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Supply chains and the success of M&As: investigating the effect of structural equivalence of merging firms' supplier and customer bases

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Abstract

Purpose – This study investigates the extent to which structural equivalence between acquiring and target firms is associated with post-merger and acquisition (M&A) performance—a relationship that is proposed to be moderated by industry-level vertical relatedness between acquiring and target firms.

Design/methodology/approach – Applying social network analysis and regression, this study analyzes a buyer–supplier relationship network dataset of 279 M&A deals completed between 2010 and 2017 to test the hypotheses. Structural equivalence is measured as the proportion of common customers and suppliers between an acquiring firm and a target firm.

Findings – Supporting a view about the importance of supply chains in explaining M&As outcomes, the results suggest that the structural equivalence in the supplier network is positively associated with post-M&A firm performance. The results also show that the effect of the structural equivalence in the customer network is moderated by vertical relatedness between two merging firms (i.e. structural equivalence contributes to post-M&A performance when vertical industry relatedness is high).

Originality/value – This study contributes to the M&A and supply network literature by investigating the performance implications of structural equivalence in supplier and customer networks, demonstrating the importance of taking a supply chain view when explaining M&As outcomes. Specifically, the authors suggest considering structural equivalence as a new type of relatedness between merging firms (i.e. relatedness in network resources in explaining post-M&A performance). It also indicates how industry-level vertical resource relatedness, which is about relatedness in internal resources between the two firms, could interact with firm-level network resource relatedness, which is about relatedness in external supply chain resources between the two firms, in affecting post-M&A performance.

Keywords Mergers and acquisitions, Supply networks, Structural equivalence, Vertical relatedness
Paper type Research paper

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1. Introduction

Firms rely on their supply chain partners to obtain valuable resources, launch competitive actions and maintain competitive advantages (Carr and Pearson, 2002; Serpa and Krishnan, 2018; Vanpoucke *et al.*, 2014). Mergers and acquisitions (M&As) are transactions through which a firm takes control of another company's productive assets (Zollo and Singh, 2004). M&As are considered an effective way of investing firms' resources (Hitt *et al.*, 1998; Pablo, 1994) and an important tool for enhancing firms' competitiveness (Pablo, 1994). Recent research has shown that a firm is more likely to acquire another firm when the combined supply chain provides greater structural advantages, such as more connections and more structural holes (Hernandez and Shaver, 2019).

This brings up the importance of firms' supply chain in explaining post-M&A performance. Specifically, a firm's supply chain could play a critical role in achieving the goals of M&A in synergy creation and thus affect the post-M&A performances. For example, the main motives of M&A include (1) improving operations efficiency in supply chains (Bernile and Lyandres, 2019; Cho, 2014; Kim and Jin, 2017; Rhodes-Kropf *et al.*, 2005), (2) increasing power over customers and suppliers (Hitt *et al.*, 1998; Larsson and Finkelstein, 1999) and (3) and realizing the resource synergy between the merged firms (Capron and Pistre, 2002; Chakkol *et al.*, 2018; Hitt *et al.*, 1998). However, without effectively integrating the supply chains of the acquiring and target firms, it is challenging to achieve these goals (Chakkol *et al.*, 2018; DePamphilis, 2019; Harford *et al.*, 2019; Langabeer and Seifert, 2003).

Yet, the effect of pre-M&A supply chains on post-M&A performance has not been well examined (Fich and Nguyen, 2020; Häkkinen *et al.*, 2004). Since M&A success largely relies on the extent to which the acquiring firm could realize synergies in supply chain resources with the target, it is important to assess how the two supply chains relate before M&As. For example, supply chain structural equivalence, referred to as the extent to which two firms share common suppliers and customers (Chae *et al.*, 2020), is an important dyadic structural factor but its role in the M&A process is largely unknown. On one hand, some research found that acquiring structural equivalent firms may lead to better post-M&A performance (Benitez *et al.*, 2018; Hitt *et al.*, 1998; Kusewitt, 1985). Other research found that having common customers could reduce the post-M&A performance (Rogan and Sorenson, 2014). Therefore, our research aims to investigate how supply chain structural equivalence between the acquiring and target firms could explain post-M&A performance (Ahern and Harford, 2014; Alhenawi and Stilwell, 2019; Harford *et al.*, 2019).

Building on resource dependence theory (RDT)—a useful framework for understanding how interfirm dependence influences M&A decisions and performance—we examine performance implications of supply chain structural equivalence and the moderating effect of industry vertical relatedness in explaining post-M&A performance. Supply chain structural equivalence is further examined as two constructs: upstream structural equivalence as the degree of shared suppliers between the acquirer and the target firm, and downstream structural equivalence as the degree of shared customers between the two firms. In addition, industry vertical relatedness is defined as the amount of input transfer between the industries of the acquirer and the target (Fan and Lang, 2000), which could indicate the extent to which the internal resources of the two firms are potentially valuable to each other even though the two may or may not have direct transactions with each other (Brush, 1996; Eckbo, 2014; Ekkayokkaya and Paudyal, 2021; Fan and Goyal, 2006; Shenoy, 2012). Such potential value of firm resources should determine the extent to which the benefits of effective post-M&A supply chain integration, resulting from a high level of structural equivalence, could be realized. Therefore, we identify the industry vertical relatedness as an important contingent factor in moderating the performance implications of structural equivalence.

Using a unique dataset constructed from three sources, M&A deals from Bureau van Dijk (BvD) Zephyr, firm financial data from Eikon and buyer–supplier network data from FactSet

Supply Chain Relationships, we analyze 279 M&A deals completed between 2010 and 2017. The findings provide empirical evidence that the upstream structural equivalence is positively associated with post-M&A firm value, while the effect of downstream structural equivalence is moderated by the vertical industry relatedness between the two firms.

Our study contributes to the M&A and supply chain literature by showing how post-M&A performance could be explained by acquirer-target structural equivalence in their upstream and downstream supply chains, a relationship that is moderated by the vertical industry relatedness between the two firms. Although a firm's supply chain is known to affect a firm's competitive actions and performance, its effects on post-M&A performance have not been studied. By showing the effects of supply chain structural equivalence on post-M&A performance, our results establish a foundation for future M&A studies to explore other supply chain factors that explain post-M&A performance. In addition, we also contribute to the RDT literature by revealing how industry-level resource vertical dependence could determine whether the supply chain structural equivalence is beneficial or damaging to post-M&A performance. Finally, our results clearly demonstrate how the acquirer-target structural equivalence could affect post-M&A performance—a finding that offers important managerial insights from an M&A target selection's perspective.

2. Theoretical background and hypotheses

2.1 A review of supply chain embeddedness and post-M&A performance

Firms do not exist in isolation but are embedded in supply chains. As firms increasingly depend on their customers and suppliers to gain a competitive advantage (Carr and Pearson, 2002; Serpa and Krishnan, 2018; Vanpoucke *et al.*, 2014), their supply chains become an important source of resources and knowledge (Gulati *et al.*, 2000; Nahapiet and Ghoshal, 1998). As a result, firms' embeddedness in their supply chains can explain some variation in firm performances (Adler and Kwon, 2002; Kim and Zhu, 2018). For example, supply chain researchers found that a high centrality of a focal firm in its supply chains is likely to result in a higher innovation output (Bellamy *et al.*, 2014; Greve, 2009) and greater supply chain resilience (Hearnshaw and Wilson, 2013; Wiedmer *et al.*, 2021).

Also, such embeddedness is known to influence a pattern of dyadic interactions and the creation of collective outcomes in a buyer–supplier relationship (Gualandris *et al.*, 2021). For example, a buyer and a supplier in a densely connected network tend to behave more collaboratively with each other and coordinate more effectively (Autry and Griffis, 2008; Gulati and Gargiulo, 1999; Uzzi, 1999), since such structural configuration functions as informal governance (Kim and Jin, 2017; Vurro *et al.*, 2009). However, the existing supply chain network literature tends to focus on the performance implication of a firm's own position in one network, such as degree centrality and structural holes. This type of network position measure is different from structural embeddedness, which is about how one firm's network connections overlap with another firm's network connections. We seek to address this gap by investigating the structural equivalence of merging firms' supply chains.

Another important gap in the supply chain embeddedness literature is that little research has been done regarding how merging firms' supply chains would affect post-M&A performances (Häkkinen *et al.*, 2004; Harford *et al.*, 2019). In fact, M&A synergy creation such as efficiency improvement requires a successful post-M&A supply chain integration, which could be affected by acquirer-target supply chain relatedness (Langabeer and Seifert, 2003; Schweiger and Very, 2003). Without fully understanding the supply chains in which the acquirer and the target firm are embedded, managers could miss opportunities to realize economic gains from M&As (Anderson *et al.*, 2001; Linderman and Wohler, 2018). Therefore, in this paper, we also develop theoretical arguments for the role that supply chains play in the M&A with respect to relatedness using the RDT as our theoretical lens.

2.2 A resource dependence view of relatedness in M&A

Relatedness between an acquiring company and its target is an important factor in the M&A literature, as it is positively related with (1) the likelihood of takeover (Ahern and Harford, 2014; Eckbo, 2014; Fich and Nguyen, 2020; Harford *et al.*, 2019; Kim and Jin, 2017) and (2) post-M&A performance (Ahern, 2012; Ekkayokkaya and Paudyal, 2021; Fich and Nguyen, 2020). Relatedness is a multi-faceted term that refers to different types of similarity between the acquirer and the target firms (Alhenawi and Stilwell, 2019), ranging from external relatedness (e.g. the firms' respective product-market positions) to internal relatedness (e.g. corporate culture and strategic fit of the two firms) (Homburg and Bucerius, 2006). However, the M&A literature tends to focus on products or markets relatedness (Harford *et al.*, 2019; Alhenawi and Stilwell, 2019; Larsson and Finkelstein, 1999; Ramaswamy, 1997). In this case, relatedness is typically measured using pre-defined industry classification systems such as SIC codes to distinguish related deals from unrelated deals (Alhenawi and Stilwell, 2019), or product descriptions in 10-K reports (Hoberg and Phillips, 2010). Studies investigating supply chain relatedness (e.g. common suppliers between the acquirer and the target firm), however, are rare.

The RDT could be a useful theoretical angle for understanding how relatedness in supply chains affects post-M&A performance. RTD has been widely used by strategic management scholars to explain M&A decisions and performance (Drees and Heugens, 2013; Hillman *et al.*, 2009). From the perspective of RDT, firms are open systems that rely on external resources to function and survive (Emerson, 1962; Pfeffer and Salancik, 1978). By engaging in M&As, organizations reduce their dependence on valuable external resources by reducing competition, absorbing sources of input or purchases of output and diversifying operations (Pfeffer, 1976). Ultimately, RDT predicts that M&As are more likely to occur among firms with interdependent resources, which, when effectively integrated, should produce synergy for the merged firms to improve performance resulting from increased resource autonomy (Davis and Cobb, 2010; Drees and Heugens, 2013). However, the integration process could be complex and thus challenging (Gates and Very, 2003; Trichterborn *et al.*, 2016), causing organizational trauma to the acquired firms, especially when the pre-M&A resources possessed by the acquiring and acquired firms are not related (Puranam *et al.*, 2006; Zollo and Singh, 2004).

Adopting the RDT, we identify the structural equivalence between the acquirer and the target firm in the supply chains as a form of external relatedness in acquisitions for two reasons. First of all, among all the external resources, a firm's suppliers and customers in its supply chain are the most crucial for a firm's long-term success. In fact, one of the fundamental resource dependence relationships is between a firm and members of its value chain (Dobrzykowski, 2019), as the focal firm depends on its customers and suppliers in providing crucial resources such as manufacturing capability, financial assets, technologies and knowledge, all of which sustain the focal firm's daily operations (Menguc *et al.*, 2014; Flynn *et al.*, 2010, p. 59). Second, the level of sharing common suppliers and customers is even more important in M&As as the post-M&A integration typically involves the consolidation of merging firms' suppliers, production facilities and customers (DePamphilis, 2019; Langabeer and Seifert, 2003). In this case, the success of post-M&A supply chain integration is an important prerequisite for synergy creation (Hitt *et al.*, 1998; Pablo, 1994). While the structural equivalence between the acquirer and the target firm is likely to affect the post-M&A integration and the ultimate outcome of the M&A, the literature has not examined this link. Our study fills this important gap by exploring the effects of upstream and downstream structural equivalence between the acquirer and the target firm on post-M&A performance.

Successful integration of supply chain resources is, however, also dependent on the effective integration of internal resources, as argued by supply chain researchers (Flynn *et al.*, 2010; Zhao *et al.*, 2011; Horn *et al.*, 2014). From an RDT perspective, we identify the vertical resource relatedness between the acquirer and the target firm as a form of internal

relatedness in acquisitions. A major driver of acquisitions is for a firm to manage interdependence with providers of input or buyers of output by absorbing them. Therefore, vertical resource relatedness between an acquirer and a target, indicating the extent to which the two firms possess resources that have an input-output relationship, could relate to the post-M&A internal integration process, thus interacting with structural equivalence in affecting M&A performance. Adopting this RDT perspective and building upon the supply chain literature, we accordingly develop our hypotheses below.

2.3 Structural equivalence of merging firms and post-M&A performance

Structural equivalence in either upstream or downstream supply chains can be beneficial for acquirers for two reasons. First, a high level of structural equivalence reduces the level of information asymmetry between the acquirer and the target firm (Fich and Nguyen, 2020; Harford *et al.*, 2019). Often, acquirers have only a limited amount of time to gather target-related information and so they can become subject to a deal-related information asymmetry (Lim and Lee, 2016), especially when the acquirer is from an unfamiliar industry (Kim and Jin, 2017). Such information asymmetry can hamper effective target valuation (Harford *et al.*, 2019) and post-deal integration (Kim and Jin, 2017). In this case, having common customers and/or suppliers means acquiring companies already have some information on the part of the targets' supply chains occupied by these companies. Also, acquirers can obtain indirect knowledge from shared customers/suppliers regarding the target firm's supply chain and its business environment, reducing information asymmetry (Fich and Nguyen, 2020; Harford *et al.*, 2019). Therefore, it enables the acquirers to better recognize potential synergies and better appraise the value of the potential target (Bernile and Lyandres, 2019; Harford *et al.*, 2019; Hoberg and Phillips, 2010).

Second, structural equivalence in either upstream or downstream supply chains can also facilitate acquirers' post-M&A integration because it reduces the integration complexity (Hitt *et al.*, 1998; Pablo, 1994). A large number of the target firm's unique suppliers and customers can result in high integration complexity for the acquiring firm, hampering its success and diverting the attention and energy of the acquiring firm's management from other important post-M&A synergy creation tasks (Pablo, 1994). This means that a high level of structural equivalence is associated with a low level of integration complexity and better anticipation of potential changes in the demand and supply side, which increases the chance of integration success (Fich and Nguyen, 2020).

Specifically in the upstream supply chain, structural equivalence could benefit the acquirers by increasing the bargaining powers toward common suppliers. M&A deals often alter the structures of related industries affecting the competitive landscape (Bernile and Lyandres, 2019; Harford *et al.*, 2019). When there are common suppliers between the acquirer and the target, the acquirer increases its volume of business toward the common suppliers immediately after the acquisition, which results in greater bargaining power for the acquirer. Therefore, the higher level of the upstream structural equivalence, the greater bargaining power obtained by the acquirer to (1) reduce the input price and (2) increase the supplier commitment. For example, DuPont expected that 30% of the synergy of the merger with Dow comes from renegotiating the contracts with the common suppliers for a better price or other contractual terms (Dow Chemical Company, 2017). Besides, upstream supply chains have a high potential for efficiency synergy, since merging firms' supplier bases as well as production/logistics facilities are the main sources of duplication (DePamphilis, 2019). As discussed earlier, the upstream structural equivalence would facilitate acquirers' post-M&A integration efforts, which is an important prerequisite for efficiency synergy (Hitt *et al.*, 1998; Pablo, 1994). Therefore, we hypothesize that:

H1. Upstream structural equivalence between the merging firms is positively related to post-M&A financial performance.

An efficiency gain potential can also be found in downstream supply chains in the form of duplications in distribution facilities as well as sales/marketing networks (Brush, 1996). This means, the downstream structural equivalence would facilitate speedy downstream supply chain integration, therefore realization of efficiency synergy becomes possible. Besides, this speedy downstream supply chain integration would provide acquirers with an additional benefit, customer retention. Following M&As, customers of target companies often face significant changes in their business such as price, quality and sales contacts and this would create significant dissatisfaction resulting in some customer defection (Chakkol *et al.*, 2018; Kato and Schoenberg, 2014). This can be a particular concern when M&A deals are intended for growth (Benitez *et al.*, 2018; Hitt *et al.*, 1998; Schoenberg, 2006). Speedy downstream integration, therefore, would alleviate such issues minimizing customer defection. In addition, acquiring a target firm that has common customers would provide the acquirer with greater bargaining power toward those customers, increasing the output price as well as greater customer loyalty (Bastl *et al.*, 2013). Furthermore, acquiring such a target firm can also strengthen the acquirer's position as the intermediary between its suppliers and customers (Cox *et al.*, 2001). Therefore, we hypothesize that:

H2. Downstream structural equivalence between the merging firms is positively related to post-M&A financial performance.

2.4 Vertical relatedness and post-M&A performance

According to the supply chain integration literature, the benefits of supply chain resources integration will not be fully realized unless the internal resources of merged firms are effectively integrated to produce synergy (Flynn *et al.*, 2010). In other words, if an acquirer and a target lack resources that are valuable to each other, even if they share common customers or suppliers (i.e. a high level of structural equivalence), the integration of resources will not be of much value to the merged firm due to a lack of internal integration. From an RDT perspective, the resources of one firm are valuable to the other when the two firms have different but mutually dependent resources, which, when used together, produce higher value than when used separately (Lin *et al.*, 2009). We will explain below that vertical relatedness between the acquiring and target firms could indicate a higher level of resource dependence, which in turn enhances the benefits of structural equivalence in terms of improving post-M&A performance.

Vertical relatedness is an inter-industry measure capturing the amount of input transfer between industries (Fan and Lang, 2000). A high level of vertical relatedness indicates that the resources of firms from the corresponding industries have a higher potential for forming a value-adding supply chain relationship whereby the output from one firm can be used as the input for the other firm. Furthermore, working with such related partners could enable a firm to extend its activities upstream and downstream of its supply chain (Kim and Jin, 2017). This suggests that firms from the corresponding industries usually have mutually dependent resources that, when integrated within one firm, could create higher value by removing the middleman and resolving the double-marginalization problem (Arya *et al.*, 2015; Cachon, 2003). Thus, the M&A literature has shown that a high level of vertical relatedness is typically related to a cross-industry deal between two firms that either already had or could potentially form a buyer–supplier relationship (Fan and Goyal, 2006; Guckin *et al.*, 1991). Typical motives for such so-called vertical mergers are to create efficiency synergy and/or to reduce dependence on valuable external resources by increasing ownership of and control over its upstream and downstream supply chain (Brush, 1996; Eckbo, 2014; Ekkayokkaya and Paudyal, 2021; Fan and Goyal, 2006; Herger and McCorriston, 2016; Shenoy, 2012). Since the acquirer and the target have different but related resources in a supply chain, they have a higher level of resource dependence.

In contrast, a low level of vertical relatedness would indicate two types of resource dependence: (1) the two firms have very similar resources (horizontal M&A, i.e. between competitors) or (2) the two firms have different but completely unrelated resources (conglomerate M&A). Compared to the high vertical relatedness situation where two firms have mutually dependent resources, a low vertical relatedness reduces the value of each firm's resources to the other because of resource similarity (i.e. whatever you have, I have), or unrelatedness (i.e. I do not know how to use your resources or how you would use my resources). Therefore, the resource dependence between the acquiring and target firms decreases when the two firms come from industries that are less vertically related. In fact, the M&A literature has shown that conglomerate mergers or horizontal M&As are usually driven by financial or market power reasons, instead of by the need to improve operational efficiency or to reduce resource dependence (Zhu *et al.*, 2016; Jemison and Sitkin, 1986).

Due to the alignment in structural and resource relatedness, we argue that the benefits of structural equivalence for post-M&A supply chain integration are more crucial, and thus more likely to be realized, for firms coming from more vertically related industries. Indeed, successful post-M&A integration is important for all M&As, but it is especially critical when the motive of a deal is to achieve efficiency synergy (Eckbo, 2014; Shenoy, 2012). As for upstream supply chains, with a high level of structural equivalence, the acquirer is entitled to greater potential in gaining efficiency and power by consolidating two highly overlapping supply bases. This potential could be expanded if an acquirer and its target also have different but mutually dependent resources (indicated by a high level of vertical relatedness). This is because the two vertically related firms should find it easier to integrate the upstream supply chains due to their better understanding of and need for each other's internal resources. Also, a high level of vertical relatedness provides acquirers with strong motivations to achieve successful integration of upstream supply chains, since (1) upstream supply chains are often the main source of efficiency synergy (DePamphilis, 2019) and (2) reduction of dependence on external resources (e.g. suppliers' resources) by absorbing them is the main rationale for vertical M&As (Pfeffer, 1976). In contrast, when vertical relatedness is low, i.e. M&As happen between two unrelated firms or competitors, the efficiency-related supplier integration benefits associated with upstream structural equivalence will not be of much value because the primary motive of these M&A is usually to gain financial or market power. Therefore, we hypothesize that:

H3. Vertical relatedness between the acquirer and target strengthens the relationship between upstream structural equivalence and post-M&A financial performance.

Regarding downstream supply chains, vertical relatedness can also increase the efficiency-gaining and market uncertainty-reducing potential of structural equivalence in contributing to post-M&A success. In contrast, the influence of downstream structural equivalence on post-M&A performance could become less beneficial or even negative for the M&As with a low level of vertical relatedness between the acquirer and target. This is because vertically unrelated M&As such as horizontal and conglomerate M&As are typically pursued to create growth opportunities by expanding their customer base (Benitez *et al.*, 2018; Schoenberg, 2006) and diversification (Larsson and Finkelstein, 1999; King *et al.*, 2004). These opportunities for customer expansion and diversification will be limited if the acquirer and target have many shared customers. In contrast, the vertically related acquirer and target would benefit more from a high level of downstream structural equivalence as it enhances the understanding of customer needs (Chae *et al.*, 2020). Following these arguments, we hypothesize that:

H4. Vertical relatedness between the acquirer and target strengthens the relationship between downstream structural equivalence and post-M&A financial performance.

3. Methodology

3.1 Sample and data

This study seeks to investigate how the structural similarity between the acquiring firm's and target firm's buyer–supplier networks influences post-M&A firm value. For this purpose, we collected M&A deal data from BvD Zephyr, firm financial data from Eikon and buyer–supplier network data from FactSet Supply Chain Relationships. Zephyr (Bureau van Dijk, 2021) is a comprehensive proprietary database that contains information on M&A, initial public offerings and venture capital deals. This database includes global M&A deals and therefore has larger coverage of M&A events compared to alternative data sources such as SDC Platinum, which focuses on M&As between the firms listed in US stock markets. We first searched for all merger and acquisition deals that (1) were completed between 2010 and 2017 and (2) involved acquiring firms from North America, Europe and Far Eastern Asia. This was then narrowed down to deals involving the acquisition of total control of a target (acquiring more than 50% of target firms' shares).

From these initial M&A deals, we matched the acquirers and targets with the FactSet Supply Chain Relationships database, which provides archival data on supply chain relationships of over 20,000 firms based on company annual reports, press releases and investor presentations (FactSet, 2021). FactSet has several advantages over other buyer–supplier relationship network databases such as the SFAS-131 operations segment data compiled by Compustat and Bloomberg SPLC (Wang *et al.*, 2021). First, FactSet provides historical data, whereas Bloomberg SPLC provides present data only. Moreover, FactSet includes private firms and non-U.S. firms, whereas Compustat includes only the firms publicly traded in the US stock markets. Recent empirical studies have used FactSet to analyze the role that supply network structures play in innovation (Chae *et al.*, 2020) and risk management (Wang *et al.*, 2021). The number of deals that have both the acquirer and target identified in FactSet was 908. We then excluded 239 deals where the same acquirer engaged in multiple M&A deals within three fiscal years, as our dependent variable has a three-year time window (see the dependent variable section below). Finally, excluding the observations with missing financial or supply chain relationships data in the time window, the final sample size became 279.

3.2 Variables

3.2.1 Dependent variable. Our dependent variable is the post-M&A 3-year growth in Tobin's Q compared to the control group firms with similar sizes, in the same industry (4-digit NAICS) and geographic region (Zollo and Meier, 2008). Tobin's Q (Tobin, 1969), also known as the market-to-book ratio, represents an acquiring firm's stock market performance reflecting investor expectations for future financial performance. Tobin's Q is calculated as the following:

$$Tobin's\ Q = \frac{Equity\ market\ value}{Equity\ book\ value}.$$

The dependent variable, 3-year growth in Tobin's Q, is measured as the following:

$$Tobin's\ Q\ growth = \frac{Tobin's\ Q_{t+2} - Tobin's\ Q_{t-1}}{Tobin's\ Q_{t-1}},$$

where t is the M&A completion year.

To construct control group firms based on firm size, industry and geographic region, we used coarsened exact matching (CEM). Extant literature suggests that CEM has a number of advantages over other matching techniques such as propensity score matching, as CEM is

easy to comprehend and use (Iacus *et al.*, 2012). Following Zollo and Meier (2008) who specifically study post-M&A performance measures, we identified the firms in the control group with the same four-digit NAICS code, ISO geographic region code and within the tenth percentile of total assets in the same year as the firms in our final sample. These control firms did not engage in M&As during the same observation period as the firms in our sample. Through this CEM procedure, we identified control firms for each firm in our sample and subtracted the average Tobin's *Q* growth of the control firms from that of the sample firm. Also following Zollo and Meier (2008), we used these subtracted values as our dependent variable to minimize endogeneity issues.

3.2.2 Independent variables. The two independent variables of our study are upstream structural equivalence and downstream structural equivalence. We adopt the Jaccard index to measure the proportions of common suppliers (upstream structural equivalence) and common customers (downstream structural equivalence) out of the total number of supplier and customer ties that each pair of acquiring and target firms share. This measure of structural equivalence has been applied to the supply network data (e.g. Chae *et al.*, 2020). We used the Python *NetworkX* package to calculate the upstream and downstream structural equivalence values for each M&A deal in our final sample. We chose Python *NetworkX* over other options such as UCINET or Pajek because it can calculate structural equivalence from very large datasets. It has also been used in other supply network research (Hernandez and Shaver, 2019; Taghizadeh *et al.*, 2021). Using this analysis package, we constructed a sub-network that consists of the acquiring firm, the target firm and their suppliers to calculate upstream structural equivalence for each M&A deal; and a sub-network that consists of the acquiring firm, the target firm and their customers to calculate downstream structural equivalence.

3.2.3 Moderator variable. The moderator variable—vertical relatedness—captures the extent of the dollar amount of input transfer between the M&A acquiring firm's and target firm's industries. Adopting the vertical inter-industry relatedness measure developed by Fan and Lang (2000), we use the Bureau of Economic Analysis' (2021) Use Table to calculate vertical relatedness between the acquiring and target firms. Vertical relatedness is calculated as the average of two measures: The first measure is the proportion of the acquirer industry's output used by the target firm industry out of the total input to the target firm industry (v_{ij}). The second measure is the proportion of the target firm industry's output used by the acquirer industry out of the total input to the acquirer industry (v_{ji}) (see page 633 of Fan and Lang (2000) for a detailed rundown of how to calculate vertical relatedness).

3.2.4 Control variables. We include several M&A deal-specific, acquirer-specific and target-specific control variables. First, we control for the size of the M&A deal with the M&A deal value. We took the natural log of M&A deal values to reduce skewness in the data. Second, we control for pre-M&A indegree and outdegree centralities of both the acquiring and target firms as the number of suppliers and customers can influence upstream and downstream structural equivalence, respectively. We also include multiple acquirer and target firm pre-M&A financial measures that can influence the three-year Tobin's *Q* growth post-M&A. These financial measures are the natural log of sales, cost-of-goods-sold (COGS)-to-sales, return-on-assets (ROA), Tobin's *Q* and debt-to-equity. All these financial measures are based on the values one fiscal year prior to the M&A completion year. In addition, we include acquirer NAICS sector and M&A year dummy variables in our regression models to control for industry and year fixed effects. Furthermore, to control for the extent of horizontal diversification through M&A, we include the inter-industry complementarity variable. This control variable captures the degree to which acquirer and target firm industries share their input and output. The measure of this variable is also developed by Fan and Lang (2000) (see pages 633–634 to read about the measure in more detail) Table 1 presents the descriptive statistics and pairwise correlation of the variables in this study.

Table 1. Pairwise correlation and descriptive statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. Tobin's Q growth	1																			
2. M&A deal value	0.082	1																		
3. Acquirer indegree centrality	0.010	0.217	1																	
4. Target indegree centrality	−0.059	0.033	0.186	1																
5. Acquirer outdegree centrality	0.078	0.333	0.641	0.106	1															
6. Target outdegree centrality	−0.016	0.207	0.227	0.374	0.363	1														
7. Acquirer firm size	0.136	0.569	0.314	−0.021	0.600	0.162	1													
8. Target firm size	0.080	0.679	0.107	−0.004	0.238	0.246	0.506	1												
9. Acquirer COGS-to-sales	0.033	0.047	0.034	0.062	0.050	−0.027	0.109	0.065	1											
10. Target COGS-to-sales	0.067	0.289	−0.015	0.080	0.103	0.102	0.248	0.345	0.541	1										
11. Acquirer ROA	0.026	0.234	0.054	0.033	0.112	0.099	0.335	0.195	0.040	0.109	1									
12. Target ROA	−0.033	0.334	0.006	0.075	0.039	0.102	0.237	0.560	0.076	0.175	0.292	1								
13. Acquirer Tobin's Q	−0.419	0.114	0.101	0.074	0.114	0.067	0.075	0.077	−0.001	0.111	0.097	0.042	1							
14. Target Tobin's Q	0.030	0.080	0.077	−0.010	0.140	0.005	0.113	−0.134	−0.102	−0.056	0.096	−0.240	−0.039	1						
15. Acquirer leverage	−0.282	0.052	0.017	−0.016	0.085	0.053	0.127	0.125	−0.033	0.039	0.016	0.085	0.701	−0.132	1					
16. Target leverage	0.094	0.009	0.042	0.013	0.045	0.035	0.066	0.019	−0.075	−0.082	0.020	−0.058	−0.240	0.507	−0.329	1				
17. Industry complementarity	0.014	0.125	−0.016	0.054	−0.067	−0.014	−0.080	0.057	−0.142	−0.063	−0.104	0.085	0.064	−0.065	0.008	−0.101	1			
18. Upstream structural equivalence	−0.021	0.077	−0.027	0.054	−0.074	−0.005	−0.081	0.054	−0.086	−0.051	0.045	0.083	0.064	0.013	0.022	0.044	0.049	1		
19. Downstream structural equivalence	0.043	0.144	0.000	0.024	0.008	0.162	0.015	0.143	−0.088	0.014	0.073	0.103	−0.027	0.102	−0.040	0.276	0.087	0.256	1	
20. Vertical relatedness	0.075	0.048	−0.086	0.020	−0.104	−0.019	−0.106	0.049	−0.091	−0.047	−0.046	0.065	−0.087	−0.072	−0.136	−0.038	0.460	0.045	0.057	1
Mean	−1.64	13.27	18.22	9.892	22.76	6.642	8.001	5.921	0.472	0.401	4.487	−3.45	3.574	3.273	1.99	0.907	0.567	0.055	0.031	0.050
Std. dev.	14.01	2.07	34.29	13.88	41.9	11.75	2.068	2.154	0.281	0.312	13.76	20.61	6.456	11.35	6.729	7.214	0.392	0.136	0.093	0.084

Note(s): $N = 279$. Pairwise correlation higher than 0.119 is significant at $p < 0.05$

4. Analysis and results

4.1 Main results

We used ordinary least square regression with industry and year fixed effects to test our hypotheses. Table 2 presents the results of our analysis. Model 1 is the base model with control variables only and Models 2–4 test the main effects of upstream and downstream structural equivalence. Models 5–7 include the moderation effects of vertical industry relatedness. In Model 4, the regression coefficient of upstream structural equivalence is significant and positive ($B = 3.551$, $p = 0.036$) while that of downstream structural equivalence is not significant. This result supports H1 but not H2. In Model 7, the regression coefficient of the interaction term between upstream structural equivalence and vertical industry relatedness is not significant, meaning that it provides no support for H3. However, the significant and positive coefficient of the interaction between downstream structural equivalence and vertical industry relatedness ($B = 117.708$, $p = 0.023$) supports H4. The simple slope analysis (Aiken and West, 1991) reveals that the simple slope is not statistically significant when there is no vertical industry relatedness between the acquirer and target ($dy/dx = -7.843$, $p = 0.184$). In contrast, the simple slope is positive and significant at the maximum value of vertical relatedness ($dy/dx = 71.610$, $p = 0.024$). Figure 1 depicts this interaction effect. The maximum and average variance influence factors (VIF) from Model 7 are 3.60 and 2.03, respectively. Therefore, multicollinearity was not a concern in testing our hypotheses.

4.2 Endogeneity test

Although we tried to minimize endogeneity concerns by adopting relevant control variables, CEM, lagged dependent variable and industry/acquisition year fixed effects, the hypothesized relationships between structural equivalence and post-M&A financial performance could still be subject to the bias caused by omitted variables. Therefore, we performed the Durbin–Wu–Hausman test for endogeneity (Davidson and MacKinnon, 1993) to determine whether endogeneity is biasing our results. First, following the approaches used in recent studies that adopt supply network measures as potentially endogenous variables (Dong *et al.*, 2020; Sharma *et al.*, 2020), we used industry averages of upstream and downstream structural equivalence as the instruments for upstream and downstream structural equivalence. These instruments satisfy both relevance (Cragg–Donald Wald F statistic = 34.91) and exogeneity (Sargan–Hansen $\chi^2 = 3.63$, $p = 0.163$) conditions. The Durbin–Wu—Hausman test results using these instruments and all control variables used in our main models could not reject the null hypotheses that upstream structural equivalence ($F = 1.12$, $p = 0.303$) and downstream structural equivalence ($F = 1.12$, $p = 0.304$) are exogenous. These results suggest that endogeneity is not significantly biasing our regression models.

4.3 Robustness check and post hoc analysis

As described earlier in Section 4.2, the vertical relatedness measure that we used as the moderator is the average of two measures: v_{ij} (proportion of the acquirer industry's input) and v_{ji} (proportion of the target firm industry's input). For robustness, we checked whether the result changes when we use these two measures separately. If the directionality of the vertical relatedness is important, the regression results from the models using v_{ij} or v_{ji} would be significantly different from the main model. However, Table 3 shows that the support for H1 and H4 remains the same when we use either v_{ij} or v_{ji} as the moderator, which confirms the robustness of our main model.

As a post hoc analysis, we examined whether industry complementarity, which we use as a control variable in the main analysis, moderates the effects of upstream and downstream

Table 2. Regression model results

DV: Tobin's *Q* growth	Model 1	Model 2	Model 3	Model 4	Model 5	Model 7	Model 7
Constant	−15.358 (11.248)	−15.768 (11.757)	−15.582 (11.508)	−15.761 (11.597)	−15.760 (11.616)	−15.527 (11.182)	−15.525 (11.202)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
M&A deal value	0.587 (0.532)	0.560 (0.539)	0.593 (0.532)	0.561 (0.519)	0.555 (0.495)	0.578 (0.499)	0.573 (0.478)
Acquirer indegree centrality	−0.014 (0.021)	−0.012 (0.022)	−0.012 (0.022)	−0.012 (0.022)	−0.012 (0.023)	−0.013 (0.023)	−0.012 (0.023)
Target indegree centrality	−0.027 (0.043)	−0.030 (0.043)	−0.028 (0.043)	−0.030 (0.043)	−0.030 (0.043)	−0.024 (0.040)	−0.024 (0.040)
Acquirer outdegree centrality	0.022 (0.021)	0.021 (0.022)	0.021 (0.022)	0.021 (0.022)	0.021 (0.022)	0.020 (0.022)	0.020 (0.022)
Target outdegree centrality	−0.082 (0.067)	−0.082 (0.068)	−0.082 (0.072)	−0.082 (0.072)	−0.082 (0.073)	−0.078 (0.074)	−0.078 (0.074)
Acquirer firm size	0.414* (0.229)	0.469** (0.221)	0.434* (0.225)	0.469** (0.222)	0.471** (0.220)	0.457** (0.216)	0.458** (0.213)
Target firm size	0.190 (0.526)	0.151 (0.500)	0.156 (0.501)	0.151 (0.499)	0.157 (0.525)	0.187 (0.558)	0.191 (0.580)
Acquirer COGS-to-sales	−3.227* (1.771)	−3.117* (1.758)	−3.189* (1.736)	−3.119* (1.737)	−3.139* (1.788)	−3.225* (1.718)	−3.242* (1.772)
Target COGS-to-sales	6.378* (3.401)	6.513* (3.361)	6.360* (3.262)	6.515* (3.287)	6.530* (3.376)	6.326* (3.327)	6.340* (3.408)
Acquirer ROA	0.073 (0.061)	0.068 (0.060)	0.072 (0.060)	0.068 (0.059)	0.068 (0.057)	0.064 (0.060)	0.064 (0.058)
Target ROA	−0.103 (0.093)	−0.104 (0.095)	−0.103 (0.095)	−0.104 (0.095)	−0.104 (0.096)	−0.106 (0.098)	−0.106 (0.099)
Acquirer leverage	0.110 (0.217)	0.120 (0.239)	0.120 (0.234)	0.120 (0.236)	0.121 (0.240)	0.177 (0.280)	0.177 (0.283)
Target leverage	0.053 (0.038)	0.047 (0.043)	0.047 (0.031)	0.048 (0.035)	0.047 (0.034)	0.091 (0.053)	0.090 (0.052)
Acquirer Tobin's Q	−1.075*** (0.295)	−1.081*** (0.296)	−1.073*** (0.295)	−1.081*** (0.293)	−1.081*** (0.298)	−1.099*** (0.312)	−1.010*** (0.316)
Target Tobin's Q	−0.066 (0.054)	−0.065 (0.056)	−0.066 (0.054)	−0.065 (0.055)	−0.065 (0.054)	−0.070 (0.054)	−0.070 (0.054)
Industry complementarity	2.702 (1.866)	2.184 (1.456)	2.113 (1.464)	2.185 (1.424)	2.207 (1.510)	2.419 (1.718)	2.438 (1.801)
Upstream structural equivalence (H1)		3.541* (1.967)		3.551** (1.570)	4.108 (4.569)	4.207* (2.092)	4.694 (4.900)
Downstream structural equivalence (H2)			1.142 (4.546)	−0.062 (4.326)	−0.173 (3.779)	−7.751 (5.941)	−7.843 (5.693)
Vertical relatedness		5.837 (6.548)	6.365 (6.451)	5.838 (6.495)	6.015 (7.355)	−1.526 (5.858)	−1.367 (5.997)
Upstream SE × vertical relatedness (H3)					−6.034 (36.984)		−5.286 (32.865)
Downstream SE × vertical relatedness (H4)						117.775** (48.039)	117.708** (47.567)
R^2	0.299	0.301	0.300	0.301	0.301	0.305	0.305
N observations	279	279	279	279	279	279	279

Note(s): All control variables except M&A deal value are based on pre-M&A ($t-1$) values

Robust standard error clustered by acquirer industry in parenthesis. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

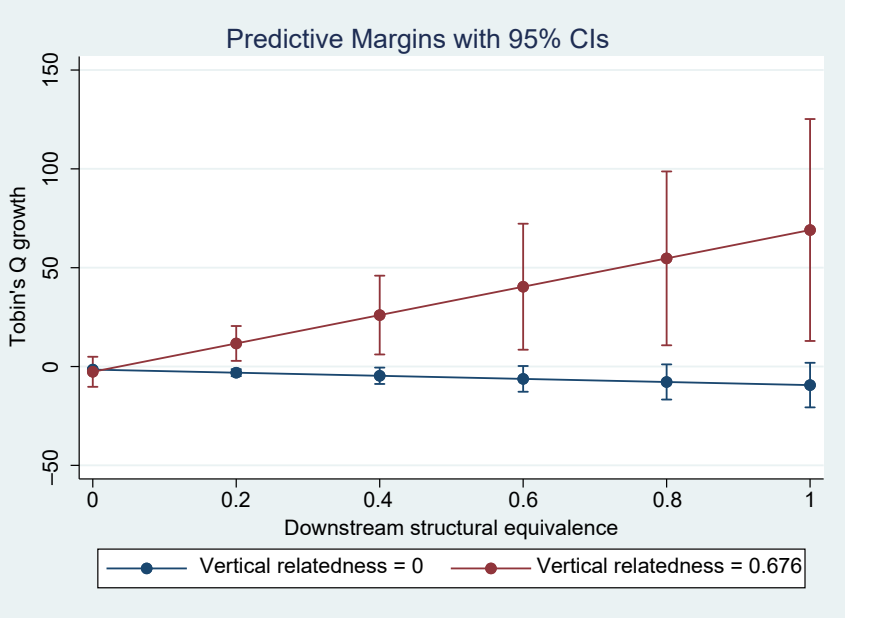

Figure 1.
Interaction between downstream structural equivalence and vertical relatedness

DV: Tobin's Q growth	Model 6	Model 7	Model 8	Model 9
Constant	−15.746 (11.628)	−15.552 (11.191)	−15.701 (11.492)	−15.486 (11.193)
Industry fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Control variables	Yes	Yes	Yes	Yes
Upstream structural equivalence (H1)	3.532** (1.537)	4.782 (4.941)	3.665** (1.634)	4.501 (4.662)
Downstream structural equivalence (H2)	0.023 (4.467)	−8.282 (5.732)	−0.121 (4.308)	−7.325 (5.544)
Vertical relatedness (v_{ij})	4.863 (6.355)	−2.042 (6.097)		
Vertical relatedness (v_{ji})			5.068 (5.495)	−1.084 (4.520)
Upstream SE × vertical relatedness (v_{ij}) (H3)		−5.384 (32.314)		
Downstream SE × vertical relatedness (v_{ij}) (H4)		124.436** (51.249)		
Upstream SE × vertical relatedness (v_{ji}) (H3)				−3.699 (31.198)
Downstream SE × vertical relatedness (v_{ji}) (H4)				110.104** (42.656)
R^2	0.301	0.305	0.301	0.304
N observations	279	279	279	279

Note(s): Robust standard error clustered by acquirer industry in parenthesis. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table 3.
Robustness check

structural equivalence. Since it captures the degree to which acquirer and target firm industries share their input and output, industry complementarity can be understood as a measure of horizontal relatedness between the acquirer and target. Unlike vertical

relatedness, however, industry complementarity does not significantly moderate the effects of upstream and downstream structural equivalence (see Table 4).

5. Discussion and conclusion

This study looks at the M&A literature from the perspective of SCM by investigating how the relatedness of supply chain resources between the two merging firms is associated with post-M&A performance. Although SCM plays an important role in ensuring post-M&A success, not many M&A studies have investigated supply chain relatedness between merging firms. This study fills this gap by considering two forms of supply chain relatedness: (1) structural equivalence to capture the external resource dependence and (2) vertical relatedness to capture the internal resource dependence. We find that structural equivalence in the upstream supply chain has a positive relationship with post-M&A performance. We also find that the effect of structural equivalence in the downstream supply chain on post-M&A performance depends on the vertical relatedness between merging firms. We discuss the theoretical contributions and managerial implications of these findings below.

5.1 Theoretical contribution

Theoretically, our study makes three contributions. First, we contribute to the M&A literature by demonstrating the different performance implications of two types of relatedness in a supply-chain context. The existing M&A literature on relatedness focuses mostly on product-market relatedness using an industry classification system as a proxy for firm-level relatedness (Alhenawi and Stilwell, 2019; Harford *et al.*, 2019). To the best of our knowledge, this is one of the first papers to investigate relatedness using granulated firm-level supply chain data. Our results indicate that different types of supply chain relatedness—as measured by upstream and downstream structural equivalence—affect post-M&A performance in different ways. Specifically, upstream structural equivalence benefits post-M&A performance, an effect that is not contingent on vertical relatedness, while downstream resource relatedness only benefits post-M&A performance when vertical relatedness is high. The more universal benefit of common suppliers—compared to the conditional benefit of common customers—might be due to the importance of post-M&A upstream supply chain integration in ensuring M&A success. This is because, regardless of the levels of vertical relatedness, some degree of supply network integration is often inevitable in achieving post-M&A synergy. A high level of overlap in the upstream supply chain could significantly reduce post-M&A integration complexity (i.e. by reducing the number of to-be-integrated nodes from merging firms' supply networks).

DV: Tobin's *Q* growth	Model 10	Model 11	Model 12
Constant	−15.800 (11.731)	−15.758 (11.608)	−15.828 (11.742)
Industry fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes
Control variables	Yes	Yes	Yes
Upstream structural equivalence	5.258 (6.695)	3.715** (1.699)	6.847 (7.096)
Downstream structural equivalence	−0.197 (3.943)	−6.733 (6.867)	−7.830 (6.141)
Industry complementarity	2.310 (1.783)	1.870 (1.496)	2.057 (1.785)
Upstream SE × industry complementarity	−2.324 (8.138)		−4.236 (8.316)
Downstream SE × industry complementarity		10.271 (7.778)	11.581 (8.036)
R^2	0.301	0.301	0.301
N observations	279	279	279

Note(s): Robust standard error clustered by acquirer industry in parenthesis. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$

Table 4.
Post hoc analysis

However, such universal benefits of customer-side structural equivalence might not exist because merging firms do not always need to integrate their customer bases. On the other hand, when an M&A deal occurs between two competitors or non-related firms, both with low vertical relatedness on the industry level, a high level of overlap in the customer bases could even limit the merged firm's market growth opportunities. These findings show that, even with the same network measure, the changes in the network context (e.g. a supplier network vs a customer network) could alter the influence of such network measures on post-M&A performance. Therefore, future M&A studies that take a network view should take the qualitative characteristics of the network (e.g. directionality, contents of the ties, etc.) into consideration beyond focusing on quantitative structural measures.

These findings also contribute to the structural embeddedness view in the social network literature by highlighting a dyadic way of defining "embeddedness." Social network theory literature argues that the value of supply chain resources is contingent on how a focal firm is positioned in a broad inter-organizational network (Bellamy *et al.*, 2014; Dyer and Nobeoka, 2000; Greve, 2009). However, the literature usually focuses on a firm's absolute network position (e.g. centrality) when measuring structural embeddedness. Using an M&A context, our results show that embeddedness is not just about how central an acquirer or a target is in a network, but also about how the ego-networks of the two merging firms overlap with each other. Since M&A often involves the absorption of the target's supply chain resources, such a relative view of embeddedness is highly relevant for explaining how structural positions of the two merging firms interact in affecting post-M&A performance (Chakkol *et al.*, 2018). Our findings also contribute to the resource-based view of M&A (e.g. Popli *et al.*, 2017) by suggesting the structural equivalence between merging firms as a strategic resource.

In identifying the significant moderating role of industry-level vertical relatedness, this study advances the M&A literature by demonstrating the importance of considering industry-level contextual variables in explaining post-M&A performance. A low level of vertical relatedness indicates that a target firm, when compared to an acquirer, is from a similar industry (horizontal M&A) or a different industry that is unrelated resource-wise (conglomerate M&A). In these two types of situations, our results show that high downstream structural equivalence could even hurt post-M&A performance. This could be due to several reasons. First, Rogan and Sorenson (2014) argued that common customers shared by merging firms could potentially discourage acquirers (1) to reach out to other potential targets with greater synergy potentials and (2) undermine the acquirer's target appraisal by creating familiarity bias. Second, acquiring new customers and entering a new market is one of the main objectives of M&A, particularly in horizontal and conglomerate M&A (Schweiger and Very, 2003; Sears and Hoetker, 2014). As a result, many common customers could limit such market growth potential and potentially erode the integration gains of the structural equivalence discussed earlier. Third, the required level of post-M&A integration is dependent upon the types of synergies the acquirer intends to achieve (Chakkol *et al.*, 2018; Hitt *et al.*, 1998). For horizontal or conglomerate mergers, an acquirer would deliberately opt for a lower level of integration to encourage innovations and growth of the target (Chakkol *et al.*, 2018). This means the post-M&A integration benefit associated with a high level of downstream structural equivalence would be negligible in such deals.

Having said this, with a high level of vertical relatedness, the firms involved in M&As tend to focus on the control over the acquiring firm's supply chain to (1) reduce its dependence on resources and knowledge held by the target and (2) to achieve efficiency synergy (Brush, 1996; Eckbo, 2014; Ekkayokkaya and Paudyal, 2021; Fan and Goyal, 2006; Shenoy, 2012). Achieving such objectives require a high degree of post-M&A integration including the sharing of various types of resources (such as human and financial resources) and a high-level supply chain integration (Hitt *et al.*, 1998; Langabeer and Seifert, 2003; Schweiger and Very, 2003). This means an acquiring firm involved in a vertical M&A can benefit more from

the integration benefit of the downstream structural equivalence. In short, this finding calls for future theory development endeavors to understand how industry-level relationships between merging firms (i.e. relatedness, similarity, etc.) could affect post-M&A performance. In this sense, this paper contributes to the social network theory literature by initiating an interesting new discussion on dual embeddedness that the performance implication of merging firms' structural embeddedness in their supply chains is related to the pattern of the merging firms' industries' embeddedness in a broader and more complex inter-industry network.

Our study also answers the calls from the RDT literature to better integrate a network view with the RDT studies to understand the performance implications of inter-organizational interdependencies (Hillman *et al.*, 2009). RDT researchers have found that organizations could use a network of inter-organizational relationships to gain access to resources/knowledge and to obtain power (Bae and Gargiulo, 2004). As noted by Lomi and Pattison (2006), inter-organizational resource dependencies extend across multiple networks, including supplier networks and customer networks. Therefore, studies investigating post-M&A performance must look further afield than internal resource dependencies between merging firms to consider a broader set of networks in assessing inter-organizational resource dependencies. To contribute to this conversation, we focus on a relative network position measure, structural equivalence and show its significant power in explaining post-M&A performance from an RDT and social network theory perspective.

5.2 Managerial implications

The findings from our study also provide several managerial implications. First, our findings show that the upstream structural equivalence has a significant impact on the post-M&A performance of the acquiring firm. Therefore, when the acquiring firm is selecting a target, it should be aware not only of the firm-level characteristics of the target but also of those of its suppliers. Several reports by consulting firms also note that supply chain managers and executives could play critical roles in achieving synergies through the M&A process, as they are involved with supplier contract renegotiation, carrier consolidation and supply chain network design (Deloitte, 2017; DHL, 2020). Yet, supply managers, who possess information from the supply base, are typically not involved in M&A decisions, and their early involvement is generally lacking in the M&A process (Linderman and Wohler, 2018). The findings from our study imply that supply managers could provide supplier-related knowledge and, thus, should be involved early in the M&A process.

Our findings also show that when the acquiring firm and the target have a high level of structural equivalence in their supply networks, the merged firm is more likely to experience better post-M&A performance. The fact that the two firms have more suppliers in common benefits the M&A in two ways. First, it could ease the post-M&A integration process as there are fewer new suppliers added to the supply base. Second, the merged firm could benefit immediately from the common suppliers via renegotiation. For example, over 30% of the synergy of the Dow–DuPont merger came from renegotiating with the common suppliers who had been giving different conditions (e.g. price and payment terms) to Dow and DuPont respectively but who now offer consistent terms to the merged firm. Therefore, we suggest that acquiring firms consider the potential benefits of sharing a greater number of common suppliers with potential target firms.

Finally, according to our findings, the downstream structural equivalence between the acquiring firm and the target could be beneficial when the two firms' industries are vertically related through the transfer of materials and services. When the acquiring firm and the target come from two industries that are highly related, they are less likely to compete directly with each other but are more likely to be in two adjacent tiers in the supply network, although the

two firms may or may not have a buyer–supplier relationship. In such cases, industry-level dissimilarities could be an important source of synergy between the acquiring firm and the target, and having common customers could further ease the process of post-M&A integration. Therefore, our findings indicate that an M&A benefits from a high level of downstream structural equivalence if the acquiring firm and the target are in two different but highly interdependent industries. Thus, we encourage acquiring firms to consider each firm's industries and customer composition jointly when evaluating potential target firms to acquire.

5.3 Limitations and future research

Our study is based on the secondary data on M&A deals and buyer–supplier relationship networks of the acquiring and target firms. While we build our theoretical arguments upon RDT and the post-M&A integration literature, our data suffer from limitations in terms of providing an in-depth understanding of the actual integration activities that occur after an M&A. Furthermore, since the data availability of FactSet favors larger firms, M&A deals involving smaller firms were excluded from our analysis. Future research could therefore employ qualitative case studies involving both large and small firms to observe how acquiring firms integrate their supply chains with those of target firms and how such acquirer-target supply chain integration activities influence post-M&A performance.

As an initial study to understand the role of structural equivalence in the M&A process, we focus on structural equivalence based on the direct (tier-1) suppliers and customers of a focal firm. However, indirect customers and suppliers could also bring important resources to the merging firms, such as key technologies, cost-saving opportunities, market intelligence, etc. In addition, the ego-networks of the merging firms could be similar, not only because they share common partners but also because their networks have similar geographic locations or industry distributions. Therefore, we encourage future studies to consider other types of supply network structural equivalence based on the similarity in lower-tier supply network members or industry/country membership.

Finally, we only consider networks that are defined by contractual buyer–supplier relationships when explaining post-M&A performance. However, the two merging firms could also share non-supply chain partners through other types of relationships, such as joint innovation ties with universities and reporting relationships with non-governmental organizations. How acquirer-target similarities of network positions in these non-supply chain networks affect post-M&A performance could be a promising future research direction.

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