Disentangling the impact of cost transparency on cooperation efficiency in exchange partnerships

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A B S T R A C T

Drawn upon the marriage of transaction cost economics and social exchange theory, this study aims to examine the effect of cost transparency on cooperation efficiency in a cooperative exchange between a manufacturer and its key suppliers. It also investigates the contingent impact of the contextual factor (e.g., demand uncertainty) and contractual factor (e.g., contract specificity) on the link between cost transparency and efficiency. The results of path analysis of survey data collected from China indicate a curvilinear relationship between transparency and efficiency in the context of Chinese manufacturers. The findings of this study also show that this curvilinear relationship is contingent on demand uncertainty and contract specificity, which exert interacting effects on the transparency-efficiency connection. This study discusses contributions to the frontier of existing theories, implications for practitioners, and future stream of research.

1. Introduction

In a buyer-supplier cooperative relationship, a buyer's competitive advantage depends on its suppliers' capabilities as well as its own competitive priorities (Arnold, 2000). It is of paramount importance for a buyer to have access to its major suppliers' information. Transparency is a crucial driving factor of a highly effective supply chain and it enables a firm to achieve its potentials in a competitive business environment (Wilding, 2003). In particular, transparency of cost information of a supplier plays a crucial role in the sustainability and efficiency of cooperative exchanges. Cost transparency refers to a supplier's disclosure of cost information on raw materials, labor, and overhead of the products it supplies to a buying firm. Prior studies suggested that information acquisition transparency is beneficial to manufacturers, but it has a double-edged sword effect on retailers (Li et al., 2014). The prior study focused on the confidentiality of information acquisition in a two-echelon supply chain. Huang and Yang (2016) highlighted forecasting with disclosing and hiding information status between suppliers and retailers. It shows that forecasting cost and production cost variance determine the production quantity of the suppliers. Exchange inefficiency in a supply chain doesn't solely result from information asymmetry (Çakanyıldırım et al., 2012). Although the studies discussed

above emphasized the importance of information acquisition and the conditions under which a supplier or a retailer could benefit from the information, they didn't explore the mechanism of the impact of cost transparency of a supplier on a buyer's cooperation efficiency. In the study of cost transparency, supply chain management researchers have focused their attention on interorganizational cost management and open-book accounting. In a cooperative exchange between a manufacturer and its major supplier, as two effective approaches to sharing cost information, interorganizational cost management and open-book accounting motivate and facilitate cost transparency through boosting trust and improving relational stability (Carr and Ng, 1995; Seal et al., 1999; Hoffjan et al., 2011), and they also lead to the success of a cooperation (Moller et al., 2011). Transparency makes a cooperative partnership efficient through enhanced "shadow of the future", which was used to describe the cooperative parties' expectation of a long term partnership (Axelrod, 1984). As such, when one exchange party has the information of the other party's moves, cooperation efficiency will be improved. Based on the work of Hoffjan et al. (2011), we define cooperation efficiency as the performance reflected in optimal prices safeguard, price change management, cost reduction, risk management capability improvement, and cost-efficient product development. It also implies the responsiveness to the changing market. Cooperation efficiency is

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different from supply chain efficiency, which is characterized by longer production lead time, high set-up costs, low unit cost but lack of responsiveness (Randall et al., 2003). In the discussion of efficient supply chains, Randall et al. (2003) explained that in an efficient supply chain, companies usually need to carry large safety stocks and have long production lead times due to large batch sizes and other constraints of capacities. As a joint cost management effort in improving cooperation efficiency, open-book accounting, on the other hand, induces a buyer to conduct cost benchmark analyses among its competing suppliers, which results in the failure of the implementation of open-book accounting (Kajueter and Kulmala, 2005). The potential opportunistic behavior of the dyads results in a loss of efficiency of the partnership (Brusset, 2014). The aforementioned inconsistency of the influence of cost information sharing efforts warrants a profound assessment of the link between cost transparency and cooperation efficiency.

The established literature on the driving factors of cooperation efficiency is subject to several limitations. First, few studies examine the drivers of cooperation efficiency from the lens of cost transparency. Practices for improving cooperation efficiency have been put forward (Moller et al., 2011; Kim and Netessine, 2013; Pomponi et al., 2015), however, few studies explore how cost transparency impacts cooperation efficiency. Prior studies on the driving factors of cooperation efficiency mainly focus their attention on joint cost management efforts (Moller et al., 2011), mutual trust (Ha et al., 2011; Pomponi et al., 2015), and supply chain integration (Danese and Romano, 2011, 2012). As well as the positive effect of sharing cost information by a supplier, unfavorable consequences of this practice have also been a concern in existing research. A buying firm can take advantage of its supplier's transparent cost information and behave opportunistically in the price negotiations (Dekker, 2004), which would increase the fixed costs (Agndal and Nilsson, 2009), deteriorate the established relationship and trust (Carr and Ng, 1995; Seal et al., 1999), thus lower the efficiency of the cooperation. Because of the both positive and negative impacts of cost transparency, further investigation is required for a better understanding of its profound impacts.

Second, prior studies examine the impact of cost transparency based on the cost management theory (e.g., Hoffjan et al., 2011; Moller et al., 2011). Since a supplier's transparent cost information induces the buying firm's opportunistic behavior in the negotiation process, a rational supplier would share manipulated cost data and behave opportunistically (Hoffjan et al., 2011; Lamming et al., 2005). This reciprocity would largely increase the transaction costs for the dyads and undermine the established trust and relationship. Relational factors partially determine the adoption of cost management and cost information sharing (Kajueter and Kulmala, 2005). Cost management theory lacks the dual capabilities of explaining the transactional and relational consequences of cost transparency. Social exchange theory embraces two elements, trust and dependence, which were related to the ability to adjust to evolving environment and sustain a long-term relationship (Mody, 1993; Parkhe, 1993). It also contends that the costs exchange partners are willing to expend on a cooperation relate to the expected rewards of the partners. In this stand, cost of transparency is that exchange partners want to pay since transparency enables a firm to develop competitive products and increase profit margin as well as induces transactional and relational considerations (Sinha, 2000). In the existing literature, incorporating the marriage of transaction cost economics and social exchange theory in the assessment of the role of cost transparency is scarce.

Third, few studies have examined the contingent roles of contextual and contractual factors (e.g., demand uncertainty and contract specificity respectively) in the investigation of the effect of cost transparency. Based on the extant literature, we have little knowledge about the interacting effect between them. Demand uncertainty is caused by lack of availability of cooperation partners and lack of knowledge about changes in markets (Cook, 1977). Social exchange theory suggests that interorganizational exchanges are effective in reducing uncertainty (Levine and White, 1961; Blau, 1964a,b). As two elements of social exchange theory, trust and

dependence in the exchanges exert significant impact on the flexibility of a cooperative party in responding to demand fluctuations (Young-Ybarra and Wiersema, 1999). Demand uncertainty mainly comes from the policies and ordering procedures of supply chain companies instead of customers with evolving purchasing behavior (Wilding, 2003), it is also a major contextual factor for the efficiency improvement in the field of supply chain management (Blome et al., 2013) and its interaction with disclosure of cost information by the supplier may imply the changes in the efficiency of a cooperative partnership between the dyads. Informed by transaction cost economics, formal contractual governance curtails the opportunism induced by the disclosure of supplier cost information, therefore, a formal contract specifying the rules and obligations of participating parties in the cooperation is crucial in suppressing opportunism, reducing transaction cost, and entailing an efficient cooperation when coupled with the release of supplier cost information. Thus, both contextual (demand uncertainty) and contractual (contract specificity) factors may serve as contingency variables in the link between cost transparency and cooperation efficiency.

To fill the research gaps, this study aims to investigate how supplier cost transparency relates to cooperation efficiency in a manufacturer's cooperative partnership with its major supplier. Our study contributes to the extant literature on supply chain management in several ways. First, grounded in the nexus of transaction cost economics and social exchange theory, this study examines the nonlinear effect of cost transparency on cooperation efficiency in a buyer-supplier partnership. Previous studies emphasize the benefits of cost transparency in a cooperative relationship, however, in this research we argue that high level of cost transparency of a supplier may decrease cooperation efficiency due to the potential opportunism caused by the advantageous benefits received by the manufacturer. The marriage of these two theories helps us gain meaningful insight into how cost transparency relates to cooperation efficiency and pave the path for the efforts of framing the theory in the area of cost transparency. Second, uncertainty induces enhanced inter-firm coordination to be better situated and adapted to the changing market (Buvik and Grùnhaug, 2000). On the other hand, evolving customer demand makes it complicated to increase cooperation efficiency because of the turbulent market changes and resultant increased costs, we investigate the contingent effect of demand uncertainty on the nonlinear link between cost transparency and cooperation efficiency. Third, contractual governance plays a crucial role in cooperative relationships to curtail potential opportunism due to the release of a supplier's cost information, this study examines the joint effect of contract specificity and cost transparency on cooperation efficiency.

This study is structured as follows. First, we discuss the theoretical background followed by hypotheses development. Second, we present the methodology of this study including sampling, data collection, data analyses, and results. Third, we provide a detailed discussion of theoretical contribution to researchers and managerial implications to practitioners in supply chain management as well as future research directions.

2. Theoretical background and hypotheses development

2.1. Marriage of transaction cost economics and social exchange theory

Transaction cost economics and social exchange theory have been widely used in grounding formal and relational factors curtailing opportunistic behavior from cooperative partners. Transaction cost economics contends that exchange partners have the potential to behave in an opportunistic way (Reich and Mankin, 1986). In the exchanges between partners, specific assets can bound a company to a certain action, which was described as "locked-in" (Ghemawat, 1991), which can be created through investing in specific assets in order to curtail the opportunism since exchange partners are locked into a long-term relationship (Williamson, 1985; Kau, 1989; Parkhe, 1993). Through investing in specific assets, credible commitments are fostered and exchange

parties' interests are aligned to pursue a shared goals and sustainable partnership (Anderson and Weitz, 1989). Based on transaction cost economics (Williamson, 1985), information asymmetry has been a major issue in buyer-supplier partnerships and it results from environmental uncertainty and bounded rationality of buyers and suppliers. Efficient cooperation requires disclosure of suppliers' cost data in order to reduce the transaction costs imposed by information asymmetry (Moller et al., 2011). On the other hand, buyers usually take advantage of the disclosure of cost data from suppliers and behave opportunistically with the cost information in their negotiation with suppliers, which reduces the profit of suppliers, increases the transaction cost for suppliers, and in turn induces suppliers to manipulate the cost information and behave opportunistically as well (Hoffjan et al., 2011; Moller et al., 2011). Consequently, both cooperative parties behave opportunistically in order to maximize their own profit at the expense of the other party's potential profit in a self-centered way. Transaction cost economics has its limitation by focusing on using formal enforcement and clauses to curtail opportunism and overcome bounded rationality since informal relational governance of exchange partnerships can reduce opportunism through cooperative parties' integrity, credibility, and benevolence (Das and Teng, 1998; Zaheer et al., 1998). In order to take the relational governance into consideration as well, this study also draws on social exchange theory because it embraces unspecified obligation and reciprocity (Cropanzano and Mitchell, 2005) and contains that self-enforcement and voluntary action of cooperative parties are motivated by the expected economic and sociological returns by the other exchange party (Blau, 1964a,b). Social exchange involves information sharing, which in turn motivates a reciprocal behavior and unenforced obligation. The resultant diffusion of "future obligations" lowers transaction cost for exchange parties and consequently reduces the opportunism and improves the cooperation efficiency. This study draws upon the nexus of both transaction cost economics and social exchange theory to deliberate the link between supplier cost transparency and cooperation efficiency in an exchange partnership. Both formal transactional and informal relational safeguards against opportunistic behavior work in a concerted fashion to curtail the potential opportunism caused by disclosure of supplier cost information. Therefore, this study frames our research inquiry using the marriage of transaction cost economics and social exchange theory.

2.2. Hypotheses development

Supplier cost transparency enables a buying firm to safeguard optimal prices, manage price changes, reduce costs, improve risk management capability, and develop cost-efficient products (Hoffjan et al., 2011). Based on the transaction cost economics, sharing cost information by the supplier would reduce the transaction costs and enhance the efficiency of the economic exchanges in the cooperation (Moller et al., 2011) through bolstering cooperation over opportunistic rent-seeking, maintaining trust and norms of integrity (Kolstad and Wiig, 2009), reducing price volatility and enhancing market liquidity (Frutos and Manzano, 2014).

On the other hand, the perception of opportunistic behaviors of cooperative partners deteriorates the performance of interfirm cooperation (Parkhe, 1993). Total cost of a product is rarely the simple summation of the lowest costs of each process in a supply chain (Wilding, 2003), this fact is usually beyond a buyer's consideration in its negotiation using shared cost information, thus resulting in lowered profit margin of the supplier and resultant deteriorated cooperative relationship. Second, a high level of cost transparency of a supplier leads to negotiations, potential opportunism, and resultant price changes, which raise fixed costs because of a decreased volume of sale (Agndal and Nilsson, 2009). The adoption of open-book accounting could impose high pressure on the supplier since its profit margin depends on the buyer's purchasing price (Hoffjan et al., 2011). The supplier's potential disadvantages of transparent cost information may induce it to manipulate the cost data before the buyer has access to it, this rational behavior of the supplier (Lamming et al., 2005) would lower the cooperation efficiency.

Third, a case study by Hultman and Axelsson (2007) indicates that prices would be exposed through the electronic marketplace at a high level of transparency. Transparency exerts not only positive, but also negative effects on the cooperation outcomes of economic exchanges. Accordingly, we posit,

H1. There is a curvilinear (inverted-U) relationship between a manufacturer's cost transparency and a buyer's cooperation efficiency in the buyer-manufacturer cooperation. In other words, medium level of cost transparency leads to the highest cooperation efficiency, low and high level of cost transparency leads to the lowest cooperation efficiency.

Demand uncertainty refers to the inability to predict customer demand in an accurate way (Blome et al., 2013). Cooperation between the buyer and the supplier is contingent on demand uncertainty (Hau et al., 2006). Uncertainty gives rise to obtaining a capability of being flexible in response to changing market demand. In order to obtain such capability, a buying firm seeks opportunities of cooperation with their potential suppliers and has strong desire for cooperation, which makes it more efficient to perform in a cooperative partnership. When the degree of cost transparency is low to moderate, such need for timely response to market requirements, managing the buyer-supplier relationship, and monitoring accuracy of forecast (Fynes et al., 2004) can bolster the role of cost transparency in the efforts of improving cooperation efficiency. Second, uncertainty facilitates strategic purchasing (Chen and Paulraj, 2004) and enhances the effect of trust built through cost transparency (Wang et al., 2011), thus leading to improved performance of the cooperative dyads. Furthermore, inventory and capacity usage can be largely reduced through minimizing oscillations caused by demand uncertainty in the efforts of boosting the cooperative relationships, as a result, costs are lowered and effectiveness of the cooperation is increased (Wilding, 2003).

Under the context of demand uncertainty, the requirements for flexibility and responsiveness entail a stable relationship between a buyer and a supplier in order to achieve a win-win situation. High level of cost transparency triggers a buying firm to perform benchmark analysis and replace existing suppliers for a lower purchasing cost, this potential opportunistic behavior can undermine the established cooperative relationship and increase the transaction cost, thus decreasing the cooperation efficiency. Second, transparency can lead to decreased profit margin of the supplier and make the exchange unfair (Sinha, 2000). The need of writing contacts regarding the contingency caused by demand uncertainty increases costs of cooperation in enforcing and executing contingent contract (Williamson, 1985).

While demand uncertainty strengthens the positive impact of cost transparency through enhancing cooperation and operations, it also bolsters the negative effect of cost transparency through supplier substitution, opportunism, and resultant unfavorable reciprocity.

H2. Demand uncertainty strengthens the curvilinear relationship between a manufacturer's cost transparency and a buyer's cooperation efficiency.

Based on Williamson (1985), contract specificity refers to contractual documents specifying the policies, procedures, duties, and objectives of each participating party. It is suggested that cooperative parties share bonding and monitoring costs when they form a cooperative relationship in order to curtail the potential opportunism (Hill, 1990). At a low to moderate level of cost transparency, there exists ambiguity and misunderstanding between the exchange partners. A specified contract detailing rules, rights, and obligations of each exchange party reduces the ambiguity and enhances the cooperation. It also further improves innovation performance (Wang et al., 2011), thus increasing the efficiency of the cooperation.

At a high level of cost transparency, transaction costs are increased with a perception of opportunistic behavior of a participating party due to the heightened outlays of contracts for effective governance of the relationship (Parkhe, 1993). Second, a specified contract is a tool to

protect the exchange parties from exploitation, which can impair established trust and commitment resulting from high cost transparency (Dekker, 2004; Kajueter and Kulmala, 2005). Furthermore, the resultant supplier opportunism due to the specified contract (Zhou et al., 2014) can reinforce the negative effect of high level of cost transparency. Based on the marriage of transaction cost economics and social exchange theory and transactional and relational elements of cooperation efficiency, we posit,

H3. Contract specificity strengthens the curvilinear relationship between a manufacturer's cost transparency and a buyer's cooperation efficiency.

3. Methods

3.1. Sample and data collection

Consistent with previous works (e.g., Revilla and Villena, 2012; Saenz et al., 2014; Yan and Dooley, 2014), we utilized key informant data from the buyer (manufacturer) as potential respondents because it decreases complexity and makes our study operationally feasible (Tangpong et al., 2008) and has been generally concentrated as a principal methodology of empirical examinations in the supply chain management research. The empirical data were collected through a survey in China. We asked respondents to answer the questions with respect to their relationship with a major supplier and this relationship has a major contribution to operational effectiveness. Since the single-side methodology has been generally used as a part of contemporary studies in the area of operations and supply chain management (e.g., Saenz et al., 2014; Revilla and Villena, 2012), we assessed buyers for the value-adding operations in dyadic buyer-supplier relationships. Due to the fact that manufacturers and their suppliers have comparable observations with respect to their exchanges (Anderson and Narus, 1990; Zaheer et al., 1998), information gathered from the manufacturers truly reflects the truths of their cooperation with suppliers. For the overview design and data collection, we accomplished a palatable response rate by following Dillman (2000) proposal for aggregate outline strategy. An instrument was designed based on previous studies. The survey is either adopted or adapted to fit our exploration setting. The primary rendition of instrument was in English, which was then translated into Chinese. To ensure reasonable comparability, two autonomous researchers who are influent in both English and Chinese were asked to make an interpretation of it back to English. They didn't discover any error in significance of the items in the survey. To guarantee that the questions were clear and justifiable to the respondents and ensure face validity, we pretested the survey instrument with executives and researchers who were working in the field of supply chain and logistics management. Consequently, minor changes were made to the original version of the survey in an effort to improve clarity and parsimony. Five hundred manufacturers spotted in Beijing were randomly selected from a rundown provided by a commercial marketing company. Telephone calls were made to request their participation and eighty-four organizations confirmed their interest in reacting to the survey either through survey monkey or site visits. The respondents were selected at the management level because of their exhaustive information about the operations of their organizations and significant comprehension and boundary spanning perspective of their key suppliers (Hallenbeck et al., 1999). We gathered seventy-six responses and removed five with missing information. As a result, seventy-one remain usable as a portion of our data collection endeavor.

Convenience sampling (Zirger and Maidique, 1990) was also adopted in our second effort in data collection. Second round data were collected from EMBA crowd at one of the top colleges in China. EMBA are suitable as the respondents since they are decision makers at the executive level (Bello et al., 2009). Those EMBA students represent senior managers in China since they were from all around China. According to Podsakoff et al. (2003), multiple data collection methods are used to decrease bias

in data collection. As a result of both data collections, 171 completed responses were collected. For both rounds of data collection, the total sample includes a broad spectrum of industries including electronics and electrical (32.3%), automobile manufacturing (17.1%), metals and machinery (14.8%), petroleum and chemical (16.3), pharmaceutical and medical (12.4%), food and beverage (4.9%), and others (2.2%). The size of companies ranges broadly with 0–100 (3.3%), 100–500 (10.6%), 501–1 000 (22.2%), 1 001–5 000 (36.2%), over 5 000 (27.7%). The respondents were in the position for at least 6 years. The average year of relationship with key suppliers are seven years.

3.2. Common method bias

Common method bias could be a concern when surveying single respondents (Podsakoff and Organ, 1986). We tried to reduce potential common method bias of this study by placing the dependent constructs before the independent constructs in the survey instrument to let the respondents answer the performance-related questions first before they answer other main survey questions. Harman's one-factor test was used to assess the common method bias (Podsakoff et al., 2003). Five factors with eigenvalues greater than one were extracted from all the measurement items, and they altogether explained 71.36% of the variance, with the first factor accounting for 29.41% of the variance. Since no single factor emerged that accounted for most of the variance, common method variance did not appear to be a problem in this study Podsakoff and Organ (1986). In addition, a single factor confirmatory factor analysis was performed (Mossholder et al., 1998). It shows the model with all items loading on one factor doesn't represent the dataset well. Through these two post hoc tests, we can say that common method bias is not a concern in this study.

3.3. Measures

A five-point Likert scale was used for all measurement items in the instrument to ensure a uniform scale width, which were anchored at 1 for strongly disagree and 5 for strongly agree. The measurement items in this survey were drawn from several sources. The measure of cost transparency was newly developed based on Moller et al. (2011), taping the degree of suppliers' sharing of information on cost of raw materials, labor, and overhead for the products they supply. Demand uncertainty was adopted from Chen and Paulraj (2004), tapping the degree of the variation in demand, and supply requirement. To measure contract specificity, we adopted three items from the work of Cannon and Perreault (1999) to capture the degree of specification of agreements and obligations of both parties in the cooperation. Cooperation efficiency is a new scale based on Hoffjan et al. (2011), reflecting the contribution of the buyer-supplier cooperation to cost reduction, price change management, risk management, and the development of cost-efficient products.

3.4. Control variables

Three control variables were included in the hypotheses testing: firm size, length of the cooperation, and interdependence. Firms in large size benefit from their scale economies, flexibility, and efficiency in resource utilization in the cooperation with suppliers (Cao and Zhang, 2011). Furthermore, large firms can achieve superior economic returns because of their strong bargaining power (Subramani and Venkatraman, 2003). Length of the cooperation can be one of the determinants of the commitment to the relationship between exchange partners due to the enhanced trust between exchange parties of a long-term relationship, which motivates cooperative parties to commit to the economic exchange (Kalwani and Narayandas, 1995). We performed logarithmic transformation for both firm size and length of the cooperation. Interdependence between a buyer and its major supplier was also included as a control variable since the degree of interdependence is related to the parties' engagements in the improvement of the dyadic performance

(Anderson and Narus, 1990; Luo et al., 2009) and it also affects the effectiveness of interorganizational cost management (Cooper and Slagmulder, 2004). The quantity of shared accounting information including cost data is determined by both relationship length and interdependence (Caglio and Ditillo, 2012). We used the number of employee of a firm to measure firm size and the years of relationship lasted to measure the length of the cooperation between a buyer and its major supplier. We adopted the measure of interdependence from the literature which was tested by Jap and Ganesan (2000) and used in the study of Luo et al. (2009), indicating the consequences when a cooperative relationship is terminated and significance of a major supplier to its buyer's business success.

3.5. Reliability and validity analyses

To assess the convergent and discriminant validity of the constructs in the theoretical model, we performed confirmatory factor analysis. A satisfactory fit for the model ($\chi^2 = 387.44$, $p = .00$, $df = 94$, CFI = 0.87, IFI = 0.87) was resulted from the analysis. Table 1 shows the results of the analysis, reliabilities, and the proportion of variance extracted for individual construct included in the model. It indicates that the measurement items share common variance with their hypothesized constructs more than with the other constructs since the estimates of proportion of variance extracted for the constructs were above the 0.5 threshold (except for contract specificity due to its relatively low loading) and are greater than the squared correlation between any pair of them. A factor can be regarded as reliable if it has loadings of items at least 0.6 (Guadagnoli and Velicer, 1988) and a cut-off of 0.4 for item loadings is suggested by Stevens (1992). Thus, convergent and discriminant validity were confirmed.

4. Analyses and results

Assumptions of structural equation modeling regarding missing data and normality were checked through Prelis. We used a covariance matrix as an input to latent variable structural equation modeling based on the marriage of transaction cost economics and social exchange theory to examine the hypothesized associations (Jöreskog and Sörbom, 1993). Latent variable structural equation modeling can test the hypothesized main and moderating effects simultaneously and offers a superior evaluation of the roles of the factors (Modi and Mabert, 2007). Structural equations of the model are reported in Table 2. For each hypothesized relationship, the completely standardized parameter estimates and *t*-values are summarized in Fig. 1. It indicates that the overall fit of the model is acceptable ($\chi^2 = 1\,045.17$, $p = .00$, *d.f.* = 4, CFI = 0.87, GFI = 0.88).

The results show that cost transparency has a curvilinear relationship (quadratic term) with cooperation efficiency ($\beta = -0.63$, t = -3.06), which suggests that hypothesis 1 is supported. We also get significant results for the moderating effects of demand uncertainty and contract specificity (demand uncertainty: $\beta = 0.42$, t = 3.18; contract specificity: $\beta = 0.61$, t = 3.93). Thus, hypotheses 2 and 3 are also supported. In summary, this study employs structure equation modeling to assess the curvilinear association of cost transparency with cooperation efficiency and the moderating effects of demand uncertainty and contract specificity on cooperation efficiency. Results show that all three hypotheses are strongly supported ($p < .05$).

4.1. Results for control variables

As mentioned earlier, there are three control variables for the structural model: length of cooperation, firm size, and interdependence. Results show that length of cooperation is positively related to cooperation efficiency ($\beta = 0.17$, t = 2.35), which is consistent with the assertion by Kalwani and Narayandas (1995) that enhanced trust in a long-term relationship between exchange parties fosters their commitment to the

Table 1
Construct measurement, reliability, and confirmatory factor analysis.

Measures	Standardized loading
Cost transparency ($\alpha = 0.88$; proportion of variance extracted: 0.77) (new scale)	
1. Our firm requests this supplier to share information on cost of raw materials for our products.	0.89
2. Our firm requests this supplier to share information on cost of labor for our products.	0.89
3. Our firm requests this supplier to share information on cost of overhead for our products.	0.85
Demand uncertainty ($\alpha = 0.85$; proportion of variance extracted: 0.78) (adopted from Chen and Paulraj, 2004)	
1. Our demand fluctuates drastically from week to week.	0.91
2. Our supply requirements vary drastically from week to week.	0.86
Contract specificity ($\alpha = 0.68$; proportion of variance extracted: 0.46) (adopted from Cannon and Perreault, 1999)	
1. We have specific, well-detailed agreements with this supplier.	0.67
2. We have customized agreements that detail the obligations of both parties.	0.75
3. We have detailed contractual agreements specifically designed with this supplier.	0.61
Cooperation efficiency ($\alpha = 0.77$; proportion of variance extracted: 0.56) (new scale)	
1. The cooperation with this supplier has contributed to our cost reduction.	0.77
2. The cooperation with this supplier has enhanced our capability in safeguarding optimal prices and management of price changes.	0.78
3. The cooperation with this supplier has improved our risk management capabilities.	0.78
4. The cooperation with this supplier has contributed to the development of cost-efficient products.	0.66
Interdependence ($\alpha = 0.86$; proportion of variance extracted: 0.65) (adopted from Luo et al., 2009)	
1. We will have to spend a great deal of resources, energy and time searching for a new partner if terminating the relationship with this supplier.	0.79
2. It would be costly to lose this supplier.	0.87
3. It would be difficult for us to replace this supplier in the business area we are in.	0.85
4. This supplier is important to our business performance.	0.70
Model Fit Index	
$\chi^2 = 1\,045.17$ (p = .00), df = 4, CFI = 0.87, GFI = 0.88	

Table 2
Structural equations.

Structural equation	R^2
$\eta_1 = -0.07\xi_1 + 0.28\xi_2 + 0.13\,\xi_3 + 0.93$	0.07
$\eta_4 = 0.17\xi_1 - 0.44\xi_2 + 0.13\,\xi_3 - 0.63\,\eta_1\eta_1 + 0.42\,\eta_1\eta_2 + 0.61\,\eta_1\eta_3 + 0.61$	0.39

economic exchanges. Unexpectedly, supplier firm size is negatively associated with cooperation efficiency ($\beta = -0.44$, t = -5.78). One of the possible explanations might be the bureaucracy embedded in large organizations in China's emerging economy which is characterized by a lack of institutional and legal frameworks, thus, it results in cooperation inefficiency. As expected, interdependence affects efficiency in a positive way ($\beta = 0.13$, t = 1.96). With high level of interdependence, exchange parties are strongly motivated to engage in performance improvement for both dyads.

5. Discussion

This study proposed and tested a curvilinear relationship between cost transparency and cooperation efficiency along with the moderating effects of contextual factor (demand uncertainty) and contractual factor (contract specificity) on the reversed-U relationship between cost
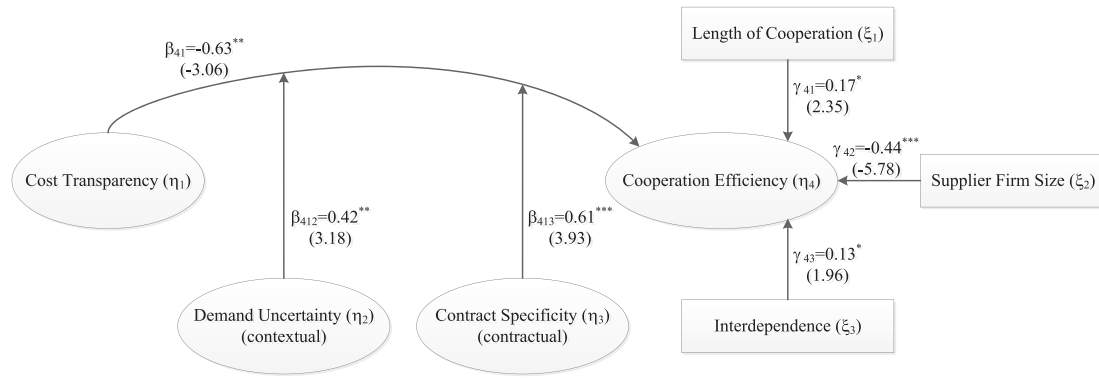
Fig. 1. Coefficients of the structural model.

transparency and cooperation efficiency using the sample data collected from China. It contributes to the existing literature on supply chain management theoretically and offers implications to senior managers of manufacturing companies practically.

5.1. Theoretical contributions

First, this study offers explanations of the inconclusive association between cost transparency of a supplier and cooperation efficiency in an economic exchange between a manufacturer and its key suppliers. This study is grounded in the marriage of transaction cost economics and social exchange theory to explain the complex impact of cost transparency of a supplier on the cooperation efficiency in an exchange between a manufacturer and its key suppliers. A manufacturer and its key suppliers share cost reduction goals, confidence can be established through the trust and favor exchange embodied in the cooperation (Carey et al., 2010). The findings of this study confirmed our propositions regarding the curvilinear association between cost transparency and cooperation efficiency. This study sheds lights and provides insights to the mechanism of the impact of cost transparency of a supplier on cooperation efficiency between a manufacturer and its key suppliers and filled the existing research gap by identifying a reversed-U relationship between cost transparency and cooperation efficiency.

Second, this study advances our understanding of transaction cost economics and social exchange theory and contributes to the nexus of these two theories. There is a tradeoff between the level of a supplier's cost transparency and reduction of transaction costs and relationship improvement due to a buyer's opportunistic behavior in response to a supplier's transparent cost information. This reciprocity makes the impact of cost transparency on cooperation efficiency complicated and nonlinear. On one hand, it increases transaction costs for both buyers and suppliers and harms the established trust and relationship between the dyads. On the other hand, moderate level of cost transparency fosters the relational improvement and lowers the transaction costs in exchanges through building the trust and enhancing the cooperation which help firms avoid internalizing an activity that may not in light with their cost saving competencies (Cao and Zhang, 2011). Both curtailed opportunism and relational capital in the cooperation result in cost reduction and the enhanced problem solving capabilities (Carey et al., 2010). The findings of this study extend both theories to an advanced level of power of explanation of the lock-in linked to the specific assets embraced in the transaction cost economics and the reciprocity implied in the social exchange theory. Specific assets invested in a relationship could serve as economic hostage to lock a partner in the relationship. The commitment fostered by the trust and dependence between the exchange parties can increase the flexibility of responding to changing environmental evolvement and market demand (Young-Ybarra and Wiersema, 1999). The marriage of the two theories explains the transactional and relational consequences of cost transparency.

Third, this study also contributes to the supply chain management literature by clarifying the significant contingent role of contextual and contractual factors in the association between cost transparency and cooperation efficiency. In particular, demand uncertainty and contract specificity result in information asymmetry, which is a source of inefficiency (Blome et al., 2013). Demand uncertainty is caused by the lack of resources and unavailability of potential partners for establishing a long-term relationship. Such uncertainty can be reduced through exchanges between partners (Levine and White, 1961; Blau, 1964a,b). Through the rules and obligations specified in a formal contract between exchange parties, opportunism induced by the sharing of cost information of suppliers can be curtailed. Transaction cost economics informs that invested specific assets help bound the exchange parties together and foster an atmosphere of sharing information with increase commitment to a win-win relationship. In the context of economic exchanges between a manufacturer and its key suppliers, the findings of this study offer a nuanced view on how both contextual and contractual factors play a contingent role in the curvilinear link between cost transparency and cooperation efficiency.

5.2. Managerial implications

First, our findings show that cost transparency is related to cooperation efficiency in a curvilinear fashion, which informs suppliers of the optimal level of disclosure of product cost information and share the cost related information with their buyers cautiously. Our results suggest that medium level of cost transparency of a supplier results in the more cooperation efficiency than low and high level of cost transparency. Medium level of cost transparency refers to the cost information shared by the suppliers includes the information (cost of raw materials, cost of labor, cost of overhead for the products) the buyers need to know in order to better cooperate and reduce the operation cost for both dyads. Specifically, a supplier needs to be cautious when a manufacturer requests to share information on cost of raw materials, cost of labor, and cost of overhead for products. It would be more beneficial to both dyads if a supplier maintains a medium level of cost sharing with its buyer. Maintaining transparency of cost information for the products and without sharing any cost information would result in low efficiency of the cooperation between the buyer and the supplier. This might be a strategy for managers of a supplying firm to enhance the efficiency of the supply chain cooperation.

Second, managers of a supplier should not be sensitive to share cost information in the face of customer demand uncertainty, changing supply requirements, and specified contract with its buyer. Demand uncertainty and contract specificity greatly facilitate the impact of cost transparency on the efficiency improvement. Both contextual and contractual factors should be considered by the managers of the exchange partners when making a decision of sharing cost information with partners. Customer demand uncertainty serves as a motivation for the dyads to share cost

information with an expectation of profit gains. With cost transparency, purchasing managers can determine the costs of new products based on the product specifications and expected cost reductions through the changes in product design (Hoffjan et al., 2011). We highlight the strengthening force of customized and well-detailed agreements between participating parties in making medium level of cost transparency more effective in enhancing cooperation efficiency. When deciding on a firm's supply chain strategy, managers of suppliers could focus on sharing the cost information with their buyers which helps reduce transaction cost and enhance economic gains for the dyads. The cost information shared should be explicitly stated in the contract when the manufacturer and supplier start to cooperate as exchange partners along the supply chain.

5.3. Limitations and further research

The interpretation of the results of this study can be constrained by several limitations, which warrant further investigations. First, the approach of survey adopted in this study may cause biases due to the subjective opinion of the respondents. In the survey, we collected the perceptions of the manufacturers from the viewpoint of buyers to test the hypothesized research model, which failed to reflect the perceptions of their suppliers in terms of cost information sharing in the economic exchanges in the cooperation. It could be helpful to survey the suppliers as well and collect paired data from both a manufacturer and its key supplier. The level of cost information shared by the supplier could be different from a standpoint of a supplier from that of a buyer since a buyer might hold the belief that its supplier always hide or shared elevated cost information with a purpose of asking for higher selling price.

Second, beyond demand uncertainty and contract specificity, other factors may act as potential contingent factors of the effect of cost transparency on cooperation efficiency between a manufacturer and its key suppliers. Other possible factors might include technological turbulence, product innovation, number of suppliers, industry competitiveness, etc. This study could be extended and advanced by examining the role of these possible moderators in the link between cost transparency and cooperation efficiency.

Third, the data collected from China may present cultural differences from their western counterparts, which pose an important bearing for companies in emerging economies. In particular, favors and trust are a medium of social exchange and dominant in conducting business in emerging economies (Teagarden and Schotter, 2013). Favors may cause confusion and result in misunderstanding in western culture. Future work may extend the research to western cultures to gain a better understanding on how and when to share a supplier's cost information with its buyer. It would be interesting to examine the mechanism of the impact of cost transparency on cooperation efficiency to see whether the impact is identical to the emerging economics.

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References

Agndal, H., Nilsson, U., 2009. Interorganizational cost management in the exchange process. Manag. Account. Res. 20, 85–101.

Anderson, J.C., Narus, J.A., 1990. A model of distributor firm and manufacturer firm working partnerships. J. Market. 54, 42–58.

Anderson, E., Weitz, B., 1989. Determinants of continuity in conventional industrial channel dyads. Market. Sci. 8, 310–323.

Arnold, U., 2000. New dimensions of outsourcing: a combination of transaction cost economics and the core competencies concept. Eur. J. Purch. Supply Manag. 6, 23–29.

Axelrod, R., 1984. The Evolution of Cooperation. Basic Books, NY.

Bello, D., Leung, K., Badebaugh, L., Tung, R.L., Witteloostuijn, A.V., 2009. From the editors: student samples in international business research. J. Int. Bus. Stud. 40, 361–364.

Blau, P., 1964a. Power and Exchange in Social Life. John Wiley & Sons, NY.

Blau, P., 1964b. Exchange and Power in Social Life. John Wiley and Sons, New York.

Blome, C., Schoenherr, T., Kaesser, M., 2013. Ambidextrous governance in supply chains: the impact on innovation and cost performance. J. Supply Chain Manag. 49 (4), 59–80.

Brusset, X.R., 2014. Estimating the supply chain efficiency loss when the seller has to estimate the buyer's willingness to pay. Oper. Res. 48 (4), 477–496.

Buvik, A., Grünhaug, K., 2000. Inter-firm dependence, environmental uncertainty and vertical co-ordination in industrial buyer-seller relationships. Omega 28 (4), 445–454.

Caglio, A., Ditillo, A., 2012. Opening the black box of management accounting information exchanges in buyer–supplier relationships. Manag. Account. Res. 23 (2), 61–78.

Çakanyıldırım, M., Feng, Q., Gan, X., Sethi, S.P., 2012. Contracting and coordination under asymmetric production cost information. Prod. Oper. Manag. 21 (2), 345–360.

Cannon, J.P., Perreault, W.D., 1999. Buyer-seller relationships in business markets. J. Market. Res. 36 (4), 439–460.

Cao, M., Zhang, Q., 2011. Supply chain collaboration: impact on collaborative advantage and firm performance. J. Oper. Manag. 29, 163–180.

Carey, S., Lawson, B., Krause, D., 2010. Social capital configuration, legal bonds and performance in buyer–supplier relationships. J. Oper. Manag. 29, 277–288.

Carr, C., Ng, J., 1995. Total cost control: nissan and its U.K. supplier partnerships. Manag. Account. Res. 6, 347–365.

Chen, I.J., Paulraj, A., 2004. Towards a theory of supply chain management: the constructs and measurements. J. Oper. Manag. 22 (2), 151–170.

Cook, K., 1977. Exchange and power in networks of interorganizational relations. Socio. Q. 18, 62–82.

Cooper, R., Slagmulder, R., 2004. Interorganizational cost management and relational context. Account. Org. Soc. 29 (1), 1–16.

Cropanzano, R., Mitchell, M., 2005. Social exchange theory: an interdisciplinary review. J. Manag. 31 (6), 874.

Danese, P., Romano, P., 2012. Relationship between downstream integration, performance measurement systems and supply network efficiency. Int. J. Prod. Res. 50 (7), 2002–2013.

Danese, Pamela, Romano, Pietro, 2011. Supply chain integration and efficiency performance: a study on the interactions between customer and supplier integration. Supply Chain Manag.: Int. J. 16 (4), 220–230.

Das, T.K., Teng, B.S., 1998. Between trust and control: developing confidence in partner cooperation in alliances. Acad. Manag. Rev. 23 (3), 491–512.

Dekker, H.C., 2004. Control of inter-organizational relationships: evidence on appropriation concerns and coordination requirements. Account. Org. Soc. 29, 27–49.

Dillman, D.A., 2000. Mail and Internet Surveys: the Tailored Design Method. John Wiley & Sons, NY.

Frutos, M.A., Manzano, C., 2014. Market transparency, market quality, and sunshine trading. J. Financ. Market. 17, 174–198.

Fynes, B., Burca, S.D., Marshall, D., 2004. Environmental uncertainty, supply chain relationship quality and performance. J. Purch. Supply Manag. 10 (4), 179–190.

Ghemawat, P., 1991. Commitment: the Dynamic of Strategy. The Free Press, New York.

Guadagnoli, E., Velicer, W., 1988. Relation of sample size to the stability of component patterns. Psychol. Bull. 103, 265–275.

Ha, B.C., Park, Y.K., Cho, S., 2011. Suppliers' affective trust and trust in competency in buyers. Int. J. Oper. Prod. Manag. 31 (1), 56–77.

Hallenbeck Jr., G.S., Hautaluoma, J.E., Bates, S.C., 1999. The benefits of multiple boundary spanning roles in purchasing. J. Supply Chain Manag. 35 (1), 38–43.

Hau, Z., Li, S., Liang, L., 2006. Impact of demand uncertainty on supply chain cooperation of single-period products. Int. J. Prod. Econ. 268–284.

Hill, C.W.L., 1990. Cooperation, opportunism, and the invisible hand: implications for transaction cost theory. Acad. Manag. Rev. 15, 500–513.

Hoffjan, A., Luhrs, S., Kolburg, A., 2011. Cost transparency in supply chains: demystification of the cooperation tenet. Supply Chains 63 (July), 230–251.

Huang, S., Yang, J., 2016. Information acquisition and transparency in a supply chain with asymmetric production cost information. Int. J. Prod. Econ. 182, 449–464.

Hultman, J., Axelsson, B., 2007. Towards a typology of transparency for marketing management research. Ind. Market. Manag. 36 (5), 627–635.

Jap, S.D., Ganesan, S., 2000. Control mechanisms and the relationship life cycle: implications for safeguarding specific investments and developing commitment. J. Market. Res. 37, 227–245.

Jöreskog, K.G., Sörbom, D., 1993. LISREL 8: Structural Equation Modeling with the SIMPLIS Command Language. Scientific Software International, Chicago, IL.

Kajueter, P., Kulmala, H.I., 2005. Open-book accounting in networks: potential achievements and reasons for failures. Manag. Account. Res. 16 (2), 179–204.

Kalwani, M.U., Narayandas, N., 1995. Long-term manufacturer-supplier relationships: do they pay off for supplier firms. J. Market. 59 (January), 1–16.

Kau, M., 1989. Verticai contractual relalions. In: Schmalensee, R., Willig, R. (Eds.), Handbook of Industrial Organization, vol. 1. Elsevier, New York, pp. 655–721.

Kim, S.H., Netessine, S., 2013. Collaborative cost reduction and component procurement under information asymmetry. Manag. Sci. 59 (1), 189–206.

Kolstad, I., Wiig, A., 2009. Is transparency the key to reducing corruption in resource-rich countries? World Dev. 521–532.

Lamming, R., Caldwell, N.D., Phillips, W.E., Harrison, D.A., 2005. Sharing sensitive information in supply relationships: the flaws in one-way open-book negotiation and the need for transparency. Eur. Manag. J. 23, 554–563.

Levine, S., White, P., 1961. Exchange as a conceptual framework for the study of interorganizational relationships. Adm. Sci. Q. 5, 583–601.

Li, T., Tong, S., Zhang, H., 2014. TransparAgency of information acquisition in a supply chain. Manuf. Serv. Oper. Manag. 16 (3), 412–424.

Luo, Y., Liu, Y., Xue, J., 2009. Relationship investment and channel performance: an analysis of mediating forces. J. Manag. Stud. 46 (7), 1113–1137.

Modi, S.B., Mabert, V.A., 2007. Supplier development: improving supplier performance through knowledge transfer. J. Oper. Manag. 25 (1), 42–64.

Mody, A., 1993. Learning through alliances. J. Econ. Behav. Organ. 20, 151–170.

Moller, K., Windolph, M., Isbruch, F., 2011. The effect of relational factors on open-book accounting and inter-organizational cost management in buyer-supplier partnerships. J. Purch. Supply Manag. 17, 121–131.

Mossholder, K.W., Bennett, N., Kemery, E.R., Wesolowski, M.A., 1998. Relationships between bases of power and work reactions: the meditational role of procedural justice. J. Manag. 24 (4), 533–552.

Parkhe, A., 1993. Strategic alliance structuring: a game theoretic and transaction cost examination of interfirm cooperation. Acad. Manag. J. 36 (4), 794–829.

Podsakoff, P.M., Organ, D.M., 1986. Self-reports in organizational research: problems and prospects. J. Manag. 12 (4), 531–544.

Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol. 88, 879–903.

Pomponi, F., Fratocchi, L., Tafuri, S.R., 2015. Trust development and horizontal collaboration in logistics: a theory based evolutionary framework. Supply Chain Manag. 20 (1), 83–97.

Randall, T.R., Morgan, R.M., Morton, A.R., 2003. Efficient versus responsive supply chain choice: an empirical examination of influential factors. J. Prod. Innovat. Manag. 20 (6), 430–443.

Reich, R., Mankin, E., 1986. Joint ventures with Japan give away our future. Harv. Bus. Rev. 64, 77–86.

Revilla, E., Villena, V.H., 2012. Knowledge integration taxonomy in buyer-supplier relationships: trade-offs between efficiency and innovation. Int. J. Prod. Econ. 140, 854–864.

Saenz, M.J., Revilla, E., Knoppen, D., 2014. Absorptive capacity in buyer-supplier relationships: empirical evidence of its mediating role. J. Supply Chain Manag. 50 (2), 18–40.

Seal, W., Cullen, J., Dunlop, A., Berry, T., Ahmed, M., 1999. Enacting a European supply chain: a case study on the role of management accounting. Manag. Account. Res. 10, 303–322.

Sinha, I., 2000. Cost transparency: the net's real threat to prices and brands. Harv. Bus. Rev. 43–50. March–April.

Stevens, J.P., 1992. Applied Multivariate Statistics for the Social Sciences, second ed. Erlbaum, Hillsdale, NJ.

Subramani, M.R., Venkatraman, N., 2003. Safeguarding investments in asymmetric interorganization al relationships: theory and evidence. Acad. Manag. J. 46, 46–62.

Tangpong, C., Michalisin, M.D., Melcher, A.J., 2008. Toward a typology of buyer–supplier relationships: a study of the computer industry. Decis. Sci. J. 39 (3), 571–593.

Teagarden, M.B., Schotter, A., 2013. Favor prevalence in emerging markets: a multi- level analysis. Asia Pac. J. Manag. 30 (2), 447–460.

Wang, L., Yeung, J.H.Y., Zhang, M., 2011. The impact of trust and contract on innovation performance: the moderating role of environmental uncertainty. Int. J. Prod. Econ. 134 (1), 114–122.

Wilding, R., 2003. The 3 Ts of highly effective supply chains. Supply Chain Pract. 5 (3), 30–39.

Williamson, O.E., 1985. The Economic Institutions of Capitalism. The Free Press, NY.

Yan, T., Dooley, K., 2014. Buyer-supplier collaboration quality in new product development projects. J. Supply Chain Manag. 50 (2), 59–83.

Young-Ybarra, C., Wiersema, M., 1999. Strategic flexibility in information technology alliances: The influence of transaction cost economics and social exchange theory. Organ. Sci. 10 (4), 439–459.

Zaheer, A., McEvily, W., Perrone, V., 1998. Does trust matter? Exploring the effects of inter-organizational and interpersonal trust on performance. Organ. Sci. 9, 141–159.

Zhou, K.Z., Zhang, Q., Sheng, S., Xie, E., Bao, Y., 2014. Are relational ties always good for knowledge acquisition? Buyer-supplier exchanges in China. J. Oper. Manag. 32, 88–98.

Zirger, B.J., Maidique, M.A., 1990. A model of new product development: an empirical test. Manag. Sci. 36 (7), 867–883.