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How Does Downstream Customer SRDI "Little Giant" Certification Drive Supply Chain Diversification Among Upstream Suppliers? Evidence from China

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Highlights

Please indicate how your work links to systems science via your contributions to systems practice, theory, and/or methodology.

- This study adopts a supply chain systems perspective to examine how a firm-targeted industrial policy intervention propagates across interdependent customer–supplier relationships, linking downstream certification with strategic reconfiguration by connected upstream suppliers.
- It develops an interfirm transmission framework that connects policy-induced changes in downstream firms, relational spillovers through supply chain linkages, and upstream suppliers' diversification responses, while distinguishing external reputation effects from internal operational buffering adjustments.

What are the main findings and/or the implications of the main findings?

- SRDI certification of downstream customers is associated with significantly greater supply chain diversification among upstream suppliers, with the association more evident in procurement relationships and stronger among suppliers with pre-certification overinvestment and larger market shares.
- The results provide suggestive evidence consistent with reputation-related and operating-resource adjustment channels, suggesting that firm-targeted industrial policy may influence both external transaction conditions and internal resource-allocation responses across supply chain networks.

Abstract

Growing uncertainty in the external environment has heightened concerns about supply chain security and resilience. Existing studies mainly examine the effects of China's Specialized, Refined, Distinctive, and Innovative (SRDI) "Little Giant" certification on certified firms themselves, while its implications for the supply chain configuration of connected firms remain less understood. Using the staggered timing of certification, this study uses customer–supplier relationship data from Chinese listed firms over the period 2012–2025 and employs a staggered difference-in-differences model to examine whether downstream customer certification is associated with changes in supply chain diversification among upstream suppliers. The results show that "Little Giant" certification significantly reduces the concentration of upstream suppliers' major trading relationships, leading to a more dispersed distribution of transaction shares across major partners. This finding remains stable across a range of alternative specifications, while an interaction-weighted event-study analysis provides complementary evidence on heterogeneous treatment timing and dynamic patterns. The mechanism analysis provides suggestive evidence consistent with

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a reputation-related channel and operating-resource adjustment: certified customers are associated with greater positive media exposure for their suppliers and higher operating working capital investment, while changes in current assets provide complementary evidence of operating-resource adjustment. Further analysis indicates that the estimated association is more evident in procurement relationships than in sales relationships, although the difference between the two estimates is not statistically significant. The estimated association also tends to be stronger among suppliers that exhibited overinvestment before certification and those with larger pre-certification market shares. These findings extend research on the economic consequences of SRDI certification from certified firms to their supply chain partners and suggest that firm-targeted industrial policy may be associated with cross-firm adjustments in major trading relationships through existing customer–supplier linkages.

Keywords: national-level SRDI "Little Giant" certification; supply chain diversification; upstream suppliers; small- and medium-sized enterprises (SMEs); customer–supplier relationships; industrial policy spillovers; staggered difference-in-differences

1. Introduction

Global supply chains are increasingly exposed to disruptions arising from the restructuring of production networks, intensifying geopolitical tensions, trade policy uncertainty, and other forms of external instability. Because firms are embedded in interdependent supplier–customer networks, disruptions affecting one firm can propagate through transactional relationships and threaten the stability of the wider supply chain system. To maintain transaction stability and secure access to critical resources, firms often establish long-term relationships with a limited number of key suppliers or customers.

Although concentrated supply chain relationships may generate coordination and transaction-efficiency benefits, excessive reliance on a limited number of trading partners can increase power imbalances and expose firms to greater relationship-specific and disruption risks [1–4]. Existing studies show that supply chain dependence can weaken firms' ability to respond to external shocks and amplify risk transmission across supply chain networks, thereby undermining overall supply chain stability [1,5]. Supply chain diversification has therefore emerged as an important strategy for reducing excessive dependence, broadening access to external resources, and enhancing firms' capacity to withstand supply chain disruptions. Within the SME sector, supply chain risk and resilience have also become important themes in the international literature. Existing research shows that SMEs' responses to supply chain disruptions are shaped by firm capabilities, interfirm collaboration, supplier relationships, risk-management practices, and external support. Cross-country evidence further suggests that SME risk exposure and resilience-related outcomes vary with the surrounding business and institutional environment. These studies provide an important international context for understanding how policy support and supply chain relationships may jointly shape firms' responses to external uncertainty [6–9].

Against this background, China's policy for cultivating Specialized, Refined, Distinctive, and Innovative (SRDI) enterprises provides an important institutional setting for examining whether industrial policy can influence supply chain configuration beyond directly supported firms. National-level SRDI "Little Giant" enterprises are high-quality small- and medium-sized enterprises (SMEs) characterized by sustained specialization in niche markets, strong innovation capabilities, and substantial growth potential. China has progressively established a tiered cultivation system for SRDI enterprises, under which

national-level "Little Giant" certification has become an important policy instrument for promoting high-quality SME development. As of 2026, more than 17,600 national-level SRDI "Little Giant" enterprises had been cultivated. As key nodes in industrial and supply chains, these firms may affect not only their own development but also the operational and strategic decisions of connected suppliers and customers. Existing research shows that "Little Giant" certification can improve certified firms' access to resources, market recognition, innovation capacity, operating performance, total factor productivity, and supply chain stability [10–12].

As interfirm interdependence deepens, the strategic decisions of suppliers and customers are increasingly shaped by their positions within supply chain networks. In complex supply chain systems, changes at one node may propagate to connected firms and generate broader network effects [13]. Recent studies show that "Little Giant" certification can affect the production efficiency, knowledge-search capacity, and innovation performance of connected firms [14–17]. However, this literature has focused mainly on innovation and performance outcomes and has paid relatively limited attention to whether such spillovers are also associated with changes in the structure of major trading relationships. In particular, it remains unclear whether the certification of a downstream customer is associated with changes in the concentration and distribution of transaction shares among the major trading partners of its upstream suppliers. This question is important because certification-related changes in a customer's external visibility and operating conditions may alter the incentives and resource-allocation decisions of connected suppliers, thereby affecting how they adjust their major trading relationships.

The determinants of supply chain diversification have attracted growing attention. Existing studies can be broadly divided into two streams. The first emphasizes the external institutional environment. Policies and institutional reforms such as the establishment of pilot free trade zones [18], the Manufacturing Power Strategy [19], intelligent manufacturing policies [20], government data openness [21], improvements in judicial efficiency [22], and the development of a unified national market [23] can reduce market segmentation, facilitate resource mobility, improve information transparency, facilitate the diversification of trading relationships, and reduce supply chain concentration. Firms may also respond to external shocks, including trade policy uncertainty, by diversifying their supply chains to enhance their capacity to withstand risk [24]. The second stream focuses on firm-level capabilities. Digital transformation [25–27], technological innovation, and artificial intelligence applications can promote diversification by reducing information asymmetry, improving resource-allocation efficiency, and strengthening risk-identification capabilities. Corporate participation in targeted poverty-alleviation initiatives may likewise expand external relationship networks and reduce supply chain dependence [28].

Despite these advances, an important gap remains at the intersection of the SME supply chain, industrial policy, and supply chain configuration studies. International research has developed a relatively rich understanding of how SMEs manage supply chain risks and build resilience through internal capabilities, interfirm collaboration, supplier relationships, and institutional support. However, this literature primarily focuses on outcomes experienced by the focal SME itself, such as resilience, operational performance, sustainability, and innovation. Meanwhile, studies of supply chain diversification have largely emphasized the external institutional environment or the characteristics and capabilities of the focal firm, with relatively less attention paid to changes in trading relationships triggered by shocks originating from connected firms. Research on SRDI "Little Giant" certification has also begun to document spillover effects on connected firms, particularly in terms of innovation, production efficiency, and operating performance, but whether such policy spillovers are associated with changes in the concentration of connected firms' major

trading relationships remains insufficiently examined. Accordingly, this study asks whether the certification of a downstream SME is associated with changes in the concentration and distribution of major trading relationships of its upstream suppliers.

To address this question, this study combines national-level SRDI "Little Giant" certification data with customer–supplier relationship data for Chinese listed firms over the period 2012–2025. Using the staggered timing of certification, we construct a customer–supplier dyad-year dataset and employ a staggered difference-in-differences framework to examine whether the certification of a downstream customer is associated with changes in the concentration and distribution of transaction shares among the major disclosed trading relationships of its upstream suppliers. We further investigate two potential transmission channels—a reputation-related channel and operating-resource adjustment—and examine whether the estimated association varies across procurement and sales relationships, suppliers' pre-certification investment status, and pre-certification market share.

The empirical results show that downstream customer certification significantly reduces the concentration of upstream suppliers' major trading relationships. This finding remains stable across alternative measures of diversification, alternative clustering structures, fixed-effects specifications, controls for concurrent industrial policies, and placebo tests. An interaction-weighted event-study analysis further examines heterogeneous treatment timing and dynamic patterns and is interpreted as complementary evidence rather than as an independent confirmation of the baseline estimate. Mechanism analyses provide suggestive evidence consistent with two potential channels: a reputation-related channel and operating-resource adjustment. Specifically, certification is associated with greater positive media exposure for upstream suppliers, consistent with improved external visibility. It is also associated with higher operating working capital investment, with changes in current assets providing complementary evidence of adjustments in operating resource allocation. These patterns suggest that certification may affect the conditions under which suppliers adjust their major trading relationships, while the evidence should not be interpreted as directly establishing broader improvements in supply chain resilience or stability. Further analysis suggests that the estimated association is more evident in upstream procurement relationships than in downstream sales relationships, although the difference between the two estimates is not statistically significant. The estimated association also tends to be stronger among suppliers that exhibited overinvestment prior to certification and those with larger pre-certification market shares. This study contributes to the literature in three respects.

First, this study extends the emerging literature on the supply-chain spillovers of the SRDI "Little Giant" program by focusing on a distinct outcome: the concentration of major trading relationships of connected upstream suppliers. Existing studies have documented that SRDI certification can generate spillover effects on the innovation, production efficiency, and other performance outcomes of connected firms. Building on this literature, we examine whether certification of a downstream customer is also associated with changes in how transaction shares are distributed across an upstream supplier's major trading partners. In this way, the study broadens the range of supply-chain outcomes considered in the SRDI spillover literature without treating cross-firm spillovers themselves as an unexplored phenomenon.

Second, this study extends the literature on the determinants of supply chain diversification by examining policy recognition of connected trading partners as a relational factor associated with firms' supply chain configuration. Existing research has largely emphasized the external institutional environment or the characteristics and capabilities of the focal firm. In contrast, this study shows that downstream customer certification is associated with changes in the concentration and dispersion of transaction shares among an upstream

supplier's major disclosed trading relationships, even when the supplier itself is not directly targeted by the policy. The directional decomposition further indicates that the estimated association is more evident in procurement relationships than in sales relationships, although the difference between the two estimates is not statistically significant.

Third, this study provides a more detailed account of potential channels associated with industrial-policy spillovers through supply chain relationships by examining two complementary channels and related heterogeneous patterns. The reputation-related analysis provides suggestive evidence consistent with an external-information channel: certification of a downstream customer is associated with more favorable media exposure for connected suppliers, consistent with improved external visibility. The operating-resource analysis provides suggestive evidence of adjustments in suppliers' internal resource allocation: certification is associated with higher operating working capital investment, while changes in current assets provide complementary evidence of adjustments in operating resources. The heterogeneity analysis further shows that the estimated association tends to be stronger among suppliers that exhibited overinvestment prior to certification and those with larger pre-certification market shares. Together, these findings provide suggestive evidence on potential channels and firm characteristics associated with cross-firm policy transmission through existing customer–supplier relationships, while remaining focused on changes in the concentration of major trading relationships.

2. Institutional Background and Hypothesis Development

2.1. Institutional Background of National-Level SRDI "Little Giant" Certification

In recent years, China has progressively established a tiered cultivation system for high-quality small- and medium-sized enterprises (SMEs), centered on Specialized, Refined, Distinctive, and Innovative (SRDI) firms, with the broader objective of strengthening industrial and supply chain resilience, security, and strategic autonomy. Within this system, national-level SRDI "Little Giant" enterprises are positioned as key firms in critical segments of industrial chains and are expected to contribute to strengthening weak links, improving supply chain stability, and enhancing technological self-reliance. Compared with ordinary SMEs, "Little Giant" enterprises are typically more deeply embedded in specialized divisions of labor, possess stronger technological capabilities and market positions within niche segments, and often serve as important nodes linking upstream and downstream firms.

Since 2019, China's Ministry of Industry and Information Technology (MIIT) has continuously promoted the cultivation of national-level SRDI "Little Giant" enterprises. Importantly, national-level certification is selective rather than randomly assigned. In the earlier certification rounds, provincial SME authorities primarily selected and recommended candidate firms from provincially recognized or cultivated SRDI SMEs, while the applicable criteria also emphasized specialization, innovation capability, market competitiveness, operating performance, and other firm characteristics. In 2022, the Interim Measures for the Gradient Cultivation and Management of High-Quality SMEs further formalized this tiered cultivation process. Under these rules, recognized SRDI SMEs voluntarily apply for national-level "Little Giant" status; provincial SME authorities conduct preliminary reviews of application materials and supporting documentation, undertake on-site spot checks, and recommend eligible firms to MIIT, which subsequently conducts further review, spot checks, and public disclosure before formal recognition. Because the relevant recognition rules evolved across successive rounds, the exact eligibility requirements were not identical throughout the sample period.

This institutional process implies that firms receiving national-level certification are positively selected on pre-existing characteristics. Strong specialization, innovation ca-

pability, market competitiveness, and growth potential should therefore be viewed as factors associated with selection into certification rather than as evidence that certification itself is randomly assigned. Accordingly, the empirical analysis does not rely on random assignment of certification. Instead, it exploits the staggered timing of certification within a difference-in-differences framework and relies on the assumption that, with absent certification exposure, the outcomes of exposed and comparison suppliers would have followed comparable trends.

Certification may also be partially anticipated. Firms apply before formal recognition and undergo provincial review, recommendation, central review, and public disclosure procedures before the recognition process is completed. Firms and their trading partners may therefore receive information about prospective certification before or during the formal certification year. To avoid treating this application and evaluation period as a complete post-certification year, policy is defined as beginning in the year following formal certification. This one-year lag establishes temporal ordering between formal certification and the measured post-certification period, but it does not by itself eliminate selection into certification. We therefore separately examine the sensitivity of the results to potential anticipation in the empirical analysis.

National-level "Little Giant" certification is also subject to dynamic management rather than being automatically permanent. Under the applicable rules, certification is generally valid for three years and is subject to subsequent review. Firms that continue to satisfy the relevant requirements may retain their status following review, whereas firms that no longer meet the criteria, fail to complete the required review procedures, provide false information, or commit specified serious violations may lose their certification status. In the baseline empirical design, policy is defined according to the timing of a firm's first national-level certification and therefore captures exposure associated with the initial certification event. Once treatment begins in the year following first certification, policy remains equal to one thereafter and is not reset according to subsequent renewal or withdrawal status. Accordingly, the estimated effect should be interpreted as being associated with exposure to the initial certification event rather than with continuously maintaining active certification status.

Certified firms receive policy support through fiscal assistance, financing facilitation, research and development support, and industrial-chain and supply-chain coordination programs. As of 2026, more than 17,600 national-level "Little Giant" enterprises had been cultivated across strategically important sectors, including next-generation information technology, high-end equipment manufacturing, new materials, and new energy. Given the selective nature of certification, however, the superior characteristics of certified firms should not be attributed mechanically to certification itself. Rather, certification combines pre-existing firm characteristics, institutional recognition, and subsequent policy support.

Importantly, the consequences associated with "Little Giant" certification may extend beyond certified firms themselves and be transmitted to connected suppliers and customers through existing supply chain relationships. Certification can signal a firm's technological capability, growth potential, and policy recognition, thereby potentially affecting the information environment surrounding its trading relationships. At the same time, certification-related changes in market access, innovation activities, and interfirm coordination may be associated with changes in the resource access and transaction opportunities of connected firms. National-level "Little Giant" enterprises may therefore act not only as direct recipients of industrial policy but also as potential channels through which policy-related effects are transmitted across supply chain relationships.

This raises an important question: is the certification of a downstream customer associated with changes in the supply chain configuration of its upstream suppliers through

existing transactional relationships? More specifically, is downstream customer certification associated with a less concentrated distribution of transaction shares among the major trading partners of upstream suppliers? Examining this question can deepen understanding of the broader economic consequences of SRDI policy and provide evidence on how industrial policy may be associated with cross-firm adjustments transmitted through existing customer–supplier relationships.

Eligibility for national-level SRDI "Little Giant" certification requires firms to satisfy the applicable SME classification standards and the recognition criteria in force for the relevant certification round. Because these criteria and the associated application and review procedures generate systematic selection into certification, the following empirical analysis explicitly distinguishes selection into national-level certification from suppliers' exposure to certification through pre-existing customer–supplier relationships.

2.2. An International Perspective on Supply Chain Security and Resilience

Supply chain security and resilience have become central concerns in the international literature on small- and medium-sized enterprises. Systematic reviews show that SME supply chain resilience is shaped by multiple factors, including collaboration and organizational culture, firm capabilities, information systems, financing conditions, networking, and risk-management practices [6,7]. Taken together, these studies suggest that resilience in SMEs is not simply an internal organizational attribute but is associated with the interaction of firm-level capabilities, organizational practices, and external supply-chain relationships.

At the same time, international evidence highlights the context-dependent nature of SME risk and resilience. Research from Central Europe documents cross-country differences in SMEs' perceptions of market, financial, personnel, and operational risks and shows that different dimensions of business risk are closely associated with operational performance and market position [8,9]. These findings indicate that SME vulnerability and sustainability cannot be fully understood independently of the surrounding business and institutional environment. Evidence from other regions provides further insights from a resilience perspective. Among Ghanaian SMEs, supply chain disruptions can undermine operational resilience through managers' threat interpretation bias, whereas evidence from Australian SMEs identifies digital capabilities, prior disruption experience, supplier proximity, and supplier relationships as antecedents of supply chain resilience and further highlights the role of government assistance [29,30].

A further theme emerging from the international literature is the importance of interfirm relationships as channels for accessing external knowledge and developing organizational capabilities. Sang et al. (2024) show that customer and supplier participation affect SME innovation outcomes directly and through absorptive capacity, indicating that supply-chain partners can serve as important sources of external knowledge [31]. Related evidence on SME resilience likewise emphasizes the importance of collaboration and supplier relationships in responding to disruptions [6,30]. These findings suggest that customer–supplier relationships are not merely transactional arrangements but can also serve as channels through which knowledge and capabilities may be transmitted across firms.

Overall, the international literature has developed a relatively rich understanding of how SMEs manage risk and build resilience through internal capabilities, interfirm collaboration, supplier relationships, and institutional support. However, the dominant focus remains on outcomes experienced by the focal SME itself, including resilience, operational performance, sustainability, and innovation. Less attention has been paid to whether policy support directed at one supply-chain member is associated with outcomes beyond the directly supported firm through existing customer–supplier relationships. The present

study extends this perspective by examining whether SRDI "Little Giant" certification of downstream customers is associated with changes in the concentration and distribution of transaction shares among the major trading partners of upstream suppliers. In doing so, the study shifts attention from resilience building within the focal SME to potential cross-firm adjustments associated with policy exposure through supply-chain linkages. Supply chain diversification is therefore not treated as a direct measure of resilience or security but as a structural adjustment in the distribution of major supply-chain relationships.

2.3. Theoretical Analysis and Hypothesis Development

2.3.1. Effect of Downstream Customer Certification on Upstream Suppliers' Supply Chain Diversification

Resource dependence theory posits that firms rely on external organizations to obtain critical resources and that changes in resource dependence, control, and power can induce firms to reconfigure their interorganizational relationships [32,33]. National-level SRDI "Little Giant" certification represents an institutionally endorsed signal of a firm's technological capability, innovative capacity, and growth potential. In addition to providing reputational recognition, certification is accompanied by policy support in areas such as fiscal assistance, financing facilitation, and industrial-chain coordination, thereby potentially strengthening certified firms' resource-integration capabilities and market influence [34]. As a result, certification may alter the distribution of resources and information within supply chain networks and enhance the strategic position of certified firms within those networks.

For upstream suppliers, maintaining a stable relationship with a certified "Little Giant" customer provides more than a reliable source of orders. Such a relationship may also enable suppliers to benefit from the customer's reputation, market standing, and network resources. Prior research shows that firms' reputational assessments can spill over across supply chain relationships, such that the characteristics and external evaluations of prominent trading partners influence how connected firms are perceived by other market participants [35]. These signals may reduce information asymmetry and lower the search and evaluation costs faced by potential trading partners. Consequently, suppliers associated with certified customers may gain broader market recognition and face fewer informational barriers when interacting with existing or potential trading partners.

These changes in the supplier's external information and resource environment may create incentives to reconsider the degree of dependence on its major trading partners. From a transaction cost perspective, concentrated supply chain relationships may reduce search, coordination, and monitoring costs when stable cooperation is valuable. However, excessive dependence on a limited number of customers or suppliers can weaken a firm's bargaining position, increase its exposure to relationship-specific risks, and adversely affect its financial and operational outcomes [36]. By contrast, diversification across suppliers and customers can reduce dependence on individual trading partners and may enhance firms' capacity to respond to supply chain disruptions [37,38]. Therefore, when certification-related reputational spillovers and adjustments in operating resources ease the informational and operational constraints associated with reallocating transactions, the relative benefits of maintaining a highly concentrated distribution of major trading relationships may decline.

Moreover, certification may reduce the informational and coordination costs associated with adjusting supply chain relationships. Closer cooperation with a certified customer can improve the supplier's experience in demand coordination, technological alignment, quality control, and production scheduling. These capabilities may enhance the supplier's ability to evaluate and manage trading relationships and to adjust the allocation of transactions across major partners. Existing research shows that information frictions and supplier-search costs constitute important barriers to supply chain diversification, whereas lower search and

information costs can reduce firms' dependence on a limited set of trading partners [39]. In this sense, downstream customer certification may affect upstream suppliers through two complementary forces: it improves the external information and resource environment facing suppliers while reducing the costs of adjusting the distribution of transactions across trading relationships.

Accordingly, upstream suppliers need not terminate or weaken their existing relationships with certified customers. Rather, they may respond by reducing excessive dependence on a limited number of major trading partners and reallocating transaction shares more evenly across their major disclosed supplier and customer relationships while preserving the benefits of stable cooperation. Downstream customer certification is therefore expected to promote a shift from a relatively concentrated distribution of major trading relationships toward a more dispersed one. Accordingly, the following hypothesis is proposed:

Hypothesis 1 (H1). *The national-level SRDI "Little Giant" certification of a downstream customer is associated with greater supply chain diversification among its upstream suppliers, reflected in a less concentrated distribution of transaction shares among major trading partners.*

2.3.2. National-Level SRDI "Little Giant" Certification, Supplier Reputation, and Supply Chain Diversification

Corporate reputation is an important intangible resource that shapes how external stakeholders evaluate a firm's quality, reliability, and ability to fulfill contractual obligations. In supply chain networks, such evaluations are not determined solely by a firm's own characteristics but may also be influenced by the attributes and external assessments of its trading partners. Recent evidence shows that reputational consequences can spill over across supplier–customer relationships, such that events affecting one supply chain member alter the market evaluation and strategic behavior of connected firms [35,40]. National-level SRDI "Little Giant" certification may therefore generate reputation-related spillovers that extend beyond the certified firm itself.

The certification represents a highly visible form of institutional recognition based on firms' specialization, innovative capabilities, market competitiveness, and growth potential. Certification by a government authority can therefore strengthen the market credibility of the certified downstream customer and provide external stakeholders with additional information about its underlying quality. More importantly, recent research on policy certification shows that the effects of government recognition can propagate through supply chain linkages rather than remaining confined to directly certified firms [41]. For an upstream supplier maintaining a stable trading relationship with a certified "Little Giant" customer, this relationship may consequently serve as an observable indication that the supplier is capable of meeting relatively demanding requirements concerning product quality, technological compatibility, delivery reliability, and production capacity. The favorable evaluation associated with the certified customer may therefore spill over upstream and contribute to more positive external perceptions of the supplier.

More favorable external perceptions of the supplier may, in turn, reduce information frictions in its interactions with existing and potential trading partners. External firms typically face uncertainty when evaluating counterparties, particularly regarding product quality, production capability, contractual reliability, and long-term cooperation potential. A supplier associated with a highly recognized customer may therefore be more readily perceived as a credible counterparty, reducing informational uncertainty and improving its external visibility. Such reputation-related informational advantages may reduce the informational barriers associated with adjusting the distribution of transactions across major trading relationships and thereby reduce excessive dependence on a limited number of major customers or suppliers.

The reduction in information frictions is particularly relevant to supply chain diversification. Searching for, evaluating, and coordinating with trading partners involves substantial information and matching costs. Prior research shows that lower information frictions and partner-search costs can facilitate adjustments in supply chain relationships and reduce barriers to diversification [39]. Accordingly, when downstream customer certification contributes to more favorable external perceptions of an upstream supplier, it may lower the information and evaluation costs associated with reallocating transactions across major trading relationships and reduce the need to concentrate a large share of purchases or sales on a limited number of major partners.

Taken together, national-level SRDI "Little Giant" certification may generate a reputation-related spillover from the certified downstream customer to its upstream suppliers. By increasing suppliers' positive external visibility and potentially improving external perceptions of their reliability and capabilities, this spillover may reduce information frictions and facilitate a less concentrated distribution of transaction shares across major trading relationships. A reputation-related channel therefore represents one potential pathway through which downstream customer certification may be associated with upstream supply chain diversification. Accordingly, the following hypothesis is proposed:

Hypothesis 2 (H2). *The national-level SRDI "Little Giant" certification of a downstream customer may promote the supply chain diversification of its upstream suppliers through a reputation-related channel that reduces information frictions and facilitates a less concentrated distribution of transaction shares across major trading relationships.*

2.3.3. National-Level SRDI "Little Giant" Certification, Operating Resource Adjustment, and Supply Chain Diversification

Operating-resource adjustment refers to changes in the allocation and utilization of financial and operating resources in response to evolving production and transaction requirements. In supply chain relationships, changes in operating working-capital commitment and current-asset utilization may accompany adjustments in transaction arrangements, fulfillment requirements, and interfirm coordination. Existing operations and supply chain research emphasizes that resource allocation and flexibility are important for firms' responses to changing operating conditions and supply chain uncertainty [42–44]. Accordingly, the ability to adjust operating resources may affect how firms accommodate changes in their trading relationships and operational requirements.

The national-level SRDI "Little Giant" certification of a downstream customer may alter the operating requirements faced by upstream suppliers. Certification may strengthens the customer's market recognition, access to policy resources, and growth prospects, potentially affecting expectations regarding future transactions. At the same time, certified customers may impose more demanding requirements concerning product quality, technological compatibility, delivery reliability, and supply continuity. Recent evidence shows that information and demand signals from downstream buyers can influence upstream suppliers' capacity and resource-allocation decisions [45]. Upstream suppliers maintaining established relationships with certified customers may therefore adjust their operating-resource commitments to accommodate changes in transaction requirements, production arrangements, and ongoing interfirm coordination.

One important dimension of such adjustment concerns operating working capital. Changes in accounts receivable, notes receivable, prepayments, accounts payable, advances from customers, and notes payable affect the amount of net financial resources committed to firms' operating cycles. Suppliers may also adjust the utilization of current assets as production and transaction arrangements change. These adjustments do not necessarily

represent an accumulation of deployable slack; rather, they reflect changes in the way suppliers commit and utilize operating resources in response to evolving trading conditions.

Operating-resource adjustment may, in turn, facilitate changes in the distribution of transactions across major trading relationships. Reallocating purchases and sales across major counterparties may require suppliers to accommodate changes in payment arrangements, receivables, short-term operating financing, and current-asset utilization.

Firms that can adjust these operating resources in response to changing transaction requirements may have greater flexibility to reduce excessive reliance on a limited number of major counterparties and redistribute transaction shares across major trading relationships. More broadly, prior research suggests that resource reallocation can support organizational adjustment and strategic reconfiguration when firms respond to changes in their external environment [46].

Taken together, national-level SRDI "Little Giant" certification may induce upstream suppliers to adjust the commitment and utilization of operating resources in response to changes in transaction requirements and coordination arrangements. Such adjustments may facilitate the reallocation of purchases and sales across major trading relationships and contribute to a less concentrated distribution of transaction shares. Operating-resource adjustment therefore represents a potential channel through which downstream customer certification may promote upstream supply chain diversification. Accordingly, the following hypothesis is proposed:

Hypothesis 3 (H3). *The national-level SRDI "Little Giant" certification of a downstream customer may promote the supply chain diversification of its upstream suppliers through an operating-resource adjustment channel.*

3. Empirical Research Design

3.1. Sample Selection and Data Sources

To examine the spillover effect of national-level SRDI "Little Giant" certification on the supply chain diversification of connected firms, this study constructs a panel dataset at the customer–supplier dyad-year level. Following prior studies [15,16], information on the five largest suppliers and customers of Chinese listed firms is obtained from the China Stock Market and Accounting Research (CSMAR) database and used to construct the baseline supply chain relationship dataset. Because this study focuses on how the certification of a downstream customer affects the supply chain configuration of its upstream suppliers, the supplier in each dyad is required to be a listed firm, whereas the corresponding customer may be either listed or unlisted. The resulting relationship data represent major trading partners disclosed in each reporting year and therefore constitute a contemporaneously observed major-partner network rather than a fixed or complete supply chain network. A customer–supplier dyad may consequently enter or disappear from the observed dataset across years as its transaction importance or disclosure status changes.

The firms identified in the supply chain relationship dataset are then matched with the official lists of national-level SRDI "Little Giant" enterprises published by China's Ministry of Industry and Information Technology (MIIT) using firm identifiers to determine whether a downstream customer obtained certification and the year in which certification was granted. Because the first cohort of national-level SRDI "Little Giant" enterprises was recognized in 2019, the 2019 certification round is treated as the starting point of the policy intervention. The full sample period spans 2012–2025. Firm-level financial characteristics and other control variables are also obtained from the CSMAR database. In the baseline specification, POLICY is defined according to the downstream customer's first national-level certification year and takes a value of one beginning in the year following

formal certification. As discussed in Section 2.1, this lag is used to separate the post-certification period from the application, evaluation, and announcement process and should not be interpreted as eliminating selection into certification. For the event-time analysis, observations are organized relative to the first policy-exposure year, defined as the year following formal certification, with sparsely populated distant event periods combined where appropriate to avoid imprecise estimates driven by limited observations.

Because certification may itself affect the formation, persistence, transaction importance, or disclosure of customer–supplier relationships, reliance solely on contemporaneous top-five disclosures could make observed network composition endogenous to treatment. To address this concern, we additionally construct certification exposure using pre-certification customer–supplier relationships. Specifically, a supplier is considered connected to a subsequently certified customer only when the customer–supplier relationship is observed in the year immediately preceding the customer's certification. Exposure is therefore determined using information available prior to certification rather than relationships that first appear after certification. Once a supplier is classified as exposed through such a pre-certification relationship, its exposure status from the relevant treatment date does not depend on whether the same dyad continues to appear in subsequent top-five disclosures. This construction avoids conditioning exposure on post-certification relationship survival or continued disclosure.

In this pre-certification-network robustness specification, the analysis is implemented at the supplier-year level so that each supplier-year outcome enters the estimation once, even when a supplier is connected to multiple customers. Suppliers that are not exposed through a pre-certification relationship with a certified customer, together with not-yet-exposed supplier-years prior to treatment, provide the comparison observations under the staggered difference-in-differences design. Supplier and year fixed effects are used to absorb time-invariant supplier characteristics and common annual shocks, respectively, while the event-time analysis is used to assess whether exposed and comparison suppliers exhibit differential outcome trends before certification exposure.

It should be noted that the empirical sample is not restricted to SMEs at the supplier level. The upstream suppliers in our sample are Chinese A-share listed firms that disclose major customer relationships, regardless of their size classification. SME status is relevant to the downstream customers that receive national-level SRDI "Little Giant" certification. We do not independently classify these firms as SMEs using self-defined size thresholds. Instead, their SME status follows the official Chinese classification and certification system. According to the Provisions on the Classification Standards for Small- and Medium-sized Enterprises (MIIT Joint Enterprise [2011] No. 300), enterprises are classified as medium, small, or micro firms using industry-specific thresholds based on the number of employees, operating revenue, and/or total assets. Eligibility for national-level SRDI "Little Giant" certification requires firms to satisfy these official SME classification standards. We therefore identify treated customers directly from the official lists of national-level SRDI "Little Giant" enterprises rather than reclassifying firms according to alternative international SME definitions.

The CSMAR major-partner disclosures do not necessarily identify every disclosed trading partner in a form that can be uniquely matched to an external firm identifier. Accordingly, customer-level certification exposure can only be assigned when the disclosed partner can be reliably identified and matched to the certification records. Accordingly, the observed network should be interpreted as covering identifiable and matched major-partner relationships rather than firms' complete underlying trading relationships. Changes in observed major-partner relationships should therefore not be interpreted as definitive evidence of the formation or termination of firms' complete underlying trading relationships.

To improve the reliability of the empirical analysis, the sample is screened as follows. First, listed firms in the financial and insurance industries are excluded. Second, firms designated as ST or *ST are removed. Third, observations with missing values for key variables are dropped. Finally, all continuous variables are winsorized at the 1st and 99th percentiles to mitigate the influence of extreme values. After applying the sample selection criteria and excluding observations with missing values for variables required in the baseline specification, the final regression sample consists of 21,859 customer–supplier dyad-year observations over the period 2012–2025.

3.2. Definition and Measurement of Variables

3.2.1. Dependent Variable: Upstream Suppliers' Supply Chain Diversification

The dependent variable is the supply chain diversification of upstream suppliers (*SCD*), which captures the degree of dispersion in the firm's transaction shares across its major trading partners. In this study, the term "upstream supplier" refers to the focal firm's position within a customer–supplier dyad, whereas the firm's own supply chain structure encompasses both its procurement-side supplier relationships and its sales-side customer relationships. When purchases or sales are heavily concentrated among a small number of core trading partners, the firm exhibits a relatively concentrated supply chain structure and greater dependence on those partners. By contrast, when transaction shares are more evenly distributed among major suppliers and customers, the firm exhibits a less concentrated and more diversified supply chain structure. Supply chain diversification therefore reflects a shift in the distribution of major trading relationships from concentration toward dispersion rather than a direct measure of the number of trading partners.

Prior research commonly characterizes firms' dependence on major supply chain partners using the concentration of purchases from major suppliers and sales to major customers [47,48]. Following prior research [3], we measure supply chain concentration using the firm's disclosed major supplier and customer relationships. Specifically, let $SupplierShare_{ikt}$ denote the share of firm i's annual purchases accounted for by major supplier k in year t, and let $CustomerShare_{ikt}$ denote the share of firm i's annual sales accounted for by major customer j. Procurement-side and sales-side concentration are defined as follows:

$$SupplierCon_{it} = \sum_{k=1}^{5} SupplierShare_{ikt} \tag{1}$$

$$CustomerCon_{it} = \sum_{k=1}^{5} CustomerShare_{ikt} \tag{2}$$

Overall supply chain concentration is calculated as

$$SC_{it} = \frac{SupplierCon_{it} + CustomerCon_{it}}{2} \tag{3}$$

$$SCD_{it} = 1 - SC_{it} \tag{4}$$

The denominator of $SupplierShare_{ikt}$ is firm i's total annual purchases, whereas the denominator of $CustomerShare_{ikt}$ is its total annual sales. All transaction shares are expressed as proportions, and *SCD* is therefore a unit-free index. A higher value of *SCD* indicates a less concentrated distribution of purchases and sales among the firm's disclosed major trading partners and, accordingly, a higher degree of supply chain diversification as defined in this study. This measurement approach is consistent with recent supply chain studies that jointly characterize upstream and downstream concentration using the transaction shares of the five largest suppliers and customers [2,48].

To assess the robustness of the results, we further construct two alternative measures of supply chain diversification. First, *SCD1* is defined as one minus the average of the sales share of the largest customer and the purchase share of the largest supplier:

$$SCD1_{it} = 1 - \frac{LargestSupplierShare_{it} + LargestCustomerShare_{it}}{2} \quad (5)$$

Second, *SCD2* is constructed using Herfindahl-type concentration indices based on the five largest disclosed suppliers and customers. The upstream and downstream indices are defined as:

$$SupplierHHI5_{it} = \sum_{k=1}^{5} SupplierShare_{ikt}^2 \quad (6)$$

$$CustomerHHI5_{it} = \sum_{k=1}^{5} CustomerShare_{ikt}^2 \quad (7)$$

and *SCD2* is calculated as:

$$SCD2_{it} = 1 - \frac{SupplierHHI5_{it} + CustomerHHI5_{it}}{2} \quad (8)$$

Higher values of both *SCD1* and *SCD2* indicate a less concentrated distribution of transaction shares among major trading partners. Because the HHI components of *SCD2* are calculated only from the five largest disclosed suppliers and customers rather than the complete trading network, the underlying HHI measures should be regarded as truncated concentration measures based on major trading partners. Accordingly, *SCD2* should be interpreted as an inverse measure of concentration among major trading partners rather than as a full-network diversification index. The use of the largest customer and supplier shares and Herfindahl-type indices as alternative measures follows prior supply chain concentration research [49,50].

For all three measures, missing CSMAR concentration variables are not replaced with zero. If any CSMAR variable required to construct a given diversification measure is missing, the corresponding diversification measure is treated as missing and the observation is excluded from regressions using that measure.

3.2.2. Core Explanatory Variable: Downstream Customer Certification

The core explanatory variable, Policy, captures whether a downstream customer has obtained national-level SRDI "Little Giant" certification. Certification status and certification year are identified from the official national-level SRDI "Little Giant" enterprise lists released by the Ministry of Industry and Information Technology of China (MIIT). Policy equals one beginning in the year following the downstream customer's first national-level certification and remains equal to one thereafter, and zero otherwise. For customers that are never certified during the sample period, Policy remains equal to zero throughout. This one-year lag is used to separate the post-certification period from the application, evaluation, and announcement process and to establish temporal ordering between formal certification and the measured post-certification period; it should not be interpreted as eliminating selection into certification.

3.2.3. Control Variables

Following prior research on supply chain relationships and supply chain concentration, this study includes a set of supplier-level characteristics that may be associated with firms' supply chain configuration, including financial and operating characteristics, corporate governance, and human capital [51].

The first group captures firms' financial and operating characteristics. Firm size, *SIZE*, is measured as the natural logarithm of total assets. Firm age, *AGE*, is measured as the number of years since the firm's establishment. Operating cash flow, *CASH*, is measured as net cash flow from operating activities divided by total assets. Return on assets, *ROA*, is calculated as net income divided by total assets. Financial leverage, *LEV*, is measured as total liabilities divided by total assets. Tobin's Q, *TQ*, is measured as the firm's market value divided by total assets. Inventory turnover, *ITO*, is calculated as cost of goods sold divided by the ending balance of inventory and is used to capture the efficiency of inventory utilization. These variables capture differences in firm scale and maturity, liquidity and profitability, capital structure, market valuation, and operating efficiency that prior studies have shown to be relevant to firms' supply chain relationships and configuration decisions [48,52]. Inventory efficiency is particularly relevant in the context of major customer relationships, as prior research documents a close association between customer-base concentration and firms' inventory management efficiency [53].

The second group captures corporate governance and human capital characteristics. Ownership concentration, *TOP*, is measured as the percentage of shares held by the largest shareholder. Chair–CEO duality, *DUAL*, equals one when the positions of board chair and general manager are held by the same individual and zero otherwise. Board size, *BOARDSIZE*, is measured as the total number of directors on the board. Board independence, *INDEP*, is calculated as the number of independent directors divided by the total number of directors. These governance variables follow prior supply chain concentration research that accounts for ownership concentration, board structure, and leadership characteristics when examining firms' relationships with major suppliers and customers [48]. Employee education, *EDU*, is measured as the percentage of employees with a bachelor's degree or above in the firm's total workforce and is used to capture the firm's human capital. *EDU* is expressed on a 0–100 percentage scale. This measure follows prior research using employee education data from Chinese listed firms, in which the percentage of employees with a bachelor's degree or above is employed as a firm-level indicator of employee education and human capital [54]. Human capital is also particularly relevant in the supply chain context, as recent evidence shows that employee education can shape firms' responses to dependence on major suppliers [51].

All empirical specifications additionally include year fixed effects and supplier fixed effects. Year fixed effects absorb macroeconomic, institutional, and other common shocks that vary over time, while supplier fixed effects control for time-invariant unobserved heterogeneity at the supplier level.

3.3. Model Construction

Because downstream customers obtain national-level SRDI "Little Giant" certification in different years, this study employs a staggered difference-in-differences framework to examine the spillover effect of downstream customer certification on the supply chain diversification of upstream suppliers. The baseline model is specified as follows:

$$SCD_{it} = \alpha_0 + \alpha_1 Poilcy_{j,t-1} + \gamma Controls_{it} + \delta_t + \lambda_i + \varepsilon_{ijt} \quad (9)$$

In Equation (9), SCD_{it} denotes the supply chain diversification of upstream supplier i in year t. $Policy_{j,t-1}$ denotes the one-year-lagged policy treatment indicator for downstream customer j. It equals one if customer j had obtained national-level SRDI "Little Giant" certification by year $t-1$, and zero otherwise. Equivalently, for a customer certified in year T, the treatment indicator takes the value of one from year $T+1$ onward and remains one thereafter.

The coefficient α_1 is the parameter of primary interest and captures the change in upstream supplier diversification associated with downstream customer certification. A significantly positive estimate of α_1 is consistent with the prediction that national-level SRDI "Little Giant" certification is associated with greater upstream supplier diversification.

$Controls_{i,t}$ denotes the vector of supplier-level control variables, and γ is the corresponding vector of coefficients. Supplier fixed effects λ_i control for time-invariant unobserved heterogeneity across upstream suppliers, while year fixed effects δ_t absorb macroeconomic, institutional, and other common shocks that vary over time. The error term ε_{ijt} is defined at the customer–supplier dyad-year level. Standard errors are clustered at the supplier level to account for serial correlation and dependence among observations associated with the same upstream supplier.

A linear fixed-effects DID specification is adopted as the baseline model because it is well suited to the research question and data structure. Supply chain diversification is measured as a continuous index, allowing the linear specification to provide a direct and transparent estimate of its average change following downstream customer certification. Moreover, the staggered timing of certification generates temporal variation in customer-level treatment status across customer–supplier relationships, allowing the DID framework to exploit changes in treatment status over time while controlling for supplier-specific time-invariant heterogeneity and common year shocks. We therefore use the linear DID model as the baseline specification and complement it with alternative specifications, placebo tests, and an interaction-weighted event-study estimator as complementary analyses.

The policy treatment indicator is lagged by one year in the baseline specification because adjustments in upstream suppliers' supply chain configurations may not occur immediately following downstream customer certification. The lagged specification also helps establish a clearer temporal sequence between customer certification and subsequent changes in supplier diversification.

4. Empirical Results and Analysis

4.1. Descriptive Statistics and Stylized Facts

Table 1 presents the descriptive statistics for the main variables based on 21,859 customer–supplier dyad-year observations over the period 2012–2025. The dependent variable, upstream suppliers' supply chain diversification, *SCD*, has a mean of 0.631 and a standard deviation of 0.192, with values ranging from 0.159 to 0.954. Because higher values of *SCD* indicate a less concentrated distribution of transaction shares among major suppliers and customers, the mean value of 0.631 describes the average degree of dispersion in these major trading relationships rather than the number or breadth of trading partners. At the same time, the relatively wide range and dispersion of *SCD* indicate substantial variation in the concentration and dispersion of transaction shares among major trading partners across suppliers and over time, providing meaningful cross-sectional and temporal variation for the subsequent empirical analysis.

The core explanatory variable, Policy, has a mean of 0.00526 and a standard deviation of 0.0723, with a minimum of 0 and a maximum of 1. Because Policy is a binary treatment indicator, its mean indicates that treated observations account for approximately 0.526% of the baseline customer–supplier dyad-year sample. Specifically, the baseline sample contains 360 unique certified customers, of which 93 contribute at least one post-certification treated observation under the one-year-lag treatment definition. These treated customers are connected to 78 exposed suppliers through 96 unique treated customer–supplier dyads, generating 115 treated dyad-year observations in total. The treated observations span six certification cohorts from 2019 to 2024 and five post-treatment event-time periods. This accounting clarifies that the 115 treated observations represent repeated post-certification

observations generated by a smaller set of distinct treated customers, exposed suppliers, and customer–supplier relationships, rather than 115 separate treatment events.

Table 1. Descriptive Statistics.

Variable Type	Variables	N	Mean	Sd	Min	Max
Dependent Variable	*SCD*	21,859	0.631	0.192	0.159	0.954
Core Explanatory Variable	*POLICY*	21,859	0.00526	0.0723	0	1
Control Variable	*SIZE*	21,859	22.16	1.389	19.80	25.91
Control Variable	*AGE*	21,859	19.93	6.347	7	37
Control Variable	*CASH*	21,859	0.0420	0.0664	−0.155	0.240
Control Variable	*ROA*	21,859	0.0272	0.0622	−0.274	0.209
Control Variable	*LEV*	21,859	0.428	0.211	0.0503	0.890
Control Variable	*TQ*	21,859	1.938	1.337	0.856	8.321
Control Variable	*ITO*	21,859	18.11	56.48	0.192	427.5
Control Variable	*TOP*	21,859	0.347	0.152	0.0801	0.724
Control Variable	*DUAL*	21,859	0.239	0.427	0	1
Control Variable	*BOARDSIZE*	21,859	8.616	1.596	5	13
Control Variable	*INDEP*	21,859	0.370	0.0482	0.333	0.571
Control Variable	*EDU*	21,859	33.05	22.01	3.150	91.68

4.2. Baseline Regression Analysis

Table 2 reports the baseline regression results. Column (1) controls for supplier fixed effects without including year fixed effects or additional firm-level controls. The estimated coefficient on Policy is 0.019 and is statistically significant at the 1% level. Column (2) further incorporates year fixed effects to absorb common macroeconomic, institutional, and policy shocks over time. The coefficient on Policy increases slightly to 0.024 and remains statistically significant at the 1% level. Column (3) additionally includes the full set of firm-level control variables while retaining both supplier and year fixed effects. The estimated coefficient on Policy is 0.021 and continues to be positive and statistically significant at the 1% level.

Table 2. Baseline Regression Results.

Variable	(1)	(2)	(3)
	SCD	***SCD***	***SCD***
POLICY	0.019 ***	0.024 ***	0.021 ***
	(0.006)	(0.006)	(0.006)
SIZE			0.060 ***
			(0.010)
AGE			−0.008
			(0.009)
CASH			0.059 *
			(0.034)
ROA			−0.108 **
			(0.044)
LEV			−0.102 ***
			(0.030)
TQ			−0.002
			(0.003)

Table 2. *Cont.*

Variable	(1)	(2)	(3)
	SCD	***SCD***	***SCD***
ITO			−0.000 (0.000)
TOP			0.030 (0.054)
DUAL			−0.010 (0.007)
BOARDSIZE			−0.002 (0.003)
INDEP			0.055 (0.079)
EDU			−0.001 *** (0.000)
Constant	0.631 *** (0.000)	0.631 *** (0.000)	−0.455 * (0.266)
Supplier FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
N	21,859	21,859	21,859
Adj. R^2	0.819	0.825	0.834

Notes: Standard errors clustered at the supplier-firm level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

Because higher values of *SCD* indicate a less concentrated distribution of transaction shares among major suppliers and customers, these results imply that the national-level SRDI "Little Giant" certification of a downstream customer significantly reduces the concentration of transaction shares among the major trading partners of its upstream suppliers. In the preferred specification reported in Column (3), certification is associated with an increase of approximately 0.021 in the *SCD* index, corresponding to a 2.1-percentage-point decrease in the concentration of transaction shares among major suppliers and customers. The coefficient remains stable in both magnitude and statistical significance across alternative specifications, indicating that the estimated effect is robust to the inclusion of supplier fixed effects, year fixed effects, and observable firm-level characteristics. Overall, the baseline results provide consistent support for Hypothesis 1.

4.3. Robustness Tests and Addressing Endogeneity

4.3.1. Event-Study Analysis

To examine the pre-certification trends and the dynamic pattern of the estimated effect around downstream customer certification, this study constructs a set of dynamic treatment indicators based on event time and presents the estimated coefficients in Figure 1. Because downstream customers obtained the national-level SRDI "Little Giant" certification in different years, their upstream suppliers became exposed to the policy shock at different points in time. Accordingly, the year immediately preceding certification is designated as the reference period, and the dynamic effects before and after certification are estimated relative to this period.

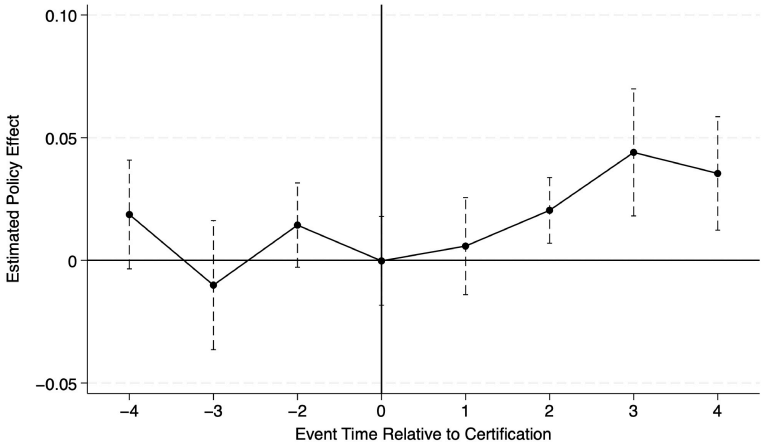


Figure 1. Event-Study Estimates around Customer Certification. Notes: The solid line connecting the markers represent the estimated event-time coefficients, and the vertical dashed bars indicate 95% confidence intervals. Event time −1 is omitted as the reference period. The vertical solid line marks the certification year (event time 0), while the horizontal solid line indicates zero estimated effect.

As shown in Figure 1, the estimated coefficients for the pre-certification periods fluctuate around zero, and their 95% confidence intervals include zero, revealing no clear systematic differential trend before certification. The estimated effects in the certification year and the first post-certification period are also statistically insignificant. From approximately the second post-certification period onward, however, the coefficients become positive and more pronounced, with several later-period estimates reaching statistical significance. This dynamic pattern suggests that the effect of downstream customer certification on the dispersion of transaction shares among upstream suppliers' major trading partners, as captured by *SCD*, does not emerge immediately but becomes more evident over time. This pattern is consistent with a delayed transmission of certification-related changes through customer–supplier relationships. Overall, Figure 1 provides complementary dynamic evidence that is consistent with the positive relationship identified in the baseline analysis, while the pre-certification estimates should not be interpreted as definitive proof of the parallel-trends assumption.

4.3.2. Placebo Test

To further assess whether the baseline findings could arise from alternative treatment assignments, this study conducts a customer-level placebo test. While holding the baseline sample and model specification constant, certification years and never-certified status are randomly reassigned across customers. The reassignment preserves the number of customers associated with each certification year and the number of never-certified customers. Under each reassignment, treatment begins one year after the assigned certification year and remains effective thereafter, while the observed customer–supplier relationships are kept unchanged. The baseline regression is then re-estimated over 1000 iterations.

Figure 2 presents the distribution of the placebo coefficients together with the observed baseline estimate. The placebo estimates are concentrated around zero, with a mean close to 0 and a median of 0.0004, whereas the observed baseline coefficient is 0.0209. Only 2 of the 1000 placebo estimates are equal to or larger than the observed estimate, yielding a finite-sample corrected upper-tail randomization p-value of approximately 0.003. The observed estimate therefore lies in the extreme right tail of the placebo distribution. This result provides additional support for the baseline finding, although the placebo test alone cannot fully rule out selective certification or other omitted factors.

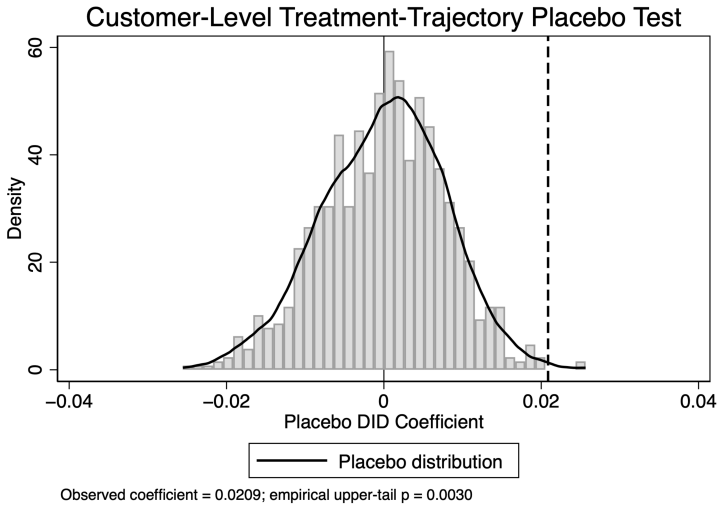


Figure 2. Customer-Level Placebo Test. Notes: The figure reports the distribution of coefficients obtained from 1000 customer-level random reassignments. Certification years and never-certified status are randomly reassigned across customers while preserving the number of customers associated with each certification year and the observed customer–supplier network. The dashed vertical line denotes the observed baseline coefficient. The empirical upper-tail probability is 0.003.

4.3.3. Dynamic Effect Estimates Using the Sun–Abraham DID Estimator

Figure 3 presents the Sun–Abraham interaction-weighted event-study estimates. Event time −1 is used as the reference period, and event time 0 corresponds to the first year of policy exposure at the dyad level. This timing is consistent with the one-year-lag treatment definition adopted in the baseline specification. The pre-treatment estimates show some variation but do not provide evidence of systematic pre-treatment dynamics. A joint test including the endpoint bin for event times −4 and earlier does not reject the null hypothesis that the reported pre-treatment coefficients are jointly equal to zero, with a p-value of 0.123. A joint test focusing on event times −3 and −2 yields a similar result, with a p-value of 0.148.

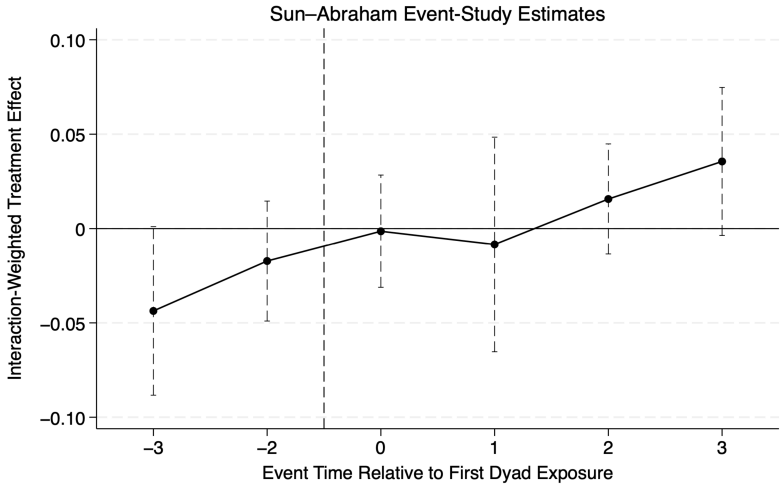


Figure 3. Sun–Abraham Interaction-Weighted Event-Study Estimates. Notes: Event time −1 is the omitted reference period. The black line with markers represents the estimated coefficients, and the vertical dashed bars indicate 95% confidence intervals. The vertical dashed reference line marks the omitted period, while the horizontal solid line indicates zero estimated effect. The full specification includes an endpoint bin for event times −4 and earlier. The figure reports the event window from −3 to +3. Dyad-year observations are inversely weighted within supplier-years so that each supplier-year receives equal total weight. The specification includes dyad and year fixed effects, with standard errors clustered at the supplier level.

After treatment, the estimated effects remain close to zero in the initial periods and become positive in later periods, suggesting that the effect on the dispersion of transaction shares among suppliers' major trading partners may emerge with a lag. However, the confidence intervals are relatively wide, particularly at longer event horizons, reflecting the limited number of treated relationships and declining effective support at longer event times. The average post-treatment estimate over event times 0 to 3 is not statistically significant. The estimated average coefficient is 0.0104, with a p-value of 0.483. Overall, the dynamic estimates suggest a possible gradual post-treatment response, although the limited precision of the estimates calls for cautious interpretation.

We further assess the sensitivity of the dynamic estimates to potential departures from parallel trends using the HonestDiD approach, which allows the robustness of the conclusions to be evaluated under alternative bounds on deviations from parallel trends. The robust confidence intervals become progressively wider as larger deviations from parallel trends are permitted. Given the relatively limited precision of the event-study estimates, this sensitivity analysis does not support strong causal claims based on the dynamic specification alone. We therefore treat the Sun–Abraham event-study results as complementary diagnostic evidence and rely on the baseline specification together with the additional robustness analyses for the main inference.

4.3.4. Conventional Robustness Checks

1. Alternative Measures of the Dependent Variable. To ensure that the results based on the alternative measures are not driven by differences in sample composition, we re-estimate the baseline *SCD* specification and the two alternative measures using the same sample of 18,809 observations. As shown in Columns (1)–(3) of Table 3, the estimated coefficients are 0.019 for *SCD*, 0.012 for *SCD1*, and 0.010 for *SCD2*, respectively, and all three estimates remain positive and statistically significant. This common-sample comparison indicates that the positive relationship is robust to alternative measures of how transaction shares are distributed among major trading partners, rather than reflecting differences in sample composition.

Table 3. Robustness Check Results.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	SCD	***SCD1***	***SCD2***	***SCD***	***SCD***	***SCD***	***SCD***	***Control for SEI Policy***	***Exclude SEI-Affected Observations***
POLICY	0.019 *** (0.006)	0.012 ** (0.005)	0.010 *** (0.004)	0.021 *** (0.006)	0.011 ** (0.005)	0.016 *** (0.006)	0.015 ** (0.006)	0.020 *** (0.006)	0.016 ** (0.007)
SEI Firm								0.053 * (0.027)	
Constant	−0.432 (0.281)	0.258 (0.192)	0.503 *** (0.133)	−0.455 * (0.266)	−0.505 * (0.274)	−0.178 (0.277)	−0.509 ** (0.252)	−0.458 * (0.264)	−0.626 ** (0.289)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	18,809	18,809	18,809	21,859	21,620	21,831	21,858	21,859	17,399
Adj. R^2	0.858	0.829	0.843	0.834	0.895	0.865	0.852	0.834	0.843

Notes: Standard errors are clustered at the supplier level, except in Column (4), where standard errors are two-way clustered at the supplier and customer levels. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. SEI refers to Strategic Emerging Industries.

2. Alternative Clustering Structure and High-Dimensional Fixed Effects. Because the empirical analysis is conducted at the customer–supplier dyad-year level, error terms

may be correlated across observations involving the same upstream supplier or the same downstream customer. In addition, unobserved regional and industry-specific shocks may simultaneously affect firms' supply chain configurations and the transmission of certification effects. Failure to account for these sources of dependence and time-varying heterogeneity may lead to biased statistical inference or confounded estimates.

To address these concerns, this study conducts two sets of robustness tests. First, the baseline model is re-estimated using two-way clustered standard errors at the supplier and customer levels, allowing for arbitrary correlation among observations associated with the same upstream supplier and the same downstream customer. Second, more stringent high-dimensional fixed-effects specifications are employed by sequentially absorbing city-by-year, industry-by-year, and province-by-year fixed effects, while retaining supplier fixed effects. These specifications control for time-varying shocks common to firms located in the same city or province, as well as shocks shared by firms operating in the same industry.

As reported in Columns (4)–(7) of Table 3, the estimated coefficients on Policy remain positive and statistically significant across all specifications. When standard errors are two-way clustered at the supplier and customer levels, the estimated coefficient is 0.021 and statistically significant at the 1% level. After incorporating city-by-year fixed effects, the coefficient remains positive at 0.011 and is significant at the 5% level. The corresponding estimates are 0.016 at the 1% significance level under industry-by-year fixed effects and 0.015 at the 5% significance level under province-by-year fixed effects. Overall, these results indicate that the positive effect of downstream customer certification on upstream suppliers' supply chain diversification is robust to alternative clustering structures and stringent controls for time-varying regional and industry-level heterogeneity.

3. Accounting for Concurrent Policy Effects. A review of major industrial policies implemented during the sample period indicates that policies supporting strategic emerging industries overlap temporally with the national-level SRDI "Little Giant" certification program. Since 2010, China has continuously promoted the development of strategic emerging industries, with successive national development plans identifying their cultivation and expansion as an important policy objective. To alleviate concerns that these concurrent policy initiatives may confound the estimated effect of "Little Giant" certification, this study conducts two additional robustness tests.

First, the baseline specification is augmented with an indicator capturing exposure to the Strategic Emerging Industries policy. The indicator equals one if at least one of an upstream supplier's five largest customers is identified as a strategic emerging industry firm in a given year, and zero otherwise. Second, the sample is further restricted by excluding supplier–year observations potentially affected by the Strategic Emerging Industries policy.

Columns (8) and (9) of Table 3 report the corresponding results. In Column (8), after controlling for exposure to the Strategic Emerging Industries policy, the estimated coefficient on Policy is 0.020 and remains statistically significant at the 1% level. The coefficient on the SEI-policy exposure indicator itself is 0.053 and statistically significant at the 10% level, suggesting that exposure to strategic emerging industry firms may also be associated with greater supply chain diversification. More importantly, controlling for this concurrent policy does not materially alter the estimated effect of downstream customer certification. In Column (9), after excluding observations potentially affected by the Strategic Emerging Industries policy, the coefficient on Policy remains positive at 0.016 and statistically significant at the 5% level. Both estimates are close in magnitude to the baseline coefficient of 0.021.

Taken together, these results indicate that the positive effect of national-level SRDI "Little Giant" certification on upstream suppliers' supply chain diversification is not materially altered after accounting for concurrent policies supporting strategic emerging industries. The baseline conclusion therefore remains robust after explicitly controlling for, and alternatively excluding, observations potentially affected by this overlapping industrial policy.

4. Alternative Unit of Analysis and Dyad Fixed Effects. The baseline specification uses customer–supplier dyad-year observations, whereas *SCD* is measured at the supplier-year level. To examine whether the baseline results are affected by repeated supplier-year observations or persistent heterogeneity across customer–supplier relationships, we conduct two additional robustness checks. First, we aggregate the baseline sample to the supplier-year level and define supplier exposure based on customer relationships observed in the year immediately preceding certification, so that each supplier-year enters the estimation only once. As reported in Columns (1) and (2) of Table 4, the estimated coefficients on supplier exposure are 0.037 and 0.035, respectively, and both are statistically significant at the 5% level. Column (1) includes supplier and year fixed effects without additional firm-level controls, whereas Column (2) further includes the full set of controls. Second, we return to the customer–supplier dyad-year sample and introduce supplier–customer dyad fixed effects to absorb persistent time-invariant heterogeneity specific to each trading relationship. As shown in Column (3) of Table 4, the estimated coefficient on Policy is 0.022 and remains statistically significant at the 10% level. Overall, the positive relationship is preserved when the analysis is conducted at the supplier-year level and when persistent dyad-specific heterogeneity is absorbed, providing additional support for the robustness of the baseline findings.

Table 4. Additional Robustness Tests.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	SCD	*SCD*	*SCD*	*SCD*	*SCD*	*SCD*	*SCD*	*SCD*	*SCD*
POLICY			0.022 *	0.034 ***	0.030 **	0.034 **	0.019 **	0.021 ***	
			(0.013)	(0.013)	(0.013)	(0.014)	(0.008)	(0.006)	
Supplier Exposure	0.037 **	0.035 **							
	(0.017)	(0.017)							
POLICY_pre									0.035 **
									(0.017)
Constant	0.630 ***	−0.379	−0.423	0.617 ***	−0.701	0.744 **	−0.482 *	−0.452 *	−0.379
	(0.000)	(0.256)	(0.303)	(0.000)	(0.520)	(0.375)	(0.281)	(0.266)	(0.256)
Controls	No	Yes	Yes	No	Yes	No	Yes	Yes	Yes
2018 Covariates × Year	No	No	No	No	No	Yes	No	No	No
Supplier FE	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Supplier–Customer Dyad FE	No	No	Yes	No	No	No	No	No	No
N	6200	6200	12,873	9841	9841	9841	21,069	21,792	6200
Adj. R^2	0.775	0.787	0.863	0.807	0.818	0.824	0.836	0.834	0.787

Notes: Columns (1)–(2) use supplier-year observations, while Column (3) includes supplier–customer dyad fixed effects. Columns (4)–(6) use the same restricted sample of 9841 observations for alternative covariate adjustments. Supplier Exposure is defined using customer relationships observed in the year immediately preceding certification. Standard errors clustered at the supplier-firm level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

5. Leave-One-Out Sensitivity Tests. To examine whether the baseline results are disproportionately driven by a small number of certification events or exposed firms, we

conduct three leave-one-out sensitivity tests. First, we sequentially exclude each of the 93 treated customers and re-estimate the baseline model. The estimated coefficients remain positive and statistically significant at the 1% level in all iterations, ranging from 0.0185 to 0.0230. Second, we sequentially exclude each of the 78 exposed suppliers. The estimated coefficients again remain positive and statistically significant at the 1% level in all iterations, ranging from 0.0185 to 0.0232. Finally, we sequentially exclude each of the six certification cohorts from 2019 to 2024. The estimated coefficients remain positive and statistically significant at the 5% level in all six iterations, ranging from 0.0156 to 0.0251. Across all three exercises, the estimates remain close to the baseline coefficient of 0.0209, indicating that the baseline finding is not driven by any single treated customer, exposed supplier, or certification cohort.

Given that the treated observations correspond to 78 treated supplier clusters, we further assess statistical inference using a wild cluster bootstrap at the supplier level. Based on 9999 bootstrap replications, the treatment effect remains statistically significant at the 1% level. The bootstrap p-value is 0.0032, and the 95% confidence interval ranges from 0.0075 to 0.0334. This result provides additional support for the baseline inference under the observed treated-cluster structure.

6. Alternative Covariate Adjustment. To address the concern that some contemporaneous control variables may themselves respond to downstream customer certification, we further compare alternative covariate-adjustment strategies using the same restricted sample. As reported in Columns (4)–(6) of Table 4, Column (4) excludes contemporaneous controls, Column (5) retains the original contemporaneous controls, and Column (6) replaces them with supplier characteristics measured in 2018, prior to the first national-level SRDI "Little Giant" certification round, interacted with year indicators. The estimated coefficients are 0.034, 0.030, and 0.034, respectively. The similarity of the estimates across these three specifications indicates that the positive relationship is not materially altered by the choice between contemporaneous and pre-policy covariate adjustment.
7. Excluding 2025 Observations. The sample extends through 2025, and the 2025 observations are obtained directly from the CSMAR database based on the annual data available at the time of data extraction. Because the number of available observations in 2025 is relatively smaller than that in preceding years, we further exclude all 2025 observations and re-estimate the baseline specification to examine whether the coverage of the most recent year affects the baseline estimates.

As reported in Column 7 of Table 4, the coefficient on *POLICY* remains positive and statistically significant at the 5% level, with an estimated coefficient of 0.019 and a standard error of 0.008. The sign, magnitude, and statistical significance of the estimate are broadly consistent with the baseline result, indicating that the main findings are not driven by the inclusion of the 2025 observations and remain robust after excluding the most recent sample year.

8. Addressing Potential Anticipation Effects. The baseline specification defines *POLICY* as taking a value of one beginning in the year following a downstream customer's formal national-level SRDI "Little Giant" certification. This treatment timing is intended to distinguish the post-certification period from the application, evaluation, recommendation, and announcement process occurring before or during the formal certification year. However, because firms and their trading partners may obtain information about prospective certification during this process, potential anticipation effects cannot be completely ruled out.

To address this concern, we exclude all observations corresponding to the formal certification year and re-estimate the baseline specification. As reported in Column (8) of Table 4, the coefficient on *POLICY* remains positive and statistically significant at the 1% level, with an estimated coefficient of 0.021 and a standard error of 0.006. This estimate is nearly identical to the baseline coefficient of 0.021. The stability of the coefficient after excluding the certification year indicates that the main result is not driven by observations from the period in which application, evaluation, and certification-related information may already have begun to affect firms' behavior.

9. Robustness to Endogenous Network Formation: Pre-Certification Network Exposure. The baseline supply chain relationships are identified from contemporaneous disclosures of major trading partners. Because customer certification may itself affect relationship formation, persistence, transaction importance, or disclosure, the composition of the observed network could potentially be endogenous to treatment. To address this concern, we construct an alternative exposure measure based exclusively on customer–supplier relationships observed in the year immediately preceding the customer's certification.

Specifically, a supplier is classified as exposed only if it was already connected to a subsequently certified customer before certification. Once such pre-certification exposure is established, the supplier's treatment status from the corresponding post-certification period onward does not depend on whether the same customer–supplier relationship continues to appear in subsequent major-partner disclosures. We further conduct the estimation at the supplier-year level so that each supplier-year outcome enters the regression only once. Suppliers not exposed through a pre-certification relationship, together with not-yet-exposed supplier-years, serve as comparison observations.

As reported in Column (9) of Table 4, the coefficient on the pre-certification exposure indicator is 0.035, with a standard error of 0.017, and remains statistically significant at the 5% level. The estimation sample contains 6200 supplier-year observations. These findings indicate that the baseline result remains robust when policy exposure is determined solely from pre-certification network information and is not conditioned on the post-certification survival or continued disclosure of customer–supplier relationships.

4.4. Mechanism Analysis

The preceding theoretical analysis suggests that the national-level SRDI "Little Giant" certification of a downstream customer may promote supply chain diversification among its upstream suppliers through two channels: a reputation-related channel and operating-resource adjustment. First, certification provides an authoritative institutional endorsement of the downstream customer. Through established supply chain relationships, this positive signal may spill over to connected upstream suppliers and improve external perceptions of their product quality, production capabilities, and contractual reliability, thereby reducing information frictions and facilitating adjustments in their major trading relationships. Second, certification may strengthen downstream customers' growth prospects and increase their requirements for product quality, delivery reliability, and supply continuity. In response, upstream suppliers may adjust the commitment and utilization of operating resources to accommodate changes in transaction requirements, production arrangements, and interfirm coordination. Such operating-resource adjustments may facilitate the reallocation of purchases and sales across major trading relationships. Following Jiang (2022) [55], this study examines whether downstream customer certification is associated with changes in the proposed mechanism variables, thereby providing suggestive evidence consistent with the underlying transmission channels.

4.4.1. Reputation-Related Channel

The national-level SRDI "Little Giant" certification conveys favorable information regarding a downstream customer's technological capabilities, growth potential, and operational quality. For an upstream supplier maintaining an established trading relationship with a certified customer, this relationship may also provide external stakeholders with favorable information about the supplier's product quality, production capabilities, and contractual reliability. Consequently, the institutional endorsement associated with the certified customer may spill over through the existing customer–supplier relationship, increasing the supplier's positive media visibility and potentially improving external perceptions of the supplier.

More favorable external perceptions can reduce information-search and evaluation costs for existing and potential trading partners and alleviate information frictions in interfirm transactions. This may give suppliers greater flexibility to adjust the distribution of transactions across their major trading relationships and reduce excessive dependence on a limited number of counterparties. Accordingly, the reputation-related channel may contribute to a less concentrated distribution of transaction shares among major supply chain partners.

Following Ye et al. (2010) and Guo et al. (2024) [56,57], this study uses positive media coverage as a media-based proxy for supplier reputation. The media data provide annual firm-level news statistics from both online financial media and newspaper sources, with news reports classified into positive, neutral, and negative categories. *REP1* is measured as the natural logarithm of one plus the total number of positive online and newspaper reports concerning the supplier in a given year. *REP2* is constructed using the corresponding number of positive reports classified by the database as original news and applies the same logarithmic transformation. Thus, *REP2* provides a more restrictive alternative measure of positive media exposure. In our construction, firm-year observations with a recorded count of zero positive reports are assigned zero positive coverage before the logarithmic transformation, whereas observations with missing media information are not treated as zero. Because both measures are derived from positive media coverage, *REP1* and *REP2* should be viewed as closely related alternative proxies rather than independent measures of supplier reputation. Moreover, positive media coverage may partly reflect changes in firms' general media visibility. Accordingly, we interpret these measures as media-based proxies for reputation, and the corresponding regressions as suggestive evidence consistent with a reputation-related channel rather than as a complete causal mediation test.

Columns (1) and (2) of Table 5 report the corresponding estimates. The estimated coefficient on Policy is 0.233 for *REP1* and 0.223 for *REP2*, and both coefficients are statistically significant at the 10% level. These results indicate that downstream customer certification is associated with greater positive media coverage of upstream suppliers under both measures. Given the relatively modest statistical significance and the measurement limitations discussed above, the results should be interpreted cautiously. Taken together, the estimates provide suggestive evidence consistent with a reputation-related channel, whereby more favorable external perceptions may reduce information frictions and facilitate adjustments in the distribution of transactions across major trading relationships. Accordingly, the evidence is consistent with Hypothesis 2, but should not be interpreted as establishing a causally identified transmission mechanism.

Table 5. Results of the Mechanism Analysis.

Variable	(1)	(2)	(3)	(4)	(5)	(6)
	REP1	***REP2***	***OWCI***	***OWCI_AP***	***OWCI_AR***	***CAT***
POLICY	0.233 *	0.223 *	0.017 **	−0.001	0.005 *	−0.062 **
	(0.130)	(0.116)	(0.007)	(0.003)	(0.003)	(0.024)
Constant	−3.338 **	−2.914 **	−0.098	0.467 ***	0.591 ***	4.508 ***
	(1.480)	(1.334)	(0.247)	(0.140)	(0.173)	(1.347)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Supplier FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	18,906	18,906	11,777	21,849	21,778	21,851
Adj. R^2	0.765	0.764	0.862	0.858	0.894	0.864

Notes: Standard errors clustered at the supplier-firm level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$.

4.4.2. Operating Resource Adjustment Channel

Downstream customer certification may induce upstream suppliers to adjust the allocation of financial and operating resources in response to changes in trading requirements and relationship structures. In particular, maintaining and adjusting major trading relationships may require suppliers to commit additional resources to day-to-day operations and to alter the utilization of current assets. We therefore examine whether customer certification is associated with changes in suppliers' operating working-capital commitment and current-asset utilization.

We employ operating working-capital investment (*OWCI*) and current-asset turnover (*CAT*) as two indicators of operating-resource adjustment. *OWCI* is calculated as the sum of net accounts receivable, net notes receivable, and net prepayments, minus accounts payable, advances from customers, and notes payable, scaled by total assets. A higher *OWCI* therefore indicates a greater net commitment of financial resources to operating working capital. *CAT* is measured as operating revenue divided by average current assets and captures the turnover of current assets. To further examine the source of the change in *OWCI*, we additionally consider the accounts-payable-to-assets ratio (*OWCI_AP*) and the net-accounts-receivable-to-assets ratio (*OWCI_AR*) as two key underlying components. Because changes in *CAT* may arise from changes in either operating revenue or current-asset holdings, we do not interpret a lower *CAT* as direct evidence of greater buffering capacity.

Columns (3)–(6) of Table 5 report the results for the operating-resource adjustment channel. The coefficient on Policy is 0.017 for *OWCI* and is statistically significant at the 5% level, indicating that downstream customer certification is associated with greater operating working-capital commitment by upstream suppliers. Further examination of two underlying components shows that *OWCI_AR* increases significantly at the 10% level, whereas *OWCI_AP* does not exhibit a statistically significant change. These results suggest that the increase in operating working-capital commitment is more closely associated with changes in accounts receivable than with accounts payable. In addition, the coefficient on *CAT* is −0.062 and statistically significant at the 5% level, indicating a decline in current-asset turnover following downstream customer certification. Taken together, the results are consistent with adjustments in suppliers' operating-resource allocation following customer certification.

Taken together, the results indicate that downstream customer certification is associated with adjustments in upstream suppliers' operating resources, reflected in greater operating working-capital commitment and lower current-asset turnover. The increase in

OWCI is more closely related to changes on the receivables side. These findings provide suggestive evidence consistent with an operating-resource adjustment channel through which downstream customer certification may be related to upstream supply chain diversification.

4.5. Heterogeneity Analysis

To further examine the conditions under which the national-level SRDI "Little Giant" certification of downstream customers affects supply chain diversification among upstream suppliers, this section investigates whether the estimated effect varies across different dimensions. The purpose is to provide a more nuanced understanding of how the certification spillover effect is shaped by differences in supply chain adjustment direction, suppliers' pre-existing investment status, and market position. Specifically, the heterogeneity analysis is conducted along three dimensions: the direction of supply chain diversification, the pre-certification investment status of the upstream supplier, and the upstream supplier's pre-certification market share. These analyses help identify whether the certification effect operates differently across procurement- and sales-side adjustments and whether suppliers with different pre-certification investment conditions and market positions respond differently to downstream customer certification.

4.5.1. Direction of Supply Chain Diversification

Supply chain diversification may occur through adjustments on either the procurement or sales side, and these two forms of reconfiguration are subject to different operational constraints and adjustment costs [58]. Accordingly, this study examines supply chain diversification along the procurement and sales dimensions. Procurement-side diversification is measured as one minus supplier concentration, denoted as *SCD_sup*, whereas sales-side diversification is measured as one minus customer concentration, denoted as *SCD_cus*. The aggregate *SCD* measure and the two directional measures are separately transformed from the corresponding concentration indicators provided by the CSMAR database rather than being reconstructed from one another.

The results are reported in Columns (1)–(3) of Table 6. To eliminate potential differences arising from sample composition, all three specifications are estimated using the same sample of 19,582 observations for which both customer- and supplier-concentration measures are available. Column (1) shows that the coefficient on Policy for aggregate supply chain diversification remains positive and statistically significant at the 1% level (coefficient = 0.019). Columns (2) and (3) further distinguish the sales and procurement dimensions. The estimated coefficient is 0.011 for sales-side diversification and is statistically insignificant, whereas the coefficient for procurement-side diversification is 0.025 and statistically significant at the 1% level. An additional direct test of the coefficient difference, accounting for the correlation between the two outcomes, yields a procurement-minus-sales difference of 0.014, with a p-value of 0.209. Thus, although the procurement-side estimate is individually statistically significant, the evidence does not establish that the procurement-side effect is significantly stronger than the sales-side effect.

The positive procurement-side estimate is consistent with the possibility that downstream customer certification is associated with adjustments in the distribution of purchases across their major suppliers. Certification may strengthen downstream customers' growth prospects and operating requirements, thereby increasing upstream suppliers' need to secure reliable access to production inputs and maintain fulfillment continuity. Under such conditions, suppliers may reduce excessive dependence on a limited number of major input providers and distribute procurement shares more evenly across major supplier relationships. On the sales side, suppliers may have weaker immediate incentives to alter the distribution of sales across major customers because stable relationships with

core customers can remain valuable, particularly when certified customers are expected to provide stronger growth prospects and greater transaction stability. Given that the direct difference between the procurement- and sales-side coefficients is not statistically significant, these directional patterns should be interpreted as suggestive rather than as evidence of a statistically significant difference between the two sides.

Table 6. Results of the Heterogeneity Analysis.

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	SCD	*SCD_sup*	*SCD_cus*	*Overinvestment*	*Underinvestment*	*High Market Share*	*Low Market Share*
POLICY	0.019 ***	0.025 ***	0.011	0.053 ***	0.027 *	0.049 ***	0.018
	(0.006)	(0.008)	(0.008)	(0.011)	(0.015)	(0.012)	(0.015)
Constant	−0.429	−0.874 **	0.006	−0.693 **	−0.090	−0.671	−0.097
	(0.277)	(0.387)	(0.394)	(0.351)	(0.468)	(0.456)	(0.321)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
CODE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
YEAR	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	19,582	19,582	19,582	7088	9364	9299	8128
Adj. R^2	0.860	0.892	0.790	0.821	0.809	0.833	0.793
Difference in coefficients				−0.026		−0.031	
p-value for difference				0.080		0.068	

Notes: Standard errors clustered at the supplier level are reported in parentheses. * $p < 0.10$, ** $p < 0.05$, and *** $p < 0.01$. Columns (1)–(3) use a common sample. The procurement–sales coefficient difference is tested directly. For Columns (4)–(7), coefficient differences are calculated as the second subgroup minus the first, with empirical *p*-values obtained from 1000 supplier-level bootstrap replications. Investment-status and market-share groups are defined using pre-certification information and held fixed throughout the analysis.

4.5.2. Heterogeneity by Investment Status

A supplier's pre-existing investment status may affect its propensity and capacity to adjust resource allocation and the distribution of transactions across major supply chain relationships in response to downstream customer certification. Following Richardson (2006), we classify suppliers according to the sign of the residual from the expected investment model [59]. A positive residual indicates that actual investment exceeds the predicted level and is identified as overinvestment, whereas a negative residual indicates that actual investment falls below the predicted level and is identified as underinvestment. To avoid using potentially post-treatment information, the classification is based on the latest available investment status prior to the downstream customer's certification. For suppliers that are never exposed during the sample period, we use the latest available investment status prior to the start of the certification program. Once determined, group membership is held fixed throughout the analysis.

The results are reported in Columns (4) and (5) of Table 6. For overinvesting suppliers, the estimated coefficient on Policy is 0.053 and statistically significant at the 1% level. For underinvesting suppliers, the corresponding coefficient is 0.027 and statistically significant at the 10% level. A direct bootstrap test of the difference between the two coefficients yields an underinvestment-minus-overinvestment difference of −0.026, with an empirical *p*-value of 0.080. The between-group difference is therefore marginally significant at the 10% level, providing suggestive evidence that the effect of downstream customer certification is larger among suppliers characterized by overinvestment prior to certification.

One possible explanation is that overinvesting suppliers are characterized by a stronger propensity to deploy investment resources beyond their predicted levels. When downstream customer certification changes transaction opportunities or operating requirements, this pre-existing investment propensity may make such suppliers more responsive in reallocating transaction shares across major supply chain relationships. By contrast, under-

investing suppliers may have less scope or willingness to undertake comparable resource and transaction adjustments, resulting in a relatively smaller response to downstream customer certification.

4.5.3. Heterogeneity by Market Share

A firm's market position may affect its ability to respond to external opportunities and adjust the distribution of transactions across its major supply chain relationships. Firms with a larger market share generally possess stronger bargaining power and greater organizational and resource capacity, which may enable them to respond more effectively to the operational and transaction opportunities generated by downstream customer certification. Accordingly, this study measures firm-level market share as the ratio of a supplier's annual operating revenue to the total annual operating revenue of all firms in the same industry. To avoid classifying suppliers on the basis of potentially post-treatment information, market-share groups are determined using pre-certification values. For suppliers that are subsequently exposed to certification, we use the latest available market-share value prior to the downstream customer's certification; for suppliers that are never exposed during the sample period, we use the latest available value prior to the start of the certification program. Suppliers are then classified into high- and low-market-share groups according to the median of this pre-certification measure calculated at the supplier level, and group membership is held fixed throughout the analysis.

The results are reported in Columns (6) and (7) of Table 6. For suppliers with a high pre-certification market share, the estimated coefficient on Policy is 0.049 and statistically significant at the 1% level. For suppliers with a low pre-certification market share, the corresponding coefficient is 0.018 and is not statistically significant. Importantly, a direct bootstrap test of the difference between the two coefficients yields an estimated low-minus-high difference of -0.031, with an empirical p-value of 0.068. Thus, the between-group difference is marginally significant at the 10% level, providing weak evidence that the effect of downstream customer certification is larger among suppliers with a higher pre-certification market share.

One possible explanation is that suppliers with a stronger pre-existing market position may have greater bargaining capacity and more organizational resources available for adjusting their transaction structure. When downstream customer certification changes transaction opportunities or operating requirements, these suppliers may be better positioned to reallocate transaction shares across major supply chain relationships and reduce the concentration of their trading relationships. By contrast, suppliers with a lower market share may face greater constraints in making comparable adjustments. Nevertheless, because the between-group difference is significant only at the 10% level, this result should be interpreted as suggestive rather than as strong evidence of market-share heterogeneity.

5. Discussion, Conclusions, and Implications

5.1. Main Findings and Discussion

Against the background of rising uncertainty in global supply chains and growing policy attention to the development of high-quality SMEs, this study examines whether China's national-level SRDI "Little Giant" certification generates spillover effects beyond directly certified firms. Using customer–supplier relationship data for Chinese listed firms from 2012 to 2025, this study exploits the staggered timing of downstream customer certification within a difference-in-differences framework to investigate its effect on the supply chain diversification of upstream suppliers. In this study, supply chain diversification is reflected in a less concentrated distribution of transaction shares among firms' major disclosed trading partners. The analysis further examines the underlying transmission

channels and heterogeneous responses across different supply chain adjustment directions and supplier characteristics.

First, the results show that downstream customer certification significantly increases upstream suppliers' supply chain diversification, as reflected in a more dispersed distribution of transaction shares among major trading partners. The baseline estimate remains positive and statistically significant after using alternative measures of supply chain diversification, alternative clustering structures, high-dimensional fixed effects, controls for concurrent industrial policies, and placebo tests. The interaction-weighted Sun–Abraham event-study analysis provides complementary evidence on heterogeneous treatment timing and dynamic patterns but does not independently confirm the statistical significance of the baseline estimate. The result also remains significant when the 2025 observations are excluded. The dynamic estimates further indicate that the effect does not emerge immediately after certification but becomes more evident over time, suggesting that adjustments in major trading relationships occur gradually rather than instantaneously.

This finding is broadly consistent with international evidence showing that firms adjust their supply chain configurations in response to changes in the policy and risk environments surrounding their trading relationships. Namdar et al. (2025) show that heightened upstream policy uncertainty is associated with greater geographical diversification of firms' supply bases, indicating that shocks originating outside the focal firm can induce adjustments in sourcing structures [60]. Ersahin et al. (2024) similarly find that firms respond to greater supply chain risk by changing supplier composition, including greater reliance on geographically closer, domestic, and industry-leading suppliers, as well as greater vertical integration [61]. These studies and the present findings jointly suggest that changes in the external environment surrounding interfirm relationships can lead firms to reconsider how their supply chains are configured. The present study differs from this international evidence by focusing on an enterprise-oriented industrial policy directed at a connected downstream SME and examining how such policy treatment is associated with the diversification of an upstream supplier's major trading relationships.

At the same time, a less concentrated distribution of major trading relationships should not be interpreted as direct evidence of greater supply chain resilience or stability. Jiang et al. (2023) show that the relationship between customer or supplier concentration and firm resilience depends on both the direction of the trading relationship and the stage of disruption [2]. In their analysis, concentration can have different effects during disruption and restoration periods. This evidence highlights the context-dependent nature of the relationship between supply chain concentration and resilience. Accordingly, the present findings establish changes in the concentration and distribution of transaction shares among major disclosed trading partners, rather than directly establishing expansion of the complete supply chain network, greater resilience, or improved supply chain stability.

One possible explanation for the observed adjustment is that certification changes the information environment and operating conditions faced by connected suppliers. National-level "Little Giant" certification provides an institutionally recognized signal of the certified customer's specialization, innovation capacity, and growth potential. For upstream suppliers maintaining established trading relationships with certified customers, this signal may spill over through interfirm relationships and improve their external visibility. At the same time, changes in downstream transaction and coordination requirements may induce suppliers to adjust the commitment and utilization of operating resources. These changes may alter the conditions under which suppliers reallocate transactions across major trading partners and reduce excessive dependence on a limited number of counterparties.

Second, the mechanism analysis provides evidence consistent with two complementary transmission channels: a reputation-related channel and operating-resource adjust-

ment. Downstream customer certification is associated with greater positive media exposure for upstream suppliers, whether measured using total positive reports or original positive reports. This pattern is consistent with a reputation-related channel through which association with a certified customer may improve the external visibility of connected suppliers and reduce information frictions in their interactions with existing and potential trading partners. Lower informational barriers may, in turn, facilitate adjustments in the distribution of transactions across major trading relationships.

The second channel concerns operating-resource adjustment. Following downstream customer certification, upstream suppliers increase their operating working capital investment, while current-asset turnover declines, providing complementary evidence of adjustments in operating-resource utilization. These results are more appropriately interpreted as changes in the commitment and utilization of operating resources accompanying evolving transaction and coordination requirements, rather than as direct evidence of greater operational slack, buffering capacity, or resilience. Adjustments in operating working capital and current-asset utilization may accompany changes in payment arrangements, transaction volumes, and coordination requirements as suppliers redistribute purchases and sales across major trading partners. The mechanism results therefore provide evidence consistent with the proposed transmission channel, but should not be interpreted as a complete causal mediation decomposition.

These mechanism findings also connect with the broader international literature on SME supply chains. Based on a sample of Australian SMEs, Nakandala et al. (2025) show that digital capabilities, supplier relationships, prior disruption experience, and access to government assistance play important roles in shaping SME supply chain robustness and resilience [30]. Their findings highlight the importance of interfirm relationships, organizational resources, and external support in firms' responses to supply chain uncertainty. The present study complements this literature from a different perspective. Rather than directly examining resilience, it investigates whether policy support received by a connected downstream SME is associated with adjustments in the concentration of an upstream supplier's major trading relationships and provides evidence on the information and operating-resource channels that may accompany this adjustment.

Third, further analysis reveals heterogeneous patterns across supply chain adjustment directions and supplier characteristics. The estimated effect is statistically significant on the procurement side, whereas the corresponding sales-side estimate is not statistically significant. However, a direct test of the difference between the procurement- and sales-side coefficients shows that the difference is not statistically significant. The evidence therefore does not support the stronger conclusion that the effect operates primarily through procurement. Rather, the adjustment appears more evident in procurement relationships, while the estimated difference between the two directions remains statistically indistinguishable.

The heterogeneity analysis further indicates that the effect tends to be stronger among suppliers that exhibited overinvestment prior to certification. This pattern suggests that suppliers entering the policy shock with different pre-existing investment conditions may respond differently in reallocating transactions across major trading partners. However, because the between-group difference is only marginally significant, this result should be interpreted as evidence of a heterogeneous pattern rather than a definitive structural difference between overinvesting and underinvesting suppliers.

A similar pattern emerges with respect to suppliers' pre-certification market positions. Suppliers with larger pre-certification market shares exhibit a stronger estimated diversification response than those with smaller market shares. This finding is consistent with the possibility that suppliers with stronger pre-existing market positions face fewer constraints when adjusting major trading relationships. Again, because the between-group difference is

only marginally significant, the result is interpreted cautiously as suggestive evidence that market position may shape firms' ability to respond to policy-induced changes transmitted through supply chain relationships.

Taken together, the findings show that the effects of SRDI "Little Giant" certification can extend beyond directly supported SMEs through existing customer–supplier relationships. More specifically, downstream customer certification is associated with a more dispersed distribution of transaction shares among the major trading partners of connected upstream suppliers. The evidence on the reputation-related channel and operating-resource adjustment further identifies two potential channels associated with this process. These findings contribute to the emerging literature on SRDI supply chain spillovers by extending the range of outcomes examined from innovation, production efficiency, and operating performance to the diversification of major trading relationships. The contribution therefore lies not in treating cross-firm spillovers themselves as an unexplored phenomenon but in showing that such spillovers are also associated with changes in the concentration and distribution of major trading relationships.

The study also contributes to research on the determinants of supply chain diversification. Existing studies have largely focused on institutional conditions, external uncertainty, or the characteristics and capabilities of the focal firm. The present evidence suggests that policy treatment received by an economically connected trading partner may constitute another relational factor associated with firms' supply chain adjustment. In this sense, supply chain configuration is shaped not only by conditions directly confronting the focal firm but also by policy-induced changes transmitted through existing interfirm relationships.

Several limitations should be acknowledged. First, the supply chain relationship data primarily capture major disclosed customers and suppliers of listed firms and therefore do not represent firms' complete transaction networks. The diversification measures used in this study capture changes in the concentration and distribution of transaction shares among major disclosed trading partners rather than changes in the total number, geographic breadth, or complete network structure of all supplier and customer relationships. Accordingly, the results should not be interpreted as direct evidence that firms expand their complete supply chain networks or improve supply chain resilience or stability.

Second, the effective treatment sample is determined by the availability and matching of SRDI certification information, listed-firm supply chain disclosures, and firm-level financial data. The estimates therefore primarily characterize listed suppliers for which these data can be jointly observed. Caution is required when generalizing the findings to unlisted SMEs, firms without comparable major-partner disclosures, or other populations that are not represented in the effective treatment sample.

Third, although the staggered DID design, high-dimensional fixed effects, placebo tests, controls for concurrent industrial policies, and the Sun–Abraham estimator address several identification concerns, the observational nature of the data means that time-varying unobserved factors cannot be completely ruled out. Future research could exploit additional exogenous policy variation or more granular institutional shocks to strengthen causal identification.

Fourth, the mechanism variables are empirical proxies for broader theoretical constructs. Media-based measures capture observable positive external attention but do not represent all dimensions of corporate reputation. Similarly, operating working capital investment and current-asset measures capture particular dimensions of operating-resource adjustment rather than organizational flexibility, slack resources, or supply chain resilience themselves. Future research could employ more direct measures of external reputation, resource reallocation, relationship-specific investment, and interfirm coordination to provide a more refined assessment of the underlying mechanisms.

Finally, the findings are derived from China's institutional environment and the national-level SRDI "Little Giant" policy framework. International evidence suggests that supply chain adjustment and the consequences of trading-partner concentration can differ across institutional settings, types of uncertainty, and stages of disruption. Differences in industrial-policy design, SME support systems, capital markets, and supply chain structures may therefore limit the direct generalizability of the findings to other countries. Future comparative research could examine whether SME-oriented industrial policies generate similar changes in connected firms' major trading relationships under different institutional environments.

5.2. Policy Implications

The findings suggest that the national-level SRDI "Little Giant" policy may generate effects that extend beyond certified SMEs and be associated with adjustments in the major trading relationships of connected upstream suppliers. Therefore, policy evaluation and implementation should not focus exclusively on the direct performance of certified firms. Greater attention should be given to how policy effects may be transmitted through customer–supplier networks and to whether connected firms have sufficient capacity to adjust their major trading relationships in response to such policy exposure. Based on the empirical findings, the following policy implications are proposed.

First, the supply chain spillover effects of SRDI policy should be explicitly incorporated into policy design and evaluation. Existing policy assessment often emphasizes outcomes at the certified-firm level, such as innovation, productivity, financing, and growth. The results of this study indicate that certification is also associated with adjustments in the major trading relationships of upstream firms. Policy authorities could therefore supplement firm-level evaluation with network-level indicators, including the concentration and distribution of major supplier–customer relationships. At the same time, certified "Little Giant" enterprises could be encouraged to play a stronger role as anchor firms within industrial chains by facilitating information sharing, technological collaboration, supplier development, and broader participation of upstream firms in high-quality supply networks.

Second, policy support should strengthen the ability of upstream suppliers to convert certification spillovers into sustainable supply chain adjustment. The mechanism results provide suggestive evidence consistent with a reputation-related channel and operating-resource adjustment. Accordingly, policies can improve information disclosure, credit evaluation, and supplier-recognition mechanisms to help qualified upstream firms convert supply chain associations with certified customers into credible market signals. Financial institutions and local governments may also provide more flexible working-capital financing and supply-chain finance services to suppliers facing increased production and fulfillment requirements. Such support may help suppliers manage changes in operating-resource commitments associated with evolving transaction and coordination requirements.

Third, differentiated support should be provided to suppliers with weaker resource endowments and market positions. The stronger diversification effects observed among suppliers with larger pre-certification market shares suggest that the ability to benefit from certification spillovers may depend partly on firms' resource availability and market position. Suppliers with lower market shares may face greater constraints in adjusting their major trading relationships and may therefore benefit from improved access to credit, supplier-development programs, market information, and business-matching platforms. Rather than applying uniform support, policymakers should pay particular attention to reducing the financing and information constraints that may limit these firms' ability to adjust their supply chain relationships.

Fourth, policy support may also pay attention to procurement-side adjustments while recognizing that the estimated difference between procurement- and sales-side effects is not statistically significant. The empirical results show that the estimated association is more evident on the procurement side, but the direct difference between the procurement- and sales-side coefficients is not statistically significant. Policymakers and industry associations could therefore encourage firms to establish alternative sourcing arrangements, develop multi-source procurement strategies, improve supplier qualification systems, and strengthen digital supplier-matching platforms. These measures may help reduce excessive dependence on individual input suppliers, although the present study does not directly establish improvements in supply chain resilience or disruption-absorption capacity.

Overall, the policy objective should not be simply to maximize the number of certified "Little Giant" enterprises but to strengthen the broader supply chain system through which certification effects may be transmitted. A policy framework that combines high-quality SME cultivation, supplier capability building, financial support, and information sharing may help extend the benefits of firm-level industrial policy to connected firms and support more adaptive adjustments in major trading relationships.

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Abbreviations

The following abbreviations are used in this manuscript:

SRDI	Specialized, Refined, Distinctive, and Innovative
SMEs	Small- and Medium-Sized Enterprises
SCD	Supply Chain Diversification

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