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Financial benefits and risks of dependency in triadic supply chain relationships

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ABSTRACT

The economic consequences of interdependent relationships with suppliers and customers have long been of interest to supply chain managers and academics alike. Whereas previous studies have focused on the benefits or risks of embedded relationships that accrue to *buying firms*, this study simultaneously investigates the effects of a *supplier's* and a *customer's* embeddedness, arising from resource dependency, on a focal firm's financial performance in triadic supply chain relationships. Using 1,144 unique focal firm-years for U.S. firms from Compustat, we find that a supplier's and a customer's dependency both increase the focal firm's performance in terms of return on assets (ROA) and return on sales (ROS) by increasing asset turnover (ATO). As levels of supplier and customer dependency on the focal firm increase, however, the economic benefits of customer dependency diminish beyond a certain point, while those of supplier dependency continue to increase above that threshold. Thus, our findings show the paradoxically differing risks of the supplier's versus the customer's dependency, while establishing the unequivocal economic benefits of supplier and customer relations for focal firms in the middle of concentrated triadic relationships.

1. Introduction

The economic ramifications of a firm's interdependent relationships with suppliers and/or customers have been the popular subject of scholarly attention in various disciplines and are still being hotly debated. From the perspective of *creating* value, some researchers argue that firms can jointly create greater market value (i.e., a larger profit "pie") by pooling resources and cooperating with exchange partners than by operating alone (Cao and Zhang, 2011; Jap, 1999; Lavie, 2006; Patatoukas, 2012). Yet from the perspective of *capturing* value, other researchers have raised the concern that relationships with major customers and/or suppliers can impede a firm's profitability because the sharing of value (i.e., division of the profit pie) among supply chain members often depends on their respective bargaining powers (Galbraith and Stiles, 1983; Gosman and Kohlbeck, 2009; Lanier et al., 2010; Porter, 1980).

These diverging perspectives toward the economics of interdependent relationships are derived largely from their differing views about a relationship's nature. The former school of thought often characterizes the nature of interfirm relationships within the context of *embeddedness*, whereby firms embedded in a network of interdependent ties tend to cooperate for mutual benefits (Granovetter, 1985; Uzzi, 1996, 1997). In contrast, the latter school of thought assumes interfirm relationships to be competitive in nature where the principle of *power* governs economic behavior of self-interested parties (Galbraith and Stiles, 1983; Porter, 1980). In this regard, Porter (1980) argues that the profitability of firms with concentrated relationships in supply and distribution markets would be eroded by suppliers as well as customers.

Over decades, however, firms have moved toward highly interdependent relationships with fewer exchange partners in both upstream and downstream markets through such practices as supply base reduction and strategic partnerships (Choi and Krause, 2006; *The Economist*, 2006; Patatoukas, 2012). Under these circumstances, the following research questions arise: Why would firms seek to increase interdependency with fewer suppliers and customers despite potential power disadvantages? What benefits accrue to *focal firms* in the middle of concentrated triadic relationships?

Our study aims to investigate these research questions through the theoretical lens of *embeddedness*, a concept that refers broadly to the contingent nature of economic behavior with respect to

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cognition, social relations and structure, culture, and politics (Granovetter, 1985; Uzzi, 1996, 1997). Of these factors, we focus on relational and structural embeddedness, which concern how the quality and the network architecture of exchange relationships influence economic behavior and outcomes (Granovetter, 1985; Uzzi, 1997). More specifically, we investigate how the performance outcomes of *focal firms*, structurally positioned in the center of concentrated supply chain triads, are affected by one key aspect of relational embeddedness, the *resource dependency* of suppliers and customers.

The logic of embeddedness suggests that higher levels of *dependence* motivate exchange partners to increase the depth and breadth of their economic interactions, thus developing a stronger "relational" orientation toward information sharing, cooperation, and trust, even in the presence of power disparities (Gulati and Sytch, 2007; Uzzi, 1996, 1997). The relational benefits of embeddedness, in turn, can facilitate joint value-creation at a low risk of opportunism among the parties and thus provide a "positive side" to the weaker parties in unbalanced power relationships.

Nevertheless, high levels of embeddedness can also generate diminishing returns by impairing a party's motivation and ability to detect or adapt to environmental or behavioral changes (Anderson and Jap, 2005; Uzzi, 1997; Villena et al., 2011). A "negative side" of embeddedness thus pertains to the risk of *interdependency* that hinders a party's mobility to switch incumbent partners when the relational benefits diminish, thereby compromising its profit-maximizing potential. Thus, dependency plays an important role in the logic of embeddedness and entails a paradox of relational benefits as well as risks.

Furthermore, it is implicitly assumed that embeddedness is a role-invariant phenomenon leading suppliers and customers to similar economic behaviors and outcomes (Granovetter, 1985; Uzzi, 1997). Yet, some researchers question this assumption of unequivocal behavior in upstream (supplier–focal firm) and downstream (focal firm–buyer) relations (Cool and Henderson, 1998; Wu and Choi, 2005). Hence, we empirically investigate this implicit assumption by simultaneously assessing the financial benefits and risks of resource dependency of suppliers and customers in supply chain triads, using a large secondary dataset.

Following Lanier et al. (2010), we identify concentrated supply chain triads (supplier, focal firm, and customer) by using Statement of Financial Accounting Standards (SFAS) No. 131's major customer disclosure, which mandates that firms identify any customer accounting for more than 10% of their total sales. Consequently, each triad comprises a focal firm, a supplier (of whose total sales at least 10% are to the focal firm), and a customer (who accounts for at least 10% of the focal firm's total sales). Our sample represents 1,144 unique focal firm-years from 1992 through 2011.

Our study makes several contributions to social capital theory by investigating the financial benefits and risks of relational embeddedness that arises from the *resource dependency* of suppliers and customers in triadic supply chain relationships. First, by using a large secondary dataset, our study is the first to establish economic links between the important aspects of *embeddedness* of suppliers and customers and a focal firm's *financial* outcomes, thus building on previous findings of operational and strategic benefits to buyers in the social capital literature (e.g., Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011), while providing new evidence for the economic benefits of *customer* embeddedness via *dependency*. Second, our investigation of the diminishing returns of embeddedness reveals the paradoxically differing risks of *supplier* versus *customer dependence* on the focal firm's financial performance. Beyond a certain point, the positive effects of *customer* dependency begin to diminish while those of *supplier* dependency continue to increase. Thus, our findings challenge the role-invariant assumption underlying social capital theory. To our knowledge, this study is the first to empirically investigate the unequivocality of a supplier's and a customer's dependency and to show the differing paradoxes associated with *supplier* versus *customer* relationships.

The rest of the paper is organized as follows: in Section 2 we review the extant literature and identify gaps and in Section 3 we develop our hypotheses. Our methods are then explained in Section 4. Section 5 reports the results, and in Section 6 we perform sensitivity analyses. Our findings are discussed in Section 7, and we conclude in Section 8, where we describe the study's contributions and limitations.

2. Literature review

The performance outcomes of relationship management have been a core interest of supply chain managers and scholars, thus spawning a wide array of research streams across disciplines (Gosman and Kohlbeck, 2009; Gulati and Sytch, 2007; Lanier et al., 2010; Patatoukas, 2012; Villena et al., 2011). Most studies have focused on the relational context in *dyadic* relationships (Carey et al., 2011; Kim and Wemmerlöv, 2015; Patatoukas, 2012; Villena et al., 2011) and only a few studies have investigated *triadic* relationships in supply chains (Cool and Henderson, 1998; Galbraith and Stiles, 1983; Lanier et al., 2010). Table 1 summarizes the representative studies on the relationship–performance link and their relevant findings to this study.

Dyadic studies make the implicit assumption that the relational context in an upstream dyad (i.e., a supplier–focal firm dyad) mirrors that in a downstream dyad (i.e., a focal firm–customer dyad). Yet, Cool and Henderson (1998) contend that the power dynamics in upstream relationships are different from those in downstream relationships. More recently, some researchers (e.g., Choi and Kim, 2008; Choi and Wu, 2009; Wu and Choi, 2005) argue that triads, rather than dyads, should be taken as the supply chain's fundamental building block because the relational context in a buyer–supplier dyad is affected, not only by within–dyad, but also by between–dyad interactions. For example, a supplier–focal firm relationship can be affected not only by interactions within the dyad, but also by a focal firm's interactions with its customers (e.g., passing down cost pressure from customers to suppliers). In line with this reasoning, we moved beyond a dyadic focus and chose triadic relationships as our unit of analysis to simultaneously investigate the relational contexts in both upstream and downstream relationships.

The nature of supply chain relationships can be broadly categorized as either competitive or cooperative. Researchers often characterize *competitive* relationships in the context of *power*, focusing on the self-interested behavior of economic actors whereby the more powerful parties extract favorable terms and conditions for unilateral benefits (Galbraith and Stiles, 1983; Lanier et al., 2010; Patatoukas, 2012). Many studies that use objective performance data have focused on the role of bargaining power in competitive relationships, whether in supplier–buyer dyads (Gosman and Kohlbeck, 2009; Kelly and Gosman, 2000; Patatoukas, 2012) or in supply chain triads (Lanier et al., 2010). Studies on supply chain triads suggest, in the logic of power, that developing concentrated relationships with both suppliers and customers is an ill-fated strategy for focal firms (Cool and Henderson, 1998; Galbraith and Stiles, 1983; Lanier et al., 2010). For example, Galbraith and Stiles (1983) argue that the profitability of focal firms at the center of triadic relationships would be bargained away by suppliers as well as customers. Similarly, Lanier et al. (2010) show that supply chain members in concentrated triadic relationships could collectively achieve performance superior to that of their counterparts in diffused relationships. Yet, most of the benefits would be captured by the downstream members because of

Table 1
Representative studies on the performance effects of supply chain relationships.

Author (year)	Relationships	Performance data	Theoretical thrust	Summary of relevant findings
Kim and Wemmerlöv (2015)	Supplier–manufacturer **dyad**	**Perceptual** performance data; supplier's financial performance from survey	Customer's and supplier's **power** as a function of their dependence on one another and cooperative interactions	A manufacturing customer's power, as measured by its supplier's dependence, promotes cooperative interactions but has a negative effect on the firm's financial performance
Patatoukas (2012)	Supplier–buyer (including both manufacturers and retailers) **dyad**	**Objective** performance data; financial performance from secondary source (Compustat)	Buyer's **power**	A buyer's power has a negative effect on the supplier's gross margin but has a positive effect on the supplier's SGA expenses and asset turnovers
Villena et al. (2011)	Supplier–buyer **dyad**	**Perceptual** performance data; buyer's perceived performance on strategic and operational outcomes from survey	Social capitals (cognitive, relational, and structural) of **embedded** relationships	Social capitals with suppliers have positive effects on a buyer's operational and strategic performance, but such positive effects diminish as social capitals increase
Carey et al. (2011)	Supplier–manufacturer **dyad**	**Perceptual** performance data; buyer's perceived performance on innovation and cost improvement from survey	Social capitals (cognitive, relational and structural capitals) of **embedded** relationships	The relational dimension of social capital (e.g. trust, obligation and identification) fully or partially mediates the effect of the cognitive and structural dimensions on performance
Lanier et al. (2010)	Supplier–seller–buyer **triad**	**Objective** performance data; financial performance from secondary source (Compustat)	Supplier's and buyer's bargaining **power**	Supply chain members in concentrated triadic relationships can collectively achieve superior performance to their counterparts in diffused relationships, but downstream members—because of their relatively greater bargaining power—capture most of the profitability benefits
Gosman and Kohlbeck (2009)	Supplier–retailer **dyad**	**Objective** performance data; financial performance from secondary source (Compustat)	Buyer's bargain **power** and supplier's size as countervailing power	There is a negative association between the buyer's bargaining power and a supplier's gross margin, but larger suppliers can mitigate much of the negative effects
Lawson et al. (2008)	Supplier–manufacturer **dyad**	**Perceptual** performance data; buyer's perceived performance on operational improvement from survey	Social capitals from relational and structural **embeddedness**	Supplier integration and closeness increase relational capital, which in turn improves the buyer's operational performance
Gulati and Sytch (2007)	Supplier–manufacturer **dyad**	**Perceptual** performance data; buyer's perceived performance on purchasing outcomes from survey	Dependence asymmetry, joint dependence, and the elements of relational **embeddedness** (including trust, information sharing, and joint actions)	Joint dependence enhances the performance of procurement relationships for manufacturers, and this effect is partially mediated by the level of joint action and the quality of information exchange between the partners
Krause et al. (2007)	Supplier–manufacture **dyad**	**Perceptual** performance data; buyer's perceived performance on operational improvement from survey	Social capitals (cognitive, relational, and structural) of **embedded** relationships	Relational capital, in the form of buyer and supplier dependence, helps to explain buyer improvement in cost performance
Kelly and Gosman (2000)	Manufacturer–retailer **dyad**	**Objective** performance data; financial performance from secondary source (Compustat)	Buyer's bargaining **power**	The buyer's bargaining power is negatively associated with the supplier's gross margin
Cool and Henderson (1998)	Supplier–focal firm–buyer **triad**	**Perceptual** performance data; focal firm's perceived financial performance from Banque de France survey	Supplier's and buyer's bargaining **power**	There may be a positive correlation between a supplier's or customer's structurally based power and the focal firm's profitability; however, there is a negative association between the bargaining power of a supplier and that of a customer
Galbraith and Stiles (1983)	Supplier–focal firm–buyer **triad**	**Perceptual** performance data; focal firm's perceived financial performance from Profit Impact of Market Strategy (PIMS) survey	Supplier's and buyer's bargaining **power**	There is a negative association between the focal firm's profitability and the bargaining power of suppliers and customers

their relatively greater bargaining power. Despite potential power disadvantages, however, firms have moved toward concentrated relationships in both upstream and downstream markets (Choi and Krause, 2006; *The Economist*, 2006; Wilke, 2004). Thus, we conjecture that relational benefits must accrue to focal firms in concentrated triadic relationships beyond what the logic of power prescribes.

In contrast, the *cooperative* perspective examines exchange relations within the context of *embeddedness* and emphasizes the value-generating potential of social capital that manifests through such cooperative interactions as information sharing, joint action, and trust (Carey et al., 2011; Gulati and Sytch, 2007; Krause et al., 2007; Lawson et al., 2008). Most studies focus on the positive aspects of embedded relationships (Carey et al., 2011; Gulati and Sytch, 2007; Krause et al., 2007; Lawson et al., 2008); however, some researchers have identified several negative aspects including opportunism and relationship inertia that can incur greater relationship costs than performance benefits to the parties and thus diminish the positive effects of relational embeddedness (Anderson and Jap, 2005; Uzzi, 1997; Villena et al., 2011). Section 3 discusses this paradox of embeddedness in greater detail.

There are several gaps in the extant literature our study addresses. First, previous empirical studies have focused on the benefits and/or the risks of embedded relationships that accrue to *buying firms* in supplier–buyer relationships while largely ignoring the *supplier's* benefits and/or risks from the buyer's embeddedness (Gulati and Sytch, 2007; Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011). The underlying assumption is that suppliers and customers embedded in the same network of exchange relations would exhibit similar economic behavior and thus generate similar benefits and risks. However, this implicit assumption of unequivocal effects across supply chain roles has never been empirically investigated. To fill this gap, we investigate the benefits and risks of both a buyer's and a supplier's embeddedness that arises from their respective dependency on focal firms in triadic supply chain relationships. Second, most empirical studies to date have relied on survey data and thus use self-reported measures of performance that are limited to operational and/or strategic outcomes (Carey et al., 2011; Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011). While these studies capture the idiosyncratic mechanisms of embedded relationships based on primary data, their perceptual measures of performance fall short for providing specific inferences for financial outcomes. To address this shortcoming, our study uses objective performance data from audited financial statements to establish an economic link between an important aspect of relationship embeddedness, i.e. resource dependency, and financial performance.

In the next section, we review the antecedents and consequences of dependence and embeddedness as described in the extant literature. We then develop hypotheses about the benefits and the risks of embedded relationships.

3. Theoretical development and hypotheses

3.1. Dependence, embeddedness, and firm performance

The nature of a relationship is shaped largely by the level of dependence between the parties and the extent of their cooperative interactions (Gulati and Sytch, 2007; Narayandas and Rangan, 2004; Uzzi, 1997). Embedded relationships are often characterized by the high degree of trust, information sharing, and joint problem solving among supply chain members (Gulati and Sytch, 2007; Uzzi, 1996, 1997). It has been demonstrated that high levels of dependence motivate organizational commitment, often in the form of large purchase volumes, dedicated capacities, and/or relationship-specific investments, thereby leading to the development of relational capitals such as trust, fine-grained information sharing, and joint action (Gulati and Sytch, 2007; Kim and Wemmerlöv, 2015; Narayandas and Rangan, 2004; Petersen et al., 2008; Uzzi, 1996, 1997). Petersen et al. argue that a party's dependence facilitates the socialization processes such as team building, social events, and joint workshops, through which interpersonal ties are readily established across organizational boundaries.

Relational capital can build and thrive over time even in the presence of power imbalance (Gulati and Sytch, 2007; Narayandas and Rangan, 2004; Petersen et al., 2008; Uzzi, 1997). For instance, Narayandas and Rangan's longitudinal field study documents a process whereby trust and commitment are formed (or derailed) in supplier–buyer relationships with various power structures. Their findings suggest that initial power asymmetries between the parties can be redressed as high levels of interpersonal trust develop and further increase organizational commitment between the parties. Firms in embedded relationships, as Uzzi (1997) argues, strive for "integrative agreements that pool resources and promote mutually beneficial solutions, rather than distributive agreements that aim for zero-sum solutions," where "each firm satisfies rather than maximizes on price" (p. 50).

The performance benefits of such relational capital as trust, information sharing, and joint action are well documented in the literature (Cao and Zhang, 2011; Gulati and Sytch, 2007; Kim and Wemmerlöv, 2015; Lawson et al., 2008). Several studies have demonstrated that relational capital with suppliers contributes to a buyer's operational performance in terms of product/process development and/or cost efficiency (Carey et al., 2011; Gulati and Sytch, 2007; Krause et al., 2007; Lawson et al., 2008). Although fewer studies have adopted the supplier's perspective, they suggest that relational embeddedness with buyers increases a supplier's likelihood of surviving in the market (Uzzi, 1996) and that information sharing with buyers increases a supplier's profitability (Kim and Wemmerlöv, 2015). While previous studies surmise the economic benefits of embedded relationships with exchange partners based on operational benefits, no studies have directly investigated the financial impacts of a *supplier's* or a *customer's* resource dependency on a focal firm, which represents an important aspect of relational embeddedness. In this study, we thus posit that the focal firm benefits financially from the resource dependency of suppliers and customers on focal firms.

H1. A supplier's resource dependency improves the focal firm's financial performance.

H2. A customer's resource dependency improves the focal firm's financial performance.

3.2. Paradox of dependency and embeddedness

Several scholars have noted that relational embeddedness entails not only benefits but risks as well (Anderson and Jap, 2005; Soda and Usai, 1999; Uzzi, 1997; Villena et al., 2011). These authors argue that the relationship's value-creating mechanisms—for example, complementary competencies and strong structural and interpersonal ties—can foster complacency for the parties and impair their abilities to detect or adapt to environmental or behavioral changes, thereby generating diminishing returns (Anderson and Jap, 2005; Soda and Usai, 1999; Uzzi, 1997; Villena et al., 2011).

In the presence of environmental uncertainty, embedded relationships can safeguard the parties from market pressures and thus provide them competitive advantages (Soda and Usai, 1999; Uzzi, 1996, 1997; Villena et al., 2011). Yet, high levels of embeddedness can reduce the parties' motivation and/or ability to innovate and advance by providing too much insulation from competitive pressures (Collinson and Wilson, 2006; Kim et al., 2006; Uzzi, 1997). For example, Soda and Usai (1999) argue that high levels of embeddedness in an Italian contractor network initially improved the efficiency of network members during the late 1980s and early 1990s, but gradually produced negative returns for all involved by impairing motivation and ability to innovate. Similarly, Collinson and Wilson (2006) attributed high levels of embeddedness between Nippon Steel Corporation and Toyota to their relationship inertia. At the time of their study, Nippon Steel Corporation supplied more than 40% of Toyota's steel inputs and the two firms shared a joint R&D organization. Strong ties formed through joint investments and informal study groups, they argue, facilitated knowledge sharing across organizational boundaries, but also limited organizational learning by restricting the "breadth and flexibility for in-depth, rich interactions with long-term suppliers and buyers and other *keiretsu* members" (p. 1375). Uzzi (1997) and Kim et al. (2006) make the similar argument that high levels of embeddedness between exchange partners can hinder the relationship's value-creating potential by constraining the flexibility to adapt to environmental changes and by blocking the flow of innovative ideas from other supply chain members.

Such virtuous characteristics of embedded relationships as strong interpersonal ties and trust can also provide an opportunity for behavioral slacks that can cause conflicts between the parties or decrease the relationship's performance outcomes (Anderson and Jap, 2005; Villena et al., 2011). Recently, Apple has shifted away from its largest long-term supplier (Foxconn) and selected a less experienced supplier (Pegatron) as the primary assembler of a low-cost iPhone (Dou, 2013). The rupture in this long-term partnership is the result of prolonged conflicts arising from Foxconn's slacking behavior of cutting corners by making changes to component sourcing without notifying Apple and causing manufacturing glitches (Dou, 2013). Using survey data on buyer–supplier relationships, Villena et al. (2011) demonstrate the diminishing effects of relational capital with suppliers on a buying firm's operational and strategic outcomes. On the other hand, the diminishing effects of customer relationships have never been investigated on any outcomes, to the best of our knowledge.

When relational benefits diminish, however, the parties in embedded relationships cannot easily replace their exchange partners because high levels of dependency increase their switching costs (Heide and John, 1988), thereby foregoing their profit-maximizing potential. For example, Anderson and Jap (2005) claim that high switching costs contribute to why failing relationships linger in states of deterioration for long periods of time. Hence, we posit that focal firms will experience diminishing returns from the resource dependency of suppliers and customers; as dependency increases beyond a certain point, risks exceed the benefits.

H3. A supplier's resource dependency has diminishing returns for the focal firm's financial performance.

H4. A customer's resource dependency has diminishing returns for the focal firm's financial performance.

4. Method

4.1. Data collection

The sampling frame consists of U.S. public companies from 1992 to 2011 that: (1) are reported as a "major" customer by at least one supplier; and (2) have at least one major customer (i.e., a major customer accounts for more than 10% of a firm's total sales). The names and types of major customers are given by the Compustat Segment Files, which also provide the dollar amount of annual revenues generated from each major customer. Each customer name was matched to the unique firm identification (i.e., *gvkey*) of one of the companies listed in the Compustat Annual Files. Because customer names are frequently reported using different abbreviations, we inspected every match to ensure accuracy and then manually corrected inaccurate and missing matches by hand-collecting information from the Compustat database. From the supplier–customer links, we identified focal firms as a group of customers that also have at least one major customer. The initial sample of supplier–focal firm–customer triads was then linked to accounting data from the annual Compustat files. Given that firms may differ in their respective fiscal year-ends, we aligned the supplier's year-end with the nearest year-end for the major customer. After eliminating 842 observations with missing financial data and 101 observations where a firm's acquisitions in any given year represent more than 10% of its opening assets in that year, the sample frame consists of 5,869 focal firm-years.

Table 2
Focal firm identification and sample screening.

Sample selection and screening procedures to identify focal firms	Sample size
Focal firm-years, with at least one *supplier* and at least one *customer*[a] with publicly available data	5,869
(1) Focal firm-years after eliminating *suppliers* (resp., *focal firms*) that provide more than one third of a focal firm's (resp., a *customer's*) cost of goods sold	4,956
(2) Focal firm-years after eliminating *focal firms*, *suppliers*, or *customers* in SIC 99	4,846
(3) Focal firm-years after eliminating *focal firms*, *suppliers*, or *customers* in financial sector	4,627
(4) Focal firm-years after eliminating duplicated *focal firm–customer* relationships per year	1,722
(5) Focal firm-years after eliminating duplicated *supplier–focal firm* relationships per year	1,148
(6) Focal firm-years after eliminating duplicated *focal firm-year*	1,144

[a] A *supplier* sells more than 10% of its total sales to a focal firm; a *customer* accounts from more than 10% of a focal firm's total sales.

4.2. Sample selection

Following Lanier et al. (2010), we removed firms with the following characteristics: (1) suppliers (or focal firms) that provided more than one third of a focal firm's (or a customer's) cost of goods sold (COGS), in order to remove sales of capital assets; (2) nonclassified establishments (SIC 99), in light of the unknown nature of their financial and operating activities; (3) financial firms (SIC 60–67), because any separation of their financial and operating activities would be artificial; (4) duplicated focal firm–buyer relationships in any given year, to ensure unique downstream relationships for each year; (5) duplicated supplier–focal firm relationships in any given year, to ensure unique upstream relationships for each year; and (6) duplicated focal firm-years in each year, to ensure that focal firm-years are unique. This screening procedure selects a focal firm's most significant relationship with a supplier and a customer in terms of total sales amount within the supply chain (for details, see Lanier et al., 2010). The results of this procedure are summarized in Table 2. The final sample consists of 1,144 unique focal firm-years from 1992 through 2011. Table 3 provides a breakdown of observations by year.

Table 4 presents an overview of supply chain triads in the sample. The number of unique suppliers, focal firms, and customers in the sample are (respectively) 522, 365, and 167—suggesting greater consolidation in downstream markets. The average annual sales revenues are \$702, \$4,781 and \$25,392 million, respectively, for suppliers, focal firms, and customers. On average, 23.5% of a supplier's sales provide 3.8% of a focal firm's COGS. Between focal firms and customers, 19.4% of a focal firm's sales provide 4.0% of a customer's COGS. The average length of a focal firm's relationship with a supplier (customer) is 2.6 years (3.9 years). Finally,

Table 3
Observations by fiscal year.

Fiscal year	Number of observations
1992	34 (3.0%)
1993	46 (4.0%)
1994	47 (4.1%)
1995	51 (4.5%)
1996	58 (5.1%)
1997	70 (6.1%)
1998	65 (5.7%)
1999	36 (3.2%)
2000	60 (5.2%)
2001	59 (5.2%)
2002	67 (5.9%)
2003	74 (6.5%)
2004	64 (5.6%)
2005	64 (5.6%)
2006	64 (5.6%)
2007	63 (5.5%)
2008	58 (5.1%)
2009	56 (4.9%)
2010	54 (4.7%)
2011	54 (4.7%)
	1,144(100%)

the market concentration—as measured by market shares of the top four firms—is 66.5% in the supplier's market, 69.0% in the focal firm's market, and 74.6% in the customer's market. Overall, this description suggests the power disparity among each sample triad's members and the challenge of replacing exchange partners in both upstream and downstream markets.

Table 5 groups our sample firms by industry sector. Manufacturing is the most represented sector for all three members: suppliers, focal firms, and customers.

4.3. Measures

4.3.1. Independent variables

Since levels of dependence affect the relationship's nature and the extent of interaction (see Section 3.1), researchers have used the measure of dependence to capture the degree of embeddedness in supplier–buyer relationships (Krause et al., 2007; Uzzi, 1996). Uzzi (1996), for example, used the magnitude of exchange as a proxy for a supplier's embeddedness in relationships with manufacturers. Krause et al. (2007) also captured the relational embeddedness based on the dependency of a supplier and a buyer on one another. Based on the theoretical and empirical associations between levels of dependence and embeddedness established in the literature (e.g., Krause et al., 2007; Uzzi, 1996), we use a supplier's and a customer's dependence on a focal firm as proxies for their respective degrees of dependence-based relational embeddedness. We measure supplier's dependency (SDEP) as the ratio of its sales to the focal firm over its total sales; this ratio is first transformed using the natural logarithm to reduce the non-normality of the distribution, the heteroskadesticity of residuals, and the collinearity between direct and quadratic terms (Cohen et al., 2003). We then center SDEP by subtracting the sample mean to further reduce multicollinearity between its direct and quadratic terms (Cohen et al., 2003). A customer's dependency (CDEP) is defined as the proportion of its COGS provided by the focal firm; this proportion is also transformed using the natural logarithm and then centered by subtracting the sample mean for the same reasons specified above.

Table 4
Overview of supply chain triads.

Trait	Suppliers	Focal firms	Customers
Unique firms in sample	522	365	167
Average total revenues (USD million)	$702	$4,781	$25,392
Sales amount to the supply chain member	23.5%	19.4%	n.a.
Input provided by the supply chain member	n.a.	3.8%	4.0%
Relationship duration with a focal firm	2.6 years	n.a.	3.9 years
Market concentration of top four firms	66.5%	69.0%	74.6%

Note: "n.a." = not applicable.

Table 5
Sample firms sorted by economic sector.

Sector (2-digit SIC range)	Suppliers (%)	Focal firms (%)	Customers (%)
Agriculture, forestry, and fishing (01–09)	2 (0.2%)	0 (0%)	1 (0.1%)
Mining (10–14)	108 (9.4%)	71 (6.2%)	28 (2.4%)
Construction (15–17)	8 (0.7%)	0 (0%)	0 (0%)
Manufacturing (20–39)	854 (74.7%)	860 (75.2%)	489 (42.7%)
Transportation and public utilities (40–49)	35 (3.1%)	43 (3.8%)	127 (11.1%)
Wholesale and retail trade (50–59)	42 (3.7%)	101 (8.8%)	437 (38.2%)
Services (70–89)	95 (8.3%)	69 (6.0%)	62 (5.4%)
Total	1,144 (100%)	1,144 (100%)	1,144 (100%)

4.3.2. Dependent variables

A focal firm's performance outcomes are measured by several accounting-based metrics. Return on assets (ROA) is chosen to capture both profitability and asset efficiency at the most aggregated level (ROA = net income ÷ total assets). ROA is then decomposed into return on sales (ROS) and asset turnover (ATO) (ROA = ROS × ATO). ROS captures the profit margin achieved on sales (ROS = net income ÷ net sales), while ATO captures a firm's asset efficiency in generating sales revenues (ATO = net sales ÷ total assets). ROS is further broken down into the more granular measures of gross margin (GM), and selling, general, and administrative expenses (SGA). GM captures the margin generated by sales and is measured as net sales less cost of goods sold divided by net sales. SGA considers the burden of administrative overhead including relationship management and is measured as the ratio of selling, general, and administrative expenses to net sales. Lastly, a firm's operational efficiency is estimated by inventory levels (INV), measured as the ratio of total inventory to total assets. We measure all performance variables by cumulative outcomes over 2 years ($\text{year}_t + \text{year}_{t+1}$) to capture both temporal and lagged effects of resource dependency on a focal firm's performance. Overall, our cumulative performance measures capture comprehensive aspects of a firm's profitability and efficiency while ensuring the antecedence of dependency to performance outcomes.

4.3.3. Control variables

Extraneous effects are controlled by numerous variables related to industry, firm, relationship, and time period of our sample. Industry memberships are controlled to reduce the potential correlation of performance measures within a specific industry by four dummy variables: one each for manufacturing, transportation and public utilities, wholesale/retail, and services. The firm-level control variables are: (1) the focal firm's sales growth (SG), measured as the firm's annual growth of sales, (2) market share (SHARE), measured as the ratio of the focal firm's sales to industry sales (using 4-digit SIC code), (3) years of operation (AGE), (4) business diversification (DIV), measured as the number of business segments, (5) financial leverage (LEV), measured as the ratio of last year's total assets to last year's total equity, and (6) firm size (SIZE), measured as the natural log of total assets. We chose these firm-level variables because they are known to affect financial performance (Patatoukas, 2012).

Table 6
Descriptive statistics and empirical distributions.

Variable	N	Mean	S.D.	Percentile				
				5th	25th	50th	75th	95th
SDEP (raw)	1,144	0.24	0.21	0.05	0.11	0.16	0.29	0.74
SDEP	1,144	0	0.83	−1.23	−0.43	−0.06	0.53	1.47
CDEP (raw)	1,144	0.04	0.06	0.001	0.01	0.02	0.05	0.17
CDEP	1,144	0	1.66	−3.11	−1.02	0.11	1.25	2.46
ROA	1,144	0.02	0.15	−0.23	−0.002	0.05	0.09	0.18
ROS	1,144	−0.01	0.37	−0.32	−0.001	0.04	0.09	0.23
ATO	1,144	1.30	1.00	0.34	0.69	1.05	1.55	3.53
INV	1,144	0.13	0.11	0.002	0.05	0.10	0.17	0.37
GM	1,144	0.39	0.25	0.06	0.19	0.36	0.55	0.87
SGA	1,144	0.25	0.24	0.03	0.09	0.19	0.35	0.59
SG	1,144	0.16	0.42	−0.25	−0.004	0.09	0.24	0.69
SHARE	1,144	0.14	0.19	0.001	0.01	0.05	0.21	0.52
AGE	1,144	22.89	22.43	0.95	6.52	14.72	31.89	75.39
DIV	1,144	2.53	1.76	1	1	2	4	6
LEV	1,144	2.89	6.34	−0.18	1.52	2.28	3.41	7.93
SIZE	1,144	8.17	1.76	4.81	7.11	8.34	9.38	10.78
SSHR	1,144	0.04	0.10	0.00004	0.0005	0.003	0.02	0.27
CSHR	1,144	0.33	0.25	0.02	0.14	0.26	0.51	0.76
SSIZE	1,144	5.30	1.95	2.09	4.05	5.23	6.77	10.70
CSIZE	1,144	10.59	1.64	7.59	9.69	10.57	11.89	12.94
SYEAR	1,144	2.60	2.20	1	1	2	3	7
CYEAR	1,144	3.89	3.87	1	1	2	5	12

Variable definitions: SDEP = the natural log of the ratio of the supplier's sales to the focal firm over the supplier's total sales, centered on the mean of the overall distribution; CDEP = the natural log of the ratio of the focal firm's sales to the customer over the customer's total cost of goods sold, centered on the mean of the overall distribution; ROA = the ratio of net income to total assets cumulative over years t and $t+1$; ROS = the ratio of net income to net sales cumulative over years t and $t+1$; ATO = the ratio of net sales to total assets cumulative over years t and $t+1$; INV = the ratio of inventory to total assets cumulative over years t and $t+1$; GM = net sales minus cost of goods sold, divided by net sales, cumulative over years t and $t+1$; SGA = the ratio of selling, general, and administrative expenses to net sales cumulative over years t and $t+1$; SG = a focal firm's annual growth of sales; SHARE = the ratio of a focal firm's sales to industry sales (based on 4-digit SIC code); AGE = years of operation; DIV = number of business segments; LEV = the ratio of last year-end's total assets to last year-end's total equity; SIZE = the natural log of total assets; SSHR = the ratio of a supplier's sales to industry sales (based on 4-digit SIC code); CSHR = the ratio of a supplier's sales to industry sales (based on 4-digit SIC code); SSIZE = the natural log of the supplier's total assets; CSIZE = the natural log of the customer's total assets; SYEAR = years of relationship with a supplier; CYEAR = years of relationship with a customer. All continuous variables are winsorized at 0.5% and 99.5%.

For relationship-level control variables, we include two variables as proxies for the bargaining power of exchange partners: (1) market share and (2) firm size. We use supplier market share (SSHR) and customer market share (CSHR) to capture the focal firm's difficulty in replacing the supplier or customer. These variables were used as the proxy for market power in Lanier et al.'s study (2010). "Market share" is defined as the ratio of each member's sales to total sales of their respective industries based on 4-digit SIC code. We also control for the firm size of a supplier (SSIZE) and a customer (CSIZE), which are measured by the natural logs of total assets. In addition, we use the years of relationship with a supplier (SYEAR) and with a customer (CYEAR) to capture the focal firm's dependence on the supplier or customer over time. The literature suggests that bargaining power and the length of relationships can affect the nature and quality of interactions between the parties (e.g., Krause et al., 2007; Lanier et al., 2010).

Finally, we include a dummy variable for each year to control for market-wide effects on performance measures across firms within a specific time period. Table 6 presents the descriptive statistics and empirical distributions of all variables, and Table 7 provides key statistics for each variable by industry. The correlations among variables are reported in Table 8.

4.4. Analysis

We chose pooled ordinary least squares (OLS) regression with standard errors clustered by firm, and industry- and time-fixed effects for several reasons. First, hierarchical analysis that allows estimation of the incremental explanatory power of key variables is available with OLS regression, but not with time-series regression. Second, fixed-effect time-series regression models need a sufficient data history of at least 2 years to yield robust results (Cameron and Trivedi, 2005). However, more than one-third of our sample firms (137 out of 365 focal firms) appear only once in the dataset and more than one-fifth of firms (84 out of 365 focal firms) have a history of only 2 years. Thus, 37.5% of our data contain insufficient information for time-series regression while another 23% provide minimum information. Such limitations of our data can restrain the statistical efficiency of time-series analysis and thus induce bias in estimation (Cameron and Trivedi, 2005). Third, industry membership is known to have systematic effects on firm performance. Yet, time-invariant factors such as industry cannot be included in fixed-effect time-series regression. Fourth, fixed- and random-effect models generate unbiased estimation only when firm effects are permanent (Petersen, 2009). Yet, our sample is likely to have both permanent and temporary firm effects since the majority of a firm's fixed effects tend to disappear after 9 years (Petersen, 2009).

Although OLS regression is one of the most frequently used methods in financial studies (Petersen, 2009), we need to address four types of potential errors inherent to our cross-sectional time-series data: (1) firm-specific effects across time; (2) time period effects across firms; (3) industry-specific effects across time and firm; and (4) heteroskedasticity. These errors are addressed in our pooled OLS models as follows: first, we cluster standard errors by firm to correct standard errors for within-firm correlation of residuals over time for a given firm. The literature suggests that this clustering method generates unbiased estimates for both permanent and temporary firm-specific effects across time (Cameron and Trivedi, 2005; Petersen, 2009). Second, we control for time period effects across firms by including year dummies, since this method is most efficient for short time-series data (Petersen, 2009). Third, we use industry dummies to control for industry-specific effects across firms and time. Last, we use robust (heteroskedasticity-consistent) standard errors to estimate t-statistics in our regression analysis.

Table 7
Descriptive statistics by industry.

Variable	Mining (N = 71)			Manufacturing (N = 860)			Trans. & public util. (N = 43)			Whsl. & retail (N = 101)			Services (N = 69)		
	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.	Mean	Median	S.D.
SDEP (raw)	0.18	0.13	0.17	0.24	0.16	0.21	0.26	0.15	0.21	0.22	0.16	0.18	0.23	0.16	0.21
SDEP	−0.26	−0.25	0.85	0.01	−0.06	0.84	0.12	−0.12	0.83	0.04	−0.04	0.72	−0.02	−0.04	0.87
CDEP (raw)	0.04	0.01	0.07	0.03	0.01	0.05	0.05	0.03	0.06	0.09	0.06	0.09	0.03	0.02	0.04
CDEP	−0.37	−0.23	1.93	−0.05	−0.01	1.52	−0.11	0.84	2.31	0.99	1.42	1.76	−0.34	0.21	1.90
ROA	−0.01	0.02	0.13	0.03	0.05	0.15	−0.04	0.02	0.18	0.03	0.05	0.05	−0.03	0.05	0.25
ROS	−0.03	0.05	0.39	0.01	0.04	0.29	−0.27	0.03	0.90	0.01	0.01	0.03	−0.11	0.06	0.71
ATO	0.60	0.40	0.68	1.15	1.05	0.57	0.70	0.50	0.54	3.60	3.55	1.37	0.92	0.83	0.47
INV	0.01	0.01	0.01	0.13	0.11	0.09	0.01	0.01	0.01	0.27	0.31	0.15	0.04	0.01	0.06
GM	0.43	0.47	0.29	0.41	0.38	0.24	0.41	0.44	0.21	0.13	0.10	0.11	0.53	0.49	0.26
SGA	0.09	0.06	0.08	0.26	0.23	0.22	0.35	0.24	0.46	0.09	0.08	0.08	0.44	0.43	0.30
SG	0.28	0.18	0.65	0.14	0.08	0.35	0.31	0.15	0.65	0.16	0.09	0.37	0.26	0.13	0.71
SHARE	0.02	0.004	0.04	0.16	0.06	0.20	0.05	0.03	0.09	0.21	0.19	0.19	0.06	0.02	0.08
AGE	16.03	10.13	15.77	25.35	16.58	23.91	10.18	8.88	10.19	18.99	13.75	17.86	13.01	9.53	9.74
DIV	2.45	1	1.71	2.51	2	1.79	3	2	2.18	2.38	3	1.04	2.78	2	1.95
LEV	4.03	2.67	6.73	2.71	2.12	6.09	1.73	2.59	9.57	4.69	2.89	7.11	2.11	1.68	4.63
SIZE	8.19	8.26	1.58	8.21	8.38	1.70	8.20	8.55	2.58	7.66	7.58	1.64	8.24	8.65	2.17
SSHR	0.01	0.001	0.03	0.05	0.004	0.11	0.01	0.002	0.03	0.03	0.004	0.07	0.03	0.001	0.09
CSHR	0.17	0.07	0.21	0.36	0.32	0.24	0.12	0.08	0.15	0.24	0.14	0.24	0.32	0.24	0.23
SSIZE	5.38	5.38	1.99	5.25	5.24	1.77	4.48	4.48	2.12	6.38	5.73	2.57	4.72	4.69	2.25
CSIZE	10.46	10.51	1.39	10.65	10.58	1.66	10.46	10.94	1.47	10.03	10.18	1.68	10.97	11.14	1.49
SYEAR	2	1	2.7	2.75	2	2.25	2.02	1	2.01	2.49	2	1.76	1.84	1	1.28
CYEAR	2.41	1	2.92	4.10	3	4.05	3.23	2	3.18	3.91	3	3.05	3.29	2	3.43

Table 8
Variable correlations—Pearson (Spearman) in lower (upper) triangle.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1. SDEP	1	0.06[b]	0.09[a]	0.11[a]	−0.03	−0.01	0.11[a]	0.11[a]	0.05[c]	−0.02	0.05[c]	−0.08[b]	−0.05[c]	0.03	−0.26[a]	−0.04	−0.20[a]	−0.11[a]	0.11[a]	0.10[a]
2. CDEP	0.07[b]	1	0.06[b]	0.05[c]	0.09[a]	0.02	−0.11[a]	−0.17[a]	0.02	0.33[a]	0.15[a]	0.08[a]	0.09[a]	0.40[a]	0.21[a]	−0.28[a]	0.30[a]	−0.34[a]	0.13[a]	0.22[a]
3. ROA	0.10[a]	0.15[a]	1	0.91[a]	0.05[c]	0.04	0.39[a]	0.12[a]	0.26[a]	0.20[a]	0.21[a]	0.02	−0.11[a]	0.16[a]	0.08[b]	0.19[a]	0.02	0.02	0.04	0.08[a]
4. ROS	0.10[a]	0.17[a]	0.79[a]	1	−0.23[a]	−0.15[a]	0.56[a]	0.21[a]	0.22[a]	0.11[a]	0.25[a]	0.05[c]	−0.17[a]	0.26[a]	0.04	0.19[a]	0.04	0.01	0.03	0.08[a]
5. ATO	0.03	0.19[a]	0.07[b]	0.10[a]	1	0.64[a]	−0.66[a]	−0.49[a]	0.05	0.33[a]	−0.06[b]	−0.003	0.25[a]	−0.26[a]	0.18[a]	0.03	0.06[c]	0.07[b]	0.08[a]	0.07[b]
6. INV	−0.03	0.06[b]	0.06[b]	0.08[a]	0.56[a]	1	−0.41[a]	−0.23[a]	−0.05	0.23[a]	0.04	−0.08[a]	0.13[a]	−0.25[a]	0.20[a]	0.14[a]	−0.01	0.003	0.06[c]	0.01
7. GM	0.16[a]	−0.08[a]	0.25[a]	0.18[a]	−0.57[a]	−0.41[a]	1	0.80[a]	0.09[a]	−0.23[a]	0.14[a]	−0.10[a]	−0.41[a]	0.16[a]	−0.16[a]	0.13[a]	−0.15[a]	−0.19[a]	−0.08[a]	−0.06[b]
8. SGA	0.10[a]	−0.25[a]	−0.30[a]	−0.45[a]	−0.39[a]	−0.25[a]	0.59[a]	1	−0.01	−0.26[a]	0.07[b]	−0.11[a]	−0.43[a]	−0.02	−0.17[a]	0.15[a]	−0.21[a]	−0.24[a]	−0.10[a]	−0.11[a]
9. SG	0.02	−0.03	−0.06[b]	−0.21[a]	0.07[b]	−0.02	0.02	0.08[a]	1	−0.13[a]	−0.20[a]	−0.16[a]	−0.12[a]	−0.17[a]	−0.13[a]	−0.06[c]	−0.12[a]	−0.16[a]	−0.17[a]	−0.20[a]
10. SHARE	−0.05[c]	0.19[a]	0.16[a]	0.12[a]	0.20[a]	0.13[a]	−0.18[a]	−0.19[a]	−0.10[a]	1	0.38[a]	0.31[a]	0.26[a]	0.49[a]	0.46[a]	0.27[a]	0.39[a]	0.25[a]	0.27[a]	0.36[a]
11. AGE	0.06[c]	0.15[a]	0.17[a]	0.16[a]	−0.10[a]	−0.002	0.07[b]	−0.05[c]	−0.19[a]	0.30[a]	1	0.33[a]	0.07[b]	0.50[a]	0.22[a]	0.23[a]	0.27[a]	0.16[a]	0.24[a]	0.36[a]
12. DIV	−0.06[b]	0.10[a]	0.10[a]	0.08[a]	−0.06[c]	−0.11[a]	−0.08[a]	−0.11[a]	−0.13[a]	0.31[a]	0.41[a]	1	0.20[a]	0.47[a]	0.19[a]	0.16[a]	0.33[a]	0.33[a]	0.11[a]	0.25[a]
13. LEV	0.01	0.03	0.02	0.01	0.13[a]	0.06[b]	−0.14[a]	−0.11[a]	−0.002	0.04	0.01	−0.01	1	0.18[a]	0.19[a]	0.05	0.17[a]	0.22[a]	0.12[a]	0.17[a]
14. SIZE	0.07[b]	0.45[a]	0.21[a]	0.17[a]	−0.21[a]	−0.27[a]	0.19[a]	−0.11[a]	−0.20[a]	0.35[a]	0.50[a]	0.45[a]	−0.01	1	0.33[a]	0.17[a]	0.52[a]	0.37[a]	0.26[a]	0.42[a]
15. SSHR	−0.15[a]	0.12[a]	0.08[a]	0.06[b]	0.07[b]	0.02	−0.11[a]	−0.11[a]	−0.06[b]	0.29[a]	0.18[a]	0.22[a]	0.03	0.24[a]	1	0.16[a]	0.64[a]	0.18[a]	0.23[a]	0.21[a]
16. CSHR	−0.03	−0.25[a]	0.14[a]	0.13[a]	−0.06[c]	0.07[b]	0.07[b]	0.005	−0.08[a]	0.26[a]	0.21[a]	0.20[a]	0.01	0.16[a]	0.09[a]	1	0.10[a]	0.25[a]	0.08[a]	0.08[a]
17. SSIZE	−0.16[a]	0.33[a]	0.09[a]	0.08[a]	0.13[a]	−0.02	−0.13[a]	−0.19[a]	−0.13[a]	0.29[a]	0.27[a]	0.32[a]	0.01	0.53[a]	0.37[a]	0.09[a]	1	0.23[a]	0.25[a]	0.25[a]
18. CSIZE	−0.07[b]	−0.33[a]	0.07[b]	0.05	−0.04	−0.10[a]	−0.16[a]	−0.18[a]	−0.13[a]	0.21[a]	0.21[a]	0.32[a]	0.02	0.39[a]	0.18[a]	0.30[a]	0.23[a]	1	0.17[a]	0.26[a]
19. SYEAR	0.05[c]	0.11[a]	0.06[b]	0.08[a]	0.06[c]	−0.01	−0.09[a]	−0.12[a]	−0.14[a]	0.19[a]	0.22[a]	0.13[a]	0.02	0.23[a]	0.11[a]	0.07[b]	0.20[a]	0.18[a]	1	0.65[a]
20. CYEAR	0.07[b]	0.19[a]	0.09[a]	0.10[a]	0.02	−0.03	−0.11[a]	−0.16[a]	−0.17[a]	0.23[a]	0.42[a]	0.27[a]	0.02	0.35[a]	0.09[a]	−0.003	0.18[a]	0.25[a]	0.59[a]	1

[a] $p < 0.01$.
[b] $p < 0.05$.
[c] $p < 0.1$.
See Table 6 for variable definitions.

Prior to the regression analysis, our data were examined as follows. First, all variables were winsorized at 0.5% and 99.5% to reduce the potential bias caused by spurious extreme values (i.e., extreme values are replaced by the values from 0.5% and 99.5% of each distribution; Wilcox, 2002). Second, we examined the data for influential outliers by calculating Cook's distance, standardized residuals, and studentized residuals for all cases (Cohen et al., 2003). The residual values of several cases were greater than 3, but the Cook's distance values were all significantly below one for each performance measure. These results indicate that our analysis is unlikely to be influenced by extreme outliers. Third, we assessed variance inflation factors (VIFs) for each regressor to determine the significance of multi-collinearity among independent variables; VIFs ranged from 1.0 to 3.8, which are well below the typical threshold of 10. Therefore, multi-collinearity should not be a major issue for further analysis.

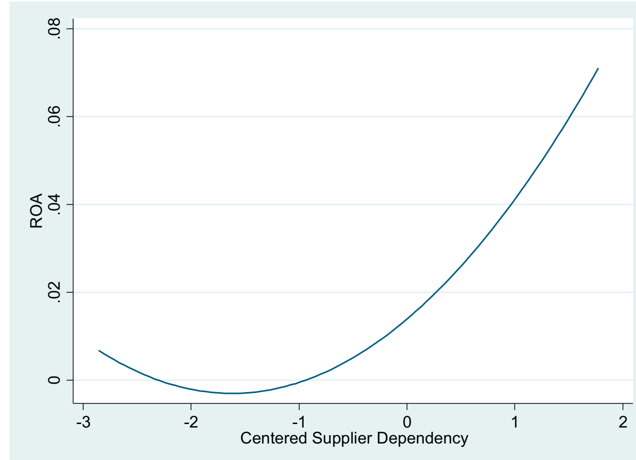

Fig. 1. ROA and supplier's dependency.

5. Results

Hierarchical analysis was used to estimate the incremental impacts of the direct and quadratic terms of a supplier's and a customer's dependency on a focal firm's performance. In the first step, performance measures were regressed on all control variables to estimate extraneous effects derived from industry, firm, relationship, and time. In the second step, the direct terms of the supplier's and the customer's dependency (SDEP and CDEP, respectively) were introduced in the presence of control variables to estimate their incremental impacts on performance. In the last step, the quadratic terms of the supplier's and the customer's dependency ($SDEP^2$ and $CDEP^2$, respectively) were added to assess the incremental impacts of the quadratic terms. For brevity of reporting, we present the regression results of the second and third steps in Tables 9 and 10, respectively, along with statistics for the incremental changes in explanatory power.

Table 9 shows our regression models that test for the effects of the supplier's and the customer's dependency on the focal firm's performance. Significant F-statistics and high adjusted R^2 values ranging from 12.5% to 67.1% suggest that our models explain a significant portion of the variation of each performance measure. Table 9 also reports the incremental changes in R^2, along with F-statistics, associated with the primary variables of interest—SDEP and CDEP. Significant values for increases in R^2 ranging from 1.5% to 11.4% indicate that the supplier's and the customer's dependency are important factors in explaining the focal firm's financial performance. As hypothesized, the results show positive associations between the supplier's dependency (SDEP) and the focal firm's ROA ($\beta = 0.016$, $p < 0.05$), ROS ($\beta = 0.044$, $p < 0.05$), ATO ($\beta = 0.101$, $p < 0.01$), and GM ($\beta = 0.020$, $p < 0.1$). SDEP also has a negative but insignificant association with INV ($\beta = -0.001$, $p > 0.1$) and a positive but insignificant association with SGA ($\beta = 0.011$, $p > 0.1$). Overall, H1 is supported.

For H2, the results support our expectation that the customer's dependency (CDEP) is positively associated with the focal firm's ROA ($\beta = 0.014$, $p < 0.05$), ROS ($\beta = 0.057$, $p < 0.01$), and ATO ($\beta = 0.214$, $p < 0.01$), while being negatively associated with SGA ($\beta = -0.076$, $p < 0.01$). Contrary to our prediction, CDEP shows a positive association with INV ($\beta = 0.017$, $p < 0.01$) and a negative association with GM ($\beta = -0.066$, $p < 0.01$). Overall, H2 is supported.

Next, we test for diminishing returns of the supplier's and the customer's dependency by regressing the focal firm's performance on the quadratic terms of SDEP and CDEP (i.e., $SDEP^2$ and $CDEP^2$) in addition to their direct terms. Any positive linear association of the focal firm's ROA, ROS, ATO, and GM with SDEP in H1 (or with CDEP in H2) are expected to have *negative* associations with $SDEP^2$ (or $CDEP^2$). Conversely, any negative linear associations of the focal firm's INV and SGA with SDEP in H1 (or with CDEP in H2) are expected to show *positive* associations with $SDEP^2$ (or $CDEP^2$). Such changes to the previous relations would demonstrate the diminishing benefits of SDEP and CDEP. The corresponding increases in R^2 values and F-statistics associated with $SDEP^2$ and $CDEP^2$ are also reported in Table 10. The results show statistically significant changes in R^2 in the range of 0.2% and 1.9%. Thus, the quadratic terms of SDEP and CDEP add substantial explanatory power to the main effect models.

To our surprise, the quadratic term of the supplier's dependency ($SDEP^2$) shows significant *positive*, rather than negative, associations with the focal firm's ROA ($\beta = 0.010$, $p < 0.01$), ROS ($\beta = 0.023$, $p < 0.05$), and GM ($\beta = 0.019$, $p < 0.01$). These results indicate *increasing*, rather than diminishing, returns to scale. In order to examine the key quadratic relationships more closely, we plotted predicted ROA and ROS values against centered SDEP in Figs. 1 and 2, respectively. Contrary to our expectation, the graphs show a U-shaped curve with increasing values of ROA and ROS around one standard deviation below SDEP mean value of 0. Hence, we do not find support for H3.

In startling contrast, the quadratic term of the customer's dependency ($CDEP^2$) shows the expected *negative* associations with the focal firm's ROA ($\beta = -0.005$, $p < 0.05$) and ROS ($\beta = -0.011$, $p < 0.05$), while having the expected *positive* associations with INV ($\beta = 0.003$, $p < 0.05$) and SGA ($\beta = 0.009$, $p < 0.05$). As hypothesized, these results suggest diminishing returns of CDEP. For a visual investigation, ROA

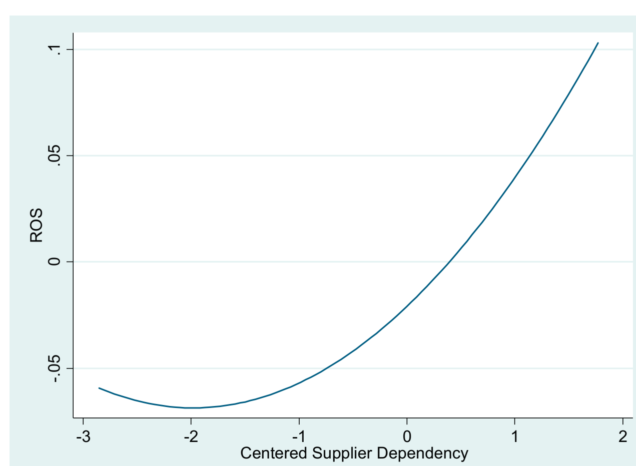

Fig. 2. ROS and supplier's dependency.

Table 9
Effects of resource dependency on focal firms' performance.

Variable	ROA	ROS	ATO	INV	GM	SGA
Predictor variables						
Supplier dependency (SDEP)	0.0156	0.0443	0.1010	−0.0012	0.0199	0.0113
(+, +, +, −, +,−)	2.21**	2.54**	2.67***	−0.28	1.69*	1.20
Customer dependency (CDEP)	0.0138	0.0574	0.2139	0.0172	−0.0664	−0.0764
(+, +, +,−, +,−)	2.23**	3.30***	7.33***	3.44***	−7.23***	−6.79***
Industry control variables						
Manufacturing	0.0106	−0.0546	0.3010	0.0942	0.0313	0.2427
	0.36	−0.66	3.35***	8.68***	0.60	7.84***
Trans. & public utilities	−0.0518	−0.2740	−0.0173	−0.0097	0.0145	0.3204
	−1.41	−1.88*	−0.13	−0.66	0.21	4.33***
Wholesale & retail	0.0277	−0.0571	2.4389	0.2194	−0.1584	0.1063
	0.82	−0.62	10.03***	5.49***	−2.74***	2.94***
Services	−0.0362	−0.123	0.1810	0.0160	0.1392	0.4032
	−0.34	−1.07	1.45	0.93	2.11**	8.04***
Firm control variables						
Sales growth (SG)	−0.0069	−0.1570	0.1259	−0.0110	0.0252	0.0338
	−0.20	−1.40	2.13**	−1.51	1.50	1.34
Market share (SHARE)	0.0192	−0.0319	0.5721	0.0301	−0.1259	−0.0366
	0.73	−0.50	3.28***	0.91	−2.02**	−0.67
Firm age (AGE)	0.0002	0.0006	−0.0003	0.0005	0.0004	0.0006
	0.59	1.05	−0.19	1.65*	0.61	1.19
Diversification (DIV)	0.0019	0.0087	0.0145	0.0013	−0.0223	−0.0154
	0.58	1.09	0.81	0.46	−3.08***	−2.82***
Financial leverage (LEV)	0.0002	−0.0005	0.0066	0.0001	−0.0028	−0.0014
	0.37	−0.45	1.88*	0.25	−3.14***	−1.95*
Firm size (SIZE)	0.0115	−0.0050	−0.2941	−0.0280	0.0991	0.0405
	1.34	−0.22	−8.72***	−6.27***	8.22***	4.13***
Relationship control variables						
Supplier market share	0.0364	0.0248	0.4208	0.0054	−0.0501	−0.0008
(SSHR)	0.75	0.32	1.75*	0.13	−0.58	−0.01
Customer market share	0.0641	0.2050	0.1678	0.0421	0.0139	−0.0868
(CSHR)	2.31**	3.22***	1.03	1.62	0.28	−1.80*
Supplier firm size	−0.0040	−0.0045	0.0429	−0.0001	−0.0149	−0.0027
(SSIZE)	−1.01	−0.53	1.88*	−0.05	−2.43**	−0.55
Customer firm size	0.0066	0.0238	0.1815	0.0119	−0.0792	−0.0685
(CSIZE)	1.24	1.99**	8.06***	2.89***	−7.88***	−8.44***
Years with suppliers	−0.0003	0.0004	0.0311	0.00003	−0.0036	−0.0032
(SYEAR)	−0.12	0.11	2.38**	0.02	−0.69	−0.77
Years with customers	−0.0023	−0.0043	−0.0090	−0.0022	−0.0038	−0.0015
(CYEAR)	−1.66*	−1.75*	−1.22	−1.54	−1.07	−0.57
Intercept	−0.1430	−0.1460	0.9062	0.1593	0.5075	0.4045
	−2.06**	−0.83	4.10***	3.68***	5.42***	4.89***
Year indicator variables	Yes	Yes	Yes	Yes	Yes	Yes
Std. errors clustered by firm	Yes	Yes	Yes	Yes	Yes	Yes
R^2	15.3%	17.7%	68.2%	43.4%	44.6%	37.3%
Adjusted R^2	12.5%	14.9%	67.1%	41.5%	42.8%	35.2%
F-statistic	3.00***	2.21***	20.56***	10.81***	12.01***	8.87***
Change in R^2 related to predictors	1.5%	3.4%	5.5%	2.7%	8.2%	11.4%
F-statistic for change	9.62***	23.05***	95.94***	26.00***	81.80***	100.56***
N	1144	1144	1144	1144	1144	1144

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$ (two-tailed tests).
See Table 6 for variable definitions.

and ROS are plotted against centered CDEP in Figs. 3 and 4, respectively. The graphs show the expected inverted-U shaped curve, with decreasing values of ROA and ROS around CDEP mean value of 0. Overall, H4 is supported.

Finally, it is worth noting the effects of several control variables. A focal firm's industry membership is significantly associated with several performance measures. On average, focal firms in the manufacturing sector have greater asset efficiency (ATO), despite having higher levels of inventory (INV) and administrative expenses (SGA). Focal firms in transportation and public utilities appear to have lower returns on sales (ROS) due to higher spending on administrative expenses (SGA). Wholesale and retail firms have higher levels of asset efficiency (ATO), inventory (INV), and administrative expenses (SGA) while experiencing lower gross margins (GM). Finally, focal firms in services have higher levels of gross margins (GM) and administrative expenses (SGA).

Among firm control variables, we find that faster growing firms (SG) achieve higher asset turnover (ATO). Focal firms with greater market share (SHARE) also achieve higher asset turnover (ATO), but at the expense of lower gross margins (GM). We also find that focal firms with high levels of diversification (DIV) and leverage (LEV) have lower gross margins (GM), but save more in selling and administrative expenses (SGA). Larger firms (SIZE) appear to have lower inventory levels (INV) and higher gross margins (GM), but they also experience lower asset efficiency (ATO) and higher administrative expenses (SGA).

For relationship variables, we control for the potential power of a supplier and a customer by including their respective market shares and firm sizes in our models (as mentioned in Section 4.3). The *supplier's* market share (SSHR) is positively associated with the focal firm's asset turnover (ATO). The *supplier*'s firm size (SSIZE) also shows a positive association with asset turnover (ATO), but

Table 10
Quadratic effects of resource dependency on focal firms' performance.

Variable	ROA	ROS	ATO	INV	GM	SGA
Predictor variables						
Supplier dependency						
Quadratic SDEP ($SDEP^2$)	0.0101	0.0233	0.0303	−0.0031	0.0189	0.0045
(−, −, −, +, −, +)	2.67***	2.32**	1.42	−0.99	2.89***	0.63
SDEP	0.0186	0.0513	0.1107	−0.0021	0.0264	0.0136
(+, +, +, −, +, −)	2.59***	3.00***	2.69***	−0.46	2.13**	1.44
Customer dependency						
Quadratic CDEP ($CDEP^2$)	−0.0050	−0.0106	−0.0061	0.0028	0.0012	0.0092
(−, −, −, +, −, +)	−2.16**	−2.06**	−0.67	1.97**	0.44	2.32**
CDEP	0.0098	0.0493	0.2113	0.0197	−0.0629	−0.0664
(+, +, +, −, +, −)	1.62	2.94***	7.33***	3.74***	−6.45***	−6.84***
Industry control variables						
Manufacturing	0.0041	−0.0686	0.2896	0.0973	0.0286	0.2499
	0.13	−0.82	3.22***	8.89***	0.55	7.88***
Trans. & public utilities	−0.0417	−0.2525	−0.0043	−0.0152	0.0128	0.3028
	−1.16	−1.81*	−0.03	−0.97	0.19	4.28***
Wholesale & retail	0.0322	−0.0479	2.443	0.2168	−0.1615	0.0961
	0.92	−0.51	10.01***	5.59***	−2.79***	2.72***
Services	−0.0362	−0.1233	0.1786	0.0156	0.1359	0.3996
	−0.87	−1.07	1.46	0.97	2.03**	8.16***
Firm control variables						
Sales growth (SG)	−0.0066	−0.1559	0.1265	−0.0112	0.0254	0.0336
	−0.19	−1.39	2.14**	−1.53	1.52	1.32
Market share (SHARE)	0.0225	−0.0253	0.5727	0.0278	−0.1307	−0.0469
	0.92	−0.44	3.31***	0.84	−2.12**	−0.91
Firm age (AGE)	0.0002	0.0006	−0.0003	0.0005	0.0004	0.0007
	0.59	1.04	−0.17	1.69*	0.70	1.36
Diversification (DIV)	0.0013	0.0074	0.0137	0.0017	−0.0222	−0.0144
	0.41	0.96	0.77	0.58	−3.13***	−2.73***
Financial leverage (LEV)	0.0001	−0.0006	0.0064	0.0001	−0.0028	−0.0013
	0.22	−0.59	1.84*	0.33	−3.24***	−1.94*
Firm size (SIZE)	0.0092	−0.0101	−0.2986	−0.0270	0.0977	0.0426
	1.07	−0.44	−8.57***	−6.21***	8.29***	4.50***
Relationship control variables						
Supplier market share	0.0480	0.0497	0.4383	−0.0005	−0.0492	−0.0176
(SSHR)	1.07	0.69	1.82*	−0.01	−0.56	−0.25
Customer market share	0.0658	0.2100	0.1861	0.0433	0.0327	−0.0693
(CSHR)	2.31**	3.32***	1.15	1.72*	0.64	−1.61
Supplier firm size	−0.0023	−0.0008	0.0464	−0.0009	−0.0136	−0.0039
(SSIZE)	−0.59	−0.10	2.01**	−0.32	−2.23**	−0.85
Customer firm size	0.0058	0.0224	0.1818	0.0124	−0.0777	−0.0657
(CSIZE)	1.08	1.82*	8.07***	3.08***	−7.97***	−8.08***
Years with suppliers	−0.0006	−0.0003	0.0302	0.0001	−0.0042	−0.0033
(SYEAR)	−0.25	−0.07	2.34**	0.07	−0.80	−0.79
Years with customers	−0.0024	−0.0045	−0.0092	−0.0021	−0.0038	−0.0014
(CYEAR)	−1.72*	−1.87*	−1.26	−1.55	−1.10	−0.55
Intercept	−0.1080	−0.0731	0.9320	0.1376	0.4790	0.3188
	−1.52	−0.43	3.88***	3.18***	5.04***	4.41***
Year indicator variables	Yes	Yes	Yes	Yes	Yes	Yes
Std. errors clustered by firm	Yes	Yes	Yes	Yes	Yes	Yes
R^2	17.2%	19.2%	68.4%	44.3%	45.4%	39.1%
Adjusted R^2	14.2%	16.3%	67.3%	42.3%	43.5%	36.9%
F-statistic	3.04***	2.31***	20.47***	11.55***	11.44***	9.28***
Change in R^2 related to predictors	1.9%	1.5%	0.2%	0.9%	0.8%	1.8%
F-statistic for change	12.35***	10.36***	2.96*	8.38***	8.22***	16.15***
N	1144	1144	1144	1144	1144	1144

*** $p < 0.01$.
** $p < 0.05$.
* $p < 0.1$ (two-tailed tests).
See Table 6 for variable definitions.

has a negative association with gross margin (GM). On the other hand, the *customer's* market share (CSHR) shows positive associations with the focal firm's ROA and ROS, and a negative association with its SGA expenses. The customer's size (CSIZE) also shows positive associations with ROS and ATO, and a negative association with SGA, but at the expense of higher inventories (INV) and lower gross margins (GM). Years with suppliers (SYEAR) are associated with higher asset efficiency (ATO), while years with customers (CYEAR) are negatively associated with overall performance (ROA) and profit margins (ROS). See Tables 9 and 10 for more details.

6. Sensitivity analysis

To test the robustness of our results, we performed several sensitivity analyses with respect to our choices for performance measures, regression methods, and outliers.

6.1. Performance measures

Our performance outcomes were measured by cumulative performance over two years ($year_t + year_{t+1}$) to capture both temporal

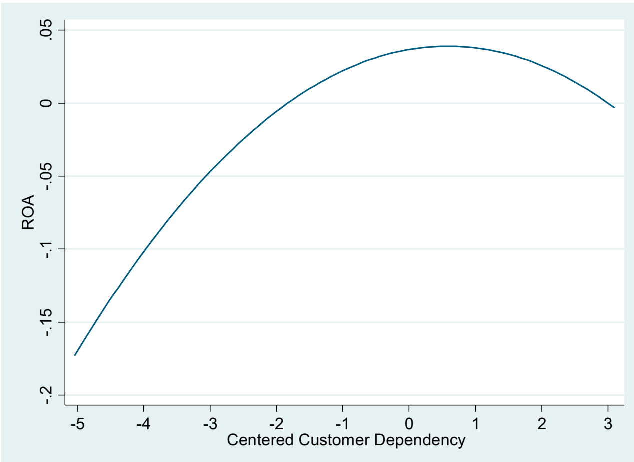

Fig. 3. ROA and customer's dependency.

and lagged effects of resource dependency on a focal firm's performance. We chose two-year cumulative outcomes for both theoretical and empirical reasons; in particular, we ensured the antecedence of dependency to performance outcomes while maintaining the temporal relevance of time between these two events. For sensitivity analysis, we considered one-year leading performance measures in year$_{t+1}$ that exclude the contemporaneous effects of dependency on performance. The results were very similar to those of our principal analysis. Minor differences were observed in lower p-values for the impact of SDEP and CDEP on ROA (p-values = 0.227 and 0.121, respectively) and the impact of SDEP on GM (p-value = 0.107). We also considered cumulative performance outcomes over 3 years (i.e., year$_t$ + year$_{t+1}$ + year$_{t+2}$). Longer-term measures of performance increased data requirements, and thus reduced the sample size to 1,030 firm-years from 1,144 firm-years. The results with three-year term measures were also similar to our principal results with two-year term measures, but showed lower p-values for the impact of SDEP on ROA and GM, and the impact of CDEP on ROA—due to the widening time differences of events beyond year$_{t+1}$. Thus, we report the results with two-year cumulative outcomes in this paper since these measures encompass both contemporaneous and leading performance.

6.2. Regression models

As explained in Section 4.4, we chose pooled OLS regression with standard errors clustered by firm instead of using fixed- or random-effect models to maximize the statistical efficiency and the explanatory power of our analysis by including all observations and relevant variables in our regression models. Specifically, a substantial portion of our data (60.5%) has insufficient (37.5%) or minimum (23%) information for fixed-effect time-series regression and thus can generate biased results (Cameron and Trivedi, 2005). Given the limitations of our data, we clustered standard errors by firm to efficiently adjust standard errors for the correlation of residuals across years for each focal firm in our cross-sectional time series data (Cameron and Trivedi, 2005; Petersen, 2009). OLS regression with clustered standard errors is one of the most frequently used methods for financial panel data analysis (Petersen, 2009).

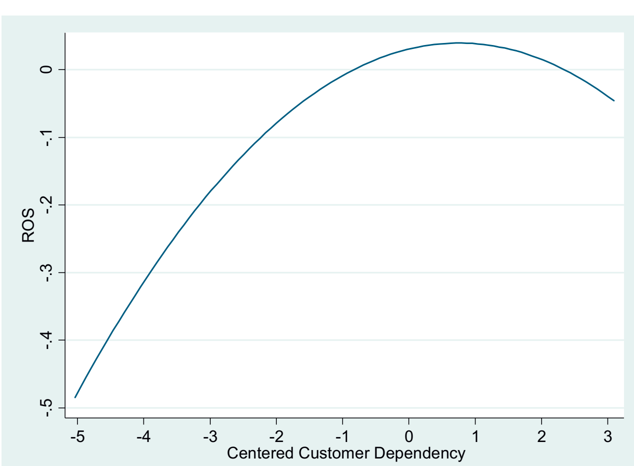

Fig. 4. ROS and customer's dependency.

Nevertheless, we tested the robustness of our OLS results by conducting panel data analysis with fixed-effect as the Hausman test suggests with p-value <0.0001. Overall, the fixed-effect analysis shows similar results for CDEP, CDEP^2 and SDEP as the OLS analysis, but suggests some different results for SDEP^2. Consistent with the OLS results, the fixed-effect results for CDEP show the expected associations with ROA ($\beta = 0.022$, $p < 0.01$), ROS ($\beta = 0.053$, $p < 0.01$), ATO ($\beta = 0.137$, $p < 0.01$) and SGA ($\beta = -0.018$, $p < 0.01$), while suggesting a positive association with INV ($\beta = 0.010$, $p < 0.01$). The results for CDEP^2 also indicate the hypothesized associations with ROS ($\beta = -0.007$, $p < 0.05$) and SGA ($\beta = 0.004$, $p < 0.01$), while showing a positive and significant association with GM ($\beta = 0.004$, $p < 0.01$). Overall, the results for CDEP^2 are similar to the OLS results, but with lower significant values. Similarly, the results for SDEP show the predicted associations with ROA ($\beta = 0.009$, $p < 0.05$) and ROS ($\beta = 0.020$, $p < 0.01$), as does our OLS analysis. The only differences in the fixed-effect results for SDEP are the lost significance for its impact on ATO and GM.

However, the fixed-effect results for SDEP^2 suggest negative associations with ROA ($\beta = -0.007$, $p < 0.05$) and ROS ($\beta = -0.009$, $p < 0.1$) as we hypothesized in H3, while showing a positive association with ATO ($\beta = 0.020$, $p < 0.1$). These results are contradictory to our OLS findings that suggest the positive impact of SDEP^2 on ROA, ROS and GM, while indicating a positive but insignificant impact on ATO. Thus, the fixed-effect results for SDEP^2 show opposite signs for the impact on ROA and ROS, while suggesting the same signs for its impact on ATO and GM albeit with different levels of significance. Although the fixed-effect results support our hypothesis about the diminishing effects of supplier dependency on performance (H3), we are highly cautious when interpreting these results for SDEP^2 due to the aforementioned limitations of our data for time-series regression analysis. While comparing the statistical efficiency of regression models is outside the scope of this study, based on the literature (Cameron and Trivedi, 2005; Petersen, 2009), we believe that OLS regression with standard errors clustered by firm is the most efficient method for financial panel data that have limited data history. Thus, we continue our discussion in Section 7 based on the results of our principal analysis presented in Tables 9 and 10.

6.3. Outliers

Although the small values of Cook's distance measure suggest no substantial influence of extreme values (see Section 4.4), we also tested the robustness of our analysis by removing all observations with large residuals whose absolute standardized and studentized residual values were greater than 3 (Cohen et al., 2003). This procedure reduced the sample size by minor amounts to the range of 1,119–1,140 firm-years depending on the performance measure. The removal of outliers did not significantly change the results, but lowered the p-value below 0.1 for the impact of CDEP on ROA. Overall, our results are robust to the presence of outliers.

7. Discussion

This study investigates the effects of both a supplier's and a buyer's dependency on the focal firm's financial performance in triadic supply chain relationships. First, we find that the supplier's dependency increases the focal firm's performance in terms of ROA and ROS by increasing asset turnover and gross margin (see Table 9). Thus, our findings establish an economic link between the supplier's dependency and financial performance. These demonstrated financial benefits of supplier dependency build on previous findings about the buyer's operational and/or strategic benefits of embedded relationships in the extant literature (Carey et al., 2011; Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011).

Second, we identify financial benefits of the customer's dependency that accrue to the focal firm—a topic seldom empirically investigated or documented in the extant literature. We find that the customer's dependency increases the focal firm's performance in terms of ROA and ROS by increasing asset turnover while reducing administrative expenses (see Table 9). These benefits of the customer's dependency, however, come at the price of lower gross margins and higher inventory levels. A recent example in the popular press provides anecdotal support for these findings: as one of the largest suppliers of Amazon, Procter and Gamble (P&G) has shared Amazon's inventory and selling costs for large volume products by accommodating Amazon in P&G's warehouses (Ng, 2013). Overall, our findings demonstrate an economic link between customer dependency, an important aspect of customer embeddedness, and financial performance. Considered together, the positive economic effects of the supplier's and the customer's dependency suggest that the relational benefits of dependence-based embeddedness are unequivocal for both suppliers and customers.

Third, we investigate the diminishing effects of the supplier's dependency by hypothesizing an inverted U-shaped curve for ROA, ROS, asset turnover, and gross margin, and hypothesizing a U-shaped curve for inventory levels and selling, general and administrative expenses. However, our findings do not substantiate the presumed financial risks of excessive supplier dependency (see Table 10). Rather, our results indicate that the focal firm's ROA, ROS and gross margin saddle at a certain point, but continue to increase as the supplier's dependency increases beyond that point (approximately one standard deviation below its mean; see Figs. 1 and 2). These non-diminishing, but rather increasing, benefits of the supplier's dependency contradict, to a certain extent, Villena et al.'s (2011) finding of diminishing effects for the supplier's relational capital on the buyer's operational and strategic performance. Many competing explanations can be offered for such different findings between the two studies based on various aspects of research design and sample. From our perspective, however, these seemingly contradictory findings can be reconciled as follows: a supplier's overembeddedness can slow down a buyer's *perceived* outcomes of operational or strategic performance, but these negative managerial *perceptions* seldom lead to *actual* financial repercussions. Rather, the focal firm's profitability can continuously improve as the supplier's dependency increases, if the supplier's resource dependence on this relationship remains greater than that of the focal firm. Thus, our findings warrant further investigation into the assumed paradox of embeddedness across varying contexts of supply chain relationships.

Fourth, we investigate the diminishing returns of the customer's dependency by hypothesizing an inverted U-shaped relationship for ROA, ROS, asset turnover, and gross margin, while hypothesizing a U-shaped relationship between CDEP and both inventory levels and selling, general and administrative expenses. Our results suggest that, beyond a certain point at which costs exceed gains, the customer's dependency yields diminishing benefits for the focal firm's ROA and ROS since its inventory and selling expenses start increasing as the customer's dependency increases above a threshold (see Table 10 and Figs. 3 and 4). These outcomes are also implied by the P&G/Amazon anecdote described above. Thus, our study offers evidence for a paradox in the economic effects of the customer's dependency that has not, to our knowledge, been empirically demonstrated in the literature. Furthermore, our simultaneous investigation of the presumed paradoxes of supplier and customer dependency reveals the remarkably differing risks derived from upstream and downstream relations. Thus, our findings challenge the underlying assumption in social capital theory that exchange partners in the same network would exhibit similar economic behaviors and outcomes (cf. Uzzi, 1997; Villena et al., 2011).

Finally, the results for our control variables support the logic of embeddedness in highly concentrated triadic relationships. We find some positive associations between supplier and customer market share (SSHR and CSHR, respectively) and the focal firm's financial performance. In particular, a customer's market share appears to positively influence the focal firm's profitability in terms of ROA and ROS, while a supplier's market share positively influences asset turnover (ATO). We also find that a customer' firm size (CSIZE) positively affects the focal firm's ROS and asset turnover (ATO) while reducing selling and administrative expenses (SGA). If the logic of power manifested in such a power-imbalanced relation with a major customer, the focal firm's profitability would be eroded by the growing bargaining power of the customer as its market share and firm size increase. Yet, our results indicate that, in relationships governed by the logic of embeddedness, the focal firm can reap greater benefits from large suppliers and customers—likely by tapping into the richer resources of exchange partners. Consistent with the research of Krause et al. (2007), our paper finds few notable associations between the focal firm's financial performance and the length of its supplier/customer relationships. The absence of such a direct link suggests that, in supply chain dyads and triads, the relational context developed over time is more important for value creation than is the passage of time per se.

8. Limitations and contributions

This study, like any other study, has certain limitations. First, we have followed Uzzi (1996) and Krause et al. (2007) in using the extent of resource dependency among exchange partners to proxy for relational embeddedness. Although a link between dependency and embeddedness is well established in the literature (as discussed in Section 3.1), our proxy captures only one dimension of relational embeddedness. Additional primary information on the context of sample relationships can help to capture the various aspects of relational embeddedness and enhance our understanding of how customer embeddedness becomes a liability for the focal firm and how the resulting risks can be mitigated. Thus, future studies that combine primary data on the relational context and secondary data on objective performance would contribute greatly to the literature on supply chain management and social capital.

Second, our sample selection was based on major customer relationships as defined by SFAS No. 131, for which firms disclose any single customer accounting for more than 10% of their total sales. Hence, our sample reflects a power imbalance between suppliers and focal firms and also between focal firms and customers. Although researchers have argued that embeddedness can thrive across both power-balanced and power-imbalanced relationships (Narayandas and Rangan, 2004; Petersen et al., 2008), the disparity we observe in the contrasting risks associated with supplier versus customer dependency (as tested by the quadratic terms in H3 and H4) might be related to the difference in the focal firm's bargaining power vis-à-vis these two members of the supply chain triad. In particular, our sample's focal firms most likely have greater bargaining power than their suppliers, but less bargaining power than their customers. A relatively weaker supplier could refrain from engaging in opportunistic behavior, but powerful customers might readily behave opportunistically toward focal firms. It would therefore be worthwhile to investigate the diminishing effects of both supplier and customer embeddedness in triadic relationships with different power structures.

Third, our data are highly aggregated at firm level. Our sample is U.S. public firms operating in a number of sectors. Many of these companies have multiple business units with different supply chains. Hence, it would be ideal to investigate supply chain relationships at the division level rather than at the firm level if data are available.

Despite these limitations, our study makes several important contributions to the literature. Whereas most previous studies in social capital or supply chain management have focused on dyadic relationships (e.g., Krause et al., 2007; Lawson et al., 2008; Patatoukas, 2012; Villena et al., 2011), we chose the triadic supply chain relationship as our unit of analysis. Using supplier–focal firm–customer triads provides several advantages to this research. First, our *triadic* study accounted for the potential chain effects between the upstream (supplier–focal firm) and downstream (focal firm–customer) relations that might extraneously affect the focal firm's performance, and thus could capture the relationship-performance dynamics in the essential form of a supply chain network as Choi and Wu (2009) argue.

Second, the triadic supply chain relationships allowed us to simultaneously investigate the benefits and risks of the *supplier's* and the *customer's* dependency on a focal firm's financial performance. As a result, our study reveals the startling differences in the presumed paradox of relational embeddedness between *supplier* and *customer* relationships, thereby challenging the role-invariant assumption of unequivocal benefits and risks underlying social capital theory. To the best of our knowledge, this study is the first to investigate this implicit assumption in the theory and to empirically demonstrate the differing risks of dependence-based embeddedness with *suppliers* versus *customers*.

Third, whereas past studies have focused on the effects of embedded relationships on operational and/or strategic outcomes (Gulati and Sytch, 2007; Krause et al., 2007; Lawson et al., 2008; Villena et al., 2011), our study uses the secondary financial data available from Compustat to investigate the focal firm's *financial* benefits and risks derived from the aspect of relational embeddedness relating to the resource dependency of suppliers and customers. Our study shows the focal firm's economic benefits as well as risks from the dependency of suppliers and customers. Notably, our findings about the increasing financial benefits of the supplier's dependency are contradictory to the paradox of supplier embeddedness proposed by theory and demonstrated by Villena et al.'s (2011) work. They show that the buyer's perceived outcomes in operational and strategic performance diminish as a supplier's relational capital increases. Such a stark contrast between operational/strategic outcomes and financial outcomes of supplier embeddedness, as demonstrated by the two studies, illustrates that economic outcomes cannot be presumed based on operational or strategic outcomes since they may not directly flow through from those performance outcomes. As far as we know, this study is the first attempt to establish economic links between dependency, an important aspect of relational embeddedness, and financial performance.

To supply chain managers, these findings provide strong empirical support for such practices as supply base optimization and strategic partnerships (Choi and Krause, 2006; *The Economist*, 2006). On the one hand, our results show that concentrated relationships with a select few *suppliers* pay off in terms of ROA and ROS by increasing asset turnover and gross margin, without any risk of diminishing returns from overembeddedness in terms of resource dependency. Rather, the focal firm's financial benefits can continue to increase as a supplier's resource dependency increases greater than the focal firm's dependence on the supplier. On the other hand, we find that *customer* dependency has paradoxical economic effects. Dependency with customers enhances the focal firm's ROA and ROS because it increases asset turnover and reduces selling expenses. Yet above a certain point, greater dependency with customers has the effect of reducing ROA and ROS by increasing both inventory levels and selling expenses. Thus, supply chain managers should strive to develop close relationships with both suppliers and customers, but they should also be careful to establish and maintain the right level of dependency with customers to maximize the benefits and minimize the risks.

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