Strategic Conservatism in Buyer-Supplier Networks: How Major Customer Status Constrains Biodiversity Conservation Efforts

Abstract

Biodiversity loss poses systemic risks to supply chain resilience and long-term value creation, yet firms exhibit uneven commitment to conservation. This study investigates how a firm's status as a major customer, defined under U.S. disclosure rules as accounting for over 10% of a supplier's sales, influences its strategic orientation toward biodiversity conservation. Grounded in resource dependence and transaction cost theories, we argue that major customers occupy a central position in the market and that suppliers are heavily dependent on them for revenue. This dependence heightens pressures on major customers to maintain stability and predictability, thereby crowding out costly and uncertain investments in biodiversity. Using a panel of 942 firm-year observations of U.S. public firms in 2012-2019, we find robust evidence that major customer status is negatively associated with biodiversity conservation commitment. This effect is magnified under three strategic contingencies: when firms face higher operational risk, when such risks are more likely to propagate to suppliers, and when firms experience weaker normative pressure. Collectively, our findings reveal a critical structural barrier within buyer-supplier networks that impedes the integration of biodiversity into corporate strategies.

Keywords: Biodiversity initiatives, major customers, buyer-supplier relationships

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1. Introduction

Global biodiversity loss is accelerating, threatening both ecological stability and economic sustainability (Winn and Pogutz, 2013; Díaz et al., 2019). Policymakers and international organizations have emphasized the urgent need for business engagement. For instance, global initiatives such as the UN's Agenda 2030 and the Convention on Biological Diversity's COP16 call on firms to assess their impacts on biodiversity, mobilize resources, and develop sustainable solutions. In parallel, companies are increasingly expected to integrate biodiversity considerations into their strategies through sustainable practices and financial commitments (Löfqvist and Ghazoul, 2019; Bebbington et al., 2020; Panwar et al., 2023; Katic et al., 2023; Unter et al., 2023).

Yet, despite these pressures, global investments in biodiversity remain far below the levels required to halt or reverse biodiversity decline (Seidl et al., 2021; Feger and Mermet, 2022; Cosma et al., 2023; zu Ermgassen et al., 2025). Moreover, research on corporate biodiversity management is still limited, and little is known about how firms can be motivated to allocate greater resources to biodiversity initiatives. Against this backdrop, scholars have begun to call for deeper investigation into the role of business in biodiversity conservation and the conditions that shape firms' engagement (Karolyi and Tobin-de la Puente, 2023; Panwar et al., 2024; Flammer et al., 2025).

Significant challenges remain in advancing research on firms' biodiversity initiatives. Much of the existing literature concentrates on firms' passive exposure to biodiversity risks. For example, how biodiversity loss affects resource security or financial performance (Carvalho et al., 2022; Giglio et al., 2023). However, far less attention is given to understanding proactive strategies that firms adopt to mitigate or reverse these risks (Addison et al., 2019). This imbalance limits our understanding of biodiversity as a potential area of strategic action. A second challenge lies in data availability. Systematic, large-scale datasets capturing firms'

biodiversity-related initiatives are scarce, and most empirical work still relies on qualitative case studies or small-scale samples. For instance, Flammer et al. (2025) used deal-level data to examine how return, risk, and impact are considered in biodiversity investment projects, but their analysis is restricted to a sample of only 33 cases. These limitations highlight the need for more comprehensive approaches to studying how firms engage with biodiversity conservation.

In this study, we draw on the MSCI ESG KLD STATS database (hereafter KLD), which provides systematic ratings of U.S. public firms' initiatives in biodiversity conservation. Our dataset comprises 942 firm-year observations over the period 2012-2019. KLD is a reputable and widely used rating agency; its composite corporate social responsibility (CSR) scores have been extensively employed in prior research (e.g., Ioannou and Serafeim, 2015; Albuquerque et al., 2019; Zhang, 2024). However, its biodiversity-specific ratings receive little scholarly attention, and our study is among the first to exploit this measure. KLD compiles firm information from multiple sources, including corporate disclosures, financial filings, and media coverage, and applies a standardized evaluation methodology. As an independent third-party agency, it enhances the consistency, comparability, and reliability of biodiversity conservation ratings.

Our study investigates how a firm's status as a major customer of its suppliers influences its biodiversity conservation initiatives. A major customer is defined as one that accounts for a substantial share of a supplier's sales revenue; in the U.S. context, this typically refers to customers responsible for at least 10% of a supplier's sales. This research question is important because buyer-supplier relationships play a central role in firms' strategic decision-making (Zhang et al., 2020; Tao et al., 2023). According to the Bureau of Economic Analysis, purchases by corporate customers represent about 55% of the value of commodities in the U.S. Despite this significance, little is known about how a firm's market position as a major customer shapes its own commitment to biodiversity conservation.

We develop our hypotheses by integrating insights from resource dependence theory, transaction cost economics, and institutional theory. Resource dependence theory posits that because suppliers are heavily dependent on major customers for revenue, these customers prioritize operational continuity rather than engaging in discretionary investments such as biodiversity (Pfeffer and Salancik, 1978; Hillman et al., 2009; Drees and Heugens, 2013). Transaction cost economics suggests that asset specificity heightens interdependence and amplifies the propagation of operational risks across supply chains, reinforcing a focus on stability at the expense of biodiversity initiatives (Coase, 1937; Williamson, 1979, 1985, 2010). Institutional theory highlights how firms' sustainability strategies are shaped by social norms and expectations, implying that major customers' biodiversity efforts are contingent on the level of social pressure in their operating regions (Meyer and Rowan, 1977; DiMaggio and Powell, 1983; Oliver, 1991).

Empirically, we find that firms identified by their suppliers as major customers are less likely to engage in proactive biodiversity conservation. This result is robust across matched samples, alternative model specifications, and alternative measures of the independent variable. To unpack the underlying mechanisms, we conduct cross-sectional analyses. First, we show that the effect is moderated by firms' market power, which reflects their vulnerability to operational risks. Second, we examine input differentiation, which determines the extent to which customer-level shocks propagate to upstream suppliers. Finally, we explore the role of regional social capital, which shapes the institutional pressures that major customers face. We find that the negative effect of major customer status on firms' biodiversity commitments is stronger when firms possess weaker market power, rely on highly differentiated inputs, and operate in regions with lower social capital. These analyses reveal that the reduced biodiversity efforts of major customers are driven by their incentive to prioritize operational stability over long-term biodiversity commitments.

Our study contributes to the literature on the determinants of firms' biodiversity initiatives in several ways. First, it represents one of the earliest systematic attempts to quantify such initiatives using a large-sample dataset. Prior research largely relies on conceptual or qualitative work (Nedopil, 2023; Panwar et al., 2023; Salmi et al., 2023; White et al., 2023; zu Ermgassen et al., 2025), case studies (Meißner & Grote, 2017; Thompson, 2019; van Oorschot et al., 2022), or small- and deal-level analyses (Flammer et al., 2025). Reviewing two decades of scholarship, Liu et al. (2025) find that nearly half of the studies were published in the past four years and that only 13 percent employed quantitative methods, underscoring the shortage of large-sample evidence. Similarly, Testa et al. (2025) emphasize that corporate biodiversity strategies remain poorly understood. In contrast, we draw on a comprehensive dataset of third-party ratings of firms' biodiversity conservation initiatives, providing robust empirical evidence that complements and extends earlier work.

Second, we offer a novel perspective by linking firms' biodiversity engagement to product-market structure, specifically their status as major customers in buyer-supplier relationships. Previous studies primarily examine biodiversity initiatives through the lenses of regulatory pressures (Kedward et al., 2023; zu Ermgassen et al., 2025), reputational concerns (Anyango-van Zwieten et al., 2019; Smith et al., 2019; Varumo et al., 2022; White et al., 2023), operational considerations (Carvalho et al., 2023; Panwar et al., 2023; White et al., 2024), and corporate governance factors (Krause et al., 2021). By focusing on how structural positions in product markets shape biodiversity strategies, our study extends the theoretical scope of the literature and introduces a previously overlooked mechanism that helps explain firms' biodiversity decisions. Our results suggest that supply chain dependencies could create disincentives for biodiversity investments.

2. The literature and hypothesis development

2.1 The literature on firms' initiatives for biodiversity conservation

Biodiversity conservation is increasingly recognized as a strategic issue for firms, yet monetizing its value remains challenging. Investments in biodiversity often entail substantial upfront costs, such as green technologies, sustainable raw materials, certification, and impact assessments. However, their financial returns are uncertain and long term (Boiral et al., 2018; Krause et al., 2021; Starks, 2023). Consequently, many firms hesitate to fully commit, despite rising awareness and external pressures.

At the same time, companies face mounting institutional and stakeholder expectations. Regulators are embedding biodiversity into formal accountability frameworks, including the Kunming-Montreal Global Biodiversity Framework and the European Union's (EU's) Corporate Sustainability Reporting Directive (CSRD; zu Ermgassen et al., 2025). NGOs and activists highlight biodiversity risks that threaten reputations (Anyango-van Zwieten et al., 2019; Varumo et al., 2022), while consumers increasingly demand environmentally responsible supply chains (Meißner and Grote, 2017). Forward-looking firms also anticipate future regulation and take preemptive action (Wunder et al., 2025). In this sense, biodiversity is becoming integral to legal compliance, reputational risk management, and strategic positioning (Liu et al., 2025).

Beyond regulatory and reputational concerns, biodiversity loss creates tangible operational risks. For industries dependent on natural capital, such as agriculture, forestry, and mining, ecosystem degradation threatens supply continuity, raises costs, and undermines long-term resource availability (Panwar et al., 2022; White et al., 2024). Firms therefore adopt biodiversity measures to mitigate these risks and secure future inputs (Carvalho et al., 2023). Simultaneously, biodiversity engagement can unlock access to sustainability-linked finance, meet investor expectations, and enhance competitiveness (White et al., 2023; Smith et al.,

2019). Internally, governance and leadership also matter: firms with board-level oversight and environmental champions are more likely to integrate biodiversity into strategy (Krause et al., 2021).

Taken together, firms undertake biodiversity initiatives for multiple, interrelated reasons: compliance with evolving regulation, mitigation of operational risk, reputation management, stakeholder expectations, and internal governance alignment. This echoes Carroll's (1991) corporate social responsibility framework, where profitability provides the foundation, but legal, ethical, and philanthropic responsibilities increasingly shape firm behavior. Nevertheless, the extent of engagement depends on how firms prioritize biodiversity relative to immediate strategic and operational demands.

Despite these insights, two important gaps remain. First, the field still lacks robust quantitative evidence: most studies are descriptive or casebased, with few large-sample, empirical analyses of corporate biodiversity initiatives (Liu et al., 2025). Second, theory and evidence on interfirm dynamics are limited. Firms are often treated as isolated actors, while the influence of buyer-supplier relationships and product-market structures on biodiversity strategies receive little attention. Addressing these gaps is critical for advancing both scholarly understanding and practical action on corporate biodiversity engagement.

2.2 Theoretical framework and main hypothesis

To explain why firms with a major customer status may deprioritize biodiversity conservation, we draw upon three theoretical perspectives: (i) resource dependence theory, (ii) transaction cost economics, and (iii) institutional theory. Each highlights a distinct mechanism through which the structural position of major customers shapes strategic decision-making. We summarize the framework in Figure 1.

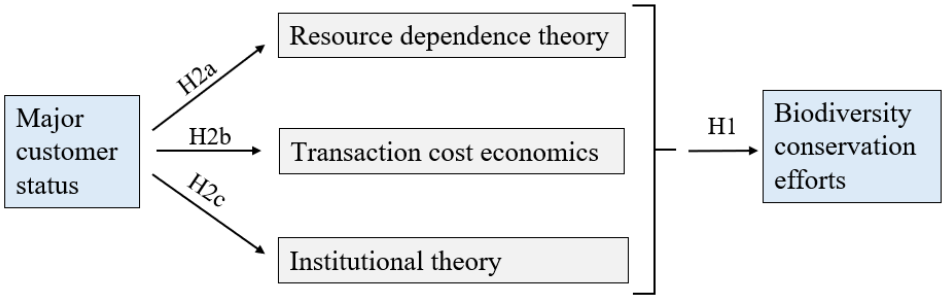


Figure 1. Theoretical framework

First, resource dependence theory emphasizes that firms rely on external organizations for critical resources and must manage these interdependencies to reduce uncertainty (Pfeffer and Salancik,1978; Hillman et al., 2009; Drees and Heugens, 2013). Major customers occupy a central role in supply chains because suppliers depend heavily on them for revenue (Kim and Zhu, 2018). This dependence creates pressure for major customers to maintain stability and predictability, as disruptions could jeopardize supplier survival and, in turn, their own input security (Zhang et al., 2025). As a result, such firms tend to prioritize operational continuity over discretionary initiatives like biodiversity conservation. The extent of this tendency depends on firms' market power: those with lower bargaining power face tighter constraints (De Loecker et al., 2020), making them particularly inclined to focus on short-term survival rather than long-term environmental goals.

Second, transaction cost economics complements this view by focusing on asset specificity and interdependence in supply chains (Coase, 1937; Williamson,1979, 1985, 2010). When inputs are highly differentiated, suppliers must make relationship-specific investments that reduce flexibility and heighten the consequences of customer-side disruptions (Nunn, 2007; Hertzel et al., 2008; Barrot and Sauvagnat, 2016; Munir et al., 2020). This amplifies operational risks and raises coordination costs, prompting major customers to invest more heavily in control and monitoring. Under such conditions, resources are directed toward ensuring supply reliability, crowding out investments in biodiversity conservation. Thus, the level of input

differentiation critically shapes how major customer status translates into sustainability engagement.

Third, institutional theory adds a contextual dimension by highlighting the influence of social norms and expectations on firm behavior (Meyer and Rowan, 1977; DiMaggio and Powell, 1983; Oliver, 1991; Dorobantu et al., 2017). Firms embedded in regions with high levels of social capital face stronger institutional pressures to act responsibly (Laursen et al., 2012; Jha and Cox, 2015; Hoi et al., 2018; Hasan et al., 2022), such as protecting biodiversity. Conversely, in low-social capital regions, where external expectations are weaker, major customers encounter fewer incentives to offset their focus on operational stability. This makes biodiversity conservation less likely to be pursued.

Taken together, these perspectives suggest that while major customer status grants firms structural power, it simultaneously creates pressures to prioritize efficiency and stability, often at the expense of biodiversity initiatives. Accordingly, we hypothesize:

H1: *Firms with a major customer status are less likely to engage in biodiversity conservation initiatives than their peers.*

2.3 Hypotheses for the underlying mechanisms

The strength of the above relationship may vary depending on contextual factors. We expect the deprioritization of biodiversity conservation to intensify when major customers lack market power, when input differentiation heightens supply chain interdependence, or when institutional pressures from social capital are weak.

2.3.1 Moderating role of market power

Resource dependence theory emphasizes that firms' discretion is conditioned by their ability to manage external dependencies (Pfeffer and Salancik, 1978; Drees and Heugens, 2013). Firms with strong market power can buffer uncertainty, exert leverage over stakeholders,

and allocate resources to long-term goals such as biodiversity. By contrast, weaker firms lack pricing flexibility and bargaining leverage, leaving them more vulnerable to external shocks and more dependent on efficiency-focused strategies (Porter, 1980; Delmas and Toffel, 2008).

For major customers, low market power heightens these pressures: because suppliers depend heavily on them, instability at the customer level can cascade through the supply chain (De Loecker et al., 2020). With limited discretion, such firms prioritize operating stability, sidelining biodiversity initiatives that yield uncertain, long-term benefits. In contrast, firms with greater market power have the slack and confidence to pursue biodiversity without jeopardizing operations. Thus, we expect the negative relationship between major customer status and biodiversity conservation to be stronger among firms with lower market power.

H2a: *The negative association between major customer status and biodiversity conservation efforts is stronger for firms with lower market power.*

2.3.2 Moderating role of input differentiation

Transaction cost economics highlights how asset specificity and interdependence shape firms' governance choices (Williamson, 1979, 1985, 2010). When inputs are standardized and easily substitutable, switching costs and disruption risks are low, giving firms greater freedom to pursue discretionary initiatives. By contrast, highly differentiated inputs require relationship-specific investments, such as specialized machinery or training, which deepen dependency and amplify the costs of disruption (Hertzel et al., 2008; Barrot and Sauvagnat, 2016; Munir et al., 2020).

For major customers, reliance on differentiated inputs heightens vulnerability to upstream instability, as disruptions at the customer level can cascade through suppliers tightly tied to their survival. To mitigate these risks, firms prioritize operational safeguards over long-term

initiatives like biodiversity conservation. Thus, biodiversity engagement is particularly constrained in supply chains with high input specificity.

H2b: *The negative association between major customer status and biodiversity conservation efforts is stronger when firms rely on more differentiated intermediate inputs.*

2.3.3 Moderating role of regional social capital

Institutional theory emphasizes that firms' strategies are shaped by their broader social environments (DiMaggio and Powell, 1983; Dorobantu et al., 2017). In regions with high social capital, firms face stronger normative pressures to engage in socially responsible practices, making environmental commitments more legitimate (Jha and Cox, 2015; Hoi et al., 2018; Hasan et al., 2022). Conversely, in low-social capital regions, such pressures are weak, and the legitimacy benefits of biodiversity conservation are limited.

For major customers, whose operations already emphasize efficiency and stability, this context is decisive: in weak social capital environments, cost concerns dominate, while in strong social capital environments, community expectations push firms to sustain biodiversity engagement.

H2c: *The negative association between major customer status and biodiversity conservation efforts is stronger when firms operate in regions with a lower level of social capital.*

3. Research design

3.1 Data

This study examines U.S. publicly listed nonfinancial firms using a sample constructed from multiple data sources. First, biodiversity conservation performance ratings and environmental metrics are obtained from KLD for 2012-2019, the period during which KLD

systematically reports biodiversity-related data.[1] Second, information on firms' status as major customers is drawn from Compustat customer segment files. Additional firm-level characteristics used as control variables are also collected from Compustat. The final sample comprises 942 firm-year observations representing 367 unique firms. Table 1 reports the sample distribution by year (Panel A) and industry (Panel B).

[Insert Table 1 about here]

3.2 Measure for corporate biodiversity conservation efforts

We measure firms' biodiversity conservation efforts using ratings from KLD, a widely recognized ESG ratings agency that compiles data from corporate disclosures, financial filings, and media coverage. While KLD ratings have been extensively used in prior research (e.g., Ioannou and Serafeim, 2015; Albuquerque et al., 2019; Zhang, 2024), most studies rely on composite ESG scores, which mask variation in specific dimensions. One critical yet underexplored dimension is biodiversity conservation.

Since 2012, KLD has systematically reported biodiversity-related metrics within the *Biodiversity & Land Use* dimension of the Environment pillar. This dimension evaluates firms' biodiversity policies, land use practices, and community engagement. It assigns a binary "strength" indicator: one for firms demonstrating proactive initiatives to mitigate land or marine disturbance and enhance biodiversity conservation, and zero otherwise. We define our dependent variable, *Biodiversity Effort*, using this indicator. To our knowledge, this is among the first studies to employ this measure to capture corporate biodiversity conservation efforts.

This measure reflects firms' proactive engagement in conservation initiatives, rather than their passive ecological impacts. As an independent third-party agency, KLD mitigates

[1] The KLD database began reporting biodiversity-related ratings in 2012 and ceased updating after 2019; consequently, no more recent data are available.

concerns of information bias and window-dressing that often arise with self-reported data (Boiral, 2016). Moreover, KLD's standardized evaluation methodology enhances consistency and comparability of assessments across firms.

3.3 Measure for firms' status as major customers

We identify firms' status as major customers using data from the Compustat customer segment file. Under the Statements of Financial Accounting Standards (SFAS) No. 131 and No. 14, U.S. firms must disclose information on customers that account for more than 10% of total sales (Cen et al., 2017; Dong et al., 2021). Our primary measure is a binary indicator, *Major Customer*, coded one if a firm is reported as a major customer by at least one supplier, and zero otherwise. For robustness, we employ two alternative measures: (1) *Suppliers' Sales Proportion*, the average share of sales attributed to the focal major customer, and (2) *Number of Dependent Suppliers*, the count of suppliers identifying the firm as a major customer. Results remain consistent across these alternative measures.

3.4 Regression specification

We investigate the relationship between firms' status as major customers and their biodiversity conservation efforts using the following Logit regression model:

$$\Pr(Biodiversity\ Effort_{it} = 1) = \Lambda(\beta_1 Major\ Customer_{it} + \gamma X_{it} + \alpha_{ind} + \alpha_{year} + \varepsilon_{it}), \quad (1)$$

where Λ $(\cdot)$ denotes the logistic cumulative distribution function. The dependent variable, $Biodiversity\ Effort_{it}$, is a binary indicator for firms i' proactive biodiversity conservation efforts in year t. The key independent variable, $Major\ Customer_{it}$, indicates whether firm i is reported as a major customer by at least one of its suppliers in year t. We include industry fixed effects α_{ind} and year fixed effects α_{year} to account for time-invariant industry characteristics and time-varying macroeconomic conditions.

The control vector X_{it} captures firm characteristics that may affect biodiversity conservation efforts. *Profitability* and *Sales Growth* proxy for financial capacity and strategic orientation. *Firm Size* reflects operational scale and visibility, while *Financial Leverage* accounts for financing constraints. *Market-to-Book Ratio* captures growth opportunities and attractiveness to investors. *Asset Intangibility* and *Property, Plant, and Equipment* control for potential resource trade-offs, whereas *Cash Holdings* indicate financial flexibility. Finally, *Biodiversity Weakness*, based on the KLD "concern" indicator, captures existing vulnerabilities in biodiversity practices. Variable definitions are provided in Appendix A1. All continuous variables are winsorized at the 1% and 99% levels.

3.5 Summary statistics

Table 2 reports the summary statistics for the key variables. The dependent variable, *Biodiversity Effort*, has a mean of 0.063, indicating that only 6.3% of firms undertake proactive biodiversity conservation initiatives. This relatively low prevalence suggests that biodiversity-related practices remain outside the mainstream, consistent with prior evidence (e.g., Boiral and Heras-Saizarbitoria, 2017; Roberts et al., 2022). The mean value of *Major Customer* is 0.157, implying that 15.7% of firms are identified as major customers by their suppliers. The control variables exhibit distributions comparable to those documented in prior studies.

[Insert Table 2 about here]

Table 3 presents the Pearson correlation matrix. Most correlation coefficients are moderate, with the strongest observed between *Major Customer* and *Firm Size* ($r = 0.543$). To further assess multicollinearity, we report variance inflation factors (VIFs) and the condition number in the main analysis in Table 4. All values fall within conventional thresholds, indicating that multicollinearity does not materially affect our regression estimates.

[Insert Table 3 about here]

4. Main results

Table 4 presents the main regression results. In Column 1, the coefficient for *Major Customer* is negative and statistically significant (−1.065, $p < 0.05$). Column 2 further incorporates *Biodiversity Weakness* as an additional control variable. The coefficient for *Major Customer* remains stable at −1.066 and continues to be significant at the 5% level. These findings provide robust support for hypothesis H1, suggesting that firms identified as major customers engage less in biodiversity initiatives.

[Insert Table 4 about here]

The coefficient estimate for *Major Customer* is also economically meaningful. Specifically, the coefficient of −1.066 corresponds to an odds ratio of 0.344 (computed as $e^{-1.066}$), indicating a 65.6% reduction in the odds of engaging in biodiversity conservation efforts (i.e., 1 − 0.344 = 0.656). In terms of probability, this translates to a 1.74% to 5.24% decrease in the likelihood of engaging in conservation initiatives, depending on the baseline rate.[2] Given that the average proportion of firms demonstrating biodiversity efforts is only 6.3%, this effect is substantial.

Among control variables, *Firm Size* exhibits a significantly positive coefficient, consistent with prior research suggesting that larger firms are more likely to adopt biodiversity practices due to their greater capacity and stakeholder pressures (Lähtinen et al., 2016; Carvalho et al., 2022). This stands in sharp contrast to the negative effect observed for *Major Customer*. Additionally, the coefficient for *Asset Intangibility* is significantly negative, suggesting that investment in intangible assets may divert resources away from biodiversity conservation.

To assess potential multicollinearity, we examine VIFs and condition numbers. The average VIFs in Columns 1 and 2 are 1.96 and 1.98, respectively, which are well below the

[2] Specifically, the marginal effect at the means is 1.74%, while the average marginal effect is 5.24%.

conventional threshold of 10. The condition numbers are 13.28 and 13.50, also below the threshold of 30. These diagnostics indicate that multicollinearity is not a major concern in our model.

5. Robustness tests

5.1 The matched samples

To enhance comparability between treatment firms (*Major Customer* = 1) and control firms (*Major Customer* = 0), we employ two matching techniques: propensity score matching (PSM) and entropy balancing (EB).

We first implement PSM by estimating the propensity of being classified as a major customer using all control variables from Equation (1) and industry fixed effects, following Shipman et al. (2017). We conduct one-to-one nearest-neighbor matching without replacement, applying a caliper of 0.1, which yields 81 matched pairs. As reported in Panel A of Appendix A2, PSM substantially improves covariate balance between treatment and control groups.

As an alternative, we apply EB to reweight the control sample. EB assigns non-negative weights to control observations such that the weighted covariate distribution matches that of the treatment group (Hainmueller, 2012; McMullin and Schonberger, 2022). Panel B of Appendix A2 shows that covariate means are nearly identical across the treatment and weighted control groups.

Table 5 presents the results. Column 1 reports estimates based on the PSM-matched sample, with the coefficient on *Major Customer* equal to −2.004, significant at the 5% level. Column 2 reports results using the EB-weighted sample, yielding a coefficient of −1.533, also significant at the 5% level. Collectively, the findings indicate that our results are robust across both matching procedures.

[Insert Table 5 about here]

5.2 Alternative model specifications

We implement two alternative model specifications. First, we re-estimate the model using a restricted sample from 2015-2019 to address a minor change in the KLD definition of biodiversity conservation efforts. Beginning in 2015, the category previously labeled "*Natural Resource Use - Biodiversity & Land Use*" was revised to "*Natural Capital - Biodiversity & Land Use*", with expanded evaluation criteria. As reported in Column 1 of Table 6, the coefficient on *Major Customer* is −1.750 and statistically significant at the 1% level, reinforcing the robustness of our main results.

Second, we augment the specification by including *Emissions and Waste Weakness* as an additional control variable. This binary indicator, drawn from KLD, captures whether a firm exhibits weaknesses in managing toxic emissions and waste. This variable accounts for broader dimensions of environmental performance that may correlate with biodiversity efforts. As shown in Column 2 of Table 6, the coefficient on *Major Customer* is −1.066 and remains statistically significant at the 5% level, consistent with the baseline findings.

[Insert Table 6 about here]

5.3 Alternative independent variables

To more comprehensively capture a firm's status as a major customer, we construct two alternative measures: (1) *Suppliers' Sales Proportion*, defined as the proportion of a supplier's total sales attributable to the focal firm, and (2) *Number of Dependent Suppliers*, defined as the count of suppliers that identify the focal firm as a major customer. Higher values of either measure indicate greater supplier dependence.

As reported in Table 2, *Suppliers' Sales Proportion* has a mean of 0.032 and a maximum of 0.760, implying that, on average, sales to focal firms account for 3.2% of suppliers' revenue,

with the highest case reaching 76%.[3] Similarly, *Number of Dependent Suppliers* has a mean of 0.521 and a maximum of 18, indicating that focal firms are, on average, identified as major customers by roughly half a supplier, with one firm reported as a major customer by as many as 18 suppliers.

Table 7 presents the regression results based on these alternative measures. Both yield significantly negative coefficients: −3.873 for *Suppliers' Sales Proportion* (5% significance) and −0.104 for *Number of Dependent Suppliers* (10% significance). These results further corroborate our main findings.

[Insert Table 7 about here]

6. Mechanisms analysis

In this section, we explore the underlying mechanisms through cross-sectional analyses. Specifically, we examine the moderating roles of (i) firms' market power, (ii) input differentiation, and (iii) regional social capital. Together, these analyses illustrate how major customers' biodiversity conservation efforts are conditioned by the combined insights of resource dependence theory, transaction cost economics, and institutional theory.

6.1 The moderating role of firms' market power

Hypothesis H2a predicts that firms with major customer status are less likely to engage in biodiversity when they lack sufficient market power. Grounded in resource dependence theory, limited market power heightens resource constraints, thereby reducing firms' capacity to invest in biodiversity conservation that typically lacks immediate operational returns (Krause et al., 2021; Starks, 2023).

[3] For firms not identified as major customers in the Compustat segment files, information on suppliers' sales proportions to the focal firm is unavailable; in such cases, we assign a value of zero. We acknowledge, however, that this approach may introduce measurement bias.

We proxy market power using profit margin, with higher margins indicating greater market power. Firms are classified into high- and low-market power groups based on whether their profit margin is above or below the sample median. Table 8 reports the results. Columns 1 and 2 correspond to the high- and low-market power subsamples, respectively. In the high-market power subsample (Column 1), the coefficient on *Major Customer* is −0.846 and statistically insignificant. By contrast, in the low-market power subsample (Column 2), the coefficient is −2.090 and significant at the 1% level. A one-tailed Wald test further confirms that the coefficient in Column 2 is significantly more negative than that in Column 1 at the 5% level. Overall, these results support the resource dependence theory prediction that major customers with lower market power are more likely to deprioritize biodiversity conservation.

[Insert Table 8 about here]

6.2 The moderating role of input differentiation

Hypothesis H2b predicts that major customers are less likely to engage in biodiversity initiatives when their inputs are highly differentiated to suppliers, as operational risks are more likely to propagate along the supply chain. From a transaction cost perspective, input differentiation increases asset specificity and interdependence, heightening the risk of disruption (Barrot and Sauvagnat, 2016; Munir et al., 2020). To mitigate these risks, major customers may emphasize control and stability over discretionary initiatives such as biodiversity conservation, thereby narrowing the scope of their sustainability commitments.

To measure input differentiation, we follow Nunn (2007), classifying inputs traded on organized exchanges as generalized rather than differentiated. Because firms typically rely on a mix of inputs, we combine industry-level input-output structures from the U.S. Bureau of Economic Analysis (BEA) with information on input differentiation to calculate firm-level measures.

We then conduct cross-sectional analyses by splitting the sample at the median value of input differentiation. Table 9 reports the results. Columns 1 and 2 correspond to subsamples with low and high input differentiation, respectively. In the low-input differentiation subsample (Column 1), the coefficient on *Major Customer* is −0.635 and statistically insignificant. By contrast, in the high-input differentiation subsample (Column 2), the coefficient is −3.371 and significant at the 5% level. A one-tailed Wald test further confirms that the coefficient in Column 2 is significantly more negative than that in Column 1. Overall, these findings support the prediction of transaction cost economics and suggest that major customers relying on highly differentiated inputs are less likely to engage in biodiversity conservation.

[Insert Table 9 about here]

6.3 The moderating role of regional social capital

Hypothesis H2c predicts that firms with major customer status are less likely to engage in biodiversity initiatives when regional social capital is low. Institutional theory posits that firms face pressures to conform to prevailing social norms (Meyer and Rowan, 1977; Oliver, 1991; Dorobantu et al., 2017), such as expectations to generate positive social externalities, with biodiversity conservation serving as a salient example. When regional social capital is weak, these conformity pressures diminish, reducing firms' incentives to prioritize biodiversity.

We measure regional social capital using a county-level index, following prior research (e.g., Rupasingha et al., 2006; Hoi et al., 2018). This index aggregates presidential election voting rates, census response rates, and the density of NGOs and social organizations, where higher values across these metrics signify a greater level of social capital.

Table 10 presents the cross-sectional analysis. Columns 1 and 2 report estimates for subsamples with high and low levels of social capital, respectively. Results indicate that firms with major customer status are significantly less likely to engage in biodiversity initiatives

when social capital is low (Column 2; coefficient = -2.228, $p < 0.01$). In contrast, this effect is not significant in regions with high social capital (Column 1). Furthermore, the coefficient in Column 2 is significantly lower than that in Column 1 ($p < 0.05$). Taken together, these findings support the prediction of institutional theory and suggest that regional institutional environments can further constrain firms' limited investments in biodiversity conservation.

[Insert Table 10 about here]

7. Conclusions and discussions

7.1 Conclusions

Using a large panel of U.S. public firms from 2012 to 2019, this study examines how a firm's status as a major customer constrains its engagement in biodiversity conservation. We find that firms occupying a major customer position are less likely to prioritize biodiversity initiatives. Cross-sectional analyses further show that this tendency is amplified under three conditions: when firms face higher operational risk (proxied by lower market power), when risks are more likely to propagate to suppliers (proxied by input differentiation), and when firms experience weaker normative pressure (proxied by regional social capital). Taken together, these results suggest that firms holding major customer status tend to prioritize short-term operational stability over long-term biodiversity commitments, highlighting the strategic trade-offs embedded in buyer-supplier relationships.

7.2 Theoretical implications

Existing studies emphasize biodiversity engagement primarily as a response to regulatory requirements (Kedward et al., 2023; zu Ermgassen et al., 2025), reputation management (Smith et al., 2019; White et al., 2023), or operational needs (Panwar et al., 2022; Carvalho et al., 2023). Our findings identify a neglected mechanism: the structural position of firms in buyer-

supplier relationships. Specifically, we show that being a major customer systematically constrains biodiversity engagement, suggesting that market power and interdependence are central determinants of biodiversity behavior. In doing so, we extend the research agenda beyond traditional institutional or reputational logics and call for closer attention to how product-market structures shape biodiversity strategies.

In addition, our study also advances this field of biodiversity by providing comprehensive empirical evidence. Prior research largely relies on conceptual discussions, qualitative studies, or case analyses (Thompson, 2019; Nedopil, 2023; zu Ermgassen et al., 2025; Flammer et al., 2025; Liu et al., 2025). These approaches provide valuable depth but lack generalizability. To address this gap, our study employs a large-scale dataset of biodiversity conservation ratings from an independent third-party provider, thereby offering systematic evidence that complements earlier qualitative work. This methodological contribution demonstrates the feasibility of scalable biodiversity measurement and lays the groundwork for linking firm-level indicators to ecological impact metrics (Roberts et al., 2022). Such integration is crucial for evaluating the actual influence of corporate actions on biodiversity protection within planetary boundaries.

Finally, our analysis shows that the negative association between major customer status and biodiversity is not uniform but contingent on market power, input differentiation, and regional social capital. This finding aligns with prior research indicating that firms' strategies are jointly shaped by transactional dependencies (Nunn, 2007; Munir et al., 2020) and institutional pressures (Jha and Cox, 2015; Hasan et al., 2022). By identifying these moderating factors, our study contributes to a more nuanced understanding of how supply chain governance interacts with local institutional contexts to influence biodiversity outcomes.

7.3 Managerial implications

Our findings suggest that when firms act as major customers, they tend to prioritize operational stability and continuity over biodiversity efforts. From a profit maximization perspective, this focus on operational stability is understandable; however, managers should recognize that neglecting biodiversity initiatives may create long-term challenge, particularly in sectors dependent on natural capital. Integrating biodiversity into corporate strategies can therefore help firms reconcile short-term efficiency with long-term resilience.

Importantly, the extent to which firms adopt such forward-looking strategies depends on their market power. Our results show that firms with greater market power enjoy more strategic discretion to engage in biodiversity conservation. Managers in stronger positions can leverage this advantage not only to secure resources but also to shape supplier practices by embedding biodiversity requirements into procurement standards, certification programs, or long-term contracts. In this way, power asymmetries can be transformed from sources of vulnerability into positive drivers of sustainability.

The nature of inputs further conditions this dynamic. When inputs are highly specific or customized, operational risks are more likely to cascade across the supply chain, making biodiversity initiatives appear secondary. Yet managers should instead view biodiversity loss as a direct operational risk, particularly in ecosystems that underpin supply availability. Building collaborative governance mechanisms around sustainable sourcing and industry-wide sustainability standards can reduce long-term vulnerabilities while also mitigating the transaction costs associated with disruptions.

Finally, the institutional environment shapes how biodiversity commitments are perceived and rewarded. Firms operating in regions with weaker civic engagement or limited institutional pressure may face less immediate demand for conservation, but this absence may heighten reputational and regulatory risks over time. To preempt such risks, managers should

proactively align with global biodiversity frameworks (e.g., the Kunming-Montreal Global Biodiversity Framework, EU CSRD), thereby strengthening legitimacy and resilience.

7.4 Limitation and future research

This study has several limitations, which also open promising avenues for future research. First, although our measure of biodiversity conservation initiative is reliable, it is coded as a binary variable. While this approach ensures consistency across a large sample, it may not fully capture the scope of biodiversity practices. Future research can build on this foundation by employing richer datasets, such as continuous measures or multidimensional indices, allowing for a more nuanced analysis of corporate biodiversity engagement.

Second, our empirical setting focuses on U.S. public firms. This context provides a clear and well-regulated environment to test our hypotheses, but it may not fully reflect conditions in other institutional settings or among small and medium-sized enterprises. Extending the analysis to other countries, especially those with different regulatory regimes or biodiversity dependencies, could broaden our understanding of how institutional environments shape corporate biodiversity initiatives.

Finally, our research design emphasizes association rather than causality. While the integrated framework of resource dependence, transaction cost economics, and institutional theory offers strong theoretical grounding, future work could adopt causal designs, such as natural experiments, to test the robustness and the mechanisms we propose.

Taken together, our study provides an important starting point and a research agenda for advancing the understanding of how firms can balance operational priorities with biodiversity conservation within planetary boundaries.

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Table 1. Sample distribution

Panel A: Sample distribution across years		
	# of firms	Percentage (%)
2012	250	26.54
2013	104	11.04
2014	98	10.40
2015	99	10.51
2016	92	9.77
2017	85	9.02
2018	131	13.91
2019	83	8.81
Total	942	100

Panel B: Sample distribution across industries		
	# of firms	Percentage (%)
Consumer Nondurables	56	5.94
Consumer Durables	9	0.96
Manufacturing	126	13.38
Oil, Gas, and Coal Extraction and Products	406	43.10
Chemicals and Allied Products	6	0.64
Business Equipment	46	4.88
Telephone and Television Transmission	13	1.38
Wholesale, Retail, and Selected Services	48	5.10
Healthcare, Medical Equipment, and Pharmaceuticals	36	3.82
Other	196	20.81
Total	942	100

The industries in Panel B are categorized in accordance with the Fama-French 12-industry classification system, with the utilities and finance sectors excluded from the analysis.

Table 2. Summary statistics

	N	Mean	SD	Min	P25	Median	P75	Max
Dependent variable								
Biodiversity Effort	942	0.063	0.242	0.000	0.000	0.000	0.000	1.000
Main independent variable								
Major Customer	942	0.157	0.364	0.000	0.000	0.000	0.000	1.000
Alternative independent variables								
Suppliers' Sales Proportion	942	0.032	0.084	0.000	0.000	0.000	0.000	0.760
Number of Dependent Suppliers	942	0.521	1.874	0.000	0.000	0.000	0.000	18.000
Control variables								
Profitability	942	0.019	0.152	-0.576	-0.344	0.037	0.101	0.358
Financial Leverage	942	0.255	0.192	0.000	0.113	0.239	0.355	0.915
Firm Size	942	7.711	1.893	3.636	6.426	7.636	8.990	12.491
Sales Growth	942	0.160	0.583	-0.569	-0.083	0.050	0.211	3.737
Market to Book Ratio	942	2.137	3.165	-11.187	1.047	1.636	2.603	18.715
Asset Intangibility	942	0.107	0.171	0.000	0.000	0.020	0.143	0.803
Property, Plant and Equipment	942	0.581	0.381	0.012	0.281	0.569	0.817	1.875
Cash Holding	942	0.121	0.154	0.000	0.028	0.075	0.142	0.891
Biodiversity Weakness	942	0.024	0.154	0.000	0.000	0.000	0.000	1.000
Emissions and Waste Weakness	942	0.137	0.344	0.000	0.000	0.000	0.000	1.000
Moderating factors								
Market Power	939	0.028	0.051	-0.069	0.029	0.033	0.060	0.088
Input Differentiation	699	0.842	0.142	0.146	0.831	0.831	0.942	0.999
Social Capital	929	-0.770	0.751	-2.418	-1.485	-0.681	-0.244	3.906

This table reports summary statistics for the key variables over the sample period 2012-2019. Continuous variables are winsorized at the 1st and 99th percentiles. Variable definitions appear in Appendix A1.

Table 3. Pearson correlation matrix

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)
Major Customer (i)	1									
Profitability (ii)	0.026	1								
Financial Leverage (iii)	0.056	-0.096	1							
Firm Size (iv)	0.543	0.093	0.263	1						
Sales Growth (v)	-0.061	0.098	0.026	-0.150	1					
Market to Book Ratio (vi)	-0.090	-0.056	-0.101	-0.147	-0.034	1				
Asset Intangibility (vii)	-0.107	0.109	0.111	-0.086	0.005	0.129	1			
Property, Plant and Equipment (viii)	0.160	0.093	0.228	0.264	0.293	-0.125	-0.433	1		
Cash Holding (ix)	-0.154	-0.092	-0.255	-0.443	0.112	0.137	-0.001	-0.354	1	
Biodiversity Weakness (x)	0.234	0.048	-0.05	0.255	-0.068	-0.025	-0.089	0.042	-0.060	1

Table 4. Main results

Dependent variable	*Biodiversity Effort*	
	(1)	(2)
Major Customer	**-1.065****	**-1.066****
	(-2.49)	(-2.48)
Profitability	0.981	0.974
	(0.55)	(0.55)
Financial Leverage	-1.264	-1.257
	(-0.89)	(-0.88)
Firm Size	1.510***	1.507***
	(6.38)	(6.05)
Sales Growth	-0.078	-0.079
	(-0.14)	(-0.14)
Market to Book Ratio	0.084	0.084
	(1.52)	(1.49)
Asset Intangibility	-5.035**	-5.015**
	(-2.33)	(-2.34)
Property, Plant and Equipment	-0.878	-0.876
	(-1.15)	(-1.15)
Cash Holding	2.091	2.111
	(1.06)	(1.06)
Biodiversity Weakness		0.046
		(0.06)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	942	942
Log likelihood	-112.417	-112.416
Average VIFs	1.98	1.96
Condition number	13.28	13.50

This table reports logistic estimates of the relation between firms' status as a major customer and their biodiversity conservation efforts. The sample comprises 942 firm-year observations in 2012-2019. The dependent variable, *Biodiversity Effort*, is an indicator equal to one if KLD records a positive rating for biodiversity conservation efforts, and zero otherwise. The main explanatory variable, *Major Customer*, is an indicator equal to one if the firm is identified as a major customer in Compustat customer segment files. Column (1) includes baseline controls, while Column (2) additionally controls for *Biodiversity Weakness*. Variable definitions are provided in Appendix A1. To assess multicollinearity, average VIFs and condition numbers are reported. Standard errors are clustered at the firm level, and t-statistics are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Robustness test: The matched samples

	Propensity Score Matching (1)	Entropy Balancing (2)
Major Customer	**-2.004****	**-1.533****
	(-2.02)	(-2.18)
Profitability	-10.711	-8.028*
	(-1.34)	(-1.70)
Financial Leverage	-9.235**	-9.570**
	(-2.11)	(-2.02)
Firm Size	2.124	4.080***
	(1.50)	(4.34)
Sales Growth	0.928	-2.820
	(0.56)	(-1.59)
Market to Book Ratio	-0.052	-0.009
	(-0.21)	(-0.04)
Asset Intangibility	-10.089**	-8.211***
	(-2.00)	(-2.63)
Property, Plant and Equipment	-4.848	0.849
	(-1.21)	(0.67)
Cash Holding	12.819***	16.233***
	(2.61)	(2.80)
Biodiversity Weakness	-7.016**	-4.311***
	(-2.42)	(-2.75)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	162	942
Log likelihood	-19.861	-65.314

This table presents robustness tests based on the matched sample. Columns 1 and 2 use propensity score matching and entropy balancing methods, respectively. T-statistics are reported in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Robustness test: Alternative model specifications

	Alternative sample period 2015-2019 (1)	Adding additional control variable (2)
Major Customer	**-1.750*** **	**-1.066** **
	(-2.98)	(-2.48)
Profitability	0.458	0.993
	(0.21)	(0.57)
Financial Leverage	-2.691	-1.255
	(-1.63)	(-0.87)
Firm Size	1.535***	1.516***
	(5.34)	(5.35)
Sales Growth	0.553	-0.082
	(1.44)	(-0.15)
Market to Book Ratio	0.097	0.085
	(1.31)	(1.47)
Asset Intangibility	-6.410***	-5.060**
	(-3.44)	(-2.26)
Property, Plant and Equipment	-1.230	-0.878
	(-1.49)	(-1.15)
Cash Holding	5.285**	2.096
	(2.17)	(1.05)
Biodiversity Weakness	-0.086	0.041
	(-0.06)	(0.05)
Emissions and Waste Weakness		-0.048
		(-0.10)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	490	942
Log likelihood	-79.143	-112.411

This table reports robustness tests using alternative model specifications. Column 1 examines the alternative sample period of 2015-2019 to account for minor adjustment in KLD's definition for firms' biodiversity conservation efforts. Column 2 includes firms' ratings of *Emissions and Waste Weakness* as an additional control variable. T-statistics are reported in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 7. Robustness test: Alternative independent variables

	(1)	(2)
Suppliers' Sales Proportion	**-3.873****	
	(-1.98)	
Number of Dependent Suppliers		**-0.104***
		(-1.64)
Profitability	1.148	1.772
	(0.65)	(0.97)
Financial Leverage	-1.282	-1.606
	(-0.87)	(-0.99)
Firm Size	1.453***	1.425***
	(5.96)	(5.44)
Sales Growth	-0.108	-0.164
	(-0.19)	(-0.26)
Market to Book Ratio	0.077	0.070
	(1.36)	(1.38)
Asset Intangibility	-5.042**	-5.028**
	(-2.32)	(-2.28)
Property, Plant and Equipment	-0.879	-0.876
	(-1.15)	(-1.12)
Cash Holding	1.959	1.407
	(1.00)	(0.70)
Biodiversity Weakness	0.087	0.171
	(0.11)	(0.23)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	942	942
Log likelihood	-113.367	-113.873

This table presents the results of robustness tests using alternative independent variables. Column 1 examines *Suppliers' Sales Proportion*, defined as the share of suppliers' sales attributed to a specific focal customer. Column 2 considers *Number of Dependent Suppliers*, which represents the total number of suppliers that depend on the focal firm as a major customer. T-statistics are reported in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 8. Cross-sectional test: The role of firms' market power

Moderating factor	*Market Power*	
	High	Low
	(1)	(2)
Major Customer	**-0.846**	**-2.090*** **
	(-1.51)	(-2.72)
Profitability	0.810	0.760
	(0.13)	(0.30)
Financial Leverage	-0.976	-3.090
	(-0.50)	(-1.21)
Firm Size	1.297***	2.179***
	(3.85)	(3.68)
Sales Growth	-2.013*	1.400**
	(-1.86)	(2.38)
Market to Book Ratio	0.060	0.361***
	(0.87)	(2.74)
Asset Intangibility	-3.872	-7.638***
	(-1.32)	(-2.66)
Property, Plant and Equipment	-0.491	-1.023
	(-0.34)	(-1.01)
Cash Holding	-1.625	8.593***
	(-0.46)	(2.72)
Biodiversity Concern	0.154	-0.728
	(0.15)	(-0.50)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	467	472
Log likelihood	-63.046	-40.911
Difference in coefficients of *Major Customer*	-1.244** (-1.70)	

This table investigates the underlying mechanism by examining the role of firms' *Market Power*, measured by profit margins. Higher profit margins indicate greater market power. Column (1) reports results for the high-*Market Power* subsample, while Column (2) reports results for the low-*Market Power* subsample. T-statistics are in brackets. Differences in the coefficients of *Major Customer* across subsamples are tested using a one-tailed Wald test. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 9. Cross-sectional test: The role of input differentiation

Moderating factor	*Input Differentiation*	
	Low	High
	(1)	(2)
Major Customer	**-0.635**	**-3.371****
	(-1.01)	(-2.04)
Profitability	1.122	10.235
	(0.51)	(1.51)
Financial Leverage	1.998	-5.054*
	(0.79)	(-1.72)
Firm Size	1.968***	2.114***
	(3.90)	(3.49)
Sales Growth	-0.835	-0.256
	(-0.59)	(-0.14)
Market to Book Ratio	0.125	-0.368
	(1.25)	(-0.88)
Asset Intangibility	-11.131	-16.727***
	(-1.47)	(-3.10)
Property, Plant and Equipment	-0.380	-8.251**
	(-0.33)	(-2.48)
Cash Holding	0.958	5.315
	(0.28)	(1.01)
Biodiversity Weakness	-0.910	2.413
	(-0.86)	(1.43)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	350	349
Log likelihood	-52.186	-20.144
Difference in coefficients of *Major Customer*	-2.736*** (-2.34)	

This table investigates the underlying mechanisms by analyzing the role of *Input Differentiation*, which is measured as the fraction of inputs not traded on exchanges. Inputs sold on exchanges are considered less differentiated. Columns (1) and (2) report results for the low- and high-*Input Differentiation* subsamples, respectively. T-statistics are in brackets. Differences in the coefficients of *Major Customer* across subsamples are tested using a one-tailed Wald test. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Table 10. Cross-sectional test: The role of regional social capital

Moderating factor	*Social Capital*	
	High	Low
	(1)	(2)
Major Customer	**-1.140**	**-2.228*** **
	(-1.50)	(-3.59)
Profitability	5.078	-5.967*
	(1.53)	(-1.89)
Financial Leverage	0.120	-3.631
	(0.06)	(-1.00)
Firm Size	1.397***	2.573***
	(3.89)	(3.92)
Sales Growth	-1.900*	0.057
	(-1.87)	(0.09)
Market to Book Ratio	0.073	0.072
	(1.00)	(0.47)
Asset Intangibility	-3.928	-7.257***
	(-0.90)	(-3.21)
Property, Plant and Equipment	0.236	-1.136
	(0.18)	(-1.10)
Cash Holding	3.687	6.832*
	(1.14)	(1.76)
Biodiversity Concern	-1.668	1.825
	(-0.86)	(1.58)
Industry fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	468	461
Log likelihood	-48.966	-40.188
Difference in coefficients of *Major Customer*	-1.088** (-1.96)	

This table examines the underlying mechanism by analyzing the role of regional *Social Capital*, which is measured by the county-level social capital index constructed from the presidential election voting rate, census response rate, and the density of NGOs and social organizations. Columns (1) and (2) report results for the high- and low-*Social Capital* subsamples, respectively. T-statistics are in brackets**.** Differences in the coefficients of *Major Customer* across subsamples are tested using a one-tailed Wald test. ***, **, and * denote significance at the 1%, 5%, and 10% levels.

Appendix A1. Variable definition

Variable	Definition	Source
Dependent variable		
Biodiversity Effort	Indicator variable equal to one if a firm is rated as making efforts in biodiversity conservation, and zero otherwise.	KLD
Main independent variable		
Major Customer	Indicator variable equal to one if a firm is reported by its suppliers as a major customer in the Compustat customer segment file.	Compustat
Alternative independent variables		
Suppliers' Sales Proportion	Percentage of sales made by suppliers to the focal customer relative to the supplier's total sales.	Compustat
Number of Dependent Suppliers	Count of suppliers that report the focal firm as a major customer.	Compustat
Control variables		
Profitability	Net income divided by the beginning balance of total assets.	Compustat
Financial Leverage	Long-term debt divided by total assets.	Compustat
Firm Size	Natural logarithm of the beginning balance of total assets.	Compustat
Sales Growth	Growth rate of sales relative the previous year.	Compustat
Market to Book Ratio	Market value of equity divided by book value of equity	Compustat
Asset Intangibility	Intangible assets divided by the beginning balance of total assets.	Compustat
Property, Plant and Equipment	Property, plants, and equipment divided by the beginning balance of total assets.	Compustat
Cash Holding	Cash and cash equivalent divided by the beginning balance of total assets.	Compustat
Biodiversity Weakness	Indicator variable equal to one if a firm is rated as having weaknesses in biodiversity conservation, and zero otherwise.	KLD
Emissions and Waste Weakness	Indicator variable equal to one if a firm is rated as having weaknesses in toxic emissions and waste management, and zero otherwise.	KLD
Moderating factors		
Market Power	Profit margin, measured as income before extraordinary items divided by sales revenue.	Compustat
Input Differentiation	Percentage of a firm's inputs that are differentiated and not traded on organized exchanges.	BEA; Nunn (2007)
Social Capital	County-level index constructed based on presidential election voting rate, census response rate, and the density of NGOs and social organizations.	NERCRD

Appendix A2. Assessing the matching quality

Panel A. Propensity Score Matching			
	Treatment (*Major Customer*=1) N=81	Control (*Major Customer*=0) N=81	Difference (p-value)
Profitability	0.022	0.005	-0.017 (0.45)
Financial Leverage	0.337	0.340	0.003 (0.93)
Firm Size	9.192	9.199	0.007 (0.97)
Sales Growth	0.154	0.216	0.062 (0.54)
Market to Book Ratio	1.036	1.342	0.306 (0.63)
Asset Intangibility	0.071	0.077	0.006 (0.79)
Property, Plant and Equipment	0.762	0.764	0.002 (0.97)
Cash Holding	0.075	0.069	-0.006 (0.62)
Biodiversity Weakness	0.049	0.049	0.000 (1.00)

Panel B. Entropy Balancing			
	Treatment (*Major Customer*=1) N=148	Control (*Major Customer*=0) N=794	Difference
Profitability	0.028	0.028	0.000
Financial Leverage	0.279	0.279	0.000
Firm Size	10.09	10.09	0.000
Sales Growth	0.079	0.079	0.000
Market to Book Ratio	1.477	1.478	-0.001
Asset Intangibility	0.065	0.065	0.000
Property, Plant and Equipment	0.721	0.722	-0.001
Cash Holding	0.067	0.066	0.001
Biodiversity Weakness	0.108	0.107	0.001

This table evaluates the quality of matched samples. Panels A and B report and compare covariate means for samples obtained using propensity score matching and entropy balancing, respectively.