

**THE CAUSALITY OF SUPPLY RELATIONSHIPS:
A COMPARISON BETWEEN THE US, JAPAN AND EUROPE
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Abstract	This study examines the 'logic' or underlying causality of supply relationships. It develops and tests hypotheses, in a LISREL model, on detailed data for 553, 450 and 226 supply relationships in the US, Japanese and European automobile industries. The differences found between the three regions seem small, given the received view that there are fundamental differences between 'Japanese' and 'Western' contracting. However, the differences that remain suggest that in the US perhaps the 'Japanese system' has been surpassed, in a 'third way' that combines the advantages of sufficiently durable relations with the advantages of an open system with great variety.	
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This study examines the 'logic' or underlying causality of supply relationships. It develops and tests hypotheses, in a LISREL model, on detailed data for 553, 450 and 226 supply relationships in the US, Japanese and European automobile industries. The differences found between the three regions seem small, given the received view that there are fundamental differences between 'Japanese' and 'Western' contracting. However, the differences that remain suggest that in the US perhaps the 'Japanese system' has been surpassed, in a 'third way' that combines the advantages of sufficiently durable relations with the advantages of an open system with great variety.

Since the beginning of the 1980s, many Western automobile producers have changed their traditional arm's-length supply relationships – characterised by discrete transactions and short-term relationships – towards more commitment, in more durable relationships (Sako 1992, Helper 1994). This trend was inspired by Japanese achievements. It has been widely acknowledged that Japanese relationships of producers with main suppliers played a key role in the competitive advantage of Japanese automobile producers (Cusumano 1985, Womack et. al. 1990, Nishiguchi 1994). The present study seeks to understand and assess these developments. What are the underlying variables and their connections that drive these relationships? How do these differ between the US, Japan and Europe?

The analysis is conducted on the basis of a combination of perspectives:

- A theory of learning and innovation for insight in competence creation
- Transaction cost economics (TCE) for insight in issues of governance
- Social exchange theory for insight in commitment next to opportunism.

Williamson (1999) pleaded for the building of bridges between the competence and governance perspectives. We aim to contribute to that. The competence perspective tends to neglect issues of relational risk, while the governance perspective has neglected the dynamics of relations: the development of new competencies, insight in the motives of partners, and trust. From the competence perspective, we regard supply relationships as a means to utilise complementary competencies between buyers and suppliers and to develop new competencies. From the governance perspective of transaction cost theory we consider the governance of 'relational risk'. Next to the usual forms of 'specific' or 'dedicated' investment included in TCE, we suggest that building competencies and trust entails specific investments in mutual understanding and co-operation. In contrast with transaction cost economics, we include commitment and trust next to opportunism. TCE assumes that one cannot have reliable information on a partner's trustworthiness, but when we take relational dynamics and learning into account a basis for trust and commitment may emerge.

This combination of perspectives, based on earlier work of the authors, yields a set of hypotheses concerning variables that drive collaborative supply relationships and the causal relations between them. Many firm- and relation-specific characteristics are at play. For the identification and specification of those variables we build on a variety of earlier empirical studies from the literature (e.g. Monteverde and Teece 1982, Walker and Weber 1984, Levy 1984, Balakrishnan and Weber 1984, Anderson 1985, 1994, Dwyer et al. 1987, John and Weitz 1988, Heide and John 1988, 1990, 1992, Anderson and Weitz 1989, Achrol 1991, Buchanan 1992, Moorman et al. 1992, Parkhe 1993, Heide 1994, Morgan and Hunt 1994, Zaheer and Venkatraman 1995, Kumar et. al. 1995, 1998, Berger et al. 1995, Geyskens et. al. 1996, Nooteboom et al. 1997, Noorderhaven et al. 1998).

What is new here is that we recognise that causal relations between the variables are likely to be complex and circular. For example, one of the hypotheses is that dedicated investments increase dependence, and hence risk of hold-up. However, they can also increase

one's unique value for the partner, thus increasing his dependence, which increases his commitment, which reduces hold-up risk. Further examples will emerge from the empirical analysis. To test our hypotheses we employ the LISREL methodology, which is an appropriate tool to analyse such complex and sometimes circular patterns of causation.

A LISREL model is tested on data for 553, 450 and 226 supply relationships in the US, Japanese and European automobile industry. Estimates for the three regions are compared. We find differences that seem small, relative to the expectation we had on the basis of received views on systemic differences between 'Japanese' and 'Western' contracting. Several studies have argued that durable supply relationships are a specifically Japanese feature. They are supposed to be embedded and developed in a typically Japanese society characterised by high levels of trust, and for that reason cannot be established in the typically non-co-operative, competitive and low trust Western world of the United States and Europe (Hofstede 1980, Dore 1987, Womack et al. 1990, Cusumano and Takeishi 1991, Dyer and Ouchi 1993, Lamming 1993, Kamath and Liker 1994). Our results indicate that there has been considerable convergence towards a common system. Nevertheless, although there are only few remaining differences between the three regions, they seem significant. They suggest that in the US perhaps a 'third way' (Nooteboom 1998) has been found which combines the advantages of sufficiently durable relations with the advantages of an open system with a variety of relations that benefits innovation.

The outline of this paper is as follows. The first paragraph provides the theoretical basis for the study. The second paragraph specifies the variables of the LISREL model. The third paragraph specifies hypotheses. The fourth paragraph describes the data collection. The fifth paragraph presents the empirical results. The final paragraph discusses the results, limitations and further research.

THEORY

Transaction cost theory

We employ some of the insights of transaction cost economics (TCE), specifically from (Williamson 1985). That allows for 'hybrid' forms of governance 'between market and hierarchy'. The core insight from TCE is that dedicated investments create dependence, resulting in a risk of 'hold-up'. This risk is greater to the extent that there is uncertainty concerning motives and conditions of collaboration. Given the hazards of opportunism, this risk must be 'governed'. The higher this risk, the more it will require organisational integration or bilateral contracting to control it.

We take into account that there is widespread dissatisfaction with the transaction cost explanation of organisation. Empirical evidence has presented modes of governance, such as the ones studied in this article, which could not be assimilated completely into Williamson's (1985) framework. Moreover, although transaction cost economics may contribute to the explanation of why organisations exist, it has virtually nothing to say about how they work. Furthermore, it has little to say about the development of novel competencies. Finally, contrary to transaction cost economics (Williamson 1993), trust and loyalty matter. Complementary theoretical insights are needed to understand collaboration between firms. We incorporate two extensions: the development of competencies and the role of commitment.

Competencies

The first extension draws from Nooteboom's (1992) more dynamic perspective on transaction cost theory, which combines competence and governance perspectives. While Williamson focuses on static efficiency –efficiency is maximised by trading off production

costs, transaction costs and costs of organisation, given a certain state of knowledge, technology and preference– Nootboom employs a perspective of dynamic efficiency or innovation, incorporating shifts of knowledge, technology and preferences.

The current shift in many industries from 'making' to 'buying' is best explained on the basis of dynamic efficiency. In order to be at the forefront of development, and to maintain flexibility of configurations of competencies, for the sake of innovation, a producer should concentrate on the activities at which he is best, and should outsource the other activities as much as strategically possible. Furthermore, in order to reduce development times of new products and to reduce risks of maladjustment to customer needs, the supplier should be brought in as a partner in developing and launching a new product. Ongoing interaction between a customer and a supplier is a necessary condition in order to share and develop competencies.

The importance of complementary competencies is underpinned by a theory of knowledge that suggests that people's perceptions and interpretations are dependent on mental frameworks that in turn depend on idiosyncratic experience (Nootboom 2000). Those frameworks constitute 'absorptive capacity' (Cohen & Levinthal 1990). The need to create a common focus, in order to achieve common goals, is more fundamental for organisations than the need to reduce transaction costs. This is the idea of an organisation as a 'sensemaking system' (Weick 1979, 1995), 'system of shared meaning' (Smircich 1983), 'focusing device' (Nootboom 1992, 1999), or 'interpretation system' (Choo 1998). However, such organisational focus creates a risk of myopia, which needs to be repaired by employing complementary cognition from appropriate partners, at a 'cognitive distance' that is sufficiently large to yield novel insight and sufficiently small to ensure that it is still comprehensible (Nootboom 1992, 1999, 2000).

This yields a prediction that is opposite to a prediction from TCE. According to the latter, firms make more, rather than buying, when uncertainty increases, because that makes control of hold-up in outside contracting more difficult. According to Nootboom, when uncertainty increases, in the sense that technologies and markets become more complex and change becomes faster, firms have a greater need for outside complementary competence, for the sake of flexibility and learning. As a result, under higher uncertainty firms use outside suppliers more rather than less.

Competencies are not off-the-shelf products but are embedded in the heads and hands of people, in teams, organisational structure and procedures, and organisational culture. They often have a strong tacit dimension. Their development is path-dependent in the sense that they are contingent upon preceding firm-specific assets and organisational learning (cf. Lippman and Rumelt 1982). In case of tacit knowledge, ongoing interaction is needed to enable the transfer of knowledge. The linkage between firms with different complementary perspectives and competencies requires appropriate absorptive capacity and a shared language for communication. This takes time to develop, on the basis of interaction, and represents a dedicated investment, so that relations have to last a sufficiently long time to make the investment worthwhile.

Commitment and trust

We need to consider not incidental and unrelated transactions as in transaction cost economics, but transactions in the setting of an exchange relationship that develops in time (Granovetter 1985, Helper 1987, Ring and Van de Ven 1992, Sako 1992, Gulati 1995, Nootboom 1996, de Jong 1999). Not the transaction –as in Williamson's theory– but the relationship needs to be the unit of analysis. One reason for this was argued in the previous section: the need to develop and recoup dedicated investments in the building, exchange, absorption and utilisation of complementary competence.

In addition to that, an important cause as well as a consequence of repeated interaction among firms is the emergence of commitment, as a basis for trust. Commitment is

an important safeguard for relational continuity. A committed partner does not immediately exit from the relationship in case of (unforeseen) problems, but engages in 'voice' (Hirschman 1979, Helper 1987). Trust is a complex and slippery concept and cannot be fully discussed here (for a systematic discussion, see Nooteboom 2002). Trust and commitment can have both a calculative and an affective basis. Commitment may result from habituation (Gulati 1995, Nooteboom et al. 1997, de Jong et al. 1997). Also, as a relationship develops, partners begin to know each other better, and can better assess the extent and limits of trustworthiness ('knowledge based trust'). Convergence of cognitive frameworks may arise, which can lead to mutual identification ('identification based trust', cf. Lewicki and Bunker 1996). Partners understand and can identify with each other's goals, weaknesses and mistakes, and are able to engage in the give and take of voice. This does not entail that they always agree. There may be sharp disagreements, but those are combined with a willingness to express and discuss them more or less openly, while extending mutual benefit of the doubt. As a result, conflicts may deepen the relationship rather than breaking it. Mutual openness is essential to the building of trust (Zand 1972). An extensive communication system is necessary to facilitate the rich flow of information needed for the 'let's work things out' approach of the voice strategy. This information flow both requires and engenders a high degree of commitment to the relationship. In contrast, an exit-based strategy requires low commitment, so as to maintain the credibility of the threat to leave.

This does not entail that relations should last endlessly. Indeed, relations can become too durable, with too much mutual identification and trust, yielding rigidities and lack of the variety that is needed for learning. Relationships should last sufficiently long to recoup the investments necessary for high added value and learning by interaction, but not longer than that. What will emerge from this study is that while Japanese relations engendered high added value in durable collaboration, such collaboration can become too durable (Nooteboom 1998).

VARIABLES

This paragraph defines eight firm- and relation-specific variables. In empirical research of inter-organisational relationships there is much variation in topics, aims, constructs, hypotheses, data collection and methods. Nevertheless, for most of the theoretical constructs incorporated in this study, similar or closely related constructs can be found in previous empirical studies.

Supplier's dedicated investments

Supplier's dedicated investments are defined as investments in physical and/or human assets that are required to support the exchange in the focal relationship and are of less worth elsewhere (Williamson 1985). This core concept of transaction cost economics has been extensively employed in empirical research on transaction-cost explanations of vertical integration (e.g. Monteverde and Teece 1982, Walker and Weber 1984, Levy 1984, Anderson 1985, Heide and John 1988, 1990, John and Weitz 1988, Anderson and Weitz 1989,) and relational governance (e.g. Dwyer et al. 1987, Heide and John 1992, Zaheer and Venkatraman 1995, Berger et al. 1995, Nooteboom et al. 1997, Noorderhaven et al. 1998). With few exceptions, strong support is found for the expected effect of dedicated investments. They increase (perceived) risk of dependence (hold-up), and this tends to stimulate organisational integration. Heide and John (1990) find that dedicated investments also increase the extent of joint action. Further, they find that the supplier's investments in dedicated assets increase the expectations of relationship continuity. Buyer's dedicated investments are not included in the present analysis because they were absent or much less than suppliers' dedicated investments, and this is mostly the case in buyer-supplier relations.

Dependence

For both supplier and buyer, dependence is defined in terms of switching costs, i.e. as the loss due to a break of the relationship. Heide (1994) uses the replaceability of the firm's existing partner as a measure of the firm's dependence and shows that unilateral dependence undermines opportunities of flexibility, but that symmetric and high dependence promotes opportunities of flexibility. In a similar vein, Buchanan (1992) and Heide and John (1988) find that high mutual dependence enhances performance. Some studies on interorganisational exchange also incorporate the concepts of 'total interdependence' and 'interdependence asymmetry'. The former is the sum of both firms' dependence, and the latter is the difference in dependence on the two sides of a dyad (Berger et al. 1995). Kumar et al. (1995) show that total interdependence in a channel relationship has a positive effect on commitment. Further, they find that greater interdependence asymmetry increases conflict and decreases commitment. Geyskens et al. (1996) show that greater total interdependence increases both 'affective' and 'calculative' commitment. Berger et al. (1995) found similar effects on supplier's perceived dependence and supplier's net dependence (excess of own dependence over buyer's dependence).

Value

From a competence perspective the value that partners offer each other, in terms of competence, is a crucial variable. Value is defined as the competencies (including skills, knowledge and experience) partners offer each other. Transaction cost economics has a rather limited perspective on the value of the partner because it mainly emphasises the cost economising relevance of interorganisational exchange. Beside productive efficiency, value includes many more dimensions such as developmental capacity, value as a source of learning (innovative capabilities), international presence, and continuity.

Commitment

Customer's commitment is defined as the customer's efforts to maintain and continue the relationship (cf. Helper 1987). Most empirical studies find strong support for the expected positive effect of trust on 'continuance' commitment (e.g. Anderson and Weitz 1989, Achrol 1991, Moorman et al. 1992, Morgan and Hunt 1994). Geyskens et al. (1996) find that commitment is greater when total interdependence is higher and that when asymmetry increases, commitment decreases for the less dependent party and increases for the more dependent party. Berger et al. (1995) find that trust in buyer's 'goodwill' has a negative effect on the dependence perceived by the supplier. Nooteboom et al. (1997) found confirmation of the expectation that trust has a negative effect on the perceived probability of relational loss.

Future perspectives

Expectations of the future, or the 'shadow of the future', have an important impact (Macneil 1974, Heide and Miner 1992, Nooteboom 1996). In terms of the distinction made by Nooteboom et al. (1997) between effects on the size and on the probability of relational loss, expectations or 'future perspectives' have an effect on both. The supplier's future perspectives is defined as the supplier's expected continuation of the relationship with the dedicated customer of the focal dyad at a given point in time (cf. Parkhe 1993). Heide and Miner (1992) find support for the hypothesis that anticipated open-ended future interaction, which they define as 'extendedness', increases the chance of a pattern of co-operative behavior. Parkhe (1993) also showed that co-operative performance is promoted the longer the 'shadow of the future'. Anderson and Weitz (1989) also found that expectations of open-ended interaction between buyers and suppliers have a positive influence on the supplier's

investments in dedicated assets. This is consistent with the theory and experiments on repeated games (Axelrod 1984, Heide and John 1990), which show that an expectation of relational continuity increases collaboration.

Uncertainty avoidance

Uncertainty is an important variable in TCE and refers to the difficulty in predicting actions of partners or outside contingencies. Consistent with Williamson (1985) several studies have shown that uncertainty demands greater vertical integration in order to gain the opportunity to monitor and direct behavior (Anderson 1985, Zaheer and Venkatraman, 1995). Other studies, however, show conflicting evidence of the effects of uncertainty (Balakrishnan and Weber 1984, Anderson 1994). Nooteboom (1999) claims that greater uncertainty causes firms to engage more in outside relations, not less. We employ a variable 'supplier's uncertainty avoidance', which refers to the supplier's inclination or desire to avoid risks. One way to avoid risks is to avoid switching costs, by holding back on dedicated investments.

HYPOTHESES

This section develops our model, with causal relations between the variables identified in the previous paragraph. While previous studies tended to explain single variables, such as dependence, perceived relational risk, form of governance (integration, contracting), we take into account the fact that variables interact in more complex ways. Variables are explained by others but also constitute explanatory variables for them, in chains of causation that can be circular. One particularly important causal loop is the following. Dedicated investments yield dependence and hence relational risk, but they may also increase the unique value one offers to the partner, which increases his dependence and his commitment, and thereby reduces relational risk. It is important to test if this causal loop indeed occurs. If it does, it may indicate that there can be governance by mutual dependence on the basis of dedicated investments, without the need for detailed contracting. This is particularly important when contracts are costly and cumbersome, and may block the innovation and learning which is the purpose of the relationship. Clusters of hypotheses will be presented under four headings that represent what we propose as the main features of supply relationships: dedicated investments, value of the partner, commitment and uncertainty.

Dedicated investments

The hypotheses concerning the determinants and consequences of dedicated investments are as follows:

- H1A supplier's dedicated investment has a positive effect on the supplier's dependence.
- H1B supplier's future perspectives has a positive effect on the supplier's dedicated investments.
- H1C customer's value to the supplier has a positive effect on supplier's dedicated investments.

According to transaction cost economics, hold-up risk derives from dependence as the result of switching costs, which arise from dedicated investments. This yields hypothesis 1A.

One safeguard against relational risk suggested by transaction cost economics is vertical integration. In the present study vertical integration does not arise because we study relationships between two autonomous entities. Other safeguards are contracts, shared ownership of dedicated assets, and the use of hostages. Contracts are indeed used. There will

seldom be no contract at all. However, contracts may have several parts and may serve a variety of purposes (Klein Woolthuis 1999). One purpose is technical, to serve as a mere record, to support memory, like minutes of a meeting. This type of content can be quite extensive if the interface between partners is technically complex. Another purpose of a contract may be symbolic, as the seal of a psychological rather than a legal contract, or as a ritual of agreement. This type of contract tends to be very limited in content. Finally, a contract may indeed have the purpose intended by transaction cost economics, to safeguard against possible opportunism. To find out what the role of a contract is, one cannot simply record whether a contract is in place (there will always be a contract in some form). Nor is it sufficient to measure the size of the contract, since extensive contracts may have the purpose not of safeguarding against opportunism but of a record for technical co-ordination. In fact, contracts often lack the detailed contractual safeguards that transaction cost economics suggests. Such safeguards are inevitably incomplete; the more so to the extent that there is uncertainty and the purpose of the relationship is innovation. They can be very costly to monitor and to re-specify when circumstances change, and may be a source for mutual distrust when applied strictly. However, the principle of safeguarding remains important. It can be achieved by other means than contracts. For lack of a relevant measure of contracts we do not include a hypothesis stating that dedicated investments lead to contracts for safeguarding. In view of the limited viability of contracts as safeguards this may not constitute a problem. Macauley (1963) already indicated the limited significance of contracts in collaborative relations.

We propose several determinants of dedicated investments. Firstly, there must be future perspectives, i.e. the perspective of future exchange is needed to ensure that dedicated assets will be recouped. This yields hypothesis 1B. A second determinant comes from the competence perspective, where value of the partner is the core concept. The customer's value to the supplier can be defined as all skills, competencies, and capabilities the customer can offer the supplier. The more important the customer is to the supplier, the more incentives the supplier will have to invest in the relationship to make sure that the relationship continues and it maintains access to the customer's resources. This yields hypothesis 1C.

Value of the supplier

The hypotheses concerning supplier's value to the customer are as follows:

H2A Supplier's dedicated investment has a positive effect on the supplier's value to the customer.

H2B Supplier's value to the customer has a positive effect on customer's dependence.

Transaction cost economics is certainly correct to argue that dedicated investments may create risks of dependence. However, dedicated investments also create value and this may create countervailing dependence. When the supplier makes dedicated investments, he will be better able to perform tasks that are geared to the specific needs of the buyer, and therefore the supplier's value to the customer will increase. This yields Hypothesis 2A. Examples of the two-sided effect of dedicated investments, on supplier dependence and his value to the customer, are Toyota's customer supplier just-in-time systems (Dyer and Ouchi 1993). Customised investments are necessary to realise organisational input (division of labor, cycle times, and staff training), information systems, plants and other flexible manufacturing systems often not readily applicable to other partners. The customised investments, however, also create value because they reduce complexity and costs by eliminating inventories and work in progress, which ensures that there are no unnecessary buffer stocks, distribution facilities or quality inspections.

Value created by the supplier for the customer increases the latter's dependence. This yields hypothesis 2B.

Buyer commitment

The antecedent and two consequences of customer's commitment are as follows:

- H3A Customer's dependence will have a positive effect on customer's commitment.
- H3B Customer's commitment will have a positive effect on customer's value to the supplier.
- H3C Customer's commitment will have a positive effect on supplier's future perspectives.

Thus far we considered risks, safeguards, and the development of competencies. Next, we turn to customer's commitment, i.e. the customer's motivation for continuation of a long-term supply relationship. Calculative commitment (cf. Geyskens et al. 1996) refers to the customer's need to maintain the relationship given the anticipated switching costs associated with leaving. It is the result of the calculation of costs and benefits, including an assessment of the investments made in the relationship and the ability to replace or make up for the foregone investments should the relationship be terminated. Hence, the greater the customer's dependence, the greater the customer's commitment. This is hypothesis 3A.

As explained by Helper in her exit-voice approach, customer's commitment refers to all the customer's efforts to work out problems with the supplier rather than ending the relationship. Therefore, customer's commitment will contribute to the customer's value to the supplier. For example, a new supplier may present himself, offering a similar product of equal quality but at a lower price than the customer's current supplier. As a response, a committed customer will offer his current supplier assistance –for example, via specialised technical support teams– to help the current supplier to lower his price and to match his competitor's production performance. This yields hypothesis 3B.

Finally, we expect the customer's commitment to be related to the supplier's future expectations of the relationship. Customer's commitment is an indicator for the supplier that the customer will not end the relationship in the short run. Therefore, customer's commitment will increase the supplier's future perspectives. This yields hypothesis 3C.

Uncertainty avoidance

The hypothesis concerning uncertainty avoidance are as follows:

- H4A Customer's commitment will have a negative effect on supplier's uncertainty avoidance.
- H4B Supplier's uncertainty avoidance will have a negative effect on supplier's dedicated investments.
- H4C Supplier's dependence has a positive effect on supplier's uncertainty avoidance.

Customer's commitment indicates that the customer will not engage in opportunistic behavior as soon as the opportunity and an incentive for it arise. In other words, he will engage more in voice than in exit. This increases the willingness of the supplier to accept dependence. This yields hypothesis H4A.

Supplier's uncertainty avoidance refers to the supplier's inclination or desire to avoid risks, in particular hold-up risk. This risk is determined by the degree to which one is dependent, as a result of dedicated investments. Hence, one way of reducing the risk of hold-up is to reduce dedicated investments and thus reduce dependence. This yields hypothesis 4B: uncertainty avoidance has a negative effect on dedicated investments.

Suppliers dependence increases his perceived relational risk, and hence uncertainty avoidance. This is hypothesis 4C.

The causality of supply relationships

The eleven hypotheses are summarised in Table 1. Together, they yield our theoretical model. This model is presented in Figure 1.

Table 1 and Figure 1 about here

DATA AND METHOD

Data

We employ data on supply relationships that were collected via surveys in the automobile industries of the United States, Japan and Europe. The surveys were part of and financed by the International Motor Vehicle Program of the Massachusetts Institute of Technology (Cambridge, the United States), and were executed by Susan Helper and Mari Sako. The surveys were mailed to the first-tier suppliers of automobile producers. Respondents were asked to answer the survey questions for their most important customer regarding one product that was typical of their company's output and with which they were familiar. The response rates specified below were after accounting for those firms which were unreachable (mail sent to them was returned undelivered), and those which were not eligible to participate in the survey (they were not first-tier suppliers, or they specialised in supplying for heavy trucks and buses).

In spring 1993, the US survey was mailed to every automotive supplier and automaker division mentioned in the Elm guide to Automotive Sourcing. This guide lists the major first-tier suppliers –both domestic and foreign owned– to manufacturers of cars and light trucks in the United States and Canada. The target respondents were the divisional directors of marketing at independent firms and the divisional business managers or directors of strategic planning at car manufacturer components divisions. Since they commonly take a lead in interfacing with customers, they were deemed the most knowledgeable informants about customers' procurement practices. The US respondents had a wealth of experience, and were thus the single individuals able to answer all of the questions for the customer/product pair they chose. US respondents averaged more than 18 years in the automobile industry and more than 11 years in their companies. The response rate of the US survey was 55 per cent. The US survey provides detailed information about 665 supply relationships.

In Japan the survey (in Japanese) was sent out in July 1993 to all members of the Japan Auto Parts Industries Association (JAPIA), to all automotive suppliers named in *Nihon no Jidosha Buhin Kogyo 1992/1993* (Japanese Automotive Parts Industry, published by Auto Trade Journal Co. Inc. and JAPIA, Tokyo, 1992), and to the component divisions of vehicle manufacturers. The latter publication lists all first-tier suppliers (both domestic and foreign-owned) to the eleven manufacturers of cars and trucks in Japan. In order to maintain consistency with the US sample, the respondents were asked not to respond with respect to heavy trucks and buses. The target respondent in Japan was the director of sales and marketing at independent firms. For member companies of JAPIA, the survey was sent to the main contacts named by JAPIA, many of whom were either chief executives or marketing directors. JAMA (the Japan Auto Manufacturers Association) took responsibility to identify the respondents for the vehicle manufacturer components divisions. The Japanese respondents were generally well experienced: they had worked for 22 years on average at their company. The response rate was 30 percent, with 45 percent among JAPIA members. The Japanese survey provides detailed information about 472 supply relationships.

In the spring of 1994, the European survey was sent out to about 1,600 major automotive suppliers in Western Europe. This sample was compiled from several sources, including trade associations and the major vehicle manufacturers in Europe. The target respondent was the director of sales and marketing at each firm. Here also, respondents were asked not to respond with respect to heavy trucks and buses. The respondents had a wealth of experience: European respondents averaged 16 years in the automobile industry and 8 years with their companies. The response rate was 16 percent: 25 percent among suppliers from the United Kingdom, 24 percent from Germany, 9 percent from France, and 10 percent from Italy. The European survey provides detailed information about 268 supply relationships.

The data employed in this study have three main advantages. First, they provide very detailed information about the relationship between a supplier and a customer, which enable us to construct the many variables that we are interested in. Second, many items required the respondent to score on a Likert or a semantic differential type scale; i.e. many items refer to the perceptions of respondents. Measuring perceptions is increasingly acknowledged as being important because it is often perceptions rather than objective criteria that drive a firm's decision-making process. Third, the data allowed us to compare the three regions of the US, Japan and Europe. Fourth, the data concerned the automobile industry, which in all the three regions considered is one of the main industries in terms of its contribution to gross domestic product and employment. The automobile is a complex product to which supply relationships are tremendously important. An average car consists of about 15,000 components, all of which have to be produced, delivered and assembled in order to produce a well-functioning vehicle. As a result, supply does not concern mere commodities, and collaboration on the basis of dedicated investments is highly relevant.

Selection and response

Supply relationships have at least three phases: they start, they develop, and they end. Given that this paper focuses on the in-between part of ongoing interorganisational exchange, we decided to delete those respondents that answered the survey with respect to young, initial relationships. The survey incorporated a question that asked the respondent to indicate approximately how long (in years) they sold products in the particular product line to the specific customer. We used this information to remove all respondents having a past duration of the relationship of three years or less. The selection procedure results in three databases that provide us with detailed information on 553, 450 and 226 supply relationships in the United States, Japan and Europe respectively.

The European response rate may seem low. A low response rate is particularly worrisome when one intends to analyse levels of variables. The main aim of this study, however, is to identify causal relationships between variables, and here the issue is more indirect: is there any reason why there should be a response bias in causal relations? With respect to both the United States and Japan, non-response bias is assessed in several ways. First, the characteristics of those who returned the survey were compared to those of the entire population. On the characteristics of size and location no significant differences are found. Second, the survey respondents are divided into two groups based on response data. The hypothesis is that those who responded only after the second follow-up mailing might have more in common with those who did not respond at all than those who responded early. This test shows no significant differences for early and late respondents on any of the measures reported in appendix A. The statistical significance in both cases is judged using a one per cent cut-off point. With respect to Europe, a non-response analysis is not available and hence, a non-response bias may exist.

Method

This study follows the two-step approach of LISREL, separating the measurement models from the structural model (Hair et al. 1995, Jöreskog and Sörbom 1993a, 1993b). Multi-item measures based on construct definitions were developed for the six latent constructs: supplier's dependence, customer's dependence, supplier's value, customer's value, customer's commitment, and supplier's uncertainty avoidance. As usual, observed indicators that constitute the items of the survey measure these latent constructs. The other two constructs, supplier's dedicated investments and supplier's future perspectives, are measured by one item. Appendix A provides an overview of the eight constructs and the corresponding items of the survey. In the choice of items, much use has been made of previous empirical studies.

For the factor-analytic measurement of the latent constructs we used LISREL's maximum likelihood (ML) estimation procedure, based on a polychoric correlation matrix of items per construct. The acceptance level for factor-loadings was the usual .30 and estimated t-values should be larger than 2. Scale items for a specific construct were added to obtain composite measures for the six latent constructs.

For the structural model we again used LISREL's ML estimation procedure –based on the correlation matrix of the eight constructs– to obtain the standardised estimates of the parameter coefficients and the t-values. This information is used to test the hypotheses. A hypothesis is considered to be confirmed if the estimated path-coefficient is significant and has the hypothesised sign. A t-value larger than 1.28 corresponds to $p < .10$ (weakly significant); a t-value larger than 1.65 corresponds to $p < .05$ (moderately significant) and a t-value larger than 2.33 to $p < .01$ (strongly significant). Also, we used LISREL to calculate three of the most common indicators for the evaluation of the global model-fit (Boomsma 1996, Browne and Cudeck 1992, Jaros et al. 1993). These global model-fit indicators are the goodness-of-fit (GFI) index, the adjusted goodness-of-fit (AGFI) index, and the root mean square error of approximation (RMSEA). For the GFI and AGFI, a value greater than .90 is considered an indication of good fit. For the RMSEA, a value smaller than .08 is considered an indication of good fit.

EMPIRICAL RESULTS

Measurement of variables

Table 2 gives the end results of the measurement of constructs for all three regions: US, Japan and Europe.

Table 2 about here

Table 2 shows that for all three regions all items for the constructs supplier's dependence, customer's dependence, customer's value, customer's commitment, and supplier's uncertainty avoidance pass the various criteria: factor-loadings exceed .30 and are significant. A special case is the latent construct 'supplier's value'. Eight items were selected which were expected to measure this construct. The analysis resulted in three factors which have a clear interpretation: the supplier's value in terms of his skills (factor 1), innovative capabilities (factor 2), and technical competencies (factor 3). It is striking that this outcome applies to all three regions. This empirically confirms the importance of different dimensions of value in terms of competencies.

Given the satisfactory results we added the scale items for a specific construct to obtain composite measures for the six latent constructs. For one construct we made an adjustment. The construct 'supplier's uncertainty avoidance' is measured by the additive scale

of SUA1 and SUA2 divided by 'supplier's dedicated investments'. The two items that measure uncertainty avoidance incorporate the notion of dedicated investments. As a result, high scores on these items may be the result of either high levels of uncertainty avoidance –as intended– or high levels of dedicated investments. The additive scale is divided by 'dedicated investments' to correct for the latter. The other two constructs are measured by a single item, i.e. 'supplier's dedicated investments' by the amount of dedicated investments in the 1988-1992 period expressed in local currency (logarithm scale), and 'supplier's future perspectives' by the expected continuation of supply to the customer, expressed in number of years. Table 3 gives the averages for the eight constructs in the three regions. For all three regions, the summary statistics and the correlation matrices for the eight constructs are presented in Appendix B.

Table 3 about here

The literature has suggested systemic differences between the three regions, due to different approaches to buyer-supplier relationships, based on deep cultural and institutional differences. From that perspective, it is striking that in Table 3 most averages of the constructs for the three regions are quite close, and the differences that do arise run counter to expectations. For example, both supplier and customer dependence, as well as customer's commitment had similar values in the three regions. This belies the idea that in contrast with Japan Western companies avoid dependence and commitment, in supposedly ad hoc, arms-length transactions. Concerning the observed differences, it is striking that in Japan the average level of dedicated investments is much lower than in the US and EU (less than a third). One would have expected the opposite, from the perspective of durable 'Japanese' buyer-supplier relations in vertically connected 'keiretsu'. The difference is somewhat misleading because Japanese investments are measured in Yen (5.92, logarithm), US investments in dollars (14.10, logarithm) and European investments in a collection of currencies (16.48, logarithm). However, even when we converted these figures into a common currency –by means of an exchange rate– the same result appears: on average Japanese dedicated investments are still much lower than in the US and Europe. Customer's commitment in Japan is hardly higher than in the US, and lower than in the EU, which raises questions concerning the supposedly more 'loyal' relations in Japan. Furthermore, again in contrast with the received view, supplier's uncertainty avoidance in the supposedly more 'loyal' Japan is not lower than in the US and EU, but twice as high. Supplier's value is highest in the US. The fact that in Japan supplier's future perspectives is clearly highest, followed by the EU, conforms better with the received view. On average, in Japan suppliers in our sample expect the relationship to continue for about 25 years, in the US 8 years, and in Europe a little over 17 years.

For supplier's uncertainty avoidance the apparent difference is due to the fact that we adjusted the scale by dividing it by dedicated investments (which are relatively low in Japan, as noticed above). Without correction for dedicated investments uncertainty avoidance has approximately the same levels in the three regions (6.33 for US, 6.05 for Japan and 6.06 for Europe).

We conclude that while perhaps in the past there might have been great differences in buyer-supplier relations, there has been a certain amount of convergence. Also in the West, buyer-supplier relations are now characterised, at least in the auto industry, by significant levels of dedicated investments, mutual dependence, and buyer's commitment. Apparently, the West has learned from Japan concerning the benefits of a certain durability and mutual dependence in relations. Having said that, we do see some differences, and to investigate them further we proceed to the analysis of causal relations between the variables.

The causal model

We now turn to the testing of the hypotheses. The estimates of the causal model are reported in Figures 2, 3 and 4 for the US, Japan and the EU. The results for the three regions are brought together in table 4. In all three regions, the values of GFI and AGFI exceed the minimum of .90 and the values of RMSEA are less than the maximum .08. We conclude that the model fit is good.

Figures 2, 3, 4 about here

Table 4 about here

In all regions there is strong support for Hypothesis 4B that uncertainty avoidance has a negative effect on dedicated investments. One way of reducing the risk of hold-up is to reduce dedicated investments and thus reduce dependence. This, of course, is not a new insight, and just confirms part of transaction cost theory thinking.

A newer result is that in all three regions supplier's dedicated investments indeed have the double effect of increasing supplier's dependence (H1A) but also supplier's value to the customer (H2A), and in all three regions these effects are strongly significant. This confirms our ideas about the double function of dedicated investments: they create risks because they increase the supplier's switching costs, but they also create value, which create mutual dependence, which mitigates risks. Nooteboom et al. (1997) tested the effects of dedicated investments and value on perceived relational risk. Relational risk was assessed in two dimensions: the probability that something will go wrong and the size of the loss incurred when it does. They found that the buyer's value to the supplier has the expected positive effect on the size of potential loss to the supplier, but their study did not confirm the expectation that the suppliers value to the buyer has a negative effect on the supplier's perceived probability of relational loss. They explained this anomaly by blaming reality rather than the hypothesis. They argued that suppliers were not sophisticated enough in their thinking: they do not but should take into account the effect of their value on the probability of opportunistic action by the buyer. One aim of the present study was to see whether supplier value here has the expected negative effect on perceived relational risk. The empirical results suggest that it does, in a roundabout way. Supplier's value has a positive effect on customer's dependence, which has a positive effect on customer's commitment, which has a negative effect on the supplier's perceived need to avoid relational risk ('uncertainty avoidance').

There is strong support in all three regions for the hypothesis (H2B) that the value of the supplier increases the dependence of the buyer. In all three regions there is also strong support for two of the hypotheses concerning the role of commitment (H3A, H3B and H3C): customer's dependence increases commitment, and this contributes to customer's value and supplier's future perspectives. However, concerning the hypothesised negative effect of customer commitment on uncertainty avoidance (H4A) the evidence is mixed. It is weakly confirmed in the US ($p < .10$), strongly confirmed in the EU ($p < 0.1$), but it is not confirmed in Japan. Apparently, the logic of using dedicated investments to make the customer dependent and thereby reduce relational risk does not operate in Japan.

Other differences between the regions arise in the determinants of dedicated investments. As noted before, in all regions there is strong support for the negative effect of uncertainty avoidance on dedicated investment (H4B). However, the regions deviate concerning the hypothesised positive effects on dedicated investments of customer value

(H1C) and future perspectives (H1B). These are both confirmed only in the US, the first strongly (H1C: $p < .01$), and the second weakly (H1B: $p < .10$). The latter low level of significance may be due to the fact that the variable 'supplier's future perspectives' is one of the two variables without a (multivariate) normal distribution. In Japan the influence of future perspectives is strongly confirmed, but there is no significant effect of customer's value. This indicates that in the US dedicated investments are strongly oriented towards valuable partners, while in Japan they are more oriented towards continuity of the relation. In the EU there is no significant effect of either variable. In Europe, neither customer value nor future perspectives seem to be an argument for dedicated investment. We checked whether this lack of effect might be explained by lack of variation of the two variables. We found that the coefficient of variation of customer's value was low in Japan (0.18) relative to the US (0.29) and EU (0.25). This may explain the lack of effect in Japan but not the lack of effect in the EU. The coefficient of variation for future perspectives was not less in the EU (1.69), but on the contrary higher, than in the US (0.73) and Japan (1.15).

DISCUSSION

Results

This study offers a comparative analysis of the variables and the causality between them that drive supply relationships in the US, Japan, and Europe. It is based on a combination of elements from different theoretical perspectives: the competence perspective, supplemented with a theoretical perspective of knowledge and learning, insights in issues of governance from transaction cost economics, and a perspective of social exchange concerning commitment in relations. From theory we specified constructs to be measured from indicators that were largely derived from earlier empirical research. Comparing the measurements of those constructs between the three regions, we found considerable convergence, which contradicts earlier stories about fundamental, culture-bound systemic differences. The few differences we do find also contradict those stories.

Concerning the causal model, the main conclusion is that most hypotheses are confirmed in the United States, Japan and Europe and that the theoretical model fits the three datasets well. In other words, we find that that the causal structures of supply relationships in the Triad regions are more or less the same. There appears to be considerable convergence towards a common system. In the West, the car industry has learned from the collaborative buyer-supplier relations in Japan.

However, we do find some differences, and those may be significant. They can be summed up as follows. In Japan the level of dedicated investments is lower than in the West (see Table 3), and they are more based on future expectations, i.e. expected continuity of buyer-supplier relations, than on value of the customer. Customer's commitment as a result of dependence resulting from dedicated investments is not seen as reducing relational risk. In the US dedicated investments are more oriented towards valuable partners. Future perspectives is the smallest among the three regions, but it does have a weakly significant effect on dedicated investments. In Europe future perspectives takes an intermediate value. Neither customer value nor future perspectives have a significant effect on dedicated investments.

The US case conforms most to expectations, confirming all hypotheses. The evidence clearly indicates that in the US customer-supplier relations have turned around from short-term, arms-length relations, with an emphasis on price, to more durable, co-operative relations focused on joint production of added value on the basis of complementary competencies. However, there still appears to be a difference in the duration of such co-operative relations, and in the scope for suppliers to choose from a variety of potential customers. This offers advantages. Relations need to be long enough to recoup dedicated investments and to build up co-operation, on the basis of mutual understanding, trust and

joint development. But relations may also be too long; causing undue rigidity and lack of the variety of relations that is needed for innovation (cf. Nooteboom 1998). Given that in Japan suppliers are more locked into separate vertical industrial structures (keiretsu), with limited choice of partners across the boundaries of a keiretsu, the consequence would be as follows. The expected effect of customer value on dedicated investments follows from the opportunity for the best suppliers to choose the most attractive customers, and engage in more dedicated investments for them, leaving the less attractive customers to the less attractive suppliers. Those have less incentive to tie themselves down with dedicated investments, and prefer to maintain an opportunity to switch to a more attractive customer later. In the Japanese system, with a narrower scope of choice, limited by the boundaries of keiretsu, we would expect the effect of customer value to be less. Due to the lock-in effect of keiretsu there is less incentive for suppliers to compete for the most attractive customers by engaging in more dedicated investments. As a result, the average level of dedicated investments is lower. With a limited choice of customers, suppliers can only be enticed to engage more in dedicated investments by offering better conditions in terms of a durable relation, guaranteed by high commitment. This explanation is confirmed by the fact that in Japan the coefficient of variation of customer value (0.18) is less than in the US (0.29). Thus dedicated investments depend only on the expected duration of the relation, i.e. future perspectives, fed by customer commitment. In Japan, dedicated investments are not used to reduce relational risk but rather to confirm long term commitments inside keiretsu.

Of course what we offer here is only a hypothesis, inferred from the outcomes of the study, and would need independent testing. This is of some importance. If the benefits of durable relations can be obtained without making the relations longer and more rigid than necessary, and maintaining more variety of relations, this may be better from the perspective of innovation. In other words: in the US a 'third way' (Nooteboom 1998) may have been found which combines the advantages of sufficiently durable relations with the advantages of a more open system with greater variety. This would combine advantages of higher quality with higher dynamic, innovative efficiency. This is reflected in both lower levels of expected duration of relations and the weaker effect of that expectation on the level of dedicated investments. If our interpretation is correct, the Japanese may now learn from the Americans. This would entail that they break down the keiretsu system to allow for more variety and lesser durability of vertical relations.

We find the results for Europe more difficult to interpret. As in the US, customer commitment, created by supplier value, as a result of dedicated investments, is seen to reduce relational risk, which can neutralise the fact that dedicated investments also increase dependence. However, in contrast with the US, customer value does not have an effect on dedicated investments. In contrast with Japan, future perspectives does not have an effect either. In Europe the durability of relations takes an intermediate position between the US and Japan.

Research design

The method used in this study offered two advantages. This first is that in the comparative study we were able to investigate differences between the US, Japan and Europe. The second is that by using the LISREL method we were able to test multiple and circular causal patterns. One such pattern is that dedicated investments not only increase dependence, and hence relational risk, but also increases customer dependence and commitment, which reduces relational risk. This causal cycle confirms the idea that risks of dependence due to dedicated investments can be governed by mutual dependence.

A clear disadvantage of our study is that it is cross-sectional. It would be better to test the causal effects in a longitudinal study in which the sequencing of effects is studied explicitly and implications are tested for the development and the management of relationships in time. However, it is difficult to envisage a repetition of the collection of the

large volumes of survey data needed for a LISREL analysis, in all three regions, for a sequence of points in time. Furthermore, for some variables one would need a larger frequency of observation than for others. Nevertheless, the results of this study should be tested in longitudinal research, in a design for data that would be feasible to collect.

A second limitation is that the data were gathered from only one side of the interfirm dyad. This precluded any analysis of how the supplier's and the customer's perceptions differ about the working of the supply relationship.

A third limitation of course is that the study applies only to the car industry, and the results cannot be generalised to other industries without further tests. In particular, when we conclude that the US have learned from Japanese buyer-supplier relationships, and may subsequently have improved on them, the question remains whether that is also the case in other industries.

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TABLES, FIGURES AND APPENDICES

Table 1 Overview of the hypotheses

No. (1)	From Variable (2)	Sign (3)	To Variable (4)
I Dedicated Investments			
H1A	Supplier's dedicated investments	+	Supplier's dependence
H1B	Supplier's future perspectives	+	Supplier's dedicated investments
H1C	Customer's value to supplier	+	Supplier's dedicated investments
II Value of the Partner			
H2A	Supplier's dedicated investments	+	Supplier's value to the customer
H2B	Supplier's value to the customer	+	Customer's dependence
III Commitment			
H3A	Customer's dependence	+	Customer's commitment
H3B	Customer's commitment	+	Customer's value to the supplier
H3C	Customer's commitment	+	Supplier's future perspectives
IV Uncertainty			
H4A	Customer's commitment	-	Supplier's uncertainty avoidance
H4B	Supplier's uncertainty avoidance	-	Supplier's dedicated investments
H4C	Supplier's dependence	+	Supplier's uncertainty avoidance

Figure 1 The causality of supply relationships

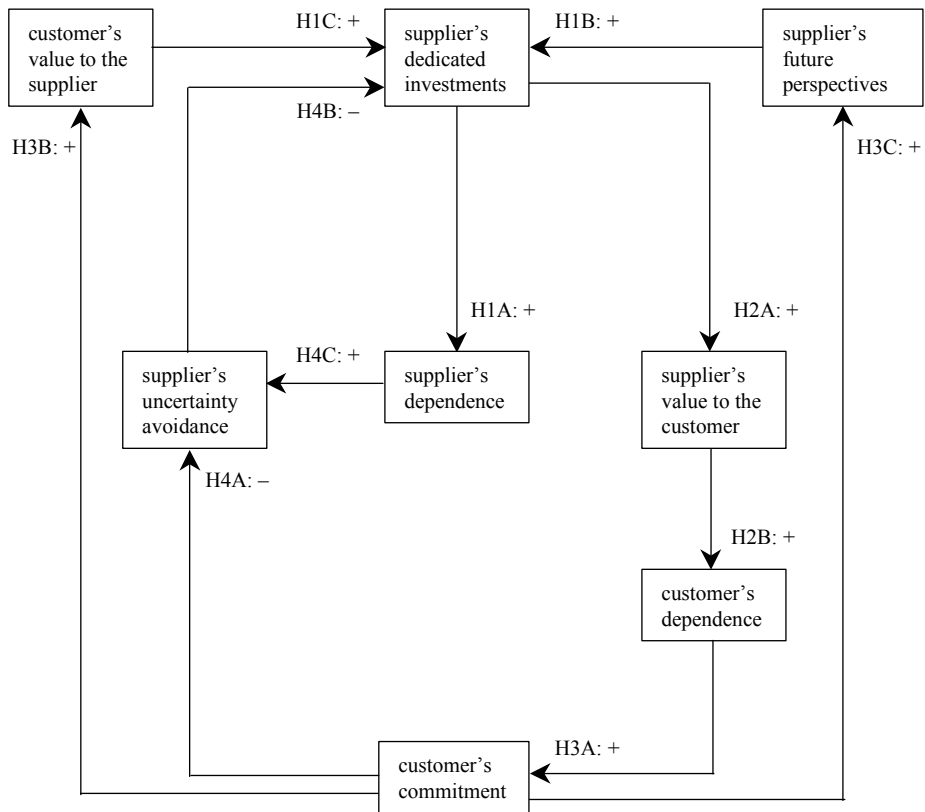


Table 2 United States, Japan and Europe: measurement of constructs^a

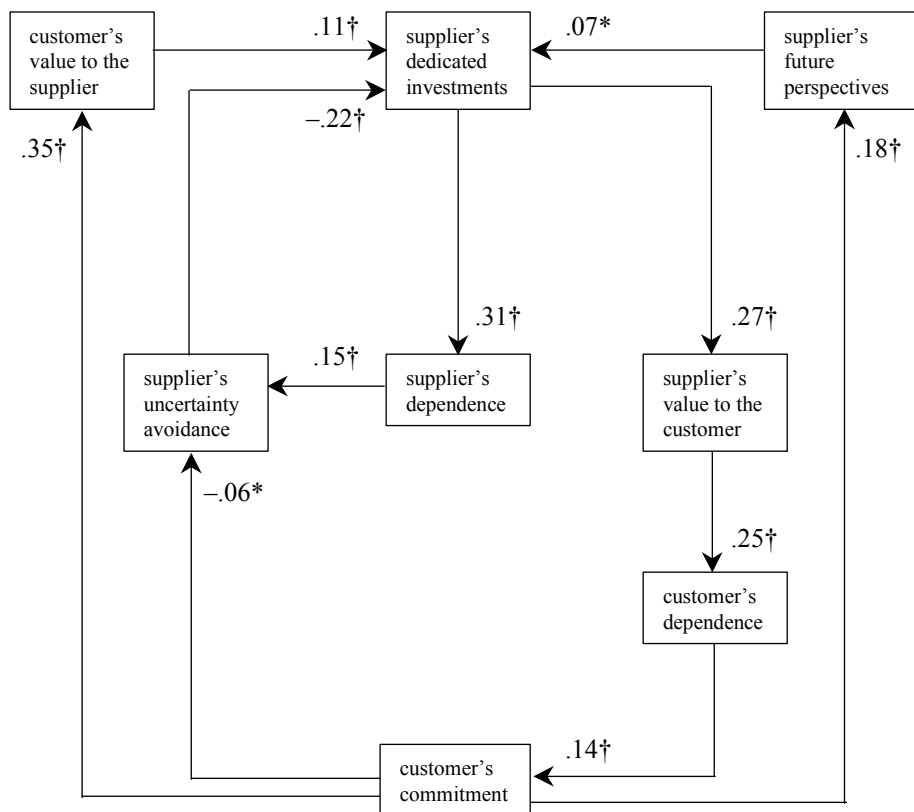
No.	Construct	Item	USA	Japan	Europe
(1)	(2)	(3)	(4)	(5)	(6)
01	Supplier's Dependence	SD1	.36 (4.25)	.32 (2.74)	.31 (2.36)
		SD2	.41 (6.12)	.34 (2.91)	.57 (5.24)
		SD3	.65 (7.48)	.59 (3.86)	.67 (5.56)
		SD4	.38 (5.83)	.39 (3.24)	.34 (3.84)
02	Customer's Dependence	CD1	.56 (10.18)	.43 (5.50)	.42 (3.72)
		CD2	.56 (10.18)	.43 (5.50)	.42 (3.72)
03	Supplier's Value Relative Skills		.49 (2.52)	.73 (3.46)	.32 (2.03)
		SV1	.63 (8.71)	.70 (6.23)	.70 (6.23)
		SV2	.78 (9.40)	.95 (6.49)	.95 (6.49)
		SV3	.91 (9.67)	.91 (6.49)	.91 (6.49)
	Technical Competencies		.41 (2.32)	.48 (2.68)	.41 (2.11)
		SV4	.43 (4.96)	.35 (3.92)	.35 (3.92)
		SV5	.42 (4.94)	.98 (3.12)	.98 (3.12)
	Innovative Capabilities		.57 (2.24)	.50 (4.34)	.38 (2.09)
SV6		.58 (5.62)	.35 (5.39)	.35 (5.39)	
SV7		.44 (5.19)	.58 (7.47)	.58 (7.47)	
	SV8	.67 (5.64)	.59 (7.48)	.59 (7.48)	
04	Customer's Value	CV1	.42 (7.86)	.39 (3.79)	.35 (3.64)
		CV2	.39 (7.36)	.68 (4.45)	.35 (3.71)
		CV3	.67 (11.49)	.42 (4.16)	.55 (4.99)
		CV4	.58 (10.64)	.44 (5.33)	.50 (4.74)
05	Customer's Commitment	CC1	.83 (14.69)	.47 (6.67)	.47 (3.89)
		CC2	.48 (9.07)	.49 (6.87)	.32 (2.94)
		CC3	.46 (8.69)	.30 (4.56)	.35 (3.19)
		CC4	.58 (10.96)	.50 (6.96)	.55 (4.21)
06	Supplier's Uncertainty Avoidance	SUA1	.67 (14.60)	.84 (20.64)	.73 (11.04)
		SUA2	.67 (14.60)	.84 (20.64)	.73 (11.04)

^a Factor-loadings for measurement models –including t-values in brackets– obtained with LISREL.

Table 3 United States, Japan and Europe: mean values for constructs

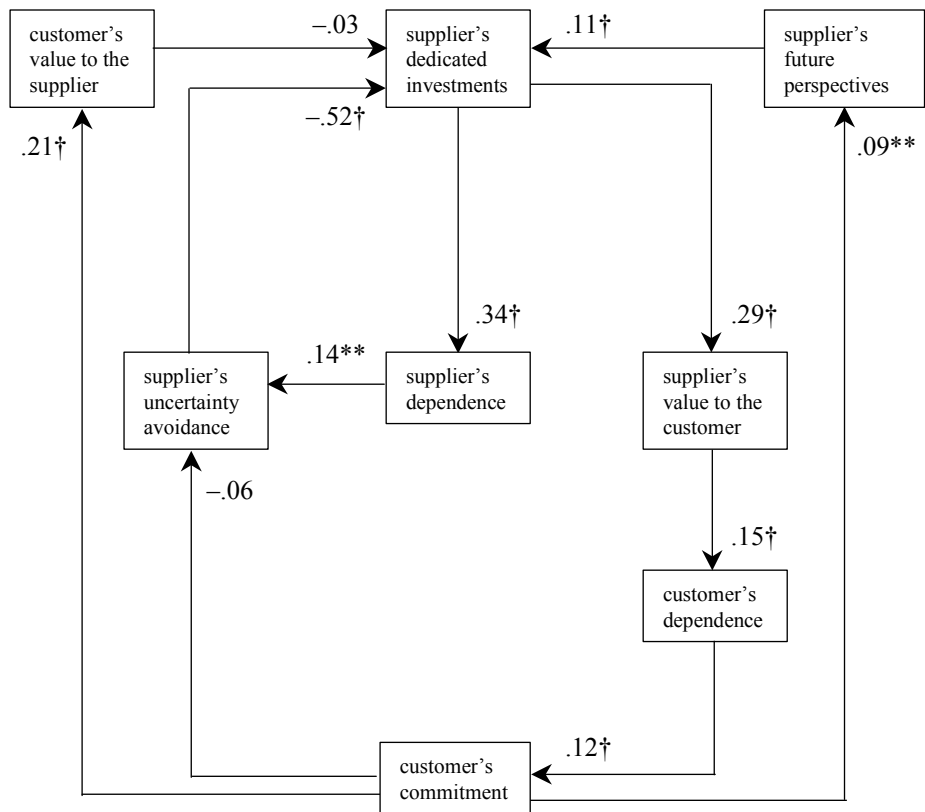
No	Construct	USA (n=553)	Japan (n=450)	Europe (n=226)
(1)	(2)	(3)	(4)	(5)
01	Supplier's dedicated investments	14,10	5,92	16,48
02	Supplier's dependence	10,49	11,34	10,57
03	Customer's dependence	8,09	8,21	8,28
04	Supplier's value to customer	25,02	23,41	25,66
05	Customer's value to the supplier	11,22	12,80	11,13
06	Customer's commitment	10,89	11,49	13,77
07	Supplier's future perspectives	7,93	25,37	17,69
08	Supplier's uncertainty avoidance	0,44	1,08	0,38

Figure 2 United States: testing the hypotheses (n=553)^a



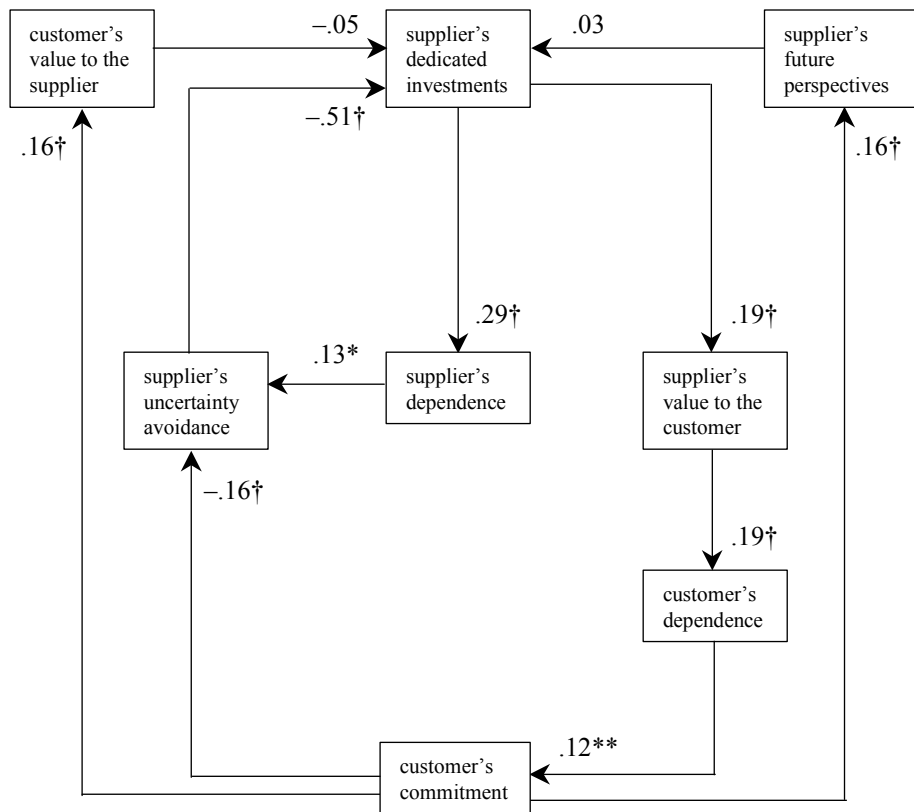
^a † $p < .01$; ** $p < .05$; and * $p < .10$

Figure 3 Japan: testing the hypotheses (n=450)^a



^a $^\dagger p < .01$; $^{**} p < .05$; $^* p < .10$

Figure 4 Europe: testing the hypotheses (n=226)^a



^a † $p < .01$; ** $p < .05$; * $p < .10$

Table 4 Summary of the results for the US, Japan, and Europe^a

Hypothesis	U.S. (t-value)	Hyp. Conf.	Japan (t-value)	Hyp. Conf.	Europe (t-value)	Hyp. Conf.
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I Dedicated Investments						
Hypothesis 1A: +	.31† (7.90)	yes	.34† (6.21)	yes	.29† (3.75)	yes
Hypothesis 1B: +	.07* (1.60)	yes	.11† (2.77)	yes	.03 (0.45)	no
Hypothesis 1C: +	.11† (2.56)	yes	-.03 (-.82)	no	-.05 (-.52)	no
II Value of the Partner						
Hypothesis 2A: +	.27† (6.68)	yes	.29† (6.34)	yes	.19† (2.92)	yes
Hypothesis 2B: +	.25† (5.95)	yes	.15† (3.33)	yes	.19† (2.95)	yes
III Commitment						
Hypothesis 3A: +	.14† (3.37)	yes	.12† (2.57)	yes	.12** (1.83)	yes
Hypothesis 3B: +	.35† (8.78)	yes	.21† (4.44)	yes	.16† (2.38)	yes
Hypothesis 3C: +	.18† (4.22)	yes	.09** (1.96)	yes	.16† (2.43)	yes
IV Uncertainty						
Hypothesis 4A: -	-.06* (-1.43)	yes	-.06 (-1.17)	no	-.16† (-2.35)	yes
Hypothesis 4B: -	-.22† (-4.86)	yes	-.52† (-11.57)	yes	-.51† (-8.25)	yes
Hypothesis 4C: +	.15† (3.19)	yes	.14** (2.28)	yes	.13* (1.55)	yes
Model Fit						
N	553		450		226	
GFI	.98		.97		.97	
AGFI	.95		.94		.93	
RMSEA	.07		.07		.06	

^a † p < .01; ** p < .05; * p < .10

Appendix A Detailed Specification of Constructs, Items and Scales

1 Supplier's dedicated investments SUPINV

Please estimate the total amount of your business unit's investment in equipment to make this product for this customer over the last four years.

Scale: the amount of investments (in log)

2 Supplier's dependence SUPDEP

SD1 If you were to stop getting these orders from this customer, approximately how much of your investment *for this product* in plant, equipment, and training would you be unlikely to find alternative uses for and have to write off?

Scale: 1 = 10% or less; 2 = 11-33%; 3 = 34-66%; 4 = 67-89%; 5 = 90-100%.

SD2 Please estimate the technical complexity involved in manufacturing the product in 1992.

Scale: 1 = fairly simple; 5 = highly complex.

SD3 Please check the appropriate range for the average piece price of the product in 1992.

Scale: 1 = <\$1; 2 = \$1-10; 3 = \$11-50; 4 = \$51-100; 5 = > \$100.

SD4 Does your business unit have any of the following?

A marketing office near your customer; a design office near your customer; a facility near your customer to consolidate shipments of your parts for 'Just-in-Time' (JIT) delivery; an engineers resident at your customer's facility.

Scale: one point for each.

3 Customer's Dependence CUSDEP

CD1 Please estimate the number of months it would take your customer to replace your business unit with another supplier. Consider the time required to locate, qualify, train, make investments, test, and develop a working relationship with another firm. Please exclude legal considerations such as the existence of long-term contracts.

Scale: 1 = 0; 2 = 1-3; 3 = 4-12; 4 = 13-24; 5 = 25-48; 6 = > 48.

CD2 What percent of your business unit's sales ends up as original equipment for cars or light trucks?

Scale: 1 = 0-10; 2 = 11-25; 3 = 26-40; 4 = 41-65; 5 = 66-80; 6 = 81-100.

4 Supplier's value to the customer SUPVAL

SV1 For design engineering. Currently, how would you rate your business unit's skills at making modifications to products or processes? Please compare yourself to other firms in your industry throughout the world.

Scale: 1 = significantly below average; 5 = significantly above average.

SV2 For making incremental process improvements. Currently, how would you rate your business unit's skills at making modifications to products or processes? Please compare yourself to other firms in your industry throughout the world.

Scale: 1 = significantly below average; 5 = significantly above average.

SV3 For implementing entirely new processes. Currently, how would you rate your business unit's skills at making modifications to products or processes? Please compare yourself to other firms in your industry throughout the world.

Scale: 1 = significantly below average; 5 = significantly above average.

SV4 Of the metal cutting machines currently in use at the plant which makes this product, about what percent are CNC?

Scale: 1 = 0%; 2 = 1-25%; 3 = 26-50%; 4 = 51-75%; 5 = 76-100%.

SV5 About how many robots (programmable machines with at least three axes of movement) are in use at the plant?

Scale: 1 = 0; 2 = 1-2; 3 = 3-5; 4 = 6-10; 5 = >10.

SV6 Approximately what percent of the contacts with your customer regarding this product were for 'your business unit providing technical assistance to customer'?

Scale: 1 = 0-19; 2 = 20-39; 3 = 40-59; 4 = 60-79; 5 = 80-100.

SV7 Which range best describes your business unit's R&D as a percent of sales?

Scale: 1 = 0%; 2 = 0.1-1%; 3 = 1.1-2%; 4 = 2.1-4%; 5 = >4%.

SV8 Please check the descriptions which apply to the product development process for your company's product.

Scale: 1 = customer took entire responsibility; 2 = customer provided majority of engineering hours; your business unit provided the rest; 3 = customer and your business unit contributed equally to the design; 4 = your business unit provided majority of engineering hours; 5 = your business unit took entire responsibility.

5 Customer's value to the supplier CUSVAL

CV1 Over the last four years, what sorts of technical assistance have you received from your customer?

Provided personnel who visited your site to aid in implementing improved procedures for zero or a nominal charge; for a fee; did not provide. Arranged for training of your personnel at their site for zero or a nominal charge; for a fee; did not provide. Provided personnel who worked two weeks or more on your shop floor to improve your processes for zero or a nominal charge; for a fee; did not provide.

Scale: one point for each.

CV2 Approximately what percent of the contacts with your customer regarding this product were for 'customer providing technical assistance to your business unit'?

Scale: 1 = 0; 2 = 1-10; 3 = 11-20; 4 = 21-30; 5 = 31-100.

CV3 The advice our customer gives us is not always helpful.

Scale: 1 = strongly agree; 5 = strongly disagree.

CV4 In dealing with this customer, we have learned much that will help us with other customers.

Scale: 1 = strongly disagree; 5 = strongly agree.

6 Customer's Commitment CUSCOM

CC1 How would your customer react if one of your competitors offered a lower price for a product of equal quality?

Scale: 1 = switch to competitor as soon as technical feasible; 2 = switch at end of contract; 3 = reduce your market share; 5 = help you match your competitors' efforts.

CC2 How would your customer react if your material suppliers raised their prices?

Scale: 1 = reduce your business unit's market share or switch to another supplier at end of contract; 2 = hold you to your original price; 3 = allow partial pass-through of your business unit's cost increases; 4 = allow full pass-through of your business unit's increases in out-of-pocket costs; 5 = provide significant help for your business unit to reduce costs.

CC3 Suppose your business unit had an idea that would allow you to reduce your costs, but would require your customer to make a slight modification in its procedures. How would your customer react?

Scale: 1 = customer does not welcome suggestions that would require modifications in its procedures; 2 = customer would adopt the suggestion, but would seek to capture most of the savings; 3 = customer would adopt the suggestion, but would seek to capture some of the savings; 5 = customer would eagerly solicit such suggestions.

CC4 We can rely on our customer to help us in ways not required by our agreement with them.

Scale: 1 = strongly disagree; 5 = strongly agree.

7 Supplier's future perspectives SUPFUT

For how long do you think there is a high probability that your business unit will be supplying this or a similar item to your customer (in years)?

Scale: the number of years.

8 Supplier's uncertainty avoidance SUPUNC

SUA1 If our customer had given us less assurance of continued business for this product, we would definitely have invested less in plant, equipment, and training which could be used to serve only this customer

Scale: 1 = strongly disagree; 5 = strongly agree

SUA2 If our customer had given us less assurance of continued business for this product, we would definitely have invested less in plant, equipment, and training which could be used to serve either this customer or other customers.

Scale: 1 = strongly disagree; 5 = strongly agree

Appendix B Summary Statistics

Table B.1 United States: summary statistics (n=553)

No (1)	Construct (2)	Mean (3)	St. D. (4)	Minim. (5)	Maxim. (6)	Skewn. (7)
01	Supplier's dedicated investments	14,10	3,62	0,00	20,72	-2,39
02	Supplier's dependence	10,49	2,54	4,00	17,00	0,07
03	Customer's dependence	8,09	2,08	2,00	12,00	-0,73
04	Supplier's value to customer	25,02	4,77	12,00	39,00	0,06
05	Customer's value to the supplier	11,22	3,22	4,00	19,00	0,01
06	Customer's commitment	10,89	2,94	4,00	18,00	-0,04
07	Supplier's future perspectives	7,93	5,77	0,00	50,00	2,43
08	Supplier's uncertainty avoidance	0,44	0,15	0,11	0,83	0,11

Table B.2 Japan: summary statistics (n=450)

No (1)	Construct (2)	Mean (3)	St. D. (4)	Minim. (5)	Maxim. (6)	Skewn. (7)
01	Supplier's dedicated investments	5,92	2,03	0,00	11,51	-0,69
02	Supplier's dependence	11,34	2,46	5,00	18,00	-0,01
03	Customer's dependence	8,21	1,91	2,00	12,00	-0,65
04	Supplier's value to customer	23,41	4,09	11,00	36,00	0,05
05	Customer's value to the supplier	12,80	2,26	5,00	19,00	0,06
06	Customer's commitment	11,49	2,25	5,00	20,00	0,32
07	Supplier's future perspectives	25,37	29,09	0,00	100,00	1,85
08	Supplier's uncertainty avoidance	1,08	0,55	0,19	3,47	0,94

Table B.3 Europe: summary statistics (n=226)

No (1)	Construct (2)	Mean (3)	St. D. (4)	Minim. (5)	Maxim. (6)	Skewn. (7)
01	Supplier's dedicated investments	16,48	3,26	6,91	23,72	-0,04
02	Supplier's dependence	10,57	2,65	5,00	18,00	0,36
03	Customer's dependence	8,28	1,79	3,00	12,00	-0,78
04	Supplier's value to customer	25,66	4,16	13,00	40,00	0,03
05	Customer's value to the supplier	11,13	2,76	4,00	17,00	0,02
06	Customer's commitment	13,77	2,84	4,00	20,00	-0,42
07	Supplier's future perspectives	17,69	29,84	0,00	100,00	2,30
08	Supplier's uncertainty avoidance	0,38	0,15	0,10	0,87	0,49

Table B4 United States: correlation matrix (n=553)^a

No Construct	01	02	03	04	05	06	07	08
01 Supplier's dedicated investments	1,00							
02 Supplier's dependence	0,35 *	1,00						
03 Customer's dependence	0,20 *	0,40 ^	1,00					
04 Supplier's value to the customer	0,27	0,34 *	0,25 *	1,00				
05 Customer's value to the supplier	0,11	0,10	0,13 *	0,10	1,00			
06 Customer's commitment	0,01	0,04 *	0,15 *	0,06	0,35	1,00		
07 Supplier's future perspectives	0,08	0,10 *	0,15 *	0,08	0,07	0,18	1,00	
08 Supplier's uncertainty avoidance	-0,17	0,08 *	0,03	-0,02	0,03	-0,06	-0,02	1,00

Table B5 Japan: correlation matrix (n=450)^a

No Construct	01	02	03	04	05	06	07	08
01 Supplier's dedicated investments	1,00							
02 Supplier's dependence	0,28 *	1,00						
03 Customer's dependence	0,20 *	0,34 ^	1,00					
04 Supplier's value to the customer	0,29	0,21 *	0,21 *	1,00				
05 Customer's value to the supplier	-0,03	0,11 *	0,06 *	-0,03	1,00			
06 Customer's commitment	-0,01	0,05 *	0,13 *	0,01	0,20	1,00		
07 Supplier's future perspectives	0,15	0,09 *	0,12 *	0,17	0,09	0,09	1,00	
08 Supplier's uncertainty avoidance	-0,49	-0,05 *	-0,02 *	-0,23	0,01	-0,06	-0,08	1,00

Table B6 Europe: correlation matrix (n=226)^a

No Construct	01	02	03	04	05	06	07	08
01 Supplier's dedicated investments	1,00							
02 Supplier's dependence	0,23 *	1,00						
03 Customer's dependence	0,11 *	0,19 ^	1,00					
04 Supplier's value to the customer	0,19	0,25 *	0,19 *	1,00				
05 Customer's value to the supplier	-0,05 *	-0,01 ^	0,13 ^	0,01 *	1,00			
06 Customer's commitment	-0,12	0,09 *	0,12 *	-0,15	0,16 *	1,00		
07 Supplier's future perspectives	0,01	0,06 *	0,06 *	0,04	0,04 *	0,16	1,00	
08 Supplier's uncertainty avoidance	-0,48	-0,01 *	0,01 *	-0,07	0,01 *	-0,17	0,02	1,00

^a Pearson correlation coefficients except for * which are polyserial and ^ which are polychoric correlation coefficients.

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