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An Empirical Examination of the Use of Bargaining Power and its Impacts on Supply Chain Financial Performance

ABSTRACT

This study empirically examines how resource dependence may be bargained away by supply chain finance (SCF) costs incurred to upstream suppliers and downstream buyers through cash-conversion-cycles. We found that a focal firm may get compensated for its resource contribution with an extra share of the financial gain by using the superior bargaining position over its vertical supply chain partners. Nevertheless, the focal firm may proactively restrain its use of bargaining power when the need for cooperative relationship with its supply chain partners prevails. Managerial and research implications for the introduction of power theory and relation theory to the SCF studies are discussed.

Keywords: Supplier Buyer Relationship; Resource Dependency; Bargaining Power; Collaboration; Supply Chain Finance; Cash Conversion Cycle

1. Introduction

A supply chain is considered a business network consisting of upstream and downstream firms, resources, activities, and relationships embedded in the network. Organizations critically depend on others in the network for the provision of vital resources (Tate et al., 2013). Aiming to align financial flows with product and information within the supply chain, supply chain finance (SCF) has become an emergent trend in the 21st century. Now the ever-expanding scope of the SCF research has included trade credit, payment terms, inventory financing, vendor management inventory, financial performances, cash flow management, working capital management, and financial risk management both from a firm's perspective and from a supply chain perspective (Gelsomino et al, 2016; Pellegrino et al., 2018; Wuttke et al. 2013).

The SCF studies note two main relationship mechanisms affecting SCF performance: bargaining and cooperative mechanisms. Using power asymmetry, a firm reduces capital costs through favorable trade credits, cash flow and cash conversion cycle (CCC) (Carnovale et al. 2018; Klapper et al., 2012; Liebl et al., 2016). For example, a firm tries to hold less capital tied up in non-valued added inventory, expedite A/P (account payables) collection and delay A/R (account receivables) payments to maximize financial gains (Farris Theodore and Hutchison, 2002). However, Hofmann and Kotzab (2010) argue that the exploitation of the given power asymmetry may damage the long-term sustainability of the vertical relationships. Cooperative relations backed by coordinated operations among vertical partners significantly improve SCF performance (Li et al., 2018; Wuttke et al., 2013).

Given two seemingly conflicting research perspectives on the relationship mechanisms in the SCF literature, Gelsomino et al. (2016) acknowledge the research gap in extant studies and call for research to develop a comprehensive approach to integrate both perspectives. To bridge the theoretical gap, this study reviews the resource dependency theory (RDT) literature and introduces the concepts of "asymmetry of power" and associated bargaining and cooperative mechanisms as a potential lens for the SCF literature. We aim to examine how power asymmetry affects a firm's cash conversion cycles and the conditions under which a firm may choose to restrain its exertion of power on supply chain partners. Building upon a large dataset of 4,588 firm-year observations, this study applies cash conversion cycles to quantify the supply chain financial implications of inter-organizational power asymmetry and adds empirical evidence to the SCF literature.

The remainder of the paper is organized as follows: Section 2 surveys the extant literature of resource dependency, power, and supply chain financial performance. Section 3 develops research hypotheses. Section 4 introduces research methodologies and data collection. We present regression results and discuss empirical findings in Section 5 and Section 6, respectively. Section 7 concludes the study with theoretical and managerial contributions, research limitations, and future research steps.

2. Literature Review

2.1 Resource Dependency

Resource dependency theory (RDT) holds that a firm's performance is affected by its surrounding ecology (Hillman and Dalziel, 2003). Due to the scarcity of strategic, internal

resources, a firm has to rely on external resources to perform. But, the uncertainty in securing these external resources is costly and hence often constrains a firm's growth. RDT predicts that a firm behaves to reduce uncertainty by managing a relationship with external parties who possess strategic resources. Particularly, RDT highlights enhanced vertical relationship by which a firm can access strategic resources of its suppliers and buyers (Pfeffer and Salancik, 2003; Salancik and Pfeffer, 1978), which are recognized as a significant determinant of firm performance given the importance of marketing and procurement functions (Zhao et al., 2008).

Unique resources that a firm possesses but its supply chain partners lack create an imparity in dependence between organizations (Emerson, 1962; Pfeffer and Salancik, 2003). Asymmetric dependence between organizations is considered the source of power over transactional partners by which one organization can control the other organization to achieve desirable outcomes (Barney, 1991; Dyer and Singh, 1998). Power is recognized to influence vertical relationships. The industrial organization (IO) literature provides a framework to identify and measure power in a vertical relationship. Among Porter's Five Forces (Porter, 1979), two vertical forces may cause power imbalance with respect to suppliers and buyers. A focal firm's dependence on its buyers rises if the focal firm is facing difficulty in finding alternative buyers. Similarly, a small supply base tends to result in more bargaining power of suppliers if the focal firm does not have enough alternative suppliers to switch to. Essentially, how valuable a firm is depends on its substitutability within the industry where it operates.

Research has found that industry attributes account for a significant portion of deviations in firm performance (Galbreath and Galvin, 2008; Weerawardena et al., 2006). For example, industry concentration level is a key determinant for firm's behaviors and performances such as profits, voluntary disclosure, and bankruptcy forecast (Chava and Jarrow, 2004; Li et al., 2013; Li, 2010). Particularly, the relative size of a firm compared to peer competitors is a major contributor to firm performance as the size captures the competitive aspects of operations such as capacity, productivity (economies of scale) and, eventually, profitability (Beck et al., 2005; Hall and Weiss, 1967). These IO studies suggest that the magnitude of bargaining power that a focal firm has over its supply chain partners must be understood in the context of their surroundings and firm-industry specific attractiveness (McGahan and Porter, 2005; Rumelt, 1991).

In summary, power is an important determinant in the vertical relationship among supply chain partners. Power possessed by a firm can be measured by the relative size of a firm compared to peer competitors and the substitutability of its upstream and downstream supply chain partners.

2.2 Asymmetry of Power in Vertical Relationships

2.2.1 Bargaining Mechanism

"*Only by understanding the power regime that exists can buyers and suppliers fully understand what is the appropriate way for them to manage relationships*." (Cox, 2004, p.346)

In the supply chain literature, a firm that has a stronger power may exercise power to exploit more gains against its weaker partners, which is called "bargaining" (Crook and Combs, 2007). Organization theory argues that a generator of competitive advantages may not necessarily turn into a beneficiary of those competitive advantages because gains in firm performance are determined not only by how large a pie is created but also by how a pie is appropriately

distributed (Barney, 1991; Coff, 1999). Similarly, management studies find that bargaining power is exercised to gain more from transactions at an inter-organizational level (Hicks, 1963), and the impact of bargaining power on firm performance is explained via the control mechanism, that coerces its partners to do what they are otherwise less willing to do (e.g., unequal distribution of gains) (Lavie, 2006; Yan and Gray, 1994).

2.2.2 Cooperating Mechanism

While bargaining mechanism is more of a negative relationship often employed in a zero-sum game where a firm's gains are achieved at the expenses of its supply chain partners (Crook and Combs, 2007; Essabbar et al., 2016), the cooperative mechanism is more of a positive relationship commonly used in a win-win situation where mutual benefits are met as agreed upon (Flynn et al., 2010; Klein et al., 2007; Yeung et al., 2009).

Negligence on mutual dependence embedded in the vertical relationship may result in a less complete explanation on the impact of power on firm performance (Dyer and Singh, 1998; Emerson, 1976; Rossetti and Choi, 2005). The relationship between two transactional parties is likely to take place when there are gains for both parties (Emerson, 1976). The existence of weaker partners still significantly serve to the formation of the powerful firm's value and power, implying that in order for one party to exercise its power against its partner, a mutual dependence is an essential antecedent even under an asymmetric dependence (Dahl, 1957; Emerson,1962; Cook and Yamagishi, 1992).

Inter-organization management studies argue that mutual dependence is a significant determinant for transactional governance, power usage and agreements among vertical partners (Williamson, 1996; Noordewier et al., 1990). For vertical collaboration, Williamson (1996) highlights the importance of organizational structures less bounded by power and dependence. Chicksand et al. (2015) emphasize firms' efforts for more balanced power and improved relationships among mutually dependent partners for performance improvement. For example, mutual dependence is found to influence procurement performance and cost reductions in a vertical relationship (e.g., in the B-to-B purchasing setting) (Noordewier et al., 1990).

Furthermore, mutual dependence may affect a firm's behavior toward its vertical partners and induce benevolent behaviors (Molm, 1997; Narasimhan et al., 2009). In an experiment setting, Molm (1997) shows that scare of loss reduces exercise of power when one's reward is at a great risk. Narasimhan et al. (2009) argue that benevolent pricing strategy of a supplier who has more power may signal its intention not to exploit gains from its partners but rather build a long-term relationship based on fairness, which helps discourage a buyer's opportunistic behaviors, such as developing internal substitutes or seeking alternate suppliers. These behaviors include willingness to give price confession (Henke et al., 2009), benevolent pricing (Narashimhan et al., 2009), guaranteed margin to encourage retailer's price mark down (Mantrala et al., 2005), and suppliers' attitudes toward for collaboration (Yeniyurt et al., 2014).

In summary, studies suggest that the exercise of power may be contingent despite power asymmetry. In this current study we examine the conditions under which a firm may be less incentivized or less likely to exercise its power even under power asymmetry.

2.3 Supply Chain Finance

A number of studies explicitly consider SCF as costs incurred to supply chain partners (Hofmann and Kotzab, 2010; Pohlen and Goldsby, 2003). In the context of the automotive industry, for example, Vázquez et al. (2016) find that the automotive manufacturer manages to shorten collection time for their customers, lengthen payment terms and push inventory to their suppliers, often result in a transfer of additional capital costs and increased risks to its supply chain partners. A less powerful partner may be coerced to bear more risks and capital costs through the use of external financing (Munson et al., 1999). These studies demonstrate the impact of a focal firm's bargaining power mechanism on SCF performance.

However, gains at the overall chain level are highlighted as the key factor to understand a firm's SCF behaviors (Caniato et al., 2016; Hofmann and Johnson, 2016; Li et al., 2018; Vázquez et al., 2016; Viskari and Kärri, 2012). In their explanatory study, Caniato et al. (2016) argue that two explicitly different objectives (i.e., firm gain oriented vs. chain value oriented) are involved in the implementation of various SCF measures, deomonstrating the impact of chain value oriented decisions on SCF performance (Randall and Theodore Farris, 2009; Caniato et al, 2016). Studies also echo that operational coordinations among vertical partners (e.g., information sharing, production cost saving, inventory shift to upstream) are critical to improving SCF performance (Viskari and Kärri, 2012).

Further, literature notes a backfiring effect that may hurt the vertical relationship. Excessive exploitation of SCF gains may result in relational retaliation and supply chain disruptions, eventually reducing gains for both the overall chain and individual partners, so called a boomerang effect (Hofmann and Kotzab, 2010). Arguing for a two-way interaction among SCF decisions and operation decisions using game theory, Li et al. (2018) find that optimal credit terms and buyer's order quantity are determined interactively because reduced order quantity resulting from an excessively short credit term may worsen the supplier's profitability. Additionally, while strong power asymmetry provides an opportunity to force favorable credit terms against partners, a focal firm may choose not to excessively exploit financially weak partners due to concerns about the partners' disruptions and ultimate deterioration of its own profitability (Wuttke et al., 2013).

In summary, our literature review identifies both theoretical and empirical gaps. First, while documenting firms' behaviors in maximizing financial gains at the firm level and the chain level, extant studies fail to pay sufficient attention to the mediating role of power that determines a firm's SCF decision. Second, a failure to incorporate the holistic views (e.g., mutual dependence and relational rent) suggested by the SCF literature may lead to an incomplete explanation of a firm's motivation behind its SCF decisions. To reconcile the seemingly conflicting research perspectives on the bargaining and collaborative mechanisms for better SCF performance, Gelsomino et al. (2016) call for a general approach by integrating both perspectives and more empirical-based holistic analyses. Building upon RDT and power asymmetry, our current research sets out to bridge both theoretical and empirical gaps based on regression analysis of a large dataset of 4,588 firm-year observations.

3. Hypothesis Development

Despite subtle differences in definitions across previous studies, the generally agreed idea is that CCC comprehensively represents the cash liquidity of a firm by capturing how fast a firm can convert account payables, account receivable and inventory holdings into cash - the speed of payment, collection, and inventory turnover (Farris Theodore and Hutchison, 2002; Lancaster and Stevens, 2011; Soenen, 1993; Stewart, 1995).

By delaying payments to its suppliers (hence longer accounts payable days) or expediting collection of sales from its buyers (hence shorter accounts receivable days), a focal firm may be able to reduce its cash conversion cycle and maintain healthy cash flows with lower capital costs. Further, power over vertical partners may enable a focal firm to minimize its own inventory expenses by pushing out raw material inventory toward its suppliers and finished goods inventory towards buyers, leading to extra inventory costs. However, a focal firm's shorter CCC results in direct capital costs to its vertical supply chain partners. In other words, gains at the focal firm shall lead to losses at its upstream and downstream partners. The CCC performance is an important measure used to describe a focal firm's supply chain performance as it shows how efficiently and effectively the flow of goods, information and payments are managed across a focal firm's supply chain.

This study first shows how a firm exercises its power to achieve higher financial performance (shorter CCC) through transferring risks and capital costs to its supply chain partners and further tests whether powerful firms may choose to restrain the use of power due to concerns that over-exploitation may backfire its vertical relationships (Figure 1).

[Insert Figure 1 about here]

3.1 Impact of Power on Costs of Supply Chain Partners

A large firm may have stronger power over its partners in a supply chain. As a supplier, a larger firm can provide various benefits to its buyers, including volume capacity, economies of scale, and a stable supply of resources for research and development, brand awareness, etc. Then, this larger supplier may gain more power if other suppliers in the same industry are not able to sufficiently provide the same benefits. For instance, since a buyer greatly appreciates exclusive know-how for competitive prices and product quality of raw materials (Pfeffer and Salancik, 2003), these benefits may become unique resources that the supplier provides and hence increases this supplier's power over buyers. The size of these benefits proportionally increases as a supplier's relative size increases compared to peer industry competitors. A larger supplier has more flexibility in production capacity and thus may better accommodate unexpected demand changes, when everything else is held constant. Bulk procurement and large batch production may lead to lowered purchasing and production costs. Economies of scale allow research and development (R&D) to introduce new products at a lower cost. The strong brand awareness of a large supplier also helps improve the brand images of a buyer firm (Spekman, 1988). The financial stability of a larger supplier guarantees more stable supply of raw materials. Based on these competitive benefits, a larger supplier may be considered more valuable than a smaller supplier and, accordingly, has stronger bargaining power over its buyers (Nair et al., 2011).

Similarly, a larger buyer may accumulate more bargaining power over its suppliers. A buyer's unique resources are inherited from their proximity to the end customers of a supply chain (Mortensen and Arlbjørn, 2012) and such benefits tend to increase as the size of a buyer

increases. A larger buyer tends to possess high quality market information because it has the broader market reach and possess more resources for marketing research and can leverage its larger market share to acquire more accurate demand information from its customers. Such information is critical for a firm to improve responsiveness to market trends and inventory planning accordingly (McCarthy and Golicic, 2002; Stank et al., 2001). Further, bulk order from a larger buyer may help a supplier realize economies of scale in purchasing, production, and delivery. A supplier may also leverage the reputation of its large buyers so that the supplier is recognized as a strategic partner of a larger manufacturer. The halo effect is tremendously beneficial for a supplier to negotiate with other business partners. A larger buyer tends to have more financial resources that can be used to support supplier's production such as a long-term investment and a third-party financing mechanism backed by larger buyers. Greater financial stability of a larger manufacturer may lower a supplier's risk of bad debt and, accordingly, cost of debt collection. Larger buyers also tend to possess more resources for knowledge transfer due to their R&D resources.

Another aspect of competitive resource that a focal firm has may include its customer portfolio. As Porter (1979) argued that high substitutability of buyers results in a lower bargaining position of buyers when the impact of losing a buyer is minimal due to a large portfolio of major customers. When a manufacturer has more customers, the risk-pooling effect from large customer portfolio reduces operational fluctuations and increases predictability in production volume, leading to large and stable aggregated quantities and hence cost reductions (Hu et al., 2019). In short, the competitive advantage expected from a manufacturer who operates in large scale or has a greater customer portfolio may be considered unique resources that can benefit a supplier. For instance, concentrated relationship portfolios result in a positive impact on competitive performance (Tang and Rai, 2012).

As a competitive supplier or buyer, these unique resources possessed by a focal firm create dependency and stronger power against its supply chain partners, *ceteris paribus*. Based on the gained bargaining power, the focal firm may attempt to obtain extra cash liquidity via delayed payments and faster collections of sales.

Additionally, bargaining power that a focal firm has over its suppliers and buyers can be applied to inventory management.

"*Each firm benefits from more inventory, but each wants the other to invest in it*." (Cachon, 1999, p.952).

A larger firm may be able to keep a lower inventory level without compromising service level. Previous studies show that a firm has strong motivation and tendency to deviate from the system optimal inventory level to maximize its own profit (Cachon, 2004; Cachon and Zipkin, 1999). Cachon (2004) argues that a firm may be able to lower inventory costs depending on who holds inventory based on contract types (push or pull contract, advance-purchase, etc.). Bargaining mechanism is embedded as a major driver for contract types. Using bargaining power or extra monetary incentives (in case of the lack of power), a supplier may try to induce the buyer to deviate from its own optimal order quantity (i.e., EOQ), because the order quantity at the buyer's EOQ may be costlier to the supplier. These studies provide a theoretical basis that bargaining mechanism-based contract terms are widely used in inventory management among supply chain partners.

In summary, by negotiating favorable contract terms, a focal firm with greater power may be able to expedite cash collection from its downstream buyers (shorter ARD), delay cash payments to its upstream suppliers (longer APD) and push out inventory to its suppliers and buyers (shorter IND), resulting in a shorter overall cash conversion cycle (CCC) given the formula of CCC (= ARD – APD + IND). Our first hypothesis is therefore formulated as follows.

Hypothesis 1*: Increased power of a focal firm leads to a shorter cash conversion cycle*

3.2 Contingent Exercise of Power

How closely and how voluntarily a firm interacts and shares information with its supply chain partners positively influence market responsiveness, highlighting the importance of relational rent (Swink et al. 2007). Market responsiveness is defined as the ability to closely accommodate the requirements of the buyers (Holweg, 2005) and can be enhanced by sharing resources in a timely manner. Improved market responsiveness (e.g., production flexibilities in volume and mix, stock availability, delivery accuracy, and speed) are associated with sales growth and profitability (Lummus et al., 2005; Narasimhan et al., 1999). Building a vertical relationship (e.g., trust, commitment, and motivations) is noted as the key to the supply chain competency such as market responsiveness (Cao and Zhang, 2011; Kim and Lee, 2010; Squire et al., 2009).

Enhanced innovation is also noted as the outcome of collaborative vertical relation (Roy et al., 2004). Innovation is referred to "process of applying new ideas and methods" (Soosay et al., 2008)(page 162). Through collaborative relations, a firm can secure a stable provision of innovative materials to improve R&D activities (Belderbos et al., 2004; De Faria et al., 2010; Flint et al., 2008). These studies note that innovation may be improved by an ability to engage vertical partners to jointly develop products, processes, and systems, and to mutually share knowledge and experiences, highlighting the importance of relational attributes. For example, trust among vertical partners is discussed as a key enabler for innovativeness in the supply chain (Fawcett et al., 2012; Panayides and Lun, 2009).

More importantly, cherishing vertical relations encourages more 'voluntary' coordination (Fawcett and Magnan, 2004; Lejeune and Yakova, 2005), positively affecting firm's innovation performance (Soosay et al., 2008). In order to reduce opportunistic behaviors of transactional parties, relationalism may be more effective than excessive use of contract relying on a coercive mechanism because it tends to encourage voluntary contributions (e.g., supplier's involvement and willingness for joint investment in partner's specific technology), leading to improved co-innovation and sales performance (Wang et al., 2011; Yeniyurt et al., 2014).

As suggested in the inter-ogranization management studies, mutually dependent relationship mitigates excessive exploitation against partners because unfairness and opportunism may cause harm to the relationship and potentially backfire financial stability and operational performance of its partners (Cook and Yamagishi, 1992; Dahl, 1957; Emerson, 1976; Ketchen and Hult, 2007; Molm, 1997; Rossetti and Choi, 2005). Mutual dependence is rather reflected in various forms of benevolent behaviors (Henke et al., 2009; Mantrala et al., 2005; Narashimhan et al., 2009). These studies hence imply that a powerful party may have to limit its power to achieve excessive gains that may backfire the relationship in a mutually lock-in situation where both parties rely on

one another. Furthermore, benevolent behaviors signaling an intention for less excessive exploitation may be critical for a collaborative relationship.

The supply literature also indicates that buyer-supplier integration leads to better supply chain performances (Omar et al., 2012; Wan et al., 2018; Zailani and Rajagopal, 2005). Specifically, Wan et al. (2018) indicate that that collaboration between buyers and suppliers can enhance sales performance through higher order fill rates. Therefore, pursuing higher sales growth, a firm may restrain its exercise of power upon its supply chain partners and maintain a collaborative relation.

In summary, we argue that the extent of how the focal firm exercises its power is contingent on its long-term objective. A firm's need for collaboration for the chain-level competency induces benevolent SCF decisions despite a stronger power. Among mutually dependent partners, excessive SCF exploitation by a focal firm may put its suppliers and buyers under financial risk, leading to delayed deliveries, poor quality, and limited capacity for innovation and sales growth. If the benefits expected from collaborative relationship outperform expected financial gains from the exploitation of its vertical partners, a firm may choose to restrain its bargaining power on SCF gains even under power asymmetry.

Therefore, we posit that a firm with high innovation intensity and high sales growth will be less likely to exercise its power, resulting in a longer CCC. Our second hypothesis is formed as follows.

Hypothesis 2a*: A firm's innovation intensity negatively moderates the relationship between its power and cash conversion cycle.*

Hypothesis 2b*: A firm's sales growth rate negatively moderates the relationship between its power and cash conversion cycle.*

4. Model and Data

4.1 Model Specification

To test our hypotheses on cash conversion cycles, we include several explanatory variables as shown in the equation below. We also include year dummies to capture any time-specific effects that are not captured by the model for particular years such as varying interest rates or faster payment collections due to increased use and advancement of information technology. In addition, we include industry dummies based on the six-digit NAICS codes, which may control for the effects of different industries on bargaining power. Note that these common control variables are included in all models.

$$f(CCC) = (\text{bargaining power, financial leverage, supply chain complexity, capital structure, firm size, time- and industry-specific variables})$$

Below are the methods used to compute each component of CCC, including account receivable days (ARD), account payable days (APD), and inventory days (IND), on an annual basis (Randall and Farris Theodore, 2009):

ARD = (Account Receivables ($) / Net Sales ($)) x 365 days
APD = (Account Payables ($) / Cost of Goods Sold ($)) x 365 days
IND = (Inventory ($) / Cost of Goods Sold ($)) x 365 days

A firm's bargaining power is a focal firm's relative power in an industry that can be exercised over its suppliers and buyers during negotiations, resulting in favorable contract terms. Following previous study conducted by Cho et al. (2018), we adopt their measurement of power variable (named Sales Ratio - SR in this study) defined by the ratio of a firm's revenue over the revenue of the industry leader who has the highest revenue in the four-digit NAICS industry, as one measure for the power possessed by the focal firm. In addition, this study proposes another power variable, SD, measured by the number of major customers who contribute more than ten percent to the focal firm's sale. Thus, our power variables are firm-industry specific variables. As mentioned in Section 3.1, we hypothesize that a firm's power is negatively associated with CCC. That is, the higher a firm's power, the shorter its CCC.

To estimate the moderating effect as hypothesized in H2a and H2b, two moderators are created: II (innovation intensity) measured by the ratio of a focal firm's R&D expense over its revenue, and SG (sales growth) measured by the year-to-year growth of revenue. We include four interaction terms between two moderators and two power variables and test H2a and H2b in four separate models.

With respect to control variables, we include DE (debt-to-equity ratio), CI (capital intensity), GD (geographic diversification), and SS (sales size) in all models. First, DE is a proxy for a firm's financial leverage. If a firm uses high financial leverage, the firm may pursue a shorter cash conversion cycle so that it has enough cash to pay for short-term liabilities. To reduce the potential bias caused by outliers, a Winsorization technique is used, replacing upper extreme values with a 99.5-percentile value and lower extreme values with a 0.5 percentile value. Second, following Gaur et al. (2005), this study defines CI as the ratio of fixed assets including property, plant, and equipment (PP&E) to total assets. Higher capital intensity is expected to be associated with shorter cash cycle. Third, GD, measured by the number of foreign countries where a focal firm has operations, or called the breadth of multi-nationality in the international business literature (Allen and Pantzalis, 1996; Cho et al., 2017), is a proxy for supply chain complexity. We believe that a higher degree of supply chain complexity leads to longer periods of debt collection and higher inventory levels (Cho et al., 2017; Han et al., 2008). Fourth, SS, measured by the logarithm term of sales, is a proxy for the accounting process efficiency. A larger firm is more efficient in inventory management, billing, collecting, and paying, leading to a shorter CCC.

Because the distribution of the cash conversion cycle is highly right-skewed, we have transformed the CCC variable using logarithmic terms and employed log-linear models to estimate the relationships between the dependent variables and the independent variables. Five estimation models are presented as follows:

Model 1: Base Model

$$\ln(CCC_{it}) = a_0 + a_1 SR_{it} + a_2 SD_{it} + a_3 DE_{it} + a_4 CI_{it} + a_5 GD_{it} + a_6 SS_{it} + \text{Time Effects} + \text{Industry Effects} + \varepsilon_{it} \quad \text{(Equation 1)}$$

whereas i represents year i and t represents firm t

Models 2: Moderating Model - SR and II

$\ln(CCC_{it}) = b_0 + b_1\, SR_{it} + b_2\, SD_{it} + b_3\, SR_{it} * II_{it} + b_4\, DE_{it} + b_5\, CI_{it} + b_6\, GD_{it} + b_7\, SS_{it} + \text{Time Effects} + \text{Industry Effects} + \varepsilon_{it}$ (Equation 2)

Models 3: Moderating Model - SD and II

$\ln(CCC_{it}) = c_0 + c_1\, SR_{it} + c_2\, SD_{it} + c_3\, SD_{it} * II_{it} + c_4\, DE_{it} + c_5\, CI_{it} + c_6\, GD_{it} + c_7\, SS_{it} + \text{Time Effects} + \text{Industry Effects} + \varepsilon_{it}$ (Equation 3)

Models 4: Moderating Model - SR and SG

$\ln(CCC_{it}) = d_0 + d_1\, SR_{it} + d_2\, SD_{it} + d_3\, SR_{it} * SG_{it} + d_4\, DE_{it} + d_5\, CI_{it} + d_6\, GD_{it} + d_7\, SS_{it} + \text{Time Effects} + \text{Industry Effects} + \varepsilon_{it}$ (Equation 4)

Model 5: Moderating Model - SD and SG

$\ln(CCC_{it}) = e_0 + e_1\, SR_{it} + e_2\, SD_{it} + e_3\, SD_{it} * SG_{it} + e_4\, DE_{it} + e_5\, CI_{it} + e_6\, GD_{it} + e_7\, SS_{it} + \text{Time Effects} + \text{Industry Effects} + \varepsilon_{it}$ (Equation 5)

We summarize the measurements and supporting studies of all variables below.

[Insert Table 1 about here]

4.2 Data Collection and Sample

This study collects annual financial data from the Compustat database over the period 2000-2011. The observations with missing values in any variable are dropped from our final analysis. As a result, this panel dataset is able to include 4,588 firm-year observations, representing 913 firms across 269 manufacturing industries based on six-digit NAICS codes over 12 years. From the Compustat's annual database, we are able to collect and calculate the dependent variable-CCC, two main explanatory variables-SR and SD, two moderators-SG and II, and control variables including DE, CI, GD, and SS. According to the Business Information Files of the Compustat database, a firm reports the amount of capital investment in global operating regions defined by the reporting firm and the number of sales of major customers. Hence, we are able to calculate the GD and SD accordingly.

5. Regression Results

5.1 Summary Statistics

Table 2 reports the descriptive statistics of the variables used in the regression models. On average, the CCC is 120.37 days or 4.53 in natural logarithmic form. SR is 0.08 on average, implying that the majority of observations are small firms and their mean revenue is only eight percent of the industry leader's size. SD shows that the number of a firm's major customers ranges from 1 to 35 and the mean is 2.93. Compared with other variables, II and SG show relatively greater variations.

[Insert Table 2 about here]

Table 3 presents the statistics of CCC, its components, and two explanatory variables by industry. It shows that the wood product manufacturing has the shortest cash cycle at 56 days. Interestingly the wood product manufacturing has the shortest accounting receivable days, account payable days and inventory days among all industries, implying high inventory turnover and great cash liquidity. The miscellaneous manufacturing has the longest cash cycle at 163 days, followed by chemical manufacturing's 160 days, machinery's 152 days, beverage and tobacco product's 145 days, and electrical equipment's 132 days. Among 21 three-digit NAICS industries, the CCCs of these five industries are higher than average. Meanwhile, these industries have the longest IND and relatively longer ARD among all manufacturing industries. It implies that their long CCCs are mainly driven by IND and ARD. Note that several firms in these industries own relatively less power because their mean SRs are lower than the overall average. Hence, there could be some association between CCC and power, as hypothesized in this study.

[Insert Table 3 about here]

Table 4 shows the correlations among variables used in the regressions. First, SR and SD are found to be negatively correlated to CCC at a significance level of 0.05. Given that SR and SD are two measures of power in this study, it shows that higher power owned by a firm is associated with shorter CCC. Such relationships are consistent with the hypotheses of this study. In addition, CCC is found to be negatively correlated to DE, CI, and SS. It implies that a firm with high financial leverage, high capital intensity, or large revenue size tend to have shorter CCC. In contrast, II has a positive correlation with CCC. It shows that a firm with high expenditure in R&D has longer CCC.

[Insert Table 4 about here]

5.2 Regression Results

The econometric models are estimated using standard panel data procedures in Stata. This procedure considers an unbalanced panel dataset with one observation for each firm for one research year in our panel. The result of the Breusch-Pagan Lagrange multiplier (LM) test shows that a random-effect generalized least squares (GLS) regression is preferred than an ordinary least squares (OLS) regression. In order to select an appropriate model to test hypotheses, the Hausman test is conducted. In the Hausman test, the null hypothesis is that the preferred model is random effects, while the alternate hypothesis is that the fixed-effect model is preferred. The Chi-square value in the Hausman test is 62.14 and the p- value is 0.74, implying that the null hypothesis cannot be rejected. Hence, the random-effect model is appropriate.

[Insert Table 5 about here]

Table 5 presents the estimation results of the five regression models. Model 1 is the base model that includes the main explanatory variables and control variables. We use the result of Model 1 to test Hypothesis 1, while the results of Models 2 to 5 are used for robustness check. Two measures of power, SR and SD, are included to test the impact of power on CCC. In Model 1, SR shows a negative impact on CCC at a 0.01 significance level. When a firm increases its

revenue by 10 percent relative to the industry leader while other variables remain the same, CCC will be shortened by 2.08 percent (=10%*($e^{-0.233}$-1)). In addition, SD also has a negative impact on CCC at a 0.1 significance level. When a firm adds one more major customer, CCC will be shortened by 0.7 percent (=($e^{-0.00719}$-1)). The results of SR and SD in Model 1 lend support for Hypothesis 1, and the results are consistent across Models 2 to 5.

To test the moderating effect of innovation intensity (Hypothesis 2a) and sales growth (Hypothesis 2b), interaction terms are included in Models 2, 3, 4, and 5. In Models 2 and 3, SR_II and SD_II shows the moderating effect of innovation intensity on the relationship between two power variables and CCC. In Model 2, the coefficient of SR_II is 0.0365, which is positive and significant with a 0.05 significance level. That is, if an industry-leading firm has high R&D expenditure, it will be less likely to exert power to shorten its CCC and be more cooperative and less coercive in its relationships with its supply chain partners. The results of Model 3 appear to be in line with those of Model 2. The coefficient of SD_II is positive and significant, implying that a firm with more major customers less likely exercises power over its partners if the firm is more innovation intensive. The results of Models 2 and 3 lend support for Hypothesis 2a.

Regarding the moderating effect of sales growth (Hypothesis 2b), we use the results of Models 4 and 5 to test this hypothesis. In Model 4, the coefficient of SR_SG is 0.0223, which is positive and significant at a 0.01 level. It shows that when an industry-leading firm less likely exerts power on its supply chain partners when it has a high sales growth rate. However, in Model 5, the coefficient of SD_SG is insignificant, implying that sales growth has no moderating impact on the relationship between the number of major customers and CCC. Hence, Hypothesis 2b is partially supported.

All control variables show expected signs, except for DE. The results show that CI has a negative impact on CCCs. Firms with higher capital investment may have shorter CCCs. GD shows a positive impact on CCCs. When firms have capital investment in more countries, the supply chain is more complex and, thus, CCC becomes longer. SS is negatively associated with CCCs, implying that a large firm tends to have shorter CCCs. DE does not show significance in all models.

6. Discussion

Our study shows that a firm with greater power tends not to exercise its power to achieve higher performance (shorter CCC), through transferring risks and capital costs to its supply chain partners. Instead, powerful organizations that penetrate the market using supply chain competencies may be concerned that over-exploitation may backfire vertical relationships, and thus choose to restrain the use of power.

Our theoretical contribution rests upon our introduction of the roles of power theories, including RDT and Porter's Five Forces (Barney, 1991; Porter, 1979; Salancik and Pfeffer, 1978; Ulrich and Barney, 1984) and relation theory (Dyer and Singh, 1998; Emerson, 1976; Narasimhan et al., 2009; Rossetti and Choi, 2005) to the SCF studies. The power literature has helped explain asymmetric gains among vertical partners. Meanwhile, the relation literature has helped account for the restrained exercise of power due to the embedded mutual dependence. Our empirical results suggest that each of these views, seemingly contrary to one another, should be applied harmoniously to better explain variances in inter-organizational performance. This study contributes to the power and performance literature by acknowledging the financial component that reveals actively functioning but often overlooked mechanisms.

How the supplier-buyer relationship affects a firm's performance has been an important question in the SCF literature. Costs associated with power asymmetry resulting from resource dependency are found to be reflected on SCF performance; that is, a weaker firm assumes financial costs and risk of stronger partners (e.g., a shorter CCC of a stronger firm). It is important to factor in power relationships to understand SCF performance. However, our findings suggest that the effect of power on SCF remains contingent despite power asymmetry and that the complementary roles of power (proactive use and restraint of power) on SCF must be understood carefully in context of various conditions.

This study emphasizes that a firm optimizes its SCF performance by considering two contrasting objectives: firm level gains and chain level gains (Gelsomino et al., 2016; Hofmann and Kotzab, 2010). Further, the impact of firm's SCF decisions is not bounded exclusively within the financial function but is extended to other functions, including operational competencies, product, finance, and information.

In this study, a firm's voluntary restraint of power exercise is observed due to the fear of relational backfiring, implying the interactions between vertical relationship and SCF. While the extent of vertical collaboration may affect SCF (Caniato et al., 2016; Lind et al., 2012; Viskari and Karri, 2012), SCF, in turn, is found to affect the vertical relationship in this study. For example, while the nature of a collaborative vs. coercive relationship between vertical partners determines the level of CCC, a firm's decision on the level of CCC may be adjusted to protect the vertical relationship. SCF is used as one of tools to signal long-term commitment (Henke et al., 2009; Nair et al., 2011; Narasimhan et al., 2009; Yeniyurt et al., 2014). This study suggests that the roles of SCF must be considered more extensively for future SCF research.

For practitioners, when the impact of financial burdens is often considered much larger on a less powerful firm than a more powerful firm, the impact of this benevolent SCF decision may be critical for the overall supply chain. A cost of borrowing the same amount of money may be higher for firms with fewer resources due to higher credit risk than for firms with more resources. Alleviating financial burdens on smaller or less powerful partners in the network can help avoid disruptions and maximize the overall chain value. An optimized level of CCC from the more holistic view must be considered by key vertical members.

Management should be cautioned that obtaining access to strategic resources of the industry leaders (resource dependency) is beneficial but costly at the same time. Particularly, partnering with an industry leader may require supplier or buyer firms to bear extra risks and expenses that they would not have to otherwise because the powerful focal firm maximizes its gains when its valuable resources are being shared by its partners. Managers should be conscious that benefits of partnering with a powerful industry leader may be overestimated if its cost of resource dependency is not adequately considered. By considering the relational rent mechanisms aforementioned (e.g., all larger firms are not in a position to exercise their power at maximum), managers should seek the right balance between benefits and costs of vertical relationship.

7. Conclusion

Based on a large dataset of manufacturing firms collected from Compustat, this study empirically examines how resource dependence may be bargained away by supply chain costs occurred to vertical partners (e.g., CCC). Our findings show that a more powerful focal firm may get compensated for its resource contribution with an extra financial gain using the superior bargaining position over its supply chain partners. Nevertheless, there are varying degrees of

power exercise depending on the level of need for a collaborative relationship with its supply chain partners.

This study makes important contributions to emergent SCF literature and practices. The theoretical contribution is the application of the resource dependency theory (RDT) to integrate seemingly conflicting research perspectives (bargaining vs. cooperating mechanisms) in SCF literature. Thus, our paper helps better understand the complementary roles of SCF in vertical supply chain relationships. Our paper emphasizes the importance of considering relational attributes to more clearly explain a firm's SCF decisions particularly under a more realistic situation (i.e., power asymmetry).

For practitioners, our study highlights the importance of optimized levels of SCF policies from the holistic perspective across both chain-level and firm function levels. Particularly, our findings may shed light on the contingent circumstances under which a firm may restrain its power and SCF gains to improve supply chain competency and the overall chain value.

This study is subject to several limitations. First, while our measure of supply chain costs, CCC, is a comprehensive indicator for overall firm performance given that the focal firms tend to have multiple vertical partners, dyadic transaction information between an individual supplier and buyer may be used to show a more complete picture of the power and relation mechanism in a vertical relationship. Second, in addition to our finding of the roles of SCF toward vertical relationship, SCF is also the outcome of cooperative activities (e.g., advanced payments, efficient inventory management, etc.) (Lind et al., 2012; Tsai, 2008; Viskari and Kärri, 2012). While our study assumes that there is no interaction, the interplay among these two attributes still can be further examined in future studies.

Figure 1 Conceptual Framework

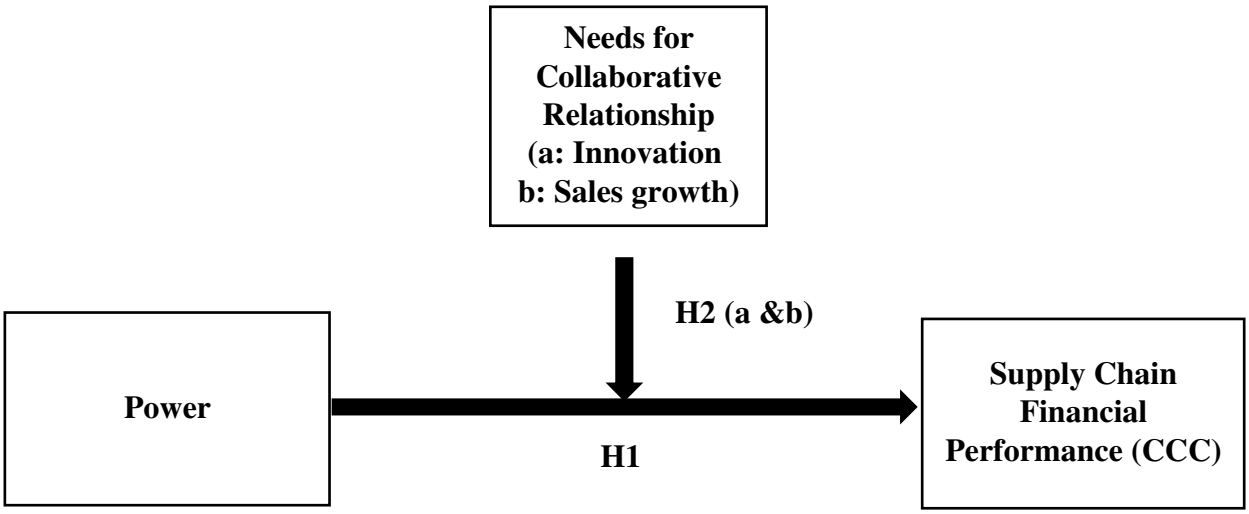

Table 1 Measurements of Variables

Variable	Definition	Measurements	Literature Support
CCC	Cash conversion cycle	Cash conversion cycle = Account receivable days – Account payable days + Inventory days	Vázquez et al. (2016); Hofmann & Kotzab (2010); Pohlen and Goldsby (2003)
SR	Sales ratio relative to the industry leader	Ratio of a firm's revenue over the revenue of the industry leader, who has the highest revenue in the industry based on the four-digit NAICS industry code	An indicator of a focal firm's power in the industry - Cho et al. (2018)
SD	Sales diversification	Number of major customers which contribute more than 10 percent of a focal firm's revenue	An indicator of buyer power over the focal firm due to diversification and customer portfolio - Hu et al. (2019); Tang & Rai (2012)
DE	Debt-to-equity ratio	Ratio of total liabilities over stockholders' equities	An indicator of financial leverage and financing risk - Han et al. (2013); Tsai (2008); Munson et al. (1999)
GD	Geographic diversification	Number of global regions where a focal firm operates and has capital investment	An indicator of supply chain complexity and operational risk - Allen and Pantzalis (1996); Han et al. (2008); Cho et al. (2017)
CI	Capital intensity	Ratio of property, plant and equipment (PPE) over total assets	An indicator of technological investments which directly impacts CCC - Han et al. (2013); Gaur et al. (2005)
SS	Sales size	Logarithm of a firm's revenue	An indicator of economies of scale - Mortensen and Arlbjørn (2012); Nair et al. (2011); Moss & Stine (1993)
II	Innovation intensity	Ratio of a focal firm's R&D expense to its revenue	An indicator of process and product innovation which affects inventory turns and inventory days of CCC - Lee et al. (2015)
SG	Sales growth	Year-to-year growth of revenue	An indicator of product demand affecting inventory

			days significantly - Han et al. (2008)

Table 2 Descriptive Statistics

Variable	Sample Size	Mean	Std. Dev.	Min	Max
ln(CCC)	4,588	4.53	0.78	-2.02	8.24
SR	4,588	0.08	0.20	0.00	1.00
SD	4,588	2.93	2.65	1.00	35.00
DE	4,588	0.43	1.88	-7.91	10.33
GD	4,588	4.26	2.65	1.00	29.00
CI	4,588	0.47	0.50	0.00	17.51
SS	4,588	6.13	1.90	-5.30	12.67
II	4,588	0.73	31.90	0.00	2,022.20
SG	4,588	0.49	16.37	-1.00	1,012.29

Table 3 Components of Cash Cycle – by Industry

NAICS / Description	ARD	APD	IND	CCC	SR	SD
311 Food Mfg.	37	41	76	71	0.13	1.85
312 Beverage and Tobacco Product Mfg.	56	46	135	145	0.07	2.00
313 Textile Mills	56	22	80	114	0.12	1.61
314 Textile Product Mills	47	42	85	90	0.13	2.13
315 Apparel Mfg.	49	40	105	115	0.05	3.60
316 Leather and Allied Product Mfg.	61	67	87	81	0.11	4.00
321 Wood Product Mfg.	30	18	43	56	0.10	1.42
322 Paper Mfg.	51	40	70	81	0.06	2.26
323 Printing and Related Support Activities	61	33	52	80	0.04	2.97
324 Petroleum and Coal Products Mfg.	54	45	54	63	0.04	1.96
325 Chemical Mfg.	71	75	163	160	0.08	2.59
326 Plastics and Rubber Products Mfg.	52	35	62	79	0.08	2.61
327 Nonmetallic Mineral Product Mfg.	42	36	59	66	0.10	3.22
331 Primary Metal Mfg.	49	37	85	97	0.08	2.90
332 Fabricated Metal Product Mfg.	57	45	101	113	0.07	2.42
333 Machinery Mfg.	73	51	129	152	0.06	2.39
334 Computer and Electronic Product Mfg.	67	62	105	111	0.09	3.23
335 Electrical Equipment, Appliance, and Component Mfg.	78	53	107	132	0.07	2.17
336 Transportation Equipment Mfg.	60	51	65	73	0.10	4.74
337 Furniture and Related Product Mfg.	57	42	53	67	0.14	3.07
339 Miscellaneous Mfg.	67	56	153	163	0.07	2.64
Overall	**65**	**56**	**112**	**120**	**0.08**	**2.93**

Table 4 Correlation Table

	ln(CCC)	SR	SD	GD	DE	CI	SS	II	SG
ln(CCC)	1								
SR	-0.1971*	1							
SD	-0.1184*	0.0074	1						
GD	0.0153	0.0151	0.0716*	1					
DE	-0.0622*	0.0135	-0.0016	-0.0218	1				
CI	-0.1242*	0.0904*	0.0073	0.0265	0.0044	1			
SS	-0.2793*	0.0559*	0.0184	0.0455*	0.1072*	0.0408*	1		
II	0.0715*	-0.0064	-0.0116	-0.001	-0.0072	-0.0152	-0.1102*	1	
SG	0.0026	-0.0001	0.004	-0.007	-0.0012	0.0037	-0.0488*	0.0000	1

* $p<0.05$

Table 5 Regression Results

VARIABLES	(1) ln(CCC)	(2) ln(CCC)	(3) ln(CCC)	(4) ln(CCC)	(5) ln(CCC)
SR	-0.233***	-0.237***	-0.230***	-0.237***	-0.233***
	(0.0321)	(0.0322)	(0.0320)	(0.0321)	(0.0321)
SD	-0.00719*	-0.00717*	-0.00715*	-0.00722*	-0.00716*
	(0.00386)	(0.00386)	(0.00384)	(0.00385)	(0.00386)
DE	0.00102	0.00102	0.000777	0.000799	0.00103
	(0.00397)	(0.00397)	(0.00395)	(0.00396)	(0.00397)
CI	-0.0426***	-0.0426***	-0.0420***	-0.0445***	-0.0425***
	(0.0123)	(0.0123)	(0.0123)	(0.0123)	(0.0123)
GD	0.00888*	0.00892*	0.00841*	0.00906*	0.00889*
	(0.00469)	(0.00469)	(0.00467)	(0.00468)	(0.00469)
SS	-0.0747***	-0.0718***	-0.0578***	-0.0738***	-0.0749***
	(0.0115)	(0.0116)	(0.0118)	(0.0115)	(0.0116)
SR_II		0.0365**			
		(0.0166)			
SD_II			0.00115***		
			(0.000195)		
SR_SG				0.0223***	
				(0.00514)	
SD_SG					-0.000062
					(0.000177)
Industry Dummy	Included	Included	Included	Included	Included
Year Dummy	Included	Included	Included	Included	Included
Constant	4.836***	4.816***	4.727***	4.832***	4.838***
	(0.491)	(0.490)	(0.489)	(0.492)	(0.492)
Observations	4,588	4,588	4,588	4,588	4,588
R-squared	0.3933	0.3943	0.3954	0.3934	0.3935
Number of Firms	913	913	913	913	913

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

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