) framework. Panel A reports the static average treatment effect on the treated (ATT) of the NPS reform. Panels B-D present dynamic treatment effects. Panel B reports the parallel trends from a fixed effects (FE) model, consistent with the baseline specification in Table 2, which assumes homogeneous treatment effects across groups and time. Panels C and D show dynamic effects using the DIDM and CSDID estimators, respectively, which address the "bad control" and negative weighting issues and are robust to treatment effect heterogeneity. In CSDID, CAverage denotes the calendar-weighted average treatment effect on the treated (ATT), averaging effects across calendar years, while GAverage denotes the group-weighted ATT, averaging effects across treatment cohorts—2016, 2017, and 2019 in this study. Dots indicate point estimates of firms' real earnings management in each event year, and whiskers represent 95% confidence intervals. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.



## Figure 3. Placebo Test

*Notes.* This figure presents the results of a placebo test based on 500 replications. In each iteration, a subset of firms is randomly assigned to the pseudo-treated group, with the remainder forming the pseudo-control group. The baseline specification from Table 2 is then re-estimated using this pseudo-sample. The figure plots the distribution of the estimated coefficients on *Policy* across all iterations.



## Table 1. Descriptive Statistics

*Notes.* Panel A reports the summary statistics of the full sample of 32,337 firm-year observations during 2012-2023. The dependent variable is *REM*, representing a firm's real earnings management. The dependent variable is *Policy*, representing whether a firm is affected by the NPS policy. All other continuous variables are winsorized at the 1st and 99th percentiles. Panel B reports the Spearman correlations among variables used in the baseline regression. See Appendix B for detailed variable definitions. Figures in bold have at least a 5% significance level.

| **Panel A: Summary Statistics** | | | | | | |
|---|---|---|---|---|---|---|
| Variables | N | Mean | Median | SD | Min | Max |
| *REM* | 32,337 | 0.002 | 0.021 | 0.206 | -0.743 | 0.553 |
| *Policy* | 32,337 | 0.042 | 0.000 | 0.200 | 0.000 | 1.000 |
| *LnSize* | 32,337 | 22.38 | 22.19 | 1.292 | 20.04 | 26.39 |
| *LnAge* | 32,337 | 2.979 | 2.996 | 0.304 | 2.079 | 3.555 |
| *Lev* | 32,337 | 0.432 | 0.426 | 0.200 | 0.061 | 0.887 |
| *Boardsize* | 32,337 | 8.693 | 9.000 | 1.906 | 5.000 | 15.00 |
| *Dual* | 32,337 | 0.282 | 0.000 | 0.450 | 0.000 | 1.000 |
| *ManagerHold* | 32,337 | 18.37 | 0.843 | 28.67 | 0.000 | 117.6 |
| *Growth* | 32,337 | 0.141 | 0.086 | 0.372 | -0.568 | 2.166 |
| *Big4* | 32,337 | 0.061 | 0.000 | 0.240 | 0.000 | 1.000 |

**Table 1 - Continued**

**Panel B: Spearman Correlations**

| | *REM* | *Policy* | *LnSize* | *LnAge* | *Lev* | *Boardsize* | *Dual* | *ManagerHold* | *Growth* | *Big4* |
|---|---|---|---|---|---|---|---|---|---|---|
| *REM* | 1.000 | | | | | | | | | |
| *Policy* | -0.002 | 1.000 | | | | | | | | |
| *LnSize* | **0.024** | **0.029** | 1.000 | | | | | | | |
| *LnAge* | **0.042** | **0.072** | **0.171** | 1.000 | | | | | | |
| *Lev* | **0.192** | **0.021** | **0.496** | **0.146** | 1.000 | | | | | |
| *Boardsize* | -0.003 | 0.003 | **0.240** | 0.007 | **0.143** | 1.000 | | | | |
| *Dual* | **-0.037** | **-0.028** | **-0.154** | **-0.086** | **-0.104** | **-0.168** | 1.000 | | | |
| *ManagerHold* | **-0.083** | **-0.025** | **-0.310** | **-0.215** | **-0.266** | **-0.195** | **0.346** | 1.000 | | |
| *Growth* | **-0.028** | 0.002 | **0.045** | **-0.077** | **0.023** | -0.005 | **0.021** | **0.062** | 1.000 | |
| *Big4* | **-0.057** | **-0.013** | **0.339** | **0.029** | **0.102** | **0.085** | **-0.053** | **-0.109** | -0.010 | 1.000 |

## Table 2. Baseline Results

*Notes.* This table presents the results of the staggered difference-in-differences (DID) tests that examine the impact of the NPS policy on corporate *REM*. Panel A presents the baseline results using *REM* as the dependent variable. *Policy* is a dummy variable equal to one if a firm is located in a city affected by the NPS reform in a given year and zero otherwise. Column (1) reports the regression without control variables, while Column (2) includes the full set of firm-level controls. Panel B decomposes *REM* into its three components: abnormal production costs (*AbPROD*), abnormal cash flows from operations (*AbCFO*), and abnormal discretionary expenses (*AbDISX*). *REM* is computed as *AbPROD-AbCFO-AbDISX*, where more negative values indicate stronger downward real earnings management. See Appendix C for detailed variable definitions. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| **Panel A: *REM*** | | |
|---|---|---|
| Variables | *REM* | |
| | (1) | (2) |
| *Policy* | -0.037*** | -0.040*** |
| | (-3.276) | (-3.534) |
| *LnSize* | | 0.007* |
| | | (1.751) |
| *LnAge* | | -0.092*** |
| | | (-3.158) |
| *Lev* | | 0.112*** |
| | | (7.722) |
| *Boardsize* | | -0.001* |
| | | (-1.722) |
| *Dual* | | -0.007* |
| | | (-1.913) |
| *ManagerHold* | | 0.000 |
| | | (0.638) |
| *Growth* | | -0.016*** |
| | | (-3.478) |
| *Big4* | | -0.012 |
| | | (-1.008) |
| *Constant* | 0.003*** | 0.088 |
| | (6.772) | (0.737) |
| *City FE* | Yes | Yes |
| *Firm FE* | Yes | Yes |
| *Year FE* | Yes | Yes |
| *N* | 32,337 | 32,337 |
| *Adj-$R^2$* | 0.574 | 0.578 |

**Table 2 - Continued**

| **Panel B: *REM* Components** | | | |
|---|---|---|---|
| Variables | *AbPROD* | *AbCFO* | *AbDISX* |
| | (1) | (2) | (3) |
| *Policy* | -0.020*** | 0.007* | 0.007* |
| | (-3.205) | (1.683) | (1.955) |
| *Controls* | Yes | Yes | Yes |
| *City FE* | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes |
| *N* | 32,337 | 32,337 | 32,337 |
| *Adj-$R^2$* | 0.510 | 0.272 | 0.767 |

## Table 3. Alternative Measures and Sample Restrictions

*Notes.* Panel A reports robustness checks using alternative key variables. Column (1) replaces the dependent variable with accrual-based earnings management (*AEM*). Column (2) substitutes the policy variable with *Policy-New*, which is defined as follows: if the NPS policy is implemented before June 30th of year *t*, *Policy-New* equals 1 from year *t* onwards and thereafter; if implemented after June 30th of year *t*, *Policy-New* equals 0 for the current year and 1 for the following years. Panel B reports results based on alternative sample restrictions. Column (1) excludes treated firms registered in municipalities directly under the central government (Chongqing). Column (2) restricts the control group to firms registered in provinces where national park pilot programs are located. See Appendix C for detailed variable definitions. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| **Panel A: Alternative Key Variables** | | |
|---|---|---|
| Variables | *AEM* | *REM* |
| | (1) | (2) |
| *Policy* | -0.009** | |
| | (-2.188) | |
| *Policy-New* | | -0.040*** |
| | | (-3.536) |
| *Controls* | Yes | Yes |
| *City FE* | Yes | Yes |
| *Firm FE* | Yes | Yes |
| *Year FE* | Yes | Yes |
| *N* | 32,241 | 32,337 |
| *Adj-$R^2$* | 0.118 | 0.578 |

| **Panel B: Alternative Sample Restrictions** | | |
|---|---|---|
| Variables | *REM* | |
| | Remove the Municipality | Reset Control Group |
| | (1) | (2) |
| *Policy* | -0.028** | -0.036*** |
| | (-2.449) | (-2.952) |
| *Controls* | Yes | Yes |
| *City FE* | Yes | Yes |
| *Firm FE* | Yes | Yes |
| *Year FE* | Yes | Yes |
| *N* | 31,891 | 11,001 |
| *Adj-$R^2$* | 0.579 | 0.582 |

## Table 4. Contemporaneous Policy Shocks

*Notes.* This table rules out competing policy influences on firms' real earnings management. Four major initiatives are considered. *CIEP1* (*CIEP2*) equals 1 if a province was under inspection or had completed inspection by the first (second) round of the Central Inspection on Environmental Protection (CIEP), conducted from January 2016 to September 2017 and from July 2019 to June 2022, respectively. *NKEFA* equals 1 for firms located in prefectures covered by the National Key Ecological Function Areas program, which designates ecologically critical zones for strict development control. *CET* and *LCC* denote the Carbon Emission Trading pilot program and the Low-Carbon City policy, respectively. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| Variables | *REM* | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *Policy* | -0.039*** | -0.040*** | -0.039*** | -0.039*** |
| | (-3.527) | (-3.551) | (-3.530) | (-3.512) |
| *CIEP1* | 0.000 | | | |
| | (0.049) | | | |
| *CIEP2* | -0.005 | | | |
| | (-1.361) | | | |
| *NKEFA* | | -0.003 | | |
| | | (-0.324) | | |
| *CET* | | | -0.007 | |
| | | | (-0.984) | |
| *LCC* | | | | -0.000 |
| | | | | (-0.060) |
| *Controls* | Yes | Yes | Yes | Yes |
| *City FE* | Yes | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes | Yes |
| *N* | 32,337 | 32,337 | 32,337 | 32,337 |
| *Adj-$R^2$* | 0.578 | 0.578 | 0.578 | 0.578 |

## Table 5. Alternative Explanations

*Notes.* This table tests whether our findings are mechanically driven by real economic shocks under the resource-based view. Nighttime luminosity data are obtained from NASA's NPP/VIIRS dataset, matched to each firm's registered 500 m × 500 m grid cell and averaged annually. Column (1) examines whether the NPS policy directly affects firms' nighttime luminosity (*Nighttime Light*). Columns (2) and (3) split the sample based on the year-over-year change in nighttime light (*Δ Nighttime Light*) to test heterogeneity across firms with positive versus negative activity growth. See Appendix C for detailed variable definitions. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

| Variables | *Nighttime Light* | *REM* | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | | *Positive Δ Nighttime Light* | *Negative Δ Nighttime Light* |
| *Policy* | 2.457 | -0.046*** | -0.024 |
| | (0.239) | (-3.414) | (-1.453) |
| *Diff P-Value* | | 0.128 | |
| *Controls* | Yes | Yes | Yes |
| *City FE* | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes |
| *N* | 32,336 | 17,537 | 13,016 |
| *Adj-$R^2$* | 0.770 | 0.576 | 0.570 |

## Table 6. Mechanism Analysis

*Notes.* This table examines the mechanisms through which political pressures affect firms' *REM*. *NPS Government Attention* captures fiscal spending on national park development and biodiversity conservation, proxied by the total value (in millions of RMB) of relevant government procurement contracts. *NPS Public Scrutiny* is measured using the Baidu Index, based on search intensity for the keywords *National Park* and *Biodiversity*, aggregated at the prefecture-year level. Both variables are scaled by 1% and mean-centered prior to estimation. See Appendix C for detailed variable definitions. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

| Variables | *REM* | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| *Policy* | -0.038*** | -0.034*** | -0.033*** |
| | (-3.361) | (-3.228) | (-3.142) |
| ***Policy*NPS Government Attention*** | **-0.004**** | | **-0.003*** |
| | **(-2.371)** | | **(-1.688)** |
| *NPS Government Attention* | 0.001 | | 0.001 |
| | (1.087) | | (1.090) |
| ***Policy*NPS Public Scrutiny*** | | **-0.022**** | **-0.021*** |
| | | **(-2.039)** | **(-1.818)** |
| *NPS Public Scrutiny* | | 0.004 | 0.004 |
| | | (0.834) | (0.800) |
| *Controls* | Yes | Yes | Yes |
| *City FE* | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes |
| *N* | 32,337 | 32,337 | 32,337 |
| *Adj-$R^2$* | 0.578 | 0.578 | 0.578 |

## Table 7. Cross-Sectional Tests

*Notes.* This table presents cross-sectional analyses of the NPS reform's effect on firms' *REM*. Panel A examines heterogeneity by firms' biodiversity exposures. *Natural Resource Dependency* classifies biodiversity-sensitive industries as those directly dependent on ecological resources, including sectors with industry codes beginning with A, B, E, M, or N, or categorized as C26, C27, and C28. *Natural Resource Impact* is proxied by firms' pollution emission intensity, capturing their direct ecological footprint. Panel B examines heterogeneity by *Regional Biodiversity*, measured by the average annual number of bird species recorded through birdwatching at the prefecture level. Diff P-Value reports p-values from Fisher's permutation test with 500 bootstrap replications, testing the statistical significance of coefficient differences between subsamples. See Appendix C for detailed variable definitions. The t-statistics reported in parentheses are based on standard errors clustered by firm. *, **, and *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

**Panel A: Biodiversity Exposure**

| Variables | *REM* | | | |
|---|---|---|---|---|
| | *Natural Resource Dependency* | | *Natural Resource Impact* | |
| | Higher | Lower | Higher | Lower |
| | (1) | (2) | (3) | (4) |
| *Policy* | -0.059*** | -0.027** | -0.037** | -0.024 |
| | (-3.001) | (-2.014) | (-2.049) | (-1.474) |
| *Diff P-Value* | 0.078 | | 0.008 | |
| *Controls* | Yes | Yes | Yes | Yes |
| *City FE* | Yes | Yes | Yes | Yes |
| *Firm FE* | Yes | Yes | Yes | Yes |
| *Year FE* | Yes | Yes | Yes | Yes |
| *N* | 7,315 | 25,022 | 16,702 | 15,635 |
| *Adj-$R^2$* | 0.654 | 0.541 | 0.617 | 0.579 |

**Panel B: Regional Biodiversity**

| Variables | *REM* | |
|---|---|---|
| | Higher | Lower |
| | (1) | (2) |
| *Policy* | -0.042*** | -0.023 |
| | (-3.227) | (-1.485) |
| *Diff P-Value* | 0.096 | |
| *Controls* | Yes | Yes |
| *City FE* | Yes | Yes |
| *Firm FE* | Yes | Yes |
| *Year FE* | Yes | Yes |
| *N* | 16,158 | 16,179 |
| *Adj-$R^2$* | 0.606 | 0.569 |