

## THE 'CLOSE BUT ADVERSARIAL' MODEL OF SUPPLIER RELATIONS IN THE U.S. AUTO INDUSTRY

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*While cooperative buyer–supplier relations are an important source of sustainable competitive advantage, noncooperative behavior persists widely. This paper tests a model incorporating noncooperative behavior within a context of formal commitment, using data from the U.S. auto industry. This 'close, but adversarial' model appears to be reasonably well supported by the data, suggesting that even within professed cooperative buyer–supplier relationships adversarial behavior persists. In contrast, a small but significant minority of the relationships were found to be characterized by high levels of trust as well as informal commitment. The results suggest specific strategies for developing cooperative supplier relations. © 1998 John Wiley & Sons, Ltd.*

### INTRODUCTION

The understanding and management of buyer–supplier relations is growing in strategic importance. Supplier relations are being recognized as important in developing sustainable competitive advantage (SCA). A key requirement for the development of SCA is the existence of *isolating mechanisms* to prevent duplication (Rumelt, 1984). Causal ambiguity, where the causes of a firm's ability to create more value than its competitors are based on tacit knowledge, is an important isolating mechanism (Reed and DeFilipi, 1990). Cooperation and associated commitment are often characterized by causal ambiguity (Yao, 1988; Ghemawat, 1991). In other words, if a firm can generate competitive advantage through cooperative buyer–supplier relations, the advantage is likely to be sustainable.

The recognition of the strategic and financial advantages of improving relations with suppliers has led to substantial changes over the last decade. There has been a trend away from short-term contracting with numerous suppliers, i.e., so-called arm's length relationships (Sako, 1992), and towards greater commitment with sole-sourcing and with longer-term contracts in the context of partnerships and alliances (Sheridan, 1990; Bergman, 1991; Galt and Dale, 1991; Helper and Sako, 1995). Further, application of strategic sourcing considerations (Krebs, 1989; Venkatesan, 1992) has led to the subcontracting of numerous activities that were formerly considered integral to the operation of the firm. This trend is particularly noticeable in the area of services. Services now contracted out to specialist suppliers include headquarters support services, warehousing and inventory management functions, payroll and accounts receivable functions. These specialist suppliers are almost always single sources (Mudambi and Schründer, 1995).

However, along with these changes, much in the buyer–supplier interface has remained the same. There is evidence that increased formal

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commitment between buyers and suppliers has not been accompanied by a corresponding increase in noncodified forms of cooperation between the parties. For instance, suppliers to the U.S. automobile industry have little expectation of being treated fairly by their customers; further, a large plurality believe that if a competitor appeared with comparable quality and a lower price, their customers would switch 'as soon as technically feasible', rather than working with them to match or better the competitor (see Helper, 1991a).

In most industries in the West, one of the main objectives of traditional supplier relations has been to minimize 'vulnerability' to supplier opportunism (Spekman, 1985, 1988a, 1988b; Sako, 1992) and has consequently led to the two sides viewing each other as adversaries. Thus, current attempts to increase informal commitment and trust are constrained by the existence of adversarial buyer-supplier relations in the past.

The current state of buyer-supplier relations in the West has been described as 'close but adversarial' (Mudambi and Mudambi, 1995). It may be argued that the proper framework for analyzing such relations is a noncooperative solution concept within a formal structure of commitment. Whether or not such a framework is appropriate is an empirical question. This is the question we seek to address in this paper. Such analysis should provide indications as to the actual impact of the formal component of commitment in the absence of the informal component.

Classic studies of traditional supplier relations (Monteverde and Teece, 1982; Morten, 1984) indicate that technologically sophisticated inputs tend to be produced in-house, while simpler components tend to be bought in. However, studies of Japanese-style supplier relations (Morris and Imrie, 1992; Thoburn and Takeshima, 1993) indicate that even complex inputs tend to be outsourced. It is reported that even for components requiring transaction-specific investment, long-term relationships with suppliers often produce higher-quality or lower-cost inputs than an internal operation (Cusumano and Takeishi, 1991; Nishiguchi, 1994). This difference provides a means of assessing the level of informal commitment undertaken by buyers.

In particular, in the automobile industry, the mechanics of Japanese-style supplier relations are based on the concept of parallel sourcing, where a supplier typically has contracts to provide an

assembler with several components for a single model as well as to provide similar components for several models (Asanuma, 1985a, 1985b; Smitka, 1991). Using game theoretic techniques, Richardson (1993) demonstrates that such a model combines many of the advantages of multiple sourcing with those of sole sourcing.

Mudambi and Mudambi (1995) use a similar methodology in an attempt to understand the mechanics of the current state of buyer-supplier relations in the West. They provide a game theoretic model of close but adversarial buyer-supplier relations in which formal commitment is accompanied by noncooperative behavior. They report that in such a framework the effectiveness of formal commitment is weak. The suppliers' perceived probability of a switch to a rival is still crucially dependent on traditional factors such as level of actual and potential competition and the difficulty in finding alternative suppliers. However, the effect of these factors is alleviated by placing the relationship within a longer time frame and by improving information flow to reduce uncertainty. These results are obtained in spite of the considerations of vulnerability inherent in a noncooperative game. In other words, some forms of cooperation can have pay-offs even in an environment where concerns about vulnerability are paramount.

In this paper, we attempt to test whether the close but adversarial model is supported by data from the U.S. auto industry. Support for such a model of buyer-supplier relations has strategic implications for the management of the firm. In particular, it implies that the increased formal commitment that has been undertaken by many buyers in the West has little value, unless it is accompanied by the informal aspects of trust. Indeed, it can lead to the worst of all possible outcomes, since it increases buyers' vulnerability without any of the pay-offs of cooperation. However, even in the environment of this noncooperative relationship, there are forms of cooperation, such as improved information flow, which may benefit both buyers and suppliers in the short run. This suggests some natural starting points for managers interested in developing cooperative buyer-supplier relations.

The paper is organized as follows. We begin with a discussion of the role of formal and informal commitment in business relations. In the next section, we discuss the model and set up

the hypotheses to be tested. We then describe the data, estimation methodology, and results. We offer some concluding remarks on the strategic implications of the results for managers in the last section.

**FORMAL VS. INFORMAL COMMITMENT**

All business relations have elements of formal and informal commitment within them. The fundamental difference between formal and informal commitment can be traced to enforceability. Formal commitment is enforceable through the legal system, while informal commitment has a stronger attitudinal component and is enforceable through more subtle means, such as reputation. These enforcement mechanisms imply differences in structure. Formal commitment requires the clear and complete specification of the two parties' mutual obligations, whereas in informal commitment these specifications are of a very general nature (Casson, 1997). Informal commitment is also closely related to trust. Trust has been described in the marketing literature as a major determinant of attitudinal commitment (Morgan and Hunt, 1994; Doney and Cannon, 1997). Trust can also be considered, as in the organization literature, to be an enforcement mechanism associated with informal commitment (Choi, 1994; Choi and Raman, 1997).

The institutional environment plays a role in determining whether formal or informal commitment is the dominant form of cooperation. In an environment with free markets, relatively good information availability, and strong legal institutions, the predominant form of cooperation is likely to be formal. In an environment where society is relatively closed and there are strong informal institutions such as social norms, conventions, and traditions, the predominant form of cooperation is likely to be informal. Finally, where both legal and social institutions are weak, 'mutual' commitment predominates. Mutual commitment can be said to involve transaction-related 'hostages'. For example, if firm A holds an asset of great value to firm B, but of no value to itself, the control of the asset provides a powerful enforcement mechanism. If B holds a similar sanction against A, the two parties hold each other hostage or, in other words, are mutually

committed to each other (Casson, 1991). The role of the institutional environment implies the typology of Table 1.

The development of buyer-supplier commitment witnessed over the last decade in the West fits best into the formal cell, with relatively strong legal institutions and weak social institutions. Thus, it is to be expected that initial cooperation will be formal and enforceable through the existing legal institutions. Moving to the hybrid cell requires the development of social institutions and cannot be expected to occur spontaneously.<sup>1</sup>

The importance of institutional development within this typology is aptly summarized by Smith Ring and Van de Ven (1994: 113):

As the uncertainty, complexity and duration of economic transactions within and between firms increase, it becomes increasingly important for scholars and managers to understand developmental processes of how equity, trust, conflict-resolution procedures and internal governance structures emerge, evolve and dissolve over time.

Nooteboom (1996) points out that the conflicting concerns about vulnerability and the need to build trust in the governance of interfirm relations emerge from different institutional settings. The 'new institutional' perspective, associated with Williamson (1975, 1985) raises concerns of vulnerability (and suggests mechanisms for its reduction) within a framework which has strong legal institutions, but weak social ones. On the other hand, the so-called 'neo-institutionalist' perspective (Dietrich, 1993; Foss, 1993; Hodgson,

Table 1. A typology of commitment

		Legal Institutions	
		Strong	Weak
Social Institutions	Strong	Hybrid	Informal
	Weak	Formal	Mutual

<sup>1</sup> Another way of operationalizing these considerations is to introduce the concept of the time horizon, so that individual gain and joint gain are viewed against the relevant intertemporal backdrop (Dabholkar, Johnston, and Cathey, 1994). This allows one to distinguish between short-term attempts at maximizing joint gain which may be viewed as cooperation and long-term efforts which may be viewed as coordination. Thus, in a process sense, cooperation is the precursor of coordination.

1993) emphasizes that trust building is a function of institutional development and change, i.e., the development of social networks and institutions. Both perspectives need to be integrated in order to reconcile the apparently conflicting considerations of vulnerability and trust.

Integration of these considerations requires a process model which incorporates both trust and vulnerability and the interactions between the two. Nooteboom (1993) provides a template for such a model, an adaptation of which appears in Figure 1. As can be seen, trust building reduces the likelihood of opportunism and allows increases in asset specificity and dependence. This allows increased vulnerability for any given set of formal enforcement mechanisms. In a sequence of periods or transactions, the question of the adequacy of the formal enforcement mechanisms can be raised at the end of each period.

**THE ANALYSIS OF PURELY FORMAL COMMITMENT**

In the general context of the make-buy decision, the analysis of supplier relations is concerned with examining different options within the 'buy'

alternative. A useful framework for analysis is the exit-voice dichotomy, originally proposed by Hirschman (1970) and adapted to the case of buyer-supplier relations by Helper (1987). An exit relationship is characterized by low commitment and a low level of information exchange, leading to suppliers perceiving a high probability of switch to a rival. By contrast, in a voice relationship both commitment and information exchange are high, leading to suppliers perceiving a low probability of switch to a rival.

For example, in a well-known study, McMillan (1990) reports that in Japanese manufacturing, with parallel sourcing, long-term relationships are the norm. In particular, 68 per cent of subcontractors had never changed parent companies, 15 percent had changed once, 10 percent had changed twice and only 7 percent had changed three or more times. Further, Martin, Mitchell, and Swaminathan (1995) find that this long-term relationship increases the chances that the buyer-supplier relationship in the home market will be replicated in foreign markets.

In the analysis presented here, we proceed another step along this path, by proposing that it is possible to set up the formal aspects of a voice relationship, without putting in place the

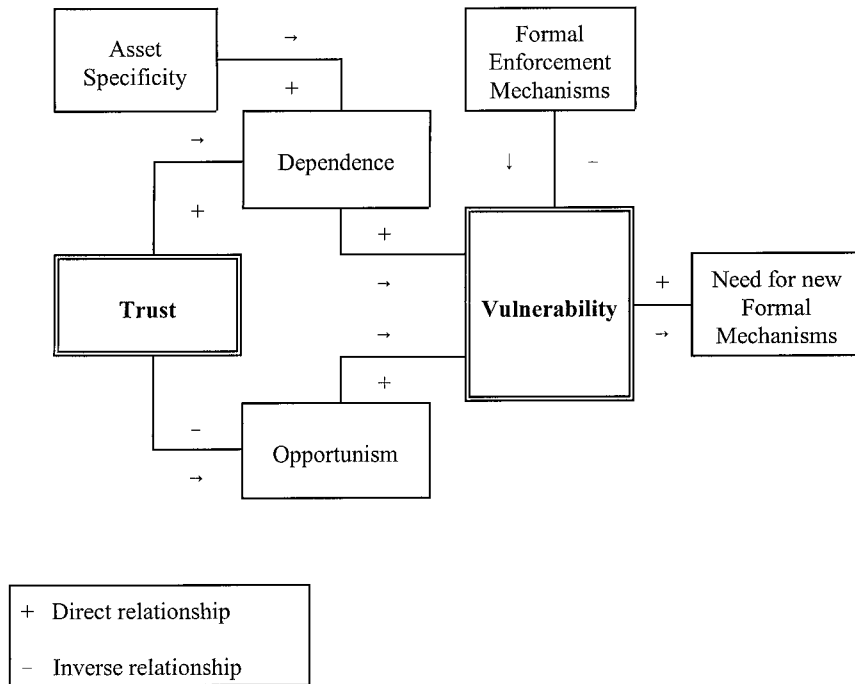


Figure 1. A causal scheme. Adapted from Nooteboom (1993)

accompanying informal aspects. This is because the formal aspects are mechanical, and generally do not depend on the history of the relationship. However, the informal aspects are crucially dependent on the past. It will be difficult, if not impossible, to instantaneously achieve the informal aspects of a voice relationship where there has been a long history of exit. This is the essence of a close but adversarial relationship.

The above description fits the current state of buyer-supplier relations in the auto industry in the United States, in which attempts at instituting the formal aspects of a voice relationship followed decades of a very adversarial exit relationship (Helper, 1991b). Thus, while buyers prune their supplier bases, sometimes going as far as single-sourcing, suppliers still fear that the appearance of a superior rival will precipitate a switch. This leads to a model of repeated single-shot games, rather than a dynamic game.

### Test procedure

A number of factors in the buyer-supplier interface will affect the equilibrium probability of a switch perceived by suppliers. The model of noncooperative behavior (the close but adversarial model) and the model of cooperative behavior have different predictions with regard to the effects of many of these factors on the suppliers' perceived switching probability.

We write the suppliers' current perceived probability of a switch ( $PSWT_t$ ), as

$$PSWT_t = f [Comp_t, Spasset_t, Tech_t, Type_t](1)$$

where  $Comp_t$  is a vector of current competitive factors,  $Spasset_t$  is a measure of the level of transaction-specific assets deployed by the supplier,  $Tech_t$  is a vector of technological factors and  $Type_t$  is a vector of product characteristics.

Within the close but adversarial model of noncooperative behavior, the buyer will take advantage of competitive weaknesses of the suppliers to reap short-term gain. However, within the cooperative model, current competitive weaknesses of the suppliers will not be exploited fully, in the hope of future gains from cooperation. This leads to the following hypothesis:

*Hypothesis 1: Current competitive factors are*

*important in explaining the suppliers' perceived probability of a switch.*

Thus, the close but adversarial model is supported by the significance of the elements of  $Comp_t$  in Equation 1. The rejection of Hypothesis 1 provides evidence in favor of the cooperative model.

In the close but adversarial model, the suppliers' investments in specific assets are not protected by trust. In fact, investments in specific assets create the possibility of hold-up by the buyer (Williamson, 1985). However, in the cooperative model, these investments represent supplier confidence and a reduced perceived probability of a switch. This implies the following hypothesis:

*Hypothesis 2: Suppliers with large amounts of specific assets do not have a lower perceived probability of a switch than those with small amounts.*

The model of noncooperative behavior is supported by the insignificance of  $Spasset_t$  in Equation 1. As above, the rejection of Hypothesis 2 provides support for the cooperative model.

Further, the model of noncooperative behavior predicts that traditional concerns of vulnerability will affect supplier relations, leading to attempts by the buyer to minimize dependency (Figure 1). Thus, the complexity of suppliers' output should be uniformly low, with little variability in the vector of technological factors. This low variability implies high standard errors associated with the elements of the vector, leading to their being insignificant in the estimation of Equation (1).

*Hypothesis 3: The technological complexity of suppliers' output does not affect the suppliers' perceived probability of a switch.*

Finally, under the close but adversarial model, product characteristics should not affect the suppliers' perceived probability of a switch. This is because period-by-period profit maximization implies that all realizable gains will be attractive to the buyer; and switching to a cheaper source will be just as likely in the case of a relatively important input as in the case of a relatively unimportant one.

*Hypothesis 4: Differences in product type do*

not affect the suppliers' perceived probability of a switch.

This implies that the coefficients of the elements of Type<sub>t</sub> are insignificant in the estimation of Equation 1.

It is important to note that the rejection of Hypotheses 1 and 2 provides support for the hypothesis of cooperative behavior, and that this is not true of either Hypothesis 3 or 4. Rejection of either of the latter two hypotheses does not necessarily provide support for the cooperative model. Thus, we have set up four tests of the model of noncooperative behavior, and two tests of the alternative model of cooperative behavior.

The expected signs of the elements of the vectors of independent variables under the two alternative models are summarized in Table 2.

A secondary test of the models would be to carry out the estimation on the basis of a pretest. The pretest would be designed to identify subsamples within the overall sample that could be expected to conform to one or other of the two models under consideration.

As noted above in our discussion of formal and informal commitment, trust generated through embeddedness bonding can be a powerful enforcement mechanism within a cooperative relationship. A cooperative relationship is likely to be characterized by high trust to control concerns about vulnerability (Figure 1). Conversely, a noncooperative relationship is likely to be characterized by low trust and formal enforcement mechanisms.

Thus, splitting the sample using measures of trust forms the basis for a pretest. Separate estimations of Equation 1 for the two subsamples are expected to yield differing results. The theory predicts that the estimates for the 'low trust'

group should support the close but adversarial model in all four tests above. Similarly, the estimates for the 'high trust' group should support the cooperative model.

## DATA AND ESTIMATION

### Data

Our data are taken from the Survey of Automotive Supplier Relations conducted in the United States in 1993. The survey was sponsored by the International Motor Vehicle Program (IMVP) at MIT. It is an unusually comprehensive data base. It is developed from a postal survey sent to every automotive supplier and automaker component division named in the *Elm Guide to Automotive Sourcing*. This guide lists the major first-tier suppliers (both domestic and foreign-owned) to manufacturers of car and light trucks in the United States and Canada. A total of 675 usable responses came from independent U.S.-owned firms, Japanese transplants, and vertically integrated divisions of U.S. automakers, representing a response rate of 55 percent.

The target respondent was the divisional director of marketing at independent firms, and the divisional business manager or director of strategic planning at automaker component divisions. These individuals were selected on the grounds that they would have the broadest knowledge about both customer relationships and about their firms' products and processes. The respondents had a wealth of experience: they averaged more than 18 years in the auto industry and more than 11 years with their company.

Our primary objective is to test Hypotheses 1–4 through the estimation of Equation 1. To this end, we must operationalize the variables in the

Table 2. Expected effects under the two alternative models

Factors	'Close but adversarial' model	Cooperative model
Competitive	H <sub>1</sub> : Significant	Insignificant
Transaction-specific assets	H <sub>2</sub> : Insignificant	Significant
Technological	H <sub>3</sub> : Insignificant	–
Product characteristics	H <sub>4</sub> : Insignificant	–

equation. The dependent variable is the suppliers' perceived probability of a switch. This is determined by four sets of independent variables, namely competitive factors, transaction-specific assets, technological factors, and product characteristics. Our secondary objective is to reestimate Equation 1 on the basis of a trust pretest. Thus, we must operationalize trust through some observable relationship characteristics.

*Dependent variable: Probability of switching*

In dealing with the suppliers' perceived probability of a switch, we are faced with two possible alternatives. We can directly solicit the suppliers' own subjective estimate of this perception. Alternatively, we can solicit some objective information, on the basis of which we can construct a proxy variable for the perceived switching probability. Neither of these approaches is ideal. On balance, we conclude that the noncomparability of subjective responses elicited using the first method is a more serious problem and therefore that the construction of proxies is preferable (Cook and Campbell, 1979; Converse and Presser, 1986).

We constructed proxies to represent the perceived probability of a switch by inverting the suppliers' perceptions of their future with their customer, and normalizing by the mean perception in the sample. The construction of two proxies is described in the Appendix. Since they are proxies for a probability, they are constructed so as to be bounded between zero and unity.

*Independent variables: Competitive factors*

These variables, representing competitive factors, were related to the threat perceived by an incumbent supplier in terms of retaining its position. In the context of the classical 5-forces model, these threats are largely horizontal (Porter, 1980). We therefore operationalize this perceived threat by considering measurable factors which could be seen as affecting incumbency (Sriram and Mummalaneni, 1990). We are able to draw four variables to represent the current competitive factors. These variables related to the competition faced by the supplier, the degree of dependence of the buyer, and the buyer's contractual commitment. The exact specifications of the variables are provided in the Appendix.

*Independent variable: Transaction-specific assets*

The level of transaction-specific assets was measured in dollar terms. It should be noted that in the U.S. auto industry power has traditionally vested with the buyers, so that the asset specificity-dependence-vulnerability linkage (Figure 1) is particularly strong (Helper, 1991b). The building of trust may be impossible without the hostages of mutual commitment.<sup>2</sup>

It is possible that some of these investments may be redeployable. However, given the brand-specific nature of most OEM requirements, there will almost certainly be costs associated with redeployment. These costs have been rated as 'substantial' (Gorman, 1993). This is all that is necessary to ensure that the variable does, in part, measure vulnerability associated with hold-up.

*Independent variables: Technological factors*

These variables were related to the type of work outsourced. They were drawn to represent the implications of the literature indicating that in the cooperative model inputs of high and low technological complexity would tend to be outsourced. However, under the close but adversarial model, outsourcing would be limited to items of low technological complexity. We were able to draw three variables representing the technological complexity of the product. These variables related to the engineering skills required in the production of the product and the product's overall complexity (see Appendix for details).

*Independent variables: Product characteristics*

These variables fulfil two objectives. First, as discussed above, the close but adversarial model predicts that product type or importance should not affect the switching probability perceived by the supplier. The data set is cross-sectional and contains suppliers of important and/or critical inputs as well as suppliers of relatively unimportant inputs. As a short-run maximizer, the buyer is as likely to switch for a large gain (as in the case of an important/critical input) as for a small one (as in the case of an unimportant input).

<sup>2</sup> We are indebted to an anonymous referee for pointing this out.

Second, even though the sample is relatively homogeneous, we note that these variables can be considered to normalize for firm-specific characteristics (specifically, supplier technology and the buyer's purchase frequency). Two variables in this category were drawn (see Appendix for details).

#### Pretest Variables: Trust

These variables were required to carry out the trust pretest, i.e., to split the sample into high-trust and low-trust subgroups. The notion of trust used here is what Sako (1992) calls 'goodwill trust' and Korczynski (1996) calls 'high trust', i.e., mutual expectations of open commitment to each other, where commitment is defined as a willingness to do more than is formally expected. The key is that there are no formal contractually binding agreements or any fixed professional standards against which such actions can be measured, so that the mutual dependence is enforced solely through the desire to have the relationship continue into the future. We were able to draw three variables to represent the level of trust in the relationship.

The first measure of trust is directly drawn from the buyer-supplier interface. Single sourcing is typically claimed to have trust-building properties. The second measure of trust is rather indirect. It has been reported that a supplier in a trusting relationship with *its* suppliers is more likely to develop a trusting relationship with its buyers (Mudambi and Schröder, 1996). The third measure is based on suppliers' own beliefs regarding the likelihood of being treated 'fairly' by the buyer allied with the assumption that a 'fair' buyer will prove to be trustworthy (see Appendix for details).

#### Estimating methodology

We initially estimate Equation 1 using the full set of regressors, encompassing the competitive and technological factors as well as product type. The estimation is carried out over the entire sample. The first stage estimating methodology used is OLS. However, the creation of both probability proxies results in large mass points at zero, ensuring that the probability variables are censored. It is well known that in this case OLS estimates are biased. The appropriate estimating methodology is Tobit.

The standard method of generating Tobit estimates (programmed into most software packages) is to use the maximum likelihood method proposed by Fair (1977). An alternative method is to correct the OLS estimates for bias. Greene (1981) shows that a method of moments procedure can be used to correct for the OLS bias. This result is further generalized by Goldberger (1981) and Chung and Goldberger (1984). Quester and Greene (1982) apply this method of moments procedure to correct OLS bias and report a strikingly close approximation to the consistent maximum likelihood Tobit estimates. They find that this is even true for dummy regressors, which are highly nonnormal.

We present three sets of estimates. First we present the (biased) OLS estimates. Next, we use the method of moments procedure and present the estimates corrected for OLS bias. Finally, we present the maximum likelihood (nonlinear) Tobit estimates. We are able to replicate Quester and Greene's (1982) result of close agreement between the 'corrected' OLS estimates and the Tobit estimates.

#### Results

The results of the estimation of the two switching probability proxies (PSWT<sub>1</sub> and PSWT<sub>2</sub>) are in extremely close agreement with each other. Hence, in interests of brevity, only the estimates of PSWT<sub>1</sub> are presented. (Estimations of PSWT<sub>2</sub> are available from the authors on request). Summary statistics relating to the variables used are presented in Table 3.

Table 3. Summary statistics

Variable	Freq.	Mean	S.D.
EXPSUP	575	8.4478	9.3994
PSWT <sub>1</sub>	575	0.4261	0.3952
PSWT <sub>2</sub>	575	0.5905	0.3497
COMP93	609	2.1675	5.1054
BID93	649	-0.06934	0.4192
MN93	673	12.981	11.543
CON93	619	1.9941	2.9399
SKILPROC	660	2.1652	0.9454
SKILDE	663	2.1644	1.1178
COMPLEX	659	3.4947	1.0051
PRICE	658	28.003	57.289
ULAB	602	15.395	11.283
INVEST	550	(1.4721)10 <sup>7</sup>	(6.8253)10 <sup>7</sup>

The estimates using the full sample are reported in Table 4. While the OLS estimates diverge in magnitude from the maximum likelihood Tobit estimates, the two estimating methodologies are in close agreement in terms of the pattern of parameter significance. This agreement, along with the large number of degrees of freedom, gives us confidence in using the estimates in our hypothesis tests. This is reinforced by the close correspondence between the bias-corrected OLS estimates and the nonlinear Tobit estimates.

We begin by examining the estimated coefficients of the elements of  $Comp_t$ , i.e., the vector of competitive factors. Here we find strong support for Hypothesis 1, i.e., the close but adversar-

ial model. Of the four elements of  $Comp_t$ , three are highly significant. The supplier's perceived probability of a switch falls as the duration of its written contract (CON93) and the time required to bring in a replacement supplier (MN93) rise. Further, the perceived switching probability rises as the number of current competitors (COMP93) rises. Only the variable representing the buyer's bid solicitation (BID93) fails to exert a significant influence.

The supplier's transaction-specific investments (INVEST), which represent considerations of hold-up, emerge significant at the 5 percent level, and the sign is positive. Increased levels of specific assets actually seem to have increased the

Table 4. Full sample: Estimation of the switching proxy. OLS, bias-corrected OLS and Tobit estimates

Dependent-variable PSWT <sub>1</sub>	OLS estimates ( <i>t</i> -statistic)	Bias-corrected OLS estimates	Tobit estimates ( <i>t</i> -statistic)
CONSTANT	0.4988 (5.53)*	0.4431	0.4445 (2.93)*
COMP93	0.00504 (2.60)*	0.009347	0.01062 (2.58)*
BID93	-0.00382 (0.08)	-0.002171	0.008012 (0.10)
MN93	-0.005702 (3.19)*	-0.006186	-0.009996 (3.16)*
CON93	-0.041126 (3.75)*	-0.054227	-0.068521 (3.62)*
SKILPROC	0.04878 (2.27)**	0.09152	0.08036 (2.23)**
SKILDE	-0.01801 (0.96)	-0.026428	-0.029601 (0.95)
COMPLEX	0.00536 (0.27)	0.00067	-0.000622 (0.02)
PRICE	-0.000294 (0.79)	-0.000423	-0.000449 (0.69)
ULAB	-0.000148 (0.09)	-0.000194	-0.000921 (0.34)
INVEST	0.60207E-09 (2.20)**	0.86427E-09	0.86769E-09 (2.01)**
<i>OLS diagnostics</i>			
$R^2 = 0.4042$	$R^2$ (Adj.) = 0.3889	$F(10,399) = 29.217$	
Log-likelihood = -172.5376	APC = 0.1433	$S_u = 0.3066$	
Akaike IC = 0.8953		$n = 410$	
<i>Tobit asymptotic diagnostics</i>			
plim $R^2 = 0.4812$	plim $R^2$ (Adj.) = 0.4587	Slope scale factor = 0.5836901	
Log-likelihood = -349.2498		Iterations to convergence = 5	

\* Parameter significant at the 1% level. \*\* Parameter significant at the 5% level.

Table 5. High-trust subsample (PS ratio): Estimation of the switching proxy. OLS, bias-corrected OLS and Tobit estimates

Dependent variable PSWT <sub>1</sub>	OLS estimates ( <i>t</i> -statistic)	Bias-corrected OLS estimates	Tobit Estimates ( <i>t</i> -statistic)
CONSTANT	0.4719 (2.82)*	0.4064	0.3828 (1.60)
COMP93	0.00543 (1.53)	-0.01362	-0.010001 (1.54)
BID93	-0.05873 (0.59)	0.097712	0.11785 (0.81)
MN93	-0.004272 (1.28)	-0.003286	-0.00566 (1.18)
CON93	-0.016873 (0.80)	-0.031642	-0.026095 (0.86)
SKILPROC	0.06946 (1.82)	0.10632	0.09768 (1.76)
SKILDE	-0.03510 (1.15)	-0.038024	-0.046107 (1.06)
COMPLEX	0.033199 (0.88)	0.05367	0.045401 (0.83)
PRICE	-0.000637 (1.12)	-0.000918	-0.001042 (1.25)
ULAB	-0.001891 (0.58)	-0.007022	-0.0040708 (0.80)
INVEST	-0.21657E-10 (2.49)**	-0.21687E-09	-0.18855E-09 (3.21)*
<i>OLS diagnostics</i>			
$R^2 = 0.1988$	$R^2$ (Adj.) = 0.1239	$F(10,107) = 2.6542$	
Log-likelihood = -170.7097		$S_0 = 0.3593$	
Akaike IC = 0.9967	APC = 0.1587	$n = 118$	
<i>Tobit asymptotic diagnostics</i>			
plim $R^2 = 0.2341$	plim $R^2$ (Adj.) = 0.2109	Slope scale factor = 0.6349103	
Log-likelihood = -47.80685		Iterations to convergence = 4	

\* Parameter significant at the 1% level. \*\* Parameter significant at the 5% level.

perceived probability of a switch, which is a stronger result than that predicted by the close, but adversarial model (Hypothesis 2). This may be because specialized suppliers are likely to have a higher level of transaction-specific investments and consequently find themselves in a weaker bargaining position. They therefore perceive greater uncertainty with respect to buyer behavior.

Proceeding to Hypothesis 3, we examine the elements of Tech<sub>*t*</sub>, the vector of technological factors. Two out of the three elements provide support for the close but adversarial model. Both design engineering capabilities (SKILDE) and the rating of product complexity (COMPLEX) appear insignificant. Only the process engineering capa-

bilities (SKILPROC) appear significant at the 5 percent level. This suggests that the supplier's process engineering skills are valued, while its design engineering skills are not. Since process engineering is a mostly tactical consideration, while design engineering is a more strategic one, this seems to support the contention that suppliers believe they are operating within a short-term relationship.

We find further support for the close but adversarial model (Hypothesis 4) on examining the elements of Type<sub>*t*</sub>, the vector of product characteristics. Both of the product characteristics, namely the low-skilled labor intensity (ULAB) and product value (PRICE), appear insignificant.

Table 6. Low-trust subsample (PS ratio): Estimation of the switching proxy. OLS, bias-corrected OLS and Tobit estimates

Dependent variable PSWT <sub>1</sub>	OLS estimates ( <i>t</i> -statistic)	Bias-corrected OLS estimates	Tobit estimates ( <i>t</i> -statistic)
CONSTANT	0.4611 (4.05)*	0.4512	0.4120 (2.04)**
COMP93	0.00563 (3.44)*	-0.00819	-0.01047 (4.05)*
BID93	-0.00628 (1.11)	0.067292	0.04331 (0.43)
MN93	-0.006723 (3.02)*	-0.015876	-0.01390 (3.21)*
CON93	-0.045771 (3.41)*	-0.066881	-0.079892 (3.26)*
SKILPROC	0.03587 (1.32)	0.09468	0.05619 (1.18)
SKILDE	-0.00375 (0.15)	-0.038024	-0.005980 (0.14)
COMPLEX	0.005545 (0.23)	0.00187	0.004610 (0.11)
PRICE	-0.000146 (0.26)	-0.000645	-0.000427 (0.40)
ULAB	-0.000281 (0.14)	-0.000879	-0.0006230 (0.17)
INVEST	0.63295E-09 (2.24)**	-1.02166E-09	0.90994E-09 (2.53)*
<i>OLS diagnostics</i>			
$R^2 = 0.6290$	$R^2$ (Adj.) = 0.6153	$F$ (10,271) = 45.947	
Log-likelihood = -115.2708		$S_n = 0.2424$	
Akaike IC = 0.8955	APC = 0.1434	$n = 282$	
<i>Tobit asymptotic diagnostics</i>			
plim $R^2 = 0.6817$	plim $R^2$ (Adj.) = 0.6648	Slope scale factor = 0.4587654	
Log-likelihood = -234.8295		Iterations to convergence = 5	

\* Parameter significant at the 1% level. \*\* Parameter significant at the 5% level.

The mass point at zero in the frequency distribution of the probability proxies is reflected in the size of the slope scaling factor, which corrects for OLS bias. Asymptotic Tobit diagnostics are as expected. The fit improves relative to the OLS estimation, since the effect of the mass point is reduced. The asymptotic estimate of  $R^2$ (Adj.) is 0.4587 compared to the OLS estimate of 0.3889.

We may now examine the results of our secondary test. We first split the sample using several different trust pre-tests. The first pretest measure we use is a single-source dummy (SS89). This yields a 'high-trust' subsample and 'low-trust' subsample. We then proceed to estimate Equation 1 separately for the two groups. However, the esti-

mates for both groups are not significantly different from each other, as can be seen from the results presented in Table 10. Further, both groups mimic the estimates for the full sample rather closely. In the interest of brevity they are not presented (but are available from the authors on request).

These results may be interpreted either as support for uniform perceptions among high- and low-trust suppliers or as a failure of the single-source trust proxy to adequately represent buyer-supplier trust. Allowing for the latter possibility, we use the other two trust proxies. The second proxy is the suppliers' own purchase/sales ratio, PS, which is reported to work well as a measure of buyer-supplier trust by Mudambi and

Schründer (1996). Splitting the sample using this proxy, we obtain a 'high-trust' subsample of 118 and 'low-trust' subsample of 282. (Note that incomplete responses mean that the usable number of responses shrinks every time another variable is added to the sample or used in cross-tabulation. Thus, the number of usable responses in the full sample is 410, but shrinks to 400 when the sample is split using PS).

The results from the high-trust subsample are presented in Table 5. Examining the estimates of the coefficients of the competitive factors, we find CON93, MN93, COMP93, and BID93 to all be statistically insignificant. This is in contrast to the results for the full sample reported in Table 4, where the first three were highly significant. The statistical insignificance of these competitive factors is a prediction of the model of cooperative behavior (a rejection of Hypothesis 1). Thus, the high-trust subsample seems to conform to the cooperative model.

Examining the coefficient of the transaction-specific investment (INVEST) it is noted that it appears significantly with a negative sign. Increased specific investments by the supplier are accompanied by a reduced perceived switching probability. This implies a rejection of Hypothesis 2. This is in direct contrast to the results for the full sample, and provides further support for the cooperative model in the high-trust subsample.

The coefficients of the technological factors and product characteristics do not militate against the predictions of the close but adversarial model (Hypotheses 3 and 4). However, this may be because the overall fit of the equation is poor, even using the Tobit estimates, indicating that switching probability itself may not be determined within a noncooperative model specification.

The results from the low-trust subsample are presented in Table 6. They closely parallel the results from the full sample. This is not surprising considering that the low-trust subsample constitutes over 70 percent of the full sample. Further, the fit of the equation is better than the fit obtained in the full sample, indicating that the noncooperative model works better when the sample is uncontaminated by high-trust firms.

We find further support for these results using the third trust proxy, i.e., the suppliers' perception of buyer 'fairness'. Splitting the sample using this proxy generated a 'high-trust' subsample of 101 and a 'low-trust' subsample of 305. The

results for these subsamples are presented in Tables 7 and 8. They may be seen to be in close agreement with the results in Tables 5 and 6. The results are summarized in Table 9.

Finally, we carry out a series of tests for the identity of parameters across models. We carry out three tests for the OLS estimates (generalized 'F', Lagrange multiplier and likelihood ratio tests), and one test (likelihood ratio test) for the Tobit estimates. These results are presented in Table 10. As mentioned above, we find that the high-trust and low-trust subsamples defined by the SS89 trust proxy are insignificantly different from each other. However, when we conduct the tests on the subsamples defined by the PS and FAIR trust proxies, we find differences that are statistically extremely significant. This supports our contention that PS and FAIR function well as proxies for trust, while SS89 does not.<sup>3</sup>

Overall, the full sample results provide support for the close, but adversarial model, as summarized in Table 9. The results from the trust pretest show that the important concept of trust can be proxied by specific management behaviors as well as attitudes. The results also strengthen the link between trust and cooperation.

## CONCLUDING REMARKS

We have posited a model of close but adversarial buyer-supplier relations in the U.S. auto industry. This model consists of a framework of formal cooperation accompanied by noncooperative behavior. Within such a framework, the buyer will take advantage of competitive weaknesses of the suppliers to reap short-term gain. Further, traditional concerns of vulnerability will affect supplier relations, leading to attempts by the buyer to minimize dependency. Finally, because period-by-period profit maximization implies that all realizable gains will be attractive to the buyer, switching to a cheaper source will be just as likely in the case of a relatively important input as in the case of a relatively unimportant one. The model is therefore supported by the signifi-

<sup>3</sup> The canonical correlation between FAIR and PS is 0.82. The corresponding values for SS89 and FAIR and SS89 and PS are 0.19 and 0.22. Thus, FAIR and PS load heavily on the same factor, while SS89 does not. We are indebted to an anonymous referee for suggesting this procedure.

Table 7. High-trust subsample (suppliers' trust rating): Estimation of the switching proxy. OLS, bias-corrected OLS and Tobit estimates

Dependent variable PSWT <sub>1</sub>	OLS estimates ( <i>t</i> -statistic)	Bias-corrected OLS estimates	Tobit estimates ( <i>t</i> -statistic)
CONSTANT	0.2410 (1.72)	0.1964	0.1636 (1.00)
COMP93	0.00202 (0.57)	0.001346	-0.001226 (0.30)
BID93	0.02523 (0.40)	0.049716	0.06849 (0.91)
MN93	0.000481 (0.19)	0.000214	0.00147 (0.49)
CON93	-0.022155 (1.38)	-0.026625	-0.032041 (1.67)
SKILPROC	0.08471 (2.51)**	0.89631	0.09494 (2.35)**
SKILDE	0.03447 (1.26)	0.000189	-0.044364 (1.37)
COMPLEX	-0.026259 (0.86)	-0.028409	-0.031860 (0.89)
PRICE	-0.000876 (1.59)	-0.001019	-0.001124 (1.70)
ULAB	0.001309 (0.52)	0.000177	-0.0019836 (0.67)
INVEST	-0.56188E-09 (1.63)	0.61603E-09	-0.64776E-09 (1.63)
<i>OLS diagnostics</i>			
$R^2 = 0.1398$	$R^2$ (Adj.) = 0.0860	$F(10,90) = 1.4628$	
Log-likelihood = -64.35738		$S_u = 0.3645$	
Akaike IC = 0.8814	APC = 0.1414	$n = 101$	
<i>Tobit asymptotic diagnostics</i>			
plim $R^2 = 0.1632$	plim $R^2$ (Adj.) = 0.1175	Slope scale factor = 0.4201782	
Log-likelihood = -106.9199		Iterations to convergence = 4	

\* Parameter significant at the 1% level. \*\* Parameter significant at the 5% level.

cance of current competitive factors and the insignificance of technological and product type factors in the determination of suppliers' perceptions of the buyer's switching probability.

Thus, while the IMVP survey picks up a considerable increase in the formal aspects of commitment between buyers and suppliers in the U.S. auto industry (Helper, 1991a), our results cast doubt over whether this has been accompanied by a like increase in informal commitment. This means that in the majority of cases formal commitment has not been accompanied by the development of mutual trust. This may stem from the decades of adversarial buyer-supplier relations in the industry.

Given the relatively strong legal institutions and weak social institutions in the West, it is not surprising that initial cooperative efforts have focused on the formally enforceable mechanisms. The next step towards a hybrid framework where formal mechanisms become secondary to informal commitment requires active efforts in developing social networks (Lane and Bachmann, 1996; Casson, 1997).

Transaction on the basis of trust, with its implicit, pre-existing and unspecified conditions for cooperation, economizes on the specification and monitoring of contracts (Nooteboom, 1996). The development of trust can provide the basis for sustainable competitive advantage since it is

Table 8. Low-trust subsample (suppliers' trust rating): Estimation of the switching proxy. OLS, bias-corrected OLS and Tobit estimates

Dependent variable PSWT <sub>1</sub>	OLS estimates ( <i>t</i> -statistic)	Bias-corrected OLS estimates	Tobit estimates ( <i>t</i> -statistic)
CONSTANT	0.6434 (5.59)*	0.6935	0.7004 (3.85)*
COMP93	0.01279 (3.01)*	0.001701	-0.025795 (3.23)*
BID93	0.00638 (0.09)	0.004021	0.002684 (0.02)
MN93	-0.008478 (3.43)*	-0.010329	-0.01447 (3.49)*
CON93	-0.041442 (2.78)*	-0.066125	-0.072116 (3.00)*
SKILPROC	0.01549 (0.56)	0.03132	0.02073 (0.48)
SKILDE	-0.03215 (1.26)	-0.04189	-0.049942 (1.28)
COMPLEX	0.017862 (0.71)	-0.028409	0.022368 (0.57)
PRICE	-0.000060 (0.12)	0.000109	0.000147 (0.19)
ULAB	-0.001869 (0.91)	-0.001973	-0.0039492 (1.21)
INVEST	0.80283E-09 (1.87)	0.91615E-09	0.97853E-09 (1.53)
<i>OLS diagnostics</i>			
$R^2 = 0.6384$	$R^2$ (Adj.) = 0.5989	$F(10,294) = 47.2067$	
Log-likelihood = -90.86251	APC = 0.1393	$S_u = 0.3648$	
Akaike IC = 0.8669		$n = 305$	
<i>Tobit asymptotic diagnostics</i>			
plim $R^2 = 0.6629$	plim $R^2$ (Adj.) = 0.6281	Slope scale factor = 0.53065409	
Log-likelihood = -188.3470		Iterations to convergence = 4	

\* Parameter significant at the 1% level. \*\* Parameter significant at the 5% level.

Table 9. Summary of results

Factors	Full sample	Low-trust subsample (PS, FAIR)	High-trust subsample (PS, FAIR)
Competitive Transaction-specific assets	Evidence favors the close, but adversarial model. H <sub>1</sub> , H <sub>3</sub> and H <sub>4</sub> cannot be rejected. In the case of H <sub>2</sub> , results are stronger than predicted.		Evidence favors the cooperative model. H <sub>1</sub> and H <sub>2</sub> are rejected
Technological Product characteristics			- -

Table 10. Testing for estimator differentials based on trust measures

	Test statistic	Trust indicator		
		Single vs. multiple source (d.f. 2 = 389)	Purchase/Sales (PS) Ratio (d.f. 2 = 378)	Suppliers' Trust Rating (d.f. 2 = 384)
OLS	Generalized $F$ -test $F$ (11, d.f. 2)	1.3365	7.8958	2.9603
	LM Test: $\chi^2$ (11)	14.7012	86.8541	32.5633
	Likelihood ratio test: $\chi^2$ (11)	15.2619	82.7317	33.0467
Tobit	Likelihood ratio test: $\chi^2$ (11)	19.5815	96.5741	103.9760

Notes:

1. Critical values

$F(11, \text{d.f. } 2)_{\text{crit}}(5\%)$  approximately 1.79

$F(11, \text{d.f. } 2)_{\text{crit}}(1\%)$  approximately 2.25

where d.f. 2 equals either 378, 384 or 389

$\chi^2(11)_{\text{crit}}(5\%) = 19.6751$

$\chi^2(11)_{\text{crit}}(1\%) = 24.7250$

2. Single-source supplies claimed to have no other firms supplying the same input to the same customer.

3. PS ratios in excess of 40% were specified to be high, and those below this figure were specified to be low. 40% was the mean PS ratio in the sample.

extremely difficult to imitate. Trust development will be easier in some institutional and societal settings than others. It follows that the competitive advantage obtainable from cooperative buyer-supplier relations will be greater in environments which are hostile to cooperation than in environments where cooperation is the norm. Japanese firms appear to derive greater competitive advantage from cooperative supplier relations in their transplant operations in the West than in their operations at home (Morris and Imrie, 1992; Nishiguchi, 1994).

The strategic advantages of cooperative buyer-supplier relations can only be realized through an intertemporal process which takes the nature of the historical relationship into account. The U.S. auto industry has been characterized by decades of adversarial buyer-supplier relations. Our findings suggest that since the close but adversarial model represents the current state of buyer-supplier relations in the majority of cases, the initial strategies must involve actions which are clearly mutually beneficial. Managers often voice an interest in improving buyer-supplier relations, but find it difficult to know where to begin. Within the close but adversarial model, several specific areas are identified where mutual gains are possible. Longer-term decision horizons and

increased information flows are two such areas. Other action plans can be developed by examining the strategic dimensions of the relationship in a generic way. Many actions in the area of quality management fit the requirements of mutual gain (Nooteboom, 1994). Finally, even actions involving increased vulnerability are possible in the early stages, provided they are protected by adequate safeguards, such as the mutual hostages previously described.

We do find some evidence suggesting that high-trust relations have been developed in a minority of cases. It is an open question as to whether these high-trust relations are the exception or the beginnings of real change in Western buyer-supplier relations. A replication of this study on data from the next IMVP survey should provide important insights into the trends. A useful avenue for further research would be to evaluate the competitive advantage generated in these high-trust dyads. This would allow the estimation of value of high-trust buyer-supplier relations both in relational as well as financial terms. Further research is needed to create a better understanding of the dynamic role of improved buyer-supplier relations in sustainable competitive advantage. To date, its full potential remains unrealized.

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## APPENDIX

### Competitive factors

- COMP93 = Number of firms supplying the same product to the same customer in 1993
- BID93 = -1, if other bids have been solicited by customer  
0, if the supplier has no information in this area  
1, if no other bids have been solicited by customer
- MN93 = Number of months required for

customer to replace supplier with another supplier

- CON93 = Length of written contract with customer

### Technological complexity of product

- SKILPROC = Rating of skill in terms of incremental process improvements
- SKILDE = Rating of skill in terms of design engineering

COMPLEX = Technical complexity involved in manufacturing the product in 1992

**Transaction-specific assets**

INVEST = Supplier's investment in equipment over the last four years to make the product (U.S.\$ '000s)

**Product characteristics**

PRICE = Average piece price of product in 1992

ULAB = Percent of total costs accounted for by hourly wages and benefits

**Proxies for supplier-perceived probability of switch**

EXPSUP = Number of years that supplier considers that there is 'a high probability that it will be supplying this customer'

$$NESUP = \frac{EXPSUP}{E [EXPSUP]}$$

NESUP is a normalized measure of the suppliers' perception of the durability of the relationship.

$$PSWT_1 = \begin{cases} 0 & \text{if } NESUP \geq 1 \\ 1 - [NESUP^2] & \text{if } 1 > NESUP > 0 \\ 1 & \text{if } NESUP = 0 \end{cases}$$

$$PSWT_2 = \begin{cases} 0 & \text{if } NESUP \geq 2^{1/2} \\ \frac{2 - [NESUP^2]}{2} & \text{if } 2^{1/2} > NESUP > 0 \\ 1 & \text{if } NESUP = 0 \end{cases}$$

The PSWT<sub>1</sub> proxy is weighted towards zero, while the PSWT<sub>2</sub> proxy reduces this tendency.

**Trust proxies**

SS89 = 1, if there is no other supplier for the same component to the buyer, i.e., the supplier is a single source

0, if there are other suppliers for the same component to the buyer

PS = 1, if supplier's own purchase/sales (PS) ratio exceeds sample mean, i.e., supplier has made itself too vulnerable to *its* suppliers

0, if supplier's own PS ratio is below sample mean

FAIR = 1, if the supplier's expectation of 'being treated fairly' by the buyer was scored at 4 or higher on a 5-point Likert scale

0, if this expectation was scored at 3 or lower