Supply risk management from a transaction cost and social exchange theory perspective

Paper for the 27th IMP conference in Glasgow, 2011

Petra Hoffmann[a], Holger Schiele[b], [c]Michael Song, [d]Koos Krabbendam

[a] Ir. Petra Hoffmann, University of Twente, School of Management and Governance, P.O. box 217, 7500 AE Enschede, The Netherlands. p.hoffmann@utwente.nl, p: +31 53 4894282. (Corresponding author).
[b] Prof. Dr. Holger Schiele, University of Twente, School of Management and Governance, P.O. box 217, 7500 AE Enschede, The Netherlands. h.schiele@utwente.nl, p: +31 53 4895615
[c] Michael Song, University of Missouri-Kansas City, School of Business and Public Adminitsration. 5110 Cherry Street, Kansas City MO 64110, United States. somgmi@umkc.edu, p: 816 235 5841
[d] Koos Krabbendam, University of Twente, School of Management and Governance, P.O. box 217, 7500 AE Enschede, The Netherlands. j.j.krabbendam@utwente.nl. p: +31 53 4893494

Abstract

Supply risk management gained prominence over the last decade, both in the academic discourse and in practical application. This research examines the influence of Transaction Cost characteristics -behavioral uncertainty, environmental uncertainty and asset specificity- on supply risk management performance. We also identify two antecedents of the transaction cost constructs based on social exchange theory: dependency and preferred customer status. We used survey data to discover a positive influence of supplier's asset specificity on supply risk management performance, and that behavioral uncertainty negatively influences supply risk management performance. Furthermore, we showed that both dependency and preferred customer status have a significant effect on supplier's asset specificity and behavioral uncertainty.

With this research we developed a framework to integrate transaction cost theory and social exchange theory to investigate supply risk management, thereby contributing to the emerging literature on this combination as a more complete governance mechanism to manage supply relationships. We also extend the existing knowledge on transaction cost theory by showing that from a supply risk management point of view, behavioral uncertainty is by far the most important determinant to consider. In order to manage supply risks effectively companies should avoid dependency, though its negative effects can to some degree be compensated by preferred customer status, as this will increase supplier's specific investments and lower behavioral uncertainty.

Keywords: *transaction cost theory, social exchange theory, supply risk management, supply chain risk management*

1. Introduction

Supply risk management is developing into a focus area in supply chain management research (Kleindorfer and Saad, 2005; Narasimhan and Talluri, 2009). The field of supply risk management gained prominence mainly for two reasons: (1) recent crises and catastrophes, and (2) modern supply chains which are inherently more vulnerable than traditional integrated production methods (Wagner and Bode, 2008). The complexity of modern supply chains and the increased reliance on the competitive advantage created by the supply chain as a whole inevitably leads to an increased exposure to supply risks. Cyclical economic downturns and subsequent supplier failures periodically increase the interest in supply risk management even more.

Faced with greater exposure to supply risks, firms increasingly try to implement supply risk management systems. In the last years, also extensive research on supply risk management has been carried out. Different risk management principles have been described for managing supply risks, such as risk identification, risk assessment or risk mitigation (see for instance Blackhurst et al., 2008; Harland et al., 2003; Kleindorfer and Saad, 2005; Knemeyer et al., 2009), but also enhancing a firm's supply chain agility or early supplier involvement (Braunscheidel and Suresh, 2009; Tang and Tomlin, 2008; Zsidisin and Smith, 2005). A performing supply risk management system allows firms to identify risk sources, measure the risk's emergence and allow to react in due time, thus mitigating supply risks.

However, the young and emerging field of research on supply risk management still leaves many questions open on how to design such a supply risk management system. For instance, little is known on origination, characteristics and causal pathways of risks (Ritchie and Brindley, 2007a) or the fundamental question on when exactly risk occur Tang and Nurmaya Musa (2010). Also, there is a need to relate risk management activities to performance (Knemeyer et al., 2009; Melnyk et al., 2004; Ritchie and Brindley, 2007a, b; Wagner and Bode, 2008), so as to eventually being able to create a framework to get hold of the risk involved in complex supply chains (Zsidisin and Ritchie, 2009). Most published models are either rather confined, lack theoretical grounding, are not empirically tested, or a combination of the above (Wagner and Bode, 2008). The challenge is how to contribute with a theoretically grounded and empirically tested model allowing firms to manage supply risks.

This study addresses these shortcomings by utilizing a comprehensive framework wherein both transaction cost economics and social exchange theory are used to examine supply risk management performance, i. e. the ability of the firm to minimize their risk exposure. More precisely, we test the social exchange theory based constructs of dependency and preferred customer status as antecedents to transaction cost based explanations for supply risk performance. Our model is investigated by surveying a large sample of firms and analyzing the success of their supply risk management efforts. Analytical techniques are used that allow for an estimation of the relationship between factors suggested by transaction costs economics and its anteceding factors derived from social exchange theory. In doing so, we contribute to the discussion linking the two theories, empirically test the assumed relationships and expand the knowledge on efficient supply risk management systems.

Findings indicate that, as opposed to often postulated, asset specificity appears not to be the most influential governance mechanism. Instead, managing behavioral uncertainty has a much higher power explaining successful supply risk management. Furthermore, the newly introduced constructs derived from social exchange theory, preferred customer status, next to dependency, is a good antecedent explaining two of the transaction cost constructs. Moreover, adding to managerial applicability, it can be shown that being a preferred customer can to a

certain extend compensate for dependency in buyer-supplier relations and ultimately reduce supply risk exposure.

In the next section we will discuss previous literature on supply risk management, transaction cost theory and social exchange theory and derive testable hypotheses. Then, we present empirical data and use them to test the relationships. Finally, a concluding discussion rounds-up this paper.

2. Theoretical Foundation

2.1 Supply Risks

According to Zsidisin et al. (2004, p. 397) supply risk is "the potential occurrence of an incident associated with inbound supply from individual supplier failures or the supply market, in which its outcomes result in the inability of the purchasing firm to meet customer demand or cause threats to customer life and safety". Analyzing supply risk, it can be differentiated between risk sources and risk outcomes, such as quality or delivery problems. Risk sources can either stem from individual supplier failures or from market characteristics, which affect all suppliers (Zsidisin, 2003).

Scholars have paid ample attention to the identification and classification of different risk sources, leading to a variety of risk categories, such as operational risk and disruption risk (Tang, 2006); relational risk and performance risk (Das and Teng, 2001); disruption risks and risks stemming from supply and demand coordination problems (Kleindorfer and Saad, 2005); capacity limitations and supply disruptions (Johnson, 2001); or environmental, network related and organizational risk sources (Jüttner et al., 2003). Chopra and Sodhi (2004) identified seven risk source categories, including disruptions and inventory risks. Schoenherr et al. (2008) use product characteristics (quality and cost), partner characteristics (service and management capabilities) and environment characteristics as a way to classify supply risks.

Summarising, it could be distinguished between environmental risks (which influence the performance of all suppliers in the affected area), financial risk (referring to the bankruptcy of a particular supplier), operational risks (deriving out of quality problems of a supplier) and strategic risks (for instance when the supplier does not consider the buyer sufficiently important and in case of bottlenecks reduces the supply for that particular buyer, but not for others). It is important to highlight that the supply risk firms are facing, thus, is a multi-facet problem resulting in the extreme form in a complete interruption of supply, but gradually emerging through quality problems or reduction in delivery quantity.

However, identifying different risk categories is not sufficient to handle these risks. Supply chain risk management is about the minimization of these risks while exploiting opportunities by aligning organizational processes and decisions (Narasimhan and Talluri, 2009). Several supply risk management processes have been described in literature, such as risk specification, risk assessment and risk mitigation (Kleindorfer and Saad, 2005); risk identification, risk assessment, risk management and risk monitoring (Hallikas et al., 2004) or risk analysis, risk evaluation and risk management (Mullai, 2009). Substantial attention has been given to the single stages of risk identification and/or assessment (see for instance Hallikas et al., 2002; Neiger et al., 2009; Pavlou and Manthou, 2008; Schoenherr et al., 2008; Zsidisin et al., 2004). Also, different risk mitigation/ reduction strategies are explored, such as sharing information, establishing back-up systems, early supplier integration, building flexibility, improving communication, building buffer inventories and multiple sourcing (Chopra and Sodhi, 2004; Kleindorfer and Saad, 2005; Tang and Tomlin, 2008; Zsidisin et al., 2000; Zsidisin and Smith, 2005). One problem is that some of these recommendations are

commonly assumed to contradict each other, such as early supplier integration and multiple sourcing. Thus, without a thorough understanding of the determinants of supply risk performance and their interrelation, managerial implications suggested without embedding them in a consistent theoretical model are not free from some arbitrariness.

2.2 Determinants of supply risk performance

Uncertainty is the key element of risk (Yates and Stone, 1992). At the same time, uncertainty also stands at the explanatory core of transaction cost economics (see for instance Kaufmann and Carter, 2006; Walker and Weber, 1987). Transaction cost economics, therefore, could contribute to the understanding of supply risks. Most of transaction cost research focuses on vertical integration (Coase, 1937; David and Han, 2004; Rindfleisch and Heide, 1997; Williamson, 1975) and governance problems in interorganizational relationships without common ownership (Rindfleisch and Heide, 1997). Yet, the use of transaction cost theory in operations management, more specifically supply chain management, should be extended, as Williamson himself recently stated (Grover and Malhotra, 2003; Hobbs, 1996; Williamson, 2008). In line, Grover and Malhotra (2003) plea for future transaction cost research to evaluate different supply chain management challenges, such as the allocation of supply chain investments or the coordination problem of information and material flows across organizations caused by complex, global supply chains. We take up this challenge to use transaction cost theory to study supply chain management, in particular from a supply risk perspective.

However, transaction cost theory has been criticized for primarily concentrating on contractual issues and neglecting relational mechanisms (Ghoshal and Moran, 1996; Nooteboom et al., 1997; Poppo and Zenger, 2002). Yet, these relational mechanisms are considered to be an important antecedent to transaction specific outcomes, for instance explaining relation-specific supply risks, as opposed to environmental supply risks affecting all suppliers operating in a particular environment. Social exchange theory has been proposed to complement transaction cost based argumentations (Bunduchi, 2008; Liu et al., 2009; Young-Ybarra and Wiersema, 1999). It is based on the concepts of reciprocity and power-dependency, which might lead to opportunism, one of the key underlying assumptions of transaction cost theory (Rindfleisch and Heide, 1997), and core to the understanding of supply risks (Ariño, 2001; Manuj and Mentzer, 2008; Morgan et al., 2007).

Transaction cost economics and social exchange theory together may provide a more comprehensive explanation of the determinants of supply risk management performance and eventually lead to empirically backed guidelines for supply risk management.

2.3 Transaction cost theory and supply risk performance

The transaction cost theory describes market and hierarchies (firms) as different governance structures to complete transactions (Coase, 1937). If transaction costs are low, the market is the best governance structure, else vertical integration is the best option. Transaction costs comprise the costs for managing relationships (search costs, contracting costs, monitoring costs and enforcement costs) but also opportunity costs (stemming from inferior governance decisions) (Dyer, 1997; Rindfleisch and Heide, 1997). The two underlying assumptions of the transaction cost theory are bounded rationality and opportunism (Rindfleisch and Heide, 1997).

Bounded rationality assumes that decision makers are limited in their information processing and communication capability. These cognitive limitations become a problem in

uncertain environments, where it is not possible to specify circumstances surrounding an exchange beforehand and performance cannot properly be assessed afterwards. Opportunism is defined as "self-interest seeking with guile" (Williamson, 1985, p. 47). Decision makers may want to serve their self-interest when given the opportunity, resulting in cheating, lying, or violation of agreements, which might lead to supply problems.

Opportunism becomes a problem when asset specificity is present in a relationship, as in these relationships market competition does not serve as a "natural" restraint on opportunistic behavior. The two assumptions of bounded rationality and opportunism have a significant impact on supply risk management, as both give rise to possible supply risks (Chopra and Sodhi, 2004; Morgan et al., 2007). Bounded rationality can for instance lead to capacity problems when a supplier is not able to estimate future demands, which leads to the risk of no or delayed supply. An example of opportunism is intellectual property leakage.

The key constructs in transaction cost theory are asset specificity and uncertainty. Asset specificity refers to the transferability of assets that support a given transaction (Williamson, 1985). These assets have little or no value outside the exchange relationship, and therefore lead to sunk cost should the relationship end. Asset specificity is safeguarding problem: market competition is limited or absent and therefore does not serve as a restraint on opportunism. In general, asset specificity is regarded as the most influential transaction cost construct (Carter and Hodgson, 2006; David and Han, 2004; McIvor, 2009).

In transaction cost theory a distinction is made between two different types of uncertainty: environmental uncertainty and behavioral uncertainty. Environmental uncertainty refers to "unanticipated changes in circumstance surrounding an exchange" (Noordewier et al., 1990, p. 82). Environmental uncertainty translates into an adaptation problem: when circumstances surrounding an exchange relationship change it can be difficult to modify agreements (Rindfleisch and Heide, 1997). Behavioral uncertainty, on the other hand, stems from difficulties in monitoring the contractual performance of exchange partners (Williamson, 1985). This is an evaluation problem: it can be difficult to verify compliance with agreements of exchange partners (Rindfleisch and Heide, 1997).

These transaction cost constructs explain the existence of supply risks, as uncertainty is a key characteristic of risk (Yates and Stone, 1992). Environmental uncertainty can for instance be demonstrated by the existence of currency exchange rate risks or natural disasters, leading to environmental supply risks. Risks related to behavioral uncertainty are risks such as delayed deliveries linked to operational or strategic supply risks. The existence of asset specificity in an exchange relationship, finally, enlarges possible risk impacts, as it leads to sunk costs.

Since transaction cost theory has been criticized for being incomplete in mainly addressing the contractual characteristics of an exchange relationship, social exchange theory will be discussed below to address the relational characteristics of such a buyer-supplier relationship (Bunduchi, 2008; Liu et al., 2009; Young-Ybarra and Wiersema, 1999).

2.3 Social Exchange theory and supply risk performance

The basic idea of social exchange theory is that social exchanges consist of a series of interactions that generate obligations (Emerson, 1976). The concepts involved in this theory are actors, resources, structures and processes (Molm, 2003). Actors (e.g. persons, firms) exchange certain resources (e.g. goods or services) within a structure (e.g. dyadic relation or network). Different types of exchange relationships exist: negotiated exchange and reciprocal exchange (Blau, 1964).

In negotiated exchange there is a common decision process, in which the actors negotiate to find agreement on the exchange conditions (Blau, 1964; Cropanzano and Mitchell, 2005;

Molm, 2003). Buyer-supplier relationships generally are regarded as negotiated relationships, since exchange contracts are involved.

In contrast, reciprocal exchange is built on the concept of reciprocal interdependence (Cropanzano and Mitchell, 2005). An action of one partner leads to the response of another partner, but this response is uncertain. The actions of the partners are not negotiated and separately performed (Molm, 2003).

Central to social exchange theory are the concepts of power and dependency, as well as trust and commitment (Molm, 2003). The dependence in a social relationship creates power, as one party will be more dependent than the other (Emerson, 1962). Especially in negotiated relations, actors may be inclined to (mis)use this power and inequality and behave opportunistically (Cropanzano and Mitchell, 2005; Molm et al., 1999).

On the other hand social exchange theory suggests that exchange relationships can develop into mutual commitments, in which actors trust each other (Cropanzano and Mitchell, 2005; Molm, 2003). This relational view is increasingly regarded as complementary to the negotiated buyer-supplier relationship, as the social interaction fosters the development of commonly held norms and trust between the exchange partners (Liu et al., 2009; Poppo and Zenger, 2002). The development of norms and trust acts as a control mechanism against opportunism, elevates relational performance (Liu et al., 2009), enhances the supplier's willingness to share information (Tsai, 1998 #2560) and leads to preferred customer treatment by the supplier (Uzzi, 1997). Social exchange theory therefore contributes to the understanding of relational supply risks.

3. Hypotheses development

3.1 Asset specificity

Asset specificity refers to the extent in which investments are specific to a certain supply relationship (Williamson, 1985). If the investments have little or no value outside this relationship, they will lead to sunk cost should this relationship end. Asset specificity can take different forms, such as physical asset specificity (e.g. investments in customized equipment), human asset specificity (e.g. possession of specific knowledge that cannot be obtained elsewhere) or site specificity (Williamson, 1991). Asset specificity causes lock-in situations, as the investing party becomes dependent on his supply chain partner (Bensaou and Anderson, 1999; Hawkins et al., 2008). In cases of asset specificity there is an exposure to risks such as raising prices or reduction of service levels (David and Han, 2004; Ellram et al., 2008; Holcomb and Hitt, 2007; Leiblein et al., 2002).

Whereas, on the one hand it has been argued that asset specificity can increase opportunistic behavior (see e.g. Hawkins et al., 2008; Rindfleisch and Heide, 1997), on the other hand, in certain situations, asset specificity is also known to lead to more cooperative behavior. For instance, Liu et al. (2009) find that in a Chinese business context, asset specificity is more likely to lead to trust (and therefore cooperative performance and better performance) than to opportunistic behavior (and therefore worse performance). Also, Rokkan (2003) states that "in relationships characterized by a strong norm of solidarity, specific investments actually decrease the receiver's opportunism", as opposed to relationships with weak norms of solidarity where asset specificity leads to opportunism.

Whereas asset specificity can increase possible opportunism from the under-investor, it will also decrease possible opportunistic behavior from the investing party (Hawkins et al., 2008). Song and Di Benedetto (2008) found that suppliers are more involved in innovation processes with a buyer if the level of specific investments of that supplier is higher. In a study

about trust, Suh and Kwon (2006) find that supplier's specific investments decrease the risk for the buyer and lead to more trust within the relationship. They state that "a company might consider a transaction-specific asset invested by their partner as a favourable devotion to their relationship" (p. 197). So in situations of supplier's asset specificity, the supplier will try his best to keep his buyer satisfied, for instance by providing valuable information. The supplier does not want to risk the buyer stepping out of the relationship, because that would transform the supplier's specific investments to sunk cost. Therefore, in case of supplier's asset specificity, (risk) governance for the buyer will be easier and more likely to succeed because the supplier will cooperate as much as possible. Also, from a supplier's point of view, the buyer could be expected to behave opportunistically when the supplier made specific investments for the relationship. To avoid this opportunism the supplier will show devotion to the relationship, for instance by building commitment and trust (Carr and Pearson, 1999; Wathne, 2000). This will decrease supply risks such as intellectual property leakage or quality problems for the buyer.

Hypothesis 1. Supplier's asset specificity is positively related to the buyer's supply risk management performance.

3.2 Uncertainty

Uncertainty is characterised by unanticipated changes surrounding an exchange relationship. The transaction cost theory assumption of bounded rationality causes problems in situations of uncertainty: not all possible future contingencies can be taken into account when specifying exchange contracts, exposing buyers to possible supply risks (Grover and Malhotra, 2003). The more uncertainty there is in an exchange relationship, the less ability the buyer has to (properly) identify and assess possible supply risks. The opportunity to manage supply risks is lower when there is little ability to predict supply risks. Therefore, supply risk management performance is negatively influenced by uncertainty.

Second, as uncertainty is a key characteristic of risk (Yates and Stone, 1992), we can easily recognize that high levels of uncertainty lead to high levels of supply risks. So uncertainty also influences supply risks management performance simply because the amount of supply risks present in uncertain relationships is higher. Recognition and minimization of risks and their impact is easier when there are not that many risks around. More risk means that companies are less likely to succeed in avoiding or overcoming these risks, and if they are able to it will place a heavy burden on their resources.

The two types of uncertainty distinguished in transaction cost theory, environmental and behavioral, lead to different kind of supply risk management problems. Environmental uncertainty is the extent to which circumstances surrounding an exchange relationship cannot be specified beforehand (Grover and Malhotra, 2003). These changing circumstances can originate from different sources, for instance from the upstream or the downstream market (Joshi and Stump, 1999). Unpredictability of technology or demand volume are examples of environmental uncertainty, they lead to adaptation problems for the supply chain. In a rapidly changing environment, firms are easily caught by surprise as it is difficult to write contracts that take into account all possible future outcomes (Klein et al., 1990). Renegotiations of contracts are likely to be needed in such volatile markets, which for instance raises the risk of delays and supplier opportunism (Anderson and Schmittlein, 1984; Hawkins et al., 2008; Joshi and Stump, 1999; Walker and Weber, 1987).

Hypothesis 2. Environmental uncertainty is negatively related to the buyer's supply risk management performance.

Behavioral uncertainty exists within the context of an exchange relationship and is the extent to which compliance with agreements of exchange partners cannot be verified ex-post: the buyer has no assurance that the supplier performs as specified (Williamson, 1985). This leads to evaluation problems such as the inability to assess supplier's quality standards (Grover and Malhotra, 2003). Morgan et al. (2007, p 522-523) found that a buyer's "ability to monitor focal supplier behavior can limit opportunistic behavior", and Kaufmann and Carter (2006) show that behavioral transparency leads to an increase in non-financial performance of the supplier relationship. Consequently, the inability to assess supplier's performance is likely to lead to opportunism and performance risks (Heide and John, 1990). Or as Poppo and Zenger (2002, p. 709) state: "when performance is difficult to measure, parties have incentives to limit their efforts toward fulfilling the agreement". So in situations of high behavioral uncertainty buyers incur more risks which places a heavy burden on risk management efforts.

Hypothesis 3. Behavioral uncertainty is negatively related to the buyer's supply risk management performance.

Having indicated the transaction cost characteristics that influence supply risk management performance in exchange relationships, we will now further develop our framework by integrating relational aspects. Including these aspects will enhance our framework as it gives a more complete view of possible governance mechanisms to manage supply risks (Liu et al., 2009; Power and Singh, 2007). We will use social exchange theory to identify the antecedents of the transaction cost constructs. The two faces of social exchange theory, as discussed by Molm (2003), are power-dependence and commitment. As we will research the governance mechanism from the buyer's perspective, we will use buyer's dependency and buyer's preferred customer status to operationalize these two faces of exchange mechanisms.

3.3 Dependency

Dependency exists in situations where the buyer has to rely on the actions of a supplier to achieve his goals. A buyer's asset specificity can be a cause of dependency (as the buyer is dependent on the supplier for his assets), but more causes for dependency exist, such as a limited supply market or poor internal management of the buyer (Kumar et al., 1995; Lonsdale, 1999). If a buyer is dependent on a particular supplier, it is likely that this supplier will be less hesitant to make specific investments for this relationship. The buyer's dependency prevents him from walking out of the relationship, thus leading to less risk of sunk cost for the supplier. Therefore we state that buyer's dependency will positively influence supplier's specific investments.

On the other hand, in situations of buyer's dependency, a supplier can behave opportunistically and could limit knowledge transfer initiatives trying to maintain or widen a possible knowledge gap (Corsten and Felde, 2005). This opportunistic behavior is likely to increase behavioral uncertainty, as information asymmetry is a frequently found representation of behavioral uncertainty (Grover and Malhotra, 2003; Hobbs, 1996). Also, although the buyer will expect opportunistic behavior from the supplier, he does not know when and how it will emerge. Buyer dependency gives suppliers no incentive whatsoever to enlighten the buyer's evaluation problem caused by behavioral uncertainty.

Hypothesis 4. A buyer's dependency is positively related to (a) supplier's asset specificity and (b) behavioral uncertainty.

3.4 Preferred customer status

A buyer is a preferred customer when he is more attractive for his supplier than other customers of this supplier. As a consequence, the buyer enjoys preferential resource allocation by the supplier (Steinle and Schiele, 2008). Supplier's commitment to the relationship with the buyer and supplier's performance both increase when a buyer has preferred customer status (Ellegaard et al., 2003). Christiansen and Maltz (2002) describe that being an interesting customer for suppliers leads to suppliers attention and loyalty, and that it warrants open exchange of knowledge and information. So if the supplier prefers the buyer compared to other buyers, he will be more committed to the relationship and more willing to cooperate. Therefore it is more likely that the supplier is willing to make specific investments for this relationship, in favour of the buyer. Also behavioral uncertainty is likely to diminish. Behavioral uncertainty is an evaluation problem: it is difficult for the buyer to assess whether the supplier performs according to the agreement (Rindfleisch and Heide, 1997). In situations of high uncertainty, the introduction of more relational structures (such as preferential customer treatment) leads to purchasing performance improvement (Noordewier et al., 1990). If the supplier prefers the buyer he will serve this buyer before his other customers and direct the best resources to this buyer, thus effectively strategic supply risk is reduced. Also, the supplier will be more inclined to provide the buyer with the information needed to assess the supplier's performance. Finally, opportunistic behavior of the supplier is also less likely if the buyer has preferred customer status, as the supplier will be reluctant to take advantage of the situation at the expense of the buyer in order to avoid loosing this attractive customer. For instance, it has been found that the supplier's awarding a buyer with preferred customer status lead to a more benevolent pricing behaviour by the supplier, that is, the latter exactly not behaving opportunistically (Schiele et al., 2011). Knowledge on the supplier's prime commitment will also decrease the behavioral uncertainty for the buyer.

Hypothesis 5. A buyer's preferred customer status with suppliers is (a) positively related to supplier's asset specificity, (b) negatively related to behavioral uncertainty.

3.5 Control variables

We included firm size (in turnover) as a control variable, as bigger firms are more likely to succeed in their risk management effort. They have more opportunity to practice (they purchase more and have more suppliers) and more resources to devote to their supply risk management system than smaller companies do. We also included purchasing volume for the same reason; firms that purchase more will be better practiced and devote more resources to their supply risk management than firms which purchase lower volumes. The last control variable included is the percentage of global sourcing: international supply chains face additional risks compared to local supply chains.

Insert figure 1 about here

---

4. Methodology

4.1 Data collection and sample

Data was collected by means of a survey administered in German-speaking countries. For the survey the database of BMEnet, an organization linked to the German association of materials management, purchasing and logistics -BME- was used. In addition to that the survey was also sent to the customer database of a German consultancy firm. The survey was sent by email to employees responsible for supply management in several German speaking countries, yielding responses from Germany, Austria, Switzerland and Luxembourg. Additionally, the survey was announced on the homepages and newsletters of BMEnet and the consultancy firm. The email and the announcement contained a link to a homepage with the questionnaire. Only one single e-mailing was necessary, as all data could be collected within one week. Because of the short time span and single mailing, differentiation between early and late respondents is neither possible nor necessary. Since we had no direct access to the databases it was not possible to check for non-response bias. No significant difference in answers between the two groups (respondents from BMEnet and respondents from the consultancy firm) could be identified.

In total the survey yielded 207 usable responses. Most of the respondents were supply managers (59 %), others were supply employees (20 %), staff (4 %), board members (4 %), supply risk employees (2 %) and supply risk managers (1 %). On average, the respondents had spent 8.7 years at their companies. Respondents came from typical German industries: mechanical engineering (23 %), electronic and electrical engineering (13 %), automotive (12 %), chemical industry (5 %), services (13 %) and others (34 %). The average number of employees for the companies is 7.840 and the average purchasing volume is € 599 million.

4.2 Measurement development

All the measures in the survey are reflective and measured on a five-point Likert scale, answers ranged from 1 “no, not at all” to 5 “yes, completely”. Questions were asked in German language. The scales were originally developed in English and translated and back-translated by two specialists.

Asset specificity refers to what extend companies in an exchange relationship have made specific investments which are of no or minor value outside that relationship. We used the measures developed by Heide and John (1990) to measure these supplier’s specific investments. To measure *Environmental uncertainty* we used the volatility items as developed by Klein, Frazier and Roth (1990), which describe the extent to which firms are taken by surprise because of environmental changes. *Behavioral uncertainty* is about difficulties in monitoring the performance of a supplier. Therefore, we used part of the items described by Grover and Malhotra (2003) to measure monitoring suppliers’ performance. We adopted the items developed by Corsten and Felde (2005) for the *Dependency* construct. *Preferred customer status* is about the attractiveness of a customer for his supplier compared to other customers of this supplier. We adapted the items developed by Gao et al. (2005). The dependent variable to be explained is *supply risk management performance*: the ability of the buyer to avoid supply risks; recognize potential risks in due time to react; and in case of their occurrence, minimize the impact on the firm. We adopted the items for supply risk management performance from the items developed by Moder (2008). All items used can be found in appendix A.

5. Analysis and Results

We used SmartPLS (Ringle et al., 2005) to validate our measures and test our hypotheses. SmartPLS is a structural equation modelling tool that uses a series of interdependent OLS regressions to minimize residual variances (Chin et al., 2003). A PLS model consists of an outer (measurement) model and an inner (structural) model. The measurement model shows the relationship between the latent variables and their observed variables, and the structural model describes the relationships between the latent variables. PLS is suitable to estimate complex structural equation models, especially when the prediction of dependent endogenous variables is the core purpose of the research (Chin, 1998; Henseler et al., 2009). Also, PLS has less strict demands on data regarding sample size and distributional assumptions than covariance-based methods (Chin, 1998; Henseler et al., 2009). Finally, it has been shown that the estimates of PLS are more accurate with sample sizes of 250 or lower as compared to co-variance based algorithms (Reinartz et al., 2009).

When evaluating the PLS model three considerations are important: (1) the reliability and validity of the measurement model, (2) the size and significance of the path coefficients, and (3) the capability of the model to predict the outcome variables (Hulland, 1999).

5.1 Measurement model

To assess the indicator reliability of the model we first examined the individual item loadings with their respective constructs. All loadings except for three are well above the 0.7 threshold (Chin, 1998; Henseler et al., 2009). One item for buyer's dependency has a loading of 0.67, and two item loadings for the preferred customer construct were 0.67 and 0.69. Hulland (1999) argues that items should only be dropped when loadings are below 0.4 or 0.5, therefore we decided to leave these constructs intact. The composite reliability scores were highly satisfactory between 0.803 and 0.872 (see table 1), showing internal consistency for each constructs as they are well above the 0.6 threshold (Henseler et al., 2009).

Convergent validity shows that each item correlates strongly with the construct it relates to. Convergent validity is satisfactory because all items load positively and with a significant t-value on their respective constructs ($t > 7.8$). Also, the average variance extracted (AVE) for each construct is above 0.5 (Chin, 2010; Fornell, 1981): the latent variable explains at least 50 % of its indicators' variance (see table 1).

Insert table 1 about here

To assess discriminant validity for the constructs we used the Fornell-Larcker Criterion (Fornell, 1981), which prescribes that the AVE of a latent variable should be higher than the squared correlations between the latent variable and the other latent variables. Basically this means that the latent variables better explain the variance of its own indicators than the variance of other latent variables, as can be seen in the cross-correlation matrix in table 2: the square root of the AVE scores (in bold on the diagonal) are all greater than the cross-correlation scores.

Insert table 2 about here

5.2 Structural model

The structural model estimates the relationship between the different constructs. To determine the significance of the path coefficients we used a bootstrapping procedure with 207 cases and 1000 samples. Missing values were dealt with by mean replacement.

The path-coefficients and t-values of the constructs can be found in table 3. The model showed an R^2 of 19.6 %, which shows the theoretical and managerial relevance of our model (Combs, 2010). The R^2 of supplier's asset specificity is 25.2 %, and that of behavioral uncertainty is 13.3 %, indicating that both dependency and preferred customer status are good explanations for behavioral uncertainty, but other antecedents clearly exist, as a large part of the construct still needs to be explained.

Hypothesis 1 states that high asset specificity for a supplier will lead to high supply risk management performance. This hypothesis is confirmed as the path coefficient is 0.185 and significant ($p < 0.01$). For hypothesis 2 - high environmental uncertainty leads to low supply risk management performance - we did not find any support: the path coefficient is only -0.082 and not significant. The existence of behavioral uncertainty has a strong significant impact ($p < 0.001$) on supply risk management performance: high uncertainty leads to worse performance. The path coefficient of behavioral uncertainty is -0.336, showing that influence of behavioral uncertainty on supply risk management performance is much larger than that of supplier's asset specificity. Finally, hypotheses 4 and 5 are also supported: both dependency and preferred customer status have a significant impact on the two transaction cost constructs. The path coefficients from dependency to supplier's asset specificity and behavioral uncertainty are respectively 0.451 and 0.249, showing that high dependency leads to more asset specificity and more behavioral uncertainty. Preferred customer status has a positive effect on supplier's asset specificity and a diminishing effect on behavioral uncertainty (path coefficients resp. 0.199 and -0.278).

None of the control variables had a significant effect on any of the constructs, except for the percentage of global sourcing which has a significant effect on supply risk management performance.

Insert table 3 about here

---

6. Discussion

In this empirical paper we tested the influence of the transaction cost concepts on supply risk management performance. We hypothesized that supplier's asset specificity has a positive influence on supply risk management performance, and that both environmental uncertainty and behavioral uncertainty have a negative influence on supply risk management performance. Whereas we found no evidence for the negative effect of environmental uncertainty, we did show that both supplier's asset specificity and behavioral uncertainty have a significant effect on supply risk management performance. Furthermore, we tested the influence of dependency and preferred customer status as social exchange theory based antecedents of two of the transaction cost constructs, namely supplier's asset specificity and behavioral uncertainty. Dependency has a dual role in supply risk management performance. On the one hand, buyer's dependency has a positive influence on supplier's specific investments, leading to better supply risk management performance. On the other hand, a buyer's dependency leads to more behavioral uncertainty, thus having a negative effect on

supply risk management performance. Given that the influence of behavioral uncertainty on supply risk management performance is twice as big as the influence of supplier's asset specificity, buyer's dependency should best be avoided. Preferred customer status reveals to be a previously largely unnoticed but highly significant antecedent of the transaction cost constructs. When a buyer has been awarded preferred customer status by the supplier, the latter is more willing to invest in assets only used for this buyer. Also, behavioral uncertainty decreases when a buyer has preferred customer status.

6.1 Theoretical implications

The findings of this study support the premises of the transaction cost theory, and more specifically, establish the importance of this theory for supply risk management. We confirm the effectiveness of asset specificity and behavioral uncertainty as governance mechanisms in supply chain settings, and more precisely, we find behavioral uncertainty to be twice as influential on supply risk management performance. These findings follow on to the findings of Suh and Kwon (2006) who find a negative impact of behavioral uncertainty on trust in a partner. They state that "the impact of behavioral uncertainty on trust and other subsequent business decisions is becoming more important due to the increasing ambiguity in the ever changing business environments in the post modern world" (p. 197). Our findings adhere to their notion and we want to stress the importance of this contribution to the existing literature base of transaction cost theory, as most former studies claim that asset specificity is the most important governance mechanism in supply chain management (Carter and Hodgson, 2006; McIvor, 2009). Our findings imply that from a supply risk management perspective, research focus should be redirected from asset specificity issues to behavioral uncertainty. Both supply risk management and transaction cost theory could benefit from a more intensified focus on the concept of behavioral uncertainty, trying to elaborate on the antecedents of and effects caused by behavioral uncertainty.

Furthermore, we enhance theory building by developing a framework that integrates the transaction cost theory and the social exchange theory, thereby contributing to the recently emerged notion that transactional and relational governance mechanisms should be used in conjunction to effectively manage buyer-supplier relationships (Liu et al., 2009; Power and Singh, 2007). Supply risk management research benefits from such an integration as it addresses both the contractual and the relational governance mechanisms affecting performance, therefore providing a more comprehensive view on supply risk management issues. From a social exchange perspective, we show that both the negotiated and the relational view on exchange relationships need to be taken into account as governance mechanisms for buyer-supplier relationships. Our findings encourage to extend the integration of transaction cost theory and social exchange theory also beyond the field of supply risk management. The two bodies of theory complement each other from a conceptual perspective, while our research has provided encouraging evidence that also from an empirical perspective it is feasible to follow this path further.

6.2 Managerial implications

Our findings indicate that in supply management, supplier's asset specificity and behavioral uncertainty both are valuable governance mechanisms that can be used to increase risk management performance. Attention should first and foremost be given to behavioral uncertainty, as this is the most influential governance mechanism for supply risk management systems. In order to decrease behavioral uncertainty and increase supplier's asset specificity two relational governance mechanisms can be used: dependency and preferred customer

status. First of all, dependency has a somewhat dual role as a governance mechanism. In order to decrease behavioral uncertainty, companies should avoid dependency from their suppliers as much as possible, as a buyer's dependency significantly increases behavioral uncertainty. On the other hand, increasing a buyer's dependency will also increase supplier's specific investments, which has a positive influence in supply risk management performance. Dependency has therefore a difficult dual role in managing supply risks, which might depend on the type of risk which is supposed to be mitigated.

Secondly, preferred customer status is a valuable mechanism to increase risk management performance in supply chain relationships. A company's preferred customer status has a positive effect on supplier's specific investments and a negative effect on behavioral uncertainty. Therefore the relational mechanism of building preferential status with a supplier reveals to be a strong governance mechanism in managing supply risks. Extending previous findings on the benefits preferred customer status has on suppliers' flexibility (Williamson, 1991 #2559), global sourcing success (Steinle, 2008 #485) and supplier contribution to innovation and supplier pricing (Schiele, 2011 #2519), our research has shown that preferred customer status also contributes to better supply risk performance. This implies that companies should try to achieve preferred customer status with their key suppliers. To some extend preferred customer status can also compensate for the increase in behavioral uncertainty caused by dependency, thus generating a competitive advantage.

7. Limitations and future research

Our research is subject to several limitations. First of all, our survey investigated the different concepts and supply risk performance for a buyer in general. To get a better understanding of the functioning of transactional and relational governance mechanisms in specific situations, these concepts should be studied in dyadic buyer-supplier relationships as well. Furthermore, we didn't investigate the transaction cost concept of exchange frequency because this can only be measured for specific exchange relationships. Another issue for future research are possible other antecedents of behavioral uncertainty. Our R^2 of 13.3 shows that many other factors have an influence on behavioral uncertainty. Since this is the most important concept for risk management, more research is needed on this topic.

References

Anderson, E., Schmittlein, D.C., 1984. Integration of the Sales Force: An Empirical Examination. The RAND Journal of Economics 15, 385-395

Ariño, A., 2001. To Do or Not to Do? Noncooperative Behavior by Commission and Omission in Interfirm Ventures. Group and Organization Management 26, 4-23

Bensaou, M., Anderson, E., 1999. Buyer-supplier relations in industrial markets: When do buyers risk making idiosyncratic investments? Organization Science 10, 460-481

Blackhurst, J.V., Scheibe, K.P., Johnson, D.J., 2008. Supplier risk assessment and monitoring for the automotive industry. International Journal of Physical Distribution & Logistics Management 38, 143-165

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

Braunscheidel, M.J., Suresh, N.C., 2009. The organizational antecedents of a firm's supply chain agility for risk mitigation and response. Journal of Operations Management 27, 119-140

Bunduchi, R., 2008. Trust, power and transaction costs in B2B exchanges - A socio-economic approach. Industrial Marketing Management 37, 610-622

Carr, A.S., Pearson, J.N., 1999. Strategically managed buyer-supplier relationships and performance outcomes. Journal of Operations Management 17, 497-519

Carter, R., Hodgson, G.M., 2006. The impact of empirical tests of transaction cost economics on the debate on the nature of the firm. Strategic Management Journal 27, 461-476
Chin, W.W., 1998. The partial least squares approach to structural equation modeling, In: Marcoulides, G.A. (Ed), Modern methods for business research. Lawrence Erlbaum Associates, Mahwah, NJ, pp. 295-277
Chin, W.W., 2010. How to write up and report PLS analyses, In: Esposito Vinzi, V., Chin, W.W., Henseler, J., Wang, H. (Eds), Handbook of Partial Least Squares. Springer, Heidelbert etc., pp. 655-690
Chin, W.W., Marcelin, B.L., Newsted, P.R., 2003. A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. Information Systems Research 14, 189-217+218
Chopra, S., Sodhi, M.S., 2004. Managing risk to avoid supply-chain breakdown. Mit Sloan Management Review 46, 53-+
Christiansen, P.E., Maltz, A., 2002. Becoming an "Interesting" Customer: Procurement Strategies for Buyers without Leverage. International Journal of Logistics: Research & Applications 5, 177-195
Coase, R.H., 1937. The nature of the firm. Economica 4, 386-405
Combs, J., 2010. From the Editors: Big Samples and Small Effects: Let's not Trade Relevance and Rigor for Power. The Academy of Management Journal (AMJ) 53, 9-13
Corsten, D., Felde, J., 2005. Exploring the performance effects of key-supplier collaboration: An empirical investigation into Swiss buyer-supplier relationships. International Journal of Physical Distribution & Logistics Management 35, 445-461
Cropanzano, R., Mitchell, M.S., 2005. Social exchange theory: An Interdisciplinary review. Journal of Management 31, 874-900
Das, T.K., Teng, B.S., 2001. Trust, control, and risk in strategic alliances: An integrated framework. Organization Studies 22, 251-283
David, R.J., Han, S.-K., 2004. A systematic assessment of the empirical support for transaction cost economics. Strategic Management Journal 25, 39-58
Dyer, J.H., 1997. Effective interfirm collaboration: How firms minimize transaction costs and maximize transaction value. Strategic Management Journal 18, 535-556
Ellegaard, C., Johansen, J., Drejer, A., 2003. Managing industrial buyer-supplier relations - The case for attractiveness. Integrated Manufacturing Systems 14, 346-356
Ellram, L.M., Tate, W.L., Billington, C., 2008. Offshore outsourcing of professional services: A transaction cost economics perspective. Journal of Operations Management 26, 148-163
Emerson, R.M., 1962. Power-Dependence Relations. American Sociological Review 27, 31-41
Emerson, R.M., 1976. Social Exchange Theory. Annual Review of Sociology 2, 335-362
Fornell, C., 1981. Evaluating structural equation models with unobservable variables and measurement error. JMR, Journal of Marketing Research 18, 39
Gao, T., Sirgy, M.J., Bird, M.M., 2005. Reducing buyer decision-making uncertainty in organizational purchasing: can supplier trust, commitment, and dependence help? Journal of Business Research 58, 397-405
Ghoshal, S., Moran, P., 1996. Bad for practice: A critique of the transaction cost theory. Academy of Management Review 21, 13-47
Grover, V., Malhotra, M.K., 2003. Transaction cost framework in operations and supply chain management research: Theory and measurement. Journal of Operations Management 21, 457-473

Hallikas, J., Karvonen, I., Pulkkinen, U., Virolainen, V.M., Tuominen, M., 2004. Risk management processes in supplier networks. International Journal of Production Economics 90, 47-58
Hallikas, J., Virolainen, V.M., Tuominen, M., 2002. Risk analysis and assessment in network environments: A dyadic case study. International Journal of Production Economics 78, 45-55
Harland, C., Brenchley, R., Walker, H., 2003. Risk in supply networks. Journal of Purchasing and Supply Management 9, 51-62
Hawkins, T.G., Wittmann, C.M., Beyerlein, M.M., 2008. Antecedents and consequences of opportunism in buyer-supplier relations: Research synthesis and new frontiers. Industrial Marketing Management 37, 895-909
Heide, J.B., John, G., 1990. Alliances in Industrial Purchasing: The Determinants of Joint Action in Buyer-Supplier Relationships. Journal of Marketing Research 27, 24-36
Henseler, J., Ringle, C., Sinkovics, R., 2009. The use of partial least squares path modeling in international marketing. Advances in International Marketing 20, 277 - 319
Hobbs, J.E., 1996. A transaction cost approach to supply chain management. Supply Chain Management 1, 15
Holcomb, T.R., Hitt, M.A., 2007. Toward a model of strategic outsourcing. Journal of Operations Management 25, 464-481
Hulland, J., 1999. Use of partial least squares (PLS) in strategic management research: A review of four recent studies. Strategic Management Journal 20, 195-204
Johnson, M.E., 2001. Learning from toys: Lessons in managing supply chain risk from the toy industry. California Management Review 43, 106-+
Joshi, A.W., Stump, R.L., 1999. Determinants of commitment and opportunism: Integrating and extending insights from transaction cost analysis and relational exchange theory. Canadian Journal of Administrative Sciences 16, 334-352
Jüttner, U., Peck, H., Christopher, M., 2003. Supply chain risk management: outlining an agenda for future research. International Journal of Logistics : Research & Applications 6, 197 - 210
Kaufmann, L., Carter, C.R., 2006. International supply relationships and non-financial performance-A comparison of U.S. and German practices. Journal of Operations Management 24, 653-675
Klein, S., Frazier, G., Roth, V., 1990. A Transaction Cost Analysis Model of Channel Integration in International Markets. JMR, Journal of Marketing Research 27, 196
Kleindorfer, P.R., Saad, G.H., 2005. Managing disruption risks in supply chains. Production and Operations Management 14, 53-68
Knemeyer, A.M., Zinn, W., Eroglu, C., 2009. Proactive planning for catastrophic events in supply chains. Journal of Operations Management 27, 141-153
Kumar, N., Scheer, L.K., Steenkamp, J.-B.E.M., 1995. The Effects of Perceived Interdependence on Dealer Attitudes. Journal of Marketing Research (JMR) 32, 348-356
Leiblein, M.J., Reuer, J.J., Dalsace, F., 2002. Do make or buy decisions matter? The influence of organizational governance on technological performance. Strategic Management Journal 23, 817-833
Liu, Y., Luo, Y., Liu, T., 2009. Governing buyer-supplier relationships through transactional and relational mechanisms: Evidence from China. Journal of Operations Management 27, 294-309
Lonsdale, C., 1999. Effectively managing vertical supply relationships: A risk management model for outsourcing. Supply Chain Management 4, 176-183
Lui, S.S., Wong, Y.-y., Liu, W., 2009. Asset specificity roles in interfirm cooperation: Reducing opportunistic behavior or increasing cooperative behavior? Journal of Business Research 62, 1214-1219

Manuj, I., Mentzer, J.T., 2008. Global supply chain risk management strategies. International Journal of Physical Distribution and Logistics Management 38, 192-223
McIvor, R., 2009. How the transaction cost and resource-based theories of the firm inform outsourcing evaluation. Journal of Operations Management 27, 45-63
Melnyk, S.A., Stewart, D.M., Swink, M., 2004. Metrics and performance measurement in operations management: Dealing with the metrics maze. Journal of Operations Management 22, 209-217
Moder, M., 2008. Supply Frühwarnsysteme. Gabler, Wiesbaden
Molm, L.D., 2003. Theoretical comparisons of forms of exchange. Sociological Theory 21
Molm, L.D., Peterson, G., Takahashi, N., 1999. Power in negotiated and reciprocal exchange. American Sociological Review 64, 876-890
Morgan, N.A., Kaleka, A., Gooner, R.A., 2007. Focal supplier opportunism in supermarket retailer category management. Journal of Operations Management 25, 512-527
Mullai, A., 2009. Risk Management System - A Conceptual Model, In: Zsidisin, G., Ritchie, B. (Eds), Supply Chain Risk: A Handbook of Assessment, Management, and Performance. Springer, Bedford, pp. 83 - 101
Narasimhan, R., Talluri, S., 2009. Perspectives on risk management in supply chains. Journal of Operations Management 27, 114-118
Neiger, D., Rotaru, K., Churilov, L., 2009. Supply chain risk identification with value-focused process engineering. Journal of Operations Management 27, 154-168
Noordewier, T., John, G., Nevin, J., 1990. Performance Outcomes of Purchasing Arrangements in Industrial Buyer-Vendor Relationships. Journal of Marketing 54, 80-93
Nooteboom, B., Berger, H., Noorderhaven, N.G., 1997. Effects of trust and governance on relational risk. Academy of Management Journal 40, 308-338
Pavlou, S., Manthou, V., 2008. Identifying and evaluating unexpected events as sources of supply chain risk. International Journal of Services and Operations Management 4, 604-617
Poppo, L., Zenger, T., 2002. Do formal contracts and relational governance function as substitutes or complements? Strategic Management Journal 23, 707-725
Power, D., Singh, P., 2007. The e-integration dilemma: The linkages between Internet technology application, trading partner relationships and structural change. Journal of Operations Management 25, 1292-1310
Reinartz, W., Haenlein, M., Henseler, J., 2009. An empirical comparison of the efficacy of covariance-based and variance-based SEM. International Journal of Research in Marketing 26, 332-344
Rindfleisch, A., Heide, J.B., 1997. Transaction cost analysis: Past, present, and future applications. Journal of Marketing 61, 30-54
Ringle, C., Wende, S., Will, A., 2005. SmartPLS 2.0 (beta),
Ritchie, B., Brindley, C., 2007a. Supply chain risk management and performance - A guiding framework for future development. International Journal of Operations & Production Management 27, 303-322
Ritchie, B., Brindley, C., 2007b. Supply chain risk management and performance: A guiding framework for future development. International Journal of Operations and Production Management 27, 303-322
Rokkan, A.I., Heide, J.B., Wathne, K.H., 2003. Specific investments in marketing relationships: Expropriation and bonding effects. Journal of Marketing Research 40, 210-224
Schiele, H., Veldman, J., Hüttinger, L., 2011. Supplier innovativeness and supplier pricing: the role of preferred customer status. International Journal of Innovation Management 15, 1-27

Schoenherr, T., Rao Tummala, V.M., Harrison, T.P., 2008. Assessing supply chain risks with the analytic hierarchy process: Providing decision support for the offshoring decision by a US manufacturing company. Journal of Purchasing and Supply Management 14, 100-111
Song, M., Di Benedetto, C.A., 2008. Supplier's involvement and success of radical new product development in new ventures. Journal of Operations Management 26, 1-22
Steinle, C., Schiele, H., 2008. Limits to global sourcing?. Strategic consequences of dependency on international suppliers: Cluster theory, resource-based view and case studies. Journal of Purchasing and Supply Management 14, 3-14
Suh, T., Kwon, I.W.G., 2006. Matter over mind: When specific asset investment affects calculative trust in supply chain partnership. Industrial Marketing Management 35, 191-201
Tang, C., Tomlin, B., 2008. The power of flexibility for mitigating supply chain risks. International Journal of Production Economics 116, 12-27
Tang, C.S., 2006. Perspectives in supply chain risk management. International Journal of Production Economics 103, 451-488
Tang, O., Nurmaya Musa, S., 2010. Identifying risk issues and research advancements in supply chain risk management. International Journal of Production Economics
Uzzi, B., 1997. Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness. Administrative Science Quarterly 42, 35-67
Wagner, S.M., Bode, C., 2008. An empirical examination of supply chain performance along several dimensions of risk. Journal of Business Logistics 29, 307-325
Walker, G., Weber, D., 1987. Supplier competition, uncertainty, and make-or-buy decisions. Academy of Management Journal 30, 589-596
Wathne, K.H., 2000. Opportunism in interfirm relationships: Forms, outcomes, and solutions. Journal of Marketing 64, 36
Williamson, O., 1985. The economic institutions of capitalism : firms, markets, relational contracting. The Free Press, New York
Williamson, O.E., 1975. Markets and Hierarchies: Analysis and Antitrust Implications. The Free Press, New York
Williamson, O.E., 1991. Comparative economic organization: The analysis of discrete structural alternatives. Administrative science quarterly 36
Williamson, O.E., 2008. Outsourcing: Transaction cost economics and supply chain management. Journal of Supply Chain Management 44, 5-16
Yates, J., Stone, E., 1992. Risk-taking behavior. Wiley Chichester
Young-Ybarra, C., Wiersema, M., 1999. Strategic flexibility in information technology alliances: The influence of transaction cost economics and social exchange theory. Organization Science, 439-459
Zsidisin, G., Ellram, L., Carter, J., Cavinato, J., 2004. An analysis of supply risk assessment techniques. International Journal of Physical Distribution & Logistics Management 34, 397
Zsidisin, G., Ritchie, B., 2009. Supply Chain Risk: A Handbook of Assessment, Management, and Performance, In: Hillier, F.S. (Ed), INT. SERIES IN OPERATIONS RESEARCH & MANAGEMENT SCIENCE. Springer
Zsidisin, G.A., 2003. A grounded definition of supply risk. Journal of Purchasing and Supply Management 9, 217-224
Zsidisin, G.A., Panelli, A., Upton, R., 2000. Purchasing organization involvement in risk assessments, contingency plans, and risk management: An exploratory study. Supply Chain Management 5, 187-197
Zsidisin, G.A., Smith, M.E., 2005. Managing supply risk with early supplier involvement: A case study and research propositions. Journal of Supply Chain Management 41, 44-57

Appendix A Survey items

All questions are based on a 5-point Likert scale (1 = no, not at all; 3 = partly; 5 = yes, completely). Questions were asked in German language.

Supplier's asset specificity

- The procedures and routines developed by our suppliers as part of their relationship with our company are tailored to our particular situation
- We often use unusual technological standards and norms that require extensive adaptation by our supplier

Environmental Uncertainty

- We are often surprised by the market development in our industry
- We are often surprised by the actions of our competitors
- We are often surprised by the customer reaction

Behavioral Uncertainty

- It takes significant effort to detect whether or not suppliers conform to specifications and quality standards
- Accurately evaluating our major suppliers requires a lot of effort
- It is costly, in time and effort, to clearly monitor the performance of our key suppliers

Dependency

- It would be difficult for us to replace our key suppliers in the short term
- Our success depends significantly on the performance of our suppliers
- Our major suppliers command resources that we would have difficulties obtaining somewhere else

Preferred customer status

- Our major suppliers are keen to stay in a long-lasting exchange relationship with us
- If other companies make a better offer to our suppliers, our suppliers would probably accept, even if it would jeopardize the business relationship with us (R)
- The best resources of our suppliers work for us
- We have the impression that our company is more attractive to our suppliers than their other customers

Supply risk management performance

- Our supply risk management is better then that of our competitors
- Overall we are satisfied with our supply risk management

In recent years, we were able to (taking into account the industry cycle):

- Minimize the frequency of supply risks occurring
- Minimize the magnitude of the effect of occurring supply risks

Appendix B Figures and tables

Figure 1 Research model

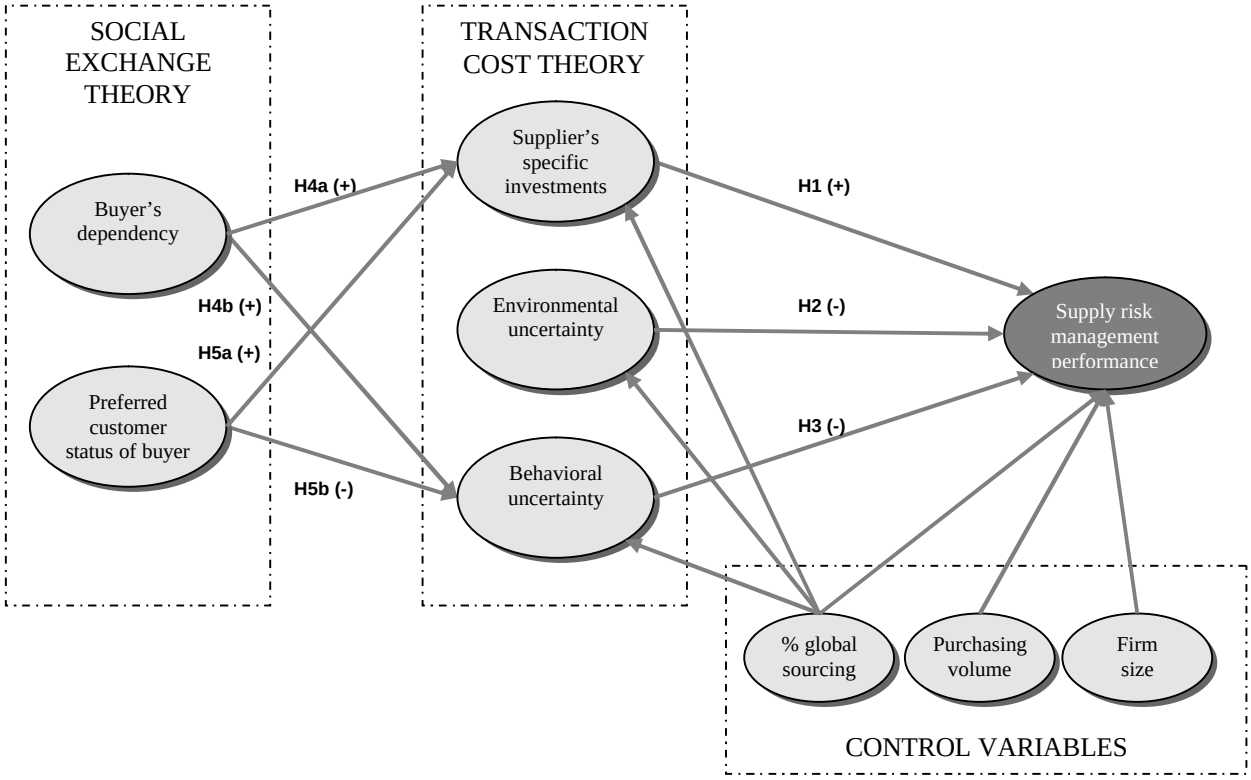

Table 1 Composite reliability and AVE scores

	Composite reliability	AVE
Supplier's specific investments	0.860	0.754
Environmental uncertainty	0.827	0.616
Behavioral uncertainty	0.872	0.696
Dependency	0.810	0.589
Preferred customer status	0.803	0.506
Supply risk management performance	0.867	0.620

Table 2 Construct cross-correlation matrix

	Supplier specific investm.	Env. uncer-tainty	Beh. uncer-tainty	Depen-dency	Pref. cust. status	Supply risk man. perf.	% glob. sourc.	Firm size	Purcha-sing volume
Supplier's specific investm.	**0.868**								
Environmental uncertainty	0.199	**0.793**							
Behavioral uncertainty	0.157	0.272	**0.834**						
Dependency	0.463	0.166	0.239	**0.765**					
Preferred customer status	0.212	-0.254	-0.268	0.049	**0.711**				
Supply risk man. perf.	0.128	-0.131	-0.328	-0.039	0.230	**0.788**			
% global sourcing	0.048	0.024	0.010	-0.006	0.068	0.180	**1.000**		
Firm size	0.048	-0.022	0.009	0.083	0.152	0.161	0.132	**1.000**	
Purchasing volume	0.080	0.060	0.035	0.049	0.096	0.107	0.089	0.826	**1.000**

[a] Values on the diagonal are shared variances within a construct (square root of AVE)

Table 3 Results of path-analysis

	Hypothesized path	Path coeffi-cient	t-value	Sig.
H1	Supplier's asset specificity => Supply risk man. perf.	0.185	2.558	$p < 0.01$
H2	Environmental uncertainty => Supply risk man. perf.	-0.082	0.962	n.s.
H3	Behavioural uncertainty => Supply risk man. perf.	-0.336	4.877	$p < 0.001$
H4a	Dependency => Supplier's asset specificity	0.451	8.441	$p < 0.001$
H4b	Dependency => Behavioural uncertainty	0.249	3.502	$p < 0.001$
H5a	Preferred customer status => Supplier's asset specificity	0.199	2.583	$p < 0.01$
H5b	Preferred customer status =>Behavioural uncertainty	-0.278	3.868	$p < 0.001$
	Control variables			
	% global sourcing => Supplier's asset specificity	0.037	0.572	n.s.
	% global sourcing => Environmental uncertainty	0.017	0.117	n.s.
	% global sourcing => Behavioural uncertainty	0.030	0.429	n.s.
	% global sourcing => Supply risk management perf.	0.158	2.353	$p < 0.01$
	Firm size => Supply risk management perf.	0.169	0.687	n.s.
	Purchasing volume => Supply risk management perf.	-0.045	0.184	n.s.