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THE MODERATING ROLE OF HORIZONTAL COMPLEXITY IN THE SUPPLIER DEPENDENCE-FINANCIAL PERFORMANCE

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Abstract

This study examines the moderating effect of a focal firm's horizontal complexity on the relationship between supplier dependence and the focal firm's financial performance. Drawing upon Transaction Cost Economics (TCE) and Resource Dependence Theory (RDT), we propose a nuanced model that integrates these theoretical perspectives to explore the strategic interplay between supplier management and supply chain configuration. We used the Bloomberg SPLC dataset of supply chain dependencies in U.S. tech firms in order to run our results. We applied fixed effects models to assess how supplier dependence and horizontal complexity impact financial performance, controlling for firm-specific factors. Our findings reveal that horizontal complexity significantly moderates the positive relationship between supplier dependence and financial performance, suggesting that firms with greater supplier base diversity can leverage their dependence on suppliers more effectively to enhance financial outcomes. This research contributes to the strategic management and supply chain literature by providing empirical evidence on the conditional effects of supplier relationships on firm performance, highlighting the importance of managing horizontal complexity in optimizing these effects. The study offers valuable insights for practitioners on the strategic balancing of supplier dependence and supply chain structure to achieve superior financial performance.

Keywords: Financial Performance; Horizontal Complexity; Supplier Dependence; Transaction Cost Economics.

Resumo

Este estudo examina o efeito moderador da complexidade horizontal de uma empresa focal na relação entre dependência de fornecedores e desempenho financeiro da empresa focal. Com base na Economia dos Custos de Transação (ECT) e na Teoria da Dependência de Recursos (TDR), propomos um modelo refinado que integra essas perspectivas teóricas para explorar a interação estratégica entre o gerenciamento de fornecedores e a configuração da cadeia de suprimentos. Nós utilizamos o Bloomberg SPLC para coletar um conjunto de dados sobre dependências da cadeia de suprimentos em empresas de tecnologia dos EUA e obter os resultados. Aplicamos modelos de efeitos fixos para avaliar como a dependência de fornecedores e a complexidade horizontal impactam o desempenho financeiro, controlando por fatores específicos da empresa. Nossos resultados revelam que a complexidade horizontal modera significativamente a relação positiva entre a dependência de fornecedores e o desempenho financeiro, sugerindo que empresas com maior diversidade na base de fornecedores podem alavancar sua dependência de fornecedores de maneira mais eficaz para aprimorar os resultados financeiros. Esta pesquisa contribui para a literatura de gestão estratégica e cadeia de suprimentos, fornecendo evidências empíricas sobre os efeitos condicionais das relações com fornecedores no desempenho da empresa, destacando a importância do gerenciamento da complexidade horizontal na otimização desses efeitos. O estudo oferece insights valiosos para os profissionais sobre o equilíbrio estratégico entre dependência de fornecedores e estrutura da cadeia de suprimentos para alcançar um desempenho financeiro superior.

Palavras-chave: Complexidade Horizontal; Dependência de Fornecedores; Desempenho Financeiro; Economia dos Custos de Transação.

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INTRODUCTION

In an increasingly interconnected and competitive global marketplace, the strategic management of supply chains has emerged as a critical determinant of firm success. The complexity of supply chain structures and the nature of supplier relationships are pivotal factors that influence a firm's operational efficiency and financial performance. Within this context, the literature has extensively explored various theoretical frameworks to understand the dynamics of supplier relationships and supply chain management. Among these, Transaction Cost Economics (TCE) and Resource Dependence Theory (RDT) have provided substantial insights into the decision-making processes of firms regarding their external linkages and dependencies. Nonetheless, little emphasis has been given to the moderating effect that they can have.

The theme of this study is the Strategic Management of Supply Chains, focusing on the Moderating Role of Horizontal Complexity. This topic addresses the pivotal role of supply chain management in enhancing a firm's operational efficiency and financial performance within the competitive global marketplace.

The justification for this research stems from the observation that, while the complexity of supply chain structures and the nature of supplier relationships significantly influence firm success, there is a scant focus on the moderating effects of horizontal complexity. The existing literature extensively covers various frameworks for understanding supply chain dynamics, yet there is a notable lack of emphasis on how horizontal complexity influences these relationships.

The objectives of this study are to bridge the gap in the existing literature by examining how a focal firm's horizontal complexity moderates the relationship between supplier dependence and financial performance. Specifically, the research seeks to unravel the nuanced interplay between these factors and provide insights into how strategic supply chain management practices can enhance firm success.

The theoretical-conceptual framework of this study integrates Transaction Cost Economics (TCE) and Resource Dependence Theory (RDT) to analyze the dynamics of supplier relationships and their impact on firm performance. This framework highlights the strategic need for firms to manage external dependencies and transaction costs effectively, particularly as they navigate the breadth and diversity of their supplier base, referred to as horizontal complexity. Additionally, the study applies the principles of lean manufacturing within the technology hardware and equipment industry to explore how minimizing waste and optimizing processes can influence financial outcomes.

The methodological framework of our study was meticulously designed to analyze the dynamics of supply chain dependencies among publicly traded American companies using the Bloomberg

terminal's Supply Chain module (SPLC). This module was selected for its ability to provide detailed mappings between key companies and their suppliers, including crucial data on cost dependencies and revenue shares. We complemented our primary dataset sourced from the SPLC module with additional data from various other Bloomberg modules. These modules provided a comprehensive set of financial and economic metrics necessary for a nuanced analysis, including market capitalization, debt levels, firm age, industry classification, and financial performance measures such as revenue and profitability. By incorporating the historical data, our study constructed a robust dataset in a panel that facilitated a thorough examination of the strategic positioning and performance dynamics within the Technology Hardware & Equipment sector. To examine the impact of horizontal complexity and dependence on financial performance, we employed econometric techniques, specifically fixed effects models, to control for firm-specific effects and eliminate omitted variable bias due to time-invariant characteristics. This approach allowed for a more accurate estimation of the causal relationships between the variables of interest by focusing on within-entity variations.

In order to run our analysis, we used the Bloomberg database. Moreover, we chose the technology hardware and equipment industry for our study due to its extensive application of lean manufacturing systems, which are pivotal in managing operational efficiency and financial performance. This industry is characterized by its rapid pace of innovation and the complexity of its supply chains, making it a fertile ground for examining the interplay between supplier dependence and financial performance through the lens of horizontal complexity. The adoption of lean manufacturing principles in this sector provides a unique opportunity to explore how minimizing waste and optimizing processes can enhance a firm's ability to manage its supplier relationships and supply chain structure effectively. Thus, investigating this industry allows us to contribute valuable insights into how firms can leverage their supply chain strategies to achieve superior financial outcomes, bridging a significant gap in the strategic management and supply chain literature.

Our results illuminate the dynamics between supplier dependence, horizontal complexity, and financial performance in the technology hardware and equipment sector. Confirming Resource Dependence Theory (RDT) and transaction cost economics (TCE), we found that strategic supply chain configurations crucially influence firm performance. Increased supplier dependence positively impacts financial outcomes, while excessive horizontal complexity hinders them. Additionally, the benefits of supplier dependence intensify with greater horizontal complexity, suggesting that a balanced supply chain strategy is essential for optimizing financial success.

This study contributes to the strategic management and supply chain literature by integrating these theoretical perspectives to analyze the conditional effects of supplier dependence on financial performance, considering the moderating role of horizontal complexity.

This reminder of this paper is as follows: First we review the relevant literature to frame our hypotheses. Secondly, we describe the methodology used to investigate our research question. Third, we present our findings. Finally, we discuss the implications of our study for theory and practice.

In the course of preparing this manuscript, ChatGPT 4.0 was employed to enhance the readability and linguistic quality of the text. The content was subsequently examined and revised by us to ensure accuracy and coherence. Full responsibility for the publication's content rests with the authors.

THEORETICAL BACKGROUND

Our study investigates the intersection of Transaction Cost Economics (TCE) and Resource Dependence Theory (RDT) to address the research gap concerning the moderation effect of a focal firm's horizontal complexity on the relationship between supplier dependence and the firm's financial performance. This literature review synthesizes key contributions in these domains to establish a theoretical foundation for our investigation.

TCE, introduced by Coase (1937) and further developed by Williamson (1975, 1985), focuses on the costs associated with transactions in the market and the implications of these costs for organizational structure and strategy. Williamson (1985) argues that firms aim to minimize transaction costs, which include search and information costs, bargaining, contracting, and enforcement costs. TCE has been applied to analyze vertical integration decisions, the formation of hybrid organizational forms, and the governance of inter-firm relationships (DAVID; HAN, 2004; MÉNARD, 2004). Researchers such as Geyskens *et al.* (2006) and Rindfleisch *et al.* (2010) have extended TCE to supply chain management, examining how transaction characteristics influence firm decisions regarding supplier relationships and network structures.

Cho *et al.* (2019) observed that companies can leverage bargaining power to gain a larger share of financial benefits within the supply chain, albeit often moderating their power use to maintain cooperative relationships. Wuttke *et al.* (2013) tied the practices of FSCM to transaction cost economics, proposing that firms focus on pre- and post-shipment financial supply chain mechanisms to manage risks and enhance working capital. Bhardwaj; Ketokivi (2020) argued for a "benign approach" to managing bilateral dependencies in supply chains, suggesting that cooperative, long-term relationships are more efficient than adversarial ones. Huang *et al.* (2009) analyzed the governance

modes of supply chain alliances, highlighting the impact of transaction characteristics like asset specificity and transaction frequency on governance decisions. Emery and Marques (2011) demonstrated that the level of raw materials inventories is influenced by a firm's transaction costs and its power relative to suppliers, emphasizing the role of power in inventory decisions.

RDT, grounded in the insights of Emerson (2019), offers a sophisticated framework for analyzing power and dependence dynamics in organizational contexts. Emerson's key contribution to this theory is his conceptualization of power as inversely related to dependence. This perspective fundamentally shapes our understanding of organizational interactions and strategic maneuvering. According to Emerson (2019), the power of one entity, A, over another, B, is directly proportional to B's dependence on A for essential resources. This dependence hinges on the criticality of the resource to B's operations and the availability of alternatives to A's resources. The more critical the resource and the fewer the alternatives, the greater A's power over B.

Resource Dependence Theory utilizes Emerson (2019) insights to delineate how organizations manage dependencies to mitigate power imbalances and enhance their autonomy. Organizations strategize around their dependencies in several ways to reduce their vulnerabilities. They may diversify their supply sources to lessen dependence on any single supplier, integrate vertically to control more stages of their production process, or innovate to develop substitute resources that decrease the necessity for resources controlled by others.

RDT, proposed by Pfeffer and Salancik (1978), emphasizes the strategic management of organizational dependencies on external resources. It posits that firms must navigate their external environment to acquire essential resources, impacting their performance and strategic decisions (CASCIARO; PISKORSKI, 2005; HILLMAN *et al.*, 2009). RDT has been instrumental in examining how firms manage power and dependence in their relationships with suppliers to secure necessary resources and sustain competitive advantage (ULRICH; BARNEY, 1984; WRY *et al.*, 2013).

Ming-Rong (2009) demonstrated that resource dependence significantly influences supply chain power, affecting cooperation performance positively within the Yangtze River Delta's manufacturing sector. This study underscores the adaptability of supply chain power dynamics based on resource availability and dependence. Touboulic *et al.* (2014) explored the role of power in sustainable supply chain practices, highlighting how power imbalances can impact the effectiveness of sustainability initiatives. Their findings suggest that managing power dynamics carefully can facilitate better sustainability outcomes. Cho *et al.* (2019) found that firms often balance the use of bargaining power with the need for maintaining cooperative relationships, indicating a nuanced approach to managing power and dependence to optimize supply chain financial performance. Casciaro and Piskorski (2005)

offered a reformulated approach to RDT that distinguishes between power imbalance and mutual dependence, affecting decisions such as mergers and acquisitions among firms. This study advances our understanding of how different dimensions of dependence influence strategic decisions in supply chains. Jain *et al.* (2017) developed a model to enhance supply chain resilience by analyzing how power and dependence dynamics among various enablers can be managed to bolster strategic assets. Their model provides empirical support for the role of resource dependence in fostering supply chain resilience.

Integrating TCE and RDT, researchers have explored how firms manage their supply chains to balance cost efficiencies with the need to secure critical resources from external suppliers (POPPO; ZENGER, 2002; CROOK *et al.*, 2008). Studies by Choi and Krause (2006) and Ho *et al.* (2010) have highlighted the complexities involved in managing supplier relationships and network structures to optimize performance. Specifically, these works suggest that a firm's supply chain strategy, including its approach to managing supplier dependence and the complexity of its supplier network, can significantly influence its financial outcomes.

Elking *et al.* (2017) conducted an empirical investigation on the impact of financial dependence, both of the focal firm and its suppliers, on the firm's financial performance, using resource dependence theory as a lens. The study, which analyzed 3,638 buyer–supplier relationships, supports the direct effects of both focal firm and supplier financial dependence on firm performance. It also noted the moderating effect of dependence asymmetry on the relationship between lean inventory strategies and firm performance, highlighting how dependence dynamics can influence supply chain strategies and outcomes.

Kim and Henderson (2015) explored the economic consequences of dependency in triadic supply chain relationships. Their study of 1,144 unique focal firm-years in the U.S. found that both supplier and customer dependencies increase the focal firm's performance in terms of return on assets (ROA) and return on sales (ROS). Interestingly, while the economic benefits of customer dependency decrease beyond a certain threshold, the benefits of supplier dependency continue to increase, suggesting differing risk profiles for supplier versus customer dependencies.

Furthermore, Kibbeling *et al.* (2013) investigated how supplier and firm market orientations influence innovativeness in supply chains and subsequently affect customer satisfaction. Their research highlights that a focal firm’s innovativeness, which is crucial for customer satisfaction, is significantly influenced by suppliers' innovativeness and market orientation. This study exemplifies the strategic value of aligning supplier capabilities with customer needs to enhance focal firm performance.

Zhang *et al.* (2021) examined how supplier dependence impacts suppliers' corporate social responsibility (CSR) performances. Their findings suggest that while supplier dependence generally has

a negative impact on CSR performance, this effect can be mitigated in industries with high volatility and improved by increasing corporate transparency. This study underscores the complex interplay between supplier dependence and CSR initiatives, with significant implications for managing ethical performance in supply chains.

Despite the rich insights provided by TCE and RDT into supplier management and supply chain configurations, limited research has directly addressed the moderating role of horizontal complexity in the relationship between supplier dependence and financial performance. Notably, Wagner and Bode (2008) and Kim (2013) have touched upon aspects of this relationship but have not fully explored the moderating effect of horizontal complexity. Our study seeks to fill this gap by explicitly examining how the breadth and diversity of a firm's supplier base (horizontal complexity) can influence the positive effects of supplier dependence on financial performance.

In summary, our literature review draws from foundational and contemporary works in TCE and RDT, highlighting the need for a more nuanced understanding of how firms can strategically manage their supplier networks to optimize financial performance. By addressing the identified research gap, this study contributes to the ongoing discourse in strategic management and supply chain literature, providing insights that can inform both theory and practice.

HYPOTHESES DEVELOPMENT

Supplier dependence and the focal firm’s financial performance

This hypothesis is grounded in Resource Dependence Theory (RDT), as articulated by Pfeffer and Salancik (1978), who argue that organizations depend on external resources to survive and succeed. According to RDT, the extent of an organization's dependence on these resources impacts its performance and strategic capabilities (PFEFFER; SALANCIK, 1978).

In supply chain contexts, supplier dependence refers to the extent to which a focal firm relies on its suppliers for essential inputs like materials, components, or specialized services. While this dependence can introduce vulnerabilities, it can also enhance performance, particularly when suppliers have unique capabilities or offer reliable and innovative contributions (COUSINS; MENGUC, 2006).

From a strategic management perspective, supplier dependence can be leveraged to achieve greater supply chain integration, which can lead to operational efficiencies, cost reductions, and enhanced product quality. Suppliers who perceive their relationship with the focal firm as valuable are more likely to invest in relationship-specific assets, which can lead to increased reliability and

continuous improvements in their outputs, thereby enhancing the focal firm's market offerings and financial outcomes (CANIËLS; GELDERMAN, 2007).

Empirical research by Kim and Henderson (2015) supports the idea that supplier dependence can positively impact focal firm performance, highlighting how strategic management of these dependencies can foster mutual benefits and align strategic objectives. They found that as supplier and customer dependency on a focal firm increases, so does the firm's performance in terms of return on assets (ROA) and return on sales (ROS), although the benefits of customer dependency may diminish beyond a certain threshold, while those of supplier dependency do not (KIM; HENDERSON, 2015).

Thus, the interaction between a focal firm and its suppliers, especially when the firm has substantial leverage, is crucial for understanding its impact on financial performance. The ability to negotiate better conditions due to this leverage supports the notion that supplier dependence can have a positive effect on a firm's financial outcomes.

Drawing from the theoretical framework provided by RDT and empirical evidence on the effects of power and dependence in supplier relationships, the following hypothesis is posited:

H1: There is a positive relationship between supplier dependence and the focal firm's financial performance.

This hypothesis reflects the expectation that increased supplier dependence on a focal firm is associated with improved financial performance for the focal firm, highlighting the strategic benefits of managing supplier dependencies effectively.

The focal firm's horizontal complexity and the focal firm's financial performance

Within the framework of supply chain management, the concept of horizontal complexity refers to the breadth and diversity of a firm's direct supplier base. This construct is pivotal in assessing how the structure of a firm's supplier network influences its operational and financial outcomes. The literature on supply chain management suggests that while a diverse supplier base can enhance resilience and mitigate risks associated with supply disruptions, it also introduces significant coordination and management challenges (HO *et al.*, 2015). These challenges include increased costs associated with monitoring and integrating a larger number of suppliers, potential inefficiencies due to complexity, and the dilution of bargaining power with any single supplier.

Building on the work of scholars such as Choi and Krause (2006), who examined the trade-offs associated with supplier base breadth, it becomes evident that beyond a certain point, the costs and

operational complexities associated with managing a wide array of suppliers may outweigh the benefits. This perspective aligns with the tenets of transaction cost economics (TCE), which posits that firms seek to optimize their governance structures to minimize the costs associated with economic exchanges, including those related to managing relationships with suppliers.

Empirical studies in the field, like the research conducted by Ho *et al.* (2010), further elucidate how increasing horizontal complexity can lead to diminishing returns in terms of financial performance due to elevated transaction costs and managerial burdens. These insights underscore the potential for a negative relationship between the extent of a firm's horizontal complexity and its financial performance, suggesting that an overly broad supplier base may inadvertently hinder a firm's ability to realize operational efficiencies and achieve optimal financial outcomes.

From the perspective of transaction cost economics, supplier base complexity is often associated with increased costs of managing relationships and heightened risks of supply chain disruptions. These increased costs and risks can potentially detract from firm performance. Choi and Krause (2006) conceptualized supply base complexity in terms of supplier number, suggesting that this complexity impacts transaction costs, supply risk, and innovation within supply chains. They propose that while a reduction in complexity can decrease transaction costs and increase responsiveness, it might also increase supply risk and reduce innovation potential.

According to resource dependence theory, supplier base complexity may also provide a strategic advantage by diversifying the sources of critical resources, thereby reducing dependency on any single supplier and potentially enhancing firm performance. However, managing a more complex supplier base requires significant coordination and may lead to inefficiencies. Adhikary *et al.* (2020) investigated the buyer-supplier network complexity and found that both vertical and horizontal dimensions of network complexity had a U-shaped relationship with firms' environmental performance, suggesting a nuanced impact of complexity on firm outcomes.

Therefore, informed by the theoretical insights from supply chain management and transaction cost economics, as well as empirical research findings, we propose the following hypothesis:

H2: There is a negative relationship between the focal firm's horizontal complexity and the focal firm's financial performance.

This hypothesis suggests that as the number of first-tier suppliers (horizontal complexity) increases, the financial performance of the focal firm may decline, highlighting the strategic importance of carefully managing supplier network breadth to balance resilience with efficiency.

Interplay between supplier dependence and a focal firm's horizontal complexity

The interplay between supplier dependence and a focal firm's horizontal complexity presents a nuanced aspect of supply chain management, suggesting that the structure of a firm's supplier network can significantly influence the effects of its dependence on suppliers on financial performance. Horizontal complexity, defined by the number of first-tier suppliers a firm has, encapsulates the breadth of a firm's supply chain network and implies a strategic approach to sourcing and risk management.

Supplier base complexity involves the number of suppliers that a focal firm manages. This complexity significantly impacts the power dynamics within supply chains. For instance, Liu *et al.* (2022) explore how a focal firm's power affects supplier flexibility within a hub-and-spoke supply chain model. They find that both coercive and legitimate power influence supplier flexibility, but the effects are moderated by the shared goals between the focal firm and its suppliers, illustrating how power dynamics evolve with the complexity of supplier relationships.

Transaction Cost Economics posits that managing more complex supplier bases increases transaction costs due to heightened coordination and monitoring needs. Concurrently, Resource Dependence Theory suggests that increased supplier base complexity enhances a firm's dependence on its suppliers but also provides leverage to mitigate risks through diversified supply sources. CHOI; KRAUSE (2006) conceptualize supply base complexity in terms of supplier number, differentiation, and inter-relationships, linking these aspects to transaction costs, supply risk, and innovation.

Drawing upon the Resource Dependence Theory (RDT) and the concept of supply chain resilience, we propose that a focal firm's horizontal complexity can serve as a moderating factor in the relationship between supplier dependence and financial performance. According to RDT, firms strive to manage their external dependencies to enhance their autonomy and bargaining power, potentially leading to improved financial outcomes. However, the benefits of such dependence might be contingent on the firm's ability to manage the inherent complexity of its supplier network efficiently.

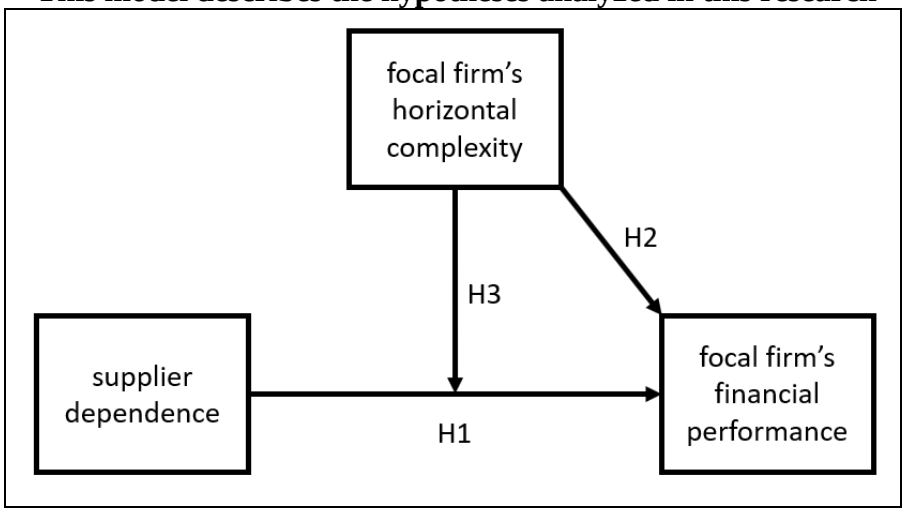
Therefore, based on the integration of insights from Resource Dependence Theory and supply chain resilience literature, we formulate the following hypothesis:

> H3: The Focal firm's horizontal complexity moderates the positive relationship between supplier dependence and the focal firm's financial performance, such that when the focal firm's horizontal complexity is higher, the positive effect of the relationship is stronger.

This hypothesis posits that the strategic management of a complex supplier network can enhance the benefits derived from supplier dependence, indicating that the interaction between these two variables is crucial for optimizing financial performance.

Finally, our conceptual model including the variables and hypothesis of our study is presented in Figure 1.

Figure 1 - Conceptual model
This model describes the hypotheses analyzed in this research



Source: Self elaboration

METHODOLOGY

Sample

We used the data from the Bloomberg terminal (SPLC - supply chain module), which targets publicly traded American companies. This module provides detailed mappings between key companies and their suppliers, including data on the proportion of a company's total cost of goods sold that is attributable to each supplier and the share of a supplier's revenue that comes from each key company, so we can calculate the focal firm's dependence and supplier's dependence. The Bloomberg SPLC module encompasses over 1.5 million relationships between suppliers and buyers, featuring more than 26,000 companies and drawing on supply chain information from a variety of global sources in multiple languages (BEORCHIA; CROOK, 2020). This module has been previously utilized in studies exploring the dynamics of power and dependency within supply chains (ELKING *et al.*, 2017).

In addition to leveraging the Bloomberg SPLC supply chain module for our primary dataset, we also utilized various other modules within the Bloomberg terminal to gather our control variables, other variables of interest, and the dependent variable. The Bloomberg terminal, renowned for its comprehensive financial and economic data, provided us with a rich array of metrics that are crucial for a nuanced analysis. These included financial indicators, market performance metrics, and specific

company information that were instrumental in building a robust dataset. Through these modules, we were able to access real-time and historical data on market capitalization, debt levels, firm age, industry classification, and financial performance measures such as revenue and profitability. This extensive use of Bloomberg's diverse data offerings allowed us to construct a detailed and comprehensive framework for our analysis, ensuring that all relevant dimensions of firm performance and strategic positioning were adequately controlled and examined within our study. This approach ensured the integrity and depth of our research, allowing for a well-rounded investigation into the dynamics at play in our chosen sector.

Moreover, we listed all the American focal firms with a market cap above US$1 billion (in 2022) under the Technology Hardware & Equipment industry group by the Global Industry Classification Standard (GICS code: 4520) to ensure that we had a representative group sample. Additionally, we retrieved all the variables for these focal firms and their respective suppliers over five years, building a data panel from 2018 to 2022. The output was 257 focal firms, with 1610 suppliers shared among the focal firms over 5 years. Thus, the final dataset comprised 6821 observations.

Dependent variable

The use the natural logarithm (for better Interpretability of large numbers) of revenue as a measure of a focal firm's financial performance is well-grounded in strategic management literature, primarily because it directly reflects the firm's market success in terms of sales generation and growth potential. Revenue, as an indicator of financial performance, is pivotal for assessing how well a company capitalizes on its competitive strategies, market presence, and operational efficiency. It offers a clear, quantitative measure of the firm's output in financial terms, serving as a critical parameter for evaluating strategic decisions and their effectiveness in generating economic returns. Notably, Hitt et al (2021) in their work "Strategic Management: Concepts and Cases: Competitiveness and Globalization" emphasize that revenue growth not only signifies the firm's ability to attract and retain customers but also reflects its adaptability in dynamic market environments. This perspective is supported by the argument that revenue encompasses the aggregate outcome of a firm’s strategic actions, including innovation, market expansion, and customer engagement, thereby serving as a comprehensive measure of its financial performance.

Independent variables

Supplier dependence: In the domain of strategic management, supplier dependence measured by the percentage of a supplier's revenue obtained from each focal firm is a critical indicator of the power dynamics and inter-firm relationships within supply chains. This measure reflects the degree of reliance a supplier has on a focal firm, which in turn can influence strategic decisions, bargaining power, and vulnerability to external pressures. Pfeffer and Salancik (1978) Resource Dependence Theory underscores the significance of such dependence, arguing that organizations seek to minimize their dependence on external entities while maximizing their influence over them. By quantifying the proportion of revenue a supplier derives from a focal firm, scholars and practitioners can gauge the extent of dependence and its potential implications for strategic maneuvers and competitive positioning. This metric is particularly valuable for understanding how focal firms can leverage their position to negotiate better terms, secure stable supply, and potentially influence supplier behaviors in ways that align with their strategic objectives.

Focal firm's horizontal complexity: Horizontal complexity, as measured by the firm's number of first-tier suppliers, is a vital dimension for evaluating a firm's supply chain structure and its implications for strategic management and operational performance. Bode and Wagner (2015) highlight that an increased number of first-tier suppliers can augment a firm's flexibility and resilience by diversifying the risk associated with supply chain disruptions. This measure of horizontal complexity captures the breadth of a firm's supplier base, reflecting its strategy for mitigating risks and ensuring supply continuity. From a strategic management perspective, a broader base of suppliers may enable firms to leverage competitive pricing, access a wider range of technologies and innovations, and enhance their ability to adapt to changes in market demand and supply conditions. However, it also necessitates sophisticated coordination and integration capabilities to manage the complexity effectively. Thus, the number of first-tier suppliers serves not only as an indicator of the firm's approach to managing supply chain risks but also as a reflection of its strategic priorities concerning flexibility, innovation access, and cost management.

Control variables: In our study, we incorporated the availability of alternate buyers or suppliers as a control variable, which is crucial for understanding the dynamics of market power and dependency in the industry context. This aspect was quantitatively assessed through the industry Herfindahl-Hirschman Index (HHI), a widely recognized measure of market concentration. According to Rhoades (1993), the HHI calculates the sum of the squared market shares of all firms within an industry, offering a precise gauge of the competitive landscape. A higher HHI value indicates a more concentrated market,

suggesting fewer available alternatives for buyers or suppliers, which could significantly influence a firm's strategic options and bargaining power. Conversely, a lower HHI reflects a more fragmented market with greater availability of alternate partners, potentially reducing individual firms' market dependency. By including the HHI as a control, we aim to account for the impact of market structure on our primary variables of interest, ensuring a more nuanced analysis of the strategic relationships and performance outcomes within different industry settings.

Controlling for market capitalization as a proxy for firm size is pivotal in empirical research because it provides a real-time valuation of a company as perceived by the market, reflecting both current performance and future growth expectations. Market capitalization, calculated as the product of a company's share price and its total number of outstanding shares, serves as a dynamic indicator of firm size. Unlike other size metrics that may lag behind real-world changes, the market cap can swiftly adjust to new information, making it an essential control variable for studies examining firm performance and strategic decisions. Fama and French (1992) underscore the significance of market capitalization in their research, highlighting its role in explaining variations in stock returns which, by extension, can influence firm behavior and strategic outcomes. By controlling for market cap, researchers can better isolate the effects of the variables of interest from the influence of firm size, ensuring more accurate and reliable results in the context of financial and strategic management studies.

Statistical Procedures

In our study, we apply advanced econometric methods to delve into the effects of horizontal complexity and dependency on financial outcomes. Initially, we utilize fixed effects models to manage potential biases in firm performance that stem from unobserved, time-invariant characteristics. This approach is crucial for mitigating omitted variable bias, which occurs when unaccounted-for, constant traits across time impact the results. By implementing fixed effects, we are able to focus exclusively on the variations within each entity. This method enhances the precision of our estimations concerning the causal relationships among the studied variables. However, it's important to note the limitation of fixed effects models in this context: they are not well-suited for analyzing the impact of variables that do not change over time, as these variables are effectively eliminated in the differencing process. This is because the technique focuses on within-entity variations, discounting any time-invariant influences that could also play a significant role (WOOLDRIDGE, 2010).

In summary, we used the following model in order to claim a moderating relationship between our independent and dependent variables:

$$Revenue_{it} = \beta_0 + \beta_1 supplier\_dep._{it} + \beta_2\ h\_complexcity_{it} + \beta_3 supplier\_dep_{it} * h\_complexcity_{it} + \Gamma X_{it} + \varepsilon_{it}$$

DATA ANALYSIS AND RESULTS

Data

Table 1 presents the descriptive statistics for our dataset, which consists of 6,821 observations gathered over the period from 2018 to 2022. This extensive data set, sourced from Bloomberg, includes a variety of financial metrics that are essential for our analysis. It provides a detailed quantitative foundation for examining trends and patterns within the data, ensuring a robust basis for our subsequent evaluations and conclusions. The metrics captured span several key variables, each carefully selected to address the specific research questions at hand, thereby offering a comprehensive snapshot of the financial landscape relevant to our study.

Table 1 - Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Focal firm marketcap	6,821	173B	553B	409M	2.910T
Focal firm market conc. index (HHI)	6,821	671.940	466.921	156.406	2611.681
Supplier market conc. index (HHI)	6,821	795.175	916.764	80.072	5053.362
Focal firm dependence	6,821	0.009	0.031	0.000	0.622
Focal firm revenue (ln)	6,821	23.578	1.464	19.728	26.700
Supplier dependence	6,821	0.033	0.089	0.000	1.000
Focal firm's supplier base size	6,821	106.202	63.036	1.000	197.000

Source: Self elaboration.

The data shows minimal average dependence of focal firms on specific suppliers, with an average of 0.009 and a maximum of 0.622, pointing to generally low but occasionally significant reliance on particular suppliers. Logarithmic focal firm revenue averages at 23.578, with a relatively narrow standard deviation, indicating that while focal firms are generally large, their revenue sizes are not excessively divergent.

Overall, these statistics underscore the diversity in the financial and operational scale of the firms within the dataset, which could influence market dynamics and competitive strategies.

Furthermore, we conducted a detailed correlation analysis to explore the interrelationships among the variables under consideration. This analytical step was of paramount importance for the initial assessment of the dynamics between different variables. It provided essential theoretical support to our understanding by illustrating how each variable might influence or be influenced by others within the dataset. By systematically examining these relationships, we gained valuable insights into the underlying patterns and potential causal connections, which are crucial for framing our subsequent

analyses and discussions. This foundational stage of our research ensures a robust framework for interpreting the complex interplay of factors relevant to our study.

Table 2 - Correlation matrix of the variables used in the model

		1	2	3	4	5	6	7
1	Focal firm marketcap	1						
2	Focal firm market conc. index (HHI)	0.2029	1					
3	Supplier market conc. index (HHI)	-0.0825	-0.0978	1				
4	Focal firm dependence	0.0238	0.0066	0.1881	1			
5	Focal firm revenue	0.5812	0.2784	-0.1752	-0.0658	1		
6	Supplier dependence	0.4656	0.1588	-0.0539	0.1926	0.3863	1	
7	Focal firm's supplier base size	0.0976	-0.4558	-0.0487	-0.1485	0.2417	0.0383	1

Source: Self elaboration.

Table 2 illustrates the correlation matrix for the variables used in our model, revealing various levels of relationships between each pair of variables.

Market capitalization of the focal firm shows a moderate positive correlation with its own revenue (0.5812) and supplier dependence (0.4656), indicating that larger firms tend to have higher revenues and are more reliant on their suppliers. The correlation with the supplier base size is relatively weak (0.0976).

This index shows a moderate positive correlation with focal firm revenue (0.2784), suggesting that firms in more concentrated markets tend to have higher revenues. Interestingly, there is a strong negative correlation with the supplier base size (-0.4558), indicating that firms in more concentrated markets might rely on fewer suppliers.

Aside from its strong correlation with market capitalization, it shows a moderate positive correlation with supplier dependence (0.3863), indicating that larger revenue firms also exhibit higher dependence on suppliers. The negative correlation with supplier market concentration (-0.1752) could imply that higher revenues are often found in less concentrated markets, where firms may have more supplier choices and thus, potentially, more negotiating power.

Apart from its correlation with focal firm dependence and revenue, supplier dependence shows a very weak correlation with supplier base size (0.0383), suggesting that the dependence level does not significantly dictate the number of suppliers a firm has.

The strong negative correlation with the focal firm market concentration index (-0.4558) is notable, as it suggests that higher market concentration among focal firms correlates with a smaller supplier base, possibly due to more consolidated control over supply chains in concentrated markets.

Results

In this section, we present the outcomes of our analysis, with Table 3 illustrating the findings.

The empirical findings from the regression analysis provide insights into the relationships between supplier dependence, the focal firm's horizontal complexity, and the focal firm's financial performance, which can be linked to the hypotheses previously outlined. Here are the interpretations connecting the results to the hypotheses:

Hypothesis 1 (H1) posited a positive relationship between supplier dependence and the focal firm's financial performance. The regression results indicate a significant positive coefficient for supplier dependence in Model 2 (0.851, p<0.001), supporting H1(Table 3). This suggests that as the focal firm's dependence on its suppliers increases, its financial performance, as measured by revenue, also improves.

Hypothesis 2 (H2) suggested a negative relationship between the focal firm's horizontal complexity and its financial performance. Consistent with H2, the coefficient for the focal firm's supplier base size is negative and significant across Model 2 and Model 3 (-0.004, p<0.001), indicating that an increase in the supplier base size is associated with a decrease in the focal firm's financial performance (Table 3).

Table 3 - Regression analysis to test hypotheses 1-3

	Model 1 FF Revenue	Model 2 FF Revenue	Model 3 FF Revenue
Focal firm marketcap	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Focal firm market concentration index (HHI)	0.000*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Supplier market concentration index (HHI)	0.000*** (0.000)	0.000*** (0.000)	0.000*** (0.000)
Focal firm dependence	0.138 (0.267)	-0.329 (0.265)	-0.279 (0.265)
Supplier dependence		0.851*** (0.126)	0.249 (0.263)
Focal firm's horizontal complexity		-0.004*** (0.000)	-0.004*** (0.000)
Supplier dep. X Focal firm's horizontal complexity			0.005** (0.002)
Constant	23.321*** (0.046)	23.581*** (0.046)	23.585*** (0.046)
Observations	6,821	6,821	6,821
Controls	Yes	Yes	Yes
R-squared	0.046	0.126	0.128

Source: Self elaboration.
Notes: *0.05, **0.01, ***0.001; Standard errors in parentheses.

Hypothesis 3 (H3) proposed that the focal firm's horizontal complexity moderates the positive relationship between supplier dependence and the focal firm's financial performance, such that the positive effect strengthens with a larger supplier base size. The interaction term between supplier dependence and the focal firm's horizontal complexity is positive and significant in Model 3 (0.005, $p<0.01$), supporting H3 (Table 3). This result suggests that the beneficial impact of supplier dependence on financial performance is enhanced when the focal firm has a larger supplier base.

Additionally, as presented in Table 3, the fixed effects model controls for unobserved heterogeneity and the significance of control variables such as the focal firm market cap and market concentration indices (both for the focal firm and suppliers) in all models ($p<0.001$) indicates their importance in explaining variations in the focal firm's revenue. The increase in R-squared from Model 1 to Model 3 (from 0.046 to 0.128) suggests that including the variables related to supplier dependence and supplier base size, along with their interaction, improves the model's explanatory power regarding the focal firm's financial performance.

In summary, the empirical results provide evidence supporting the hypothesized positive impact of supplier dependence on the focal firm's financial performance, the negative impact of a larger supplier base size, and the moderating role of supplier base size in strengthening the positive effect of supplier dependence.

ANALYSIS AND DISCUSSION

Our results affirm Hypothesis 1, revealing a positive correlation between supplier dependence and the focal firm's financial performance, as predicted by Pfeffer and Salancik (1978). This correlation supports the idea that strategic management of supplier relationships, leveraging increased dependence for better bargaining power, can lead to superior financial outcomes (DYER; SINGH, 1998; KIM; HENDERSON, 2015). The empirical data underscore the benefits of strong supplier relationships in enhancing trust, collaboration, and innovation, all of which contribute to improved financial performance.

Hypothesis 2 is validated through a demonstrated negative relationship between the focal firm's horizontal complexity and its financial performance. This supports TCE's view that managing a large number of suppliers incurs significant transaction costs and complexities that may diminish financial returns (CHOI; KRAUSE, 2006; HO *et al.*, 2015). These findings emphasize the need for firms to critically assess the breadth of their supplier networks to achieve a balance between risk mitigation and operational efficiency.

The analysis supporting Hypothesis 3 highlights the moderating effect of the focal firm's horizontal complexity on the relationship between supplier dependence and financial performance. The positive interaction effect indicates that higher horizontal complexity can enhance the benefits of supplier dependence under certain conditions (WAGNER; BODE, 2008). This suggests that a strategically diverse supplier base, when effectively managed, not only mitigates risks but also enhances financial outcomes by leveraging supplier capabilities and fostering competitive advantage (LU; SHANG, 2017).

The regression analysis provides robust support for these theoretical predictions, underscoring the importance of strategic supply chain management decisions in influencing financial performance. The significant control variables, such as market capitalization and market concentration, further highlight the complex interplay of internal strategies and external market forces in shaping firm outcomes.

Overall, the integration of RDT and TCE provides a comprehensive framework for understanding how a nuanced approach to managing supplier dependence and horizontal complexity can drive financial success. The empirical findings from this study offer actionable insights for firms in the technology hardware and equipment industry, advocating for a balanced approach to supply chain management that optimizes both supplier relationships and network configurations.

CONCLUSION

This research embarked on exploring the intricate dynamics within supply chain management by addressing the pivotal research question: "Does focal firm's horizontal complexity moderate the positive relationship between supplier dependence and the focal firm's financial performance?" Drawing from the theoretical frameworks of Resource Dependence Theory (RDT) and transaction cost economics (TCE), our empirical investigation within the technology hardware and equipment industry has yielded substantial insights that directly respond to this inquiry. The findings not only illuminate the complex interplay between supplier dependence, horizontal complexity, and financial performance but also reinforce the strategic significance of adeptly managing these dimensions within a firm's supply chain.

The empirical support for Hypothesis 1 unequivocally confirms the positive impact of supplier dependence on the focal firm's financial performance. This outcome aligns with our research question by initially establishing that supplier dependence, indeed, has a beneficial role in enhancing financial outcomes for firms. This suggests that strategic supplier relationships, characterized by a dependency

dynamic where suppliers are more reliant on the focal firm, can lead to improved bargaining positions, culminating in more favorable terms that bolster financial performance.

Furthermore, the study's findings regarding Hypothesis 2, which indicates a negative relationship between horizontal complexity and financial performance, provide a foundational understanding necessary for addressing the central research question. It highlights the potential downsides associated with an extensive supplier base, including increased management challenges and costs, which can dilute the financial benefits derived from supplier dependence.

Critically, the affirmation of Hypothesis 3 directly addresses our research question by demonstrating that the focal firm's horizontal complexity does indeed moderate the relationship between supplier dependence and financial performance. The positive and significant interaction effect uncovered in our analysis suggests that the benefits of supplier dependence on financial performance are amplified in the context of higher horizontal complexity. This moderating effect elucidates that while horizontal complexity presents its own set of challenges when effectively managed, it can enhance the positive impact of supplier dependence on financial performance.

This nuanced understanding provides a comprehensive answer to our research question, affirming that horizontal complexity acts as a critical moderating factor that can strengthen the positive effects of supplier dependence on financial outcomes. These insights are invaluable for strategic supply chain management, offering a blueprint for firms to strategically navigate their supplier relationships and supply chain configurations to optimize financial performance.

The study's implications are profound, suggesting that firms should not merely focus on enhancing supplier dependence but also on managing the breadth of their supplier base to leverage this dependence fully. This strategic balance between cultivating supplier relationships and managing horizontal complexity is essential for firms aiming to maximize their financial performance.

In conclusion, our research contributes significantly to the strategic management literature by providing empirical evidence that the focal firm's horizontal complexity moderates the positive relationship between supplier dependence and the focal firm's financial performance. This finding underscores the importance of a strategic, nuanced approach to supply chain management, where managing both supplier dependence and horizontal complexity becomes a pivotal determinant of financial success. Future research could further explore the mechanisms through which horizontal complexity enhances the benefits of supplier dependence and investigate this moderating effect in different industry contexts or under varying market conditions.

Limitations of the research

Despite the significant contributions of this study to the strategic management and supply chain management literature, it is not without its limitations. Acknowledging these limitations not only clarifies the scope of the study's conclusions but also opens avenues for future research that can extend and refine our understanding of the complex dynamics between supplier dependence, horizontal complexity, and financial performance.

Industry Specificity: This study focused exclusively on the technology hardware and equipment industry. While this provides detailed insights specific to this industry, the generalizability of the findings to other sectors remains uncertain. Different industries may exhibit unique supply chain dynamics and competitive pressures that could influence the relationship between supplier dependence, horizontal complexity, and financial performance differently.

Quantitative Measures: The operationalization of supplier dependence and horizontal complexity relied on quantitative metrics that, while informative, may not capture the qualitative aspects of supplier relationships and supply chain strategies. The complexity of supply chain relationships, including the strategic importance of specific suppliers or the qualitative impact of supplier integration, was beyond the scope of this study.

Cross-Sectional Data: The study utilized cross-sectional data, which provides a snapshot in time but limits the ability to infer causality or observe the longitudinal effects of changes in supplier dependence or horizontal complexity on financial performance.

Moderating Variables: While this research identified horizontal complexity as a moderating variable, other potential moderators such as market dynamism, technological advancements, or firm-specific capabilities were not explored. These factors could also play a significant role in shaping the strategic benefits derived from supplier relationships.

Recommendation for future research

Future research could extend the investigation to multiple industries, facilitating a comparative analysis that explores whether and how industry-specific factors influence the relationship between supplier dependence, horizontal complexity, and financial performance. Such studies could enhance the generalizability of the findings and provide nuanced insights into industry-specific supply chain strategies.

Longitudinal Analysis: Conducting longitudinal studies would enable researchers to observe the evolution of supplier relationships and supply chain configurations over time, offering deeper insights into the causal relationships and the long-term effects of strategic supply chain management practices on financial performance.

Qualitative Investigations: Qualitative research, including case studies or interviews with supply chain managers, could enrich the quantitative findings by providing deeper insights into the strategic considerations, challenges, and opportunities associated with managing supplier dependence and horizontal complexity.

In conclusion, while this study provides important contributions to understanding the strategic implications of supplier dependence and horizontal complexity on financial performance, the limitations highlighted offer a roadmap for future research. By addressing these limitations and exploring the suggested future research directions, scholars can further unravel the complex interdependencies within supply chain management, contributing to more effective and strategic supply chain practices across various industries.

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