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By Raji G. Srinivasan

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Long-term Vertical Alliances and Supplier Performance

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For the degree of Doctor of Philosophy

Signed by the final examining committee:

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Approved by: James B. Brown — Department Head — 9/29/98 — Date

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LONG-TERM VERTICAL ALLIANCES AND SUPPLIER PERFORMANCE

A Thesis

Submitted to the Faculty

of

Purdue University

by

Raji G. Srinivasan

In Partial Fulfillment of the

Requirements of the Degree

Of

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ABSTRACT

Srinivasan, Raji G. Ph.D., Purdue University, December 1998, Long-term Vertical Alliances and Supplier Performance. Major Professors: Thomas H. Brush and Arnold C. Cooper

In recent years, cooperative buyer-supplier relationships, fashioned after the Japanese management style, have become popular in industrial markets. While buyers have explicitly benefited (from these relationships) in terms of better end-product performance and lower costs, it is not clear if suppliers have also gained. Researchers wonder if the buyers' success has come at the expense of their suppliers. To this end, this dissertation attempts to study the effect of the structural attributes of long-term vertical relations on supplier performance.

Given that a long-term vertical relationship (that warrants transaction specific investments - TSIs) is the focus of analysis, the dissertation draws on two related fields of study - Transaction Cost Economics (TCE) and Theory of Incomplete Contracts. The former theory stipulates that TSIs need to be accompanied by safeguard mechanisms to serve efficiency interests of both parties. It further characterizes governance structures (for exchange relationships) along the dimensions of incentive intensity and adaptive ability. Among other factors, the latter theory focuses on "verifiability of contractual provisions" as a key source of incompleteness and rigidity in long term contracts. This dissertation synthesizes these two contributions to distinguish between "enforceable contracts" that require verifiable provisions and "self-enforcing contracts" that are supported by symbiotic, but non-verifiable mechanisms. The study argues that these two governance modes would vary systematically in terms of their safeguards, incentive intensity and adaptive features, and would therefore impact supplier performance

differently. A total of nine hypotheses, all concerning supplier performance, are developed.

These propositions are tested in the context of data collected from the Home Appliance Industry. Results from the study suggest that supplier management characterized by reciprocal investments, mutual dependence, and information sharing is a value enhancing capability. Results also indicate that merely increasing contract duration is not sufficient to serve supplier interests. Interestingly, this is not the approach taken by most American OEMs in their dealings with suppliers. In this context, this dissertation should add to our understanding of how to structure long-term OEM-Supplier relationships in ways that lead to improved performance for suppliers and sustainable advantage for OEMs.

CHAPTER ONE

INTRODUCTION

1.1 Background

In recent years, long term OEM-supplier relationships, fashioned after the Japanese management style, have become popular in many industrial markets. In contrast to spot (market) exchange, such long-lived association allows the parties to be adaptive in their negotiation and to act in a coordinated manner. While the buyers have explicitly benefited (from these relationships) in terms of better end-product performance and lower costs, it is not clear if the suppliers have also gained. Researchers have wondered if buyers' success has come at the expense of their suppliers. However, very little formal work has been done to analyze the impact of these relational exchanges on supplier performance. To this end, this dissertation attempts to study the effect of different structural attributes of long term vertical relations on supplier performance. The research question gains managerial significance in light of the fact that OEMs have not been very successful in obtaining process cost information from their suppliers. Such information is required to implement value analysis techniques that improve the competitiveness of buyers' products in the downstream market. Suppliers are hesitant to share cost information despite the fact that buyers offer longer contracts and are rationalizing their supplier-base.

More generally, supply chain management is an essential strategic activity for all manufacturing firms. This is especially true when the firm's end product in the consumer

market is an integration of multiple components and, some of these components need to be procured from external organizations. The suppliers' inputs gain strategic (competitive) significance in the downstream market through their effect on product quality and performance. More importantly, in this age of rapidly changing technologies and global markets, suppliers play a crucial role in new product and process development activities. The competitive effects of new product and process developments are felt through their impact on product design, process automation, manufacturing productivity and ultimately cost of production (Clark et al., 1987). These product design and process automation capabilities are distinctive to and embedded in each manufacturing organization in the form of engineering knowhow, accumulated information systems and supplier management skills. Such knowledge and skills are not easily imitable in the short run as they represent deliberate investments made over time (Dierickx & Cool, 1989).

In this context, Japanese OEMs have historically been exposed to heavy competition and product proliferation pressures in their domestic market. Accelerating product proliferation coupled with shortening product cycles complicates manufacturing tasks. To cope with this increasing manufacturing complexity, Japanese producers have used **a distinctive, deliberate strategy of delegating the assembly of sub-systems as well as finished products to their major suppliers.** This drastically reduces managerial complexity and allows the OEMs to focus their resources on other crucial activities such as product and process innovations. Over time, their reliance on subcontractors has increased as the latter undertook greater responsibilities in the form of testing, parts procurements and design and development functions (Nishiguchi, 1994). In fact, evidence from several industries indicates that the Japanese OEM-supplier relationships undergird their significant cost-quality-innovativeness advantage. An often quoted cite

from MITI (Ministry of International Trade and Industry, Japan) attributes much of Japan's manufacturing success to its "subcontracting structure" (Dyer & Ouchi, 1993; Richardson, 1993).

Having witnessed the competitive benefits enjoyed by Japanese firms on account of this supplier strategy, OEMs in global industrial markets have moved towards long-term associations with their suppliers, supplier-base rationalization and more cross-functional team work. The automobile industry and home appliance and electronic goods industry are cases in point. Reports on how manufacturers use their suppliers in product design and engineering processes to slash product development time and costs are on the rise. Transactions are no longer discrete, ad hoc events - they are path-dependent, planned and administered (Dwyer, Schurr & Oh, 1987). Such longevity also implies greater interdependence among the parties, and could potentially lead to problems of performance measurement - as all future contingencies cannot be foreseen and provided for. What form the governance mechanism takes (to ensure contractual performance) depends on whether the parties prefer third-party arbitration (**trilateral governance**) or mutual adjustment processes that are transaction-specific and on-going in nature (**bilateral governance**) (Williamson, 1985). In the former case, the reference point for making adaptations and resolving conflicts is the original agreement while, in the latter case, it is the entire relationship as it has developed over time. It is the latter which truly constitutes relational contracting (Macneil, 1978). To some extent, the current trends in buyer-supplier relationships in the West reflect the use of trilateral governance. In theory, relational contracting / bilateral governance provides the benefits of reduced uncertainty, managed dependence and joint profit-maximization through adaptive and coordinated decision-making. The realization of these benefits is of course contingent on the extent to which parties share information and the disincentives they

have to behave opportunistically. Typically, this is achieved through hostages exchanged by the parties to trade - thereby creating mutual mobility barriers and allowing the parties to develop joint focus in operations.

Clearly, these collaborative vertical alliances are attempting to capture the adaptive benefits of vertical integration without having to incur the costs associated with it. As mentioned earlier, the benefits include greater coordination of activities, investment in specialized assets and avoiding double-marginalization. The proclivity of these firms to retain their distinctive identity and not vertically integrate stems from a variety of reasons. External suppliers can pool diverse sources of demand and achieve greater economies of scope than an in-house division (Williamson, 1985). Independent suppliers may be able to source direct factors of production at a lower cost than larger corporations, providing the former with an absolute cost advantage. The lower (direct) labor cost of external contractors in the automobile industry is a case in point. More importantly, an in-house supplier division lacks the incentive to remain cost-competitive or technologically competent relative to the rest of the market. Since it is guaranteed the business of the purchasing department, such a division may not make the appropriate investment decisions to remain competitive with external suppliers. It is this governance problem that keeps many buyers from integrating backwards.

Another factor that contributes to the integration decision is volatility of the industry structure (Harrigan, 1983). Firms may experience volatility in terms of demand instability, technological changes etc. The more volatile the demand and technology parameters are, the more risky it is for firms to integrate. Also, in some industries, relative vale-added by upstream suppliers and innovative capability of suppliers are sufficiently high to deter buyer-firms from integrating backwards. The buyers would then be more competitive if they procured inputs from external sources rather than from

in-house operations. It would, therefore, be reasonable to argue that the production and governance inefficiencies that accompany integration together with industry volatility make bilateral alliances more competitive from the buyer's perspective.

One form of bilateral governance (relational contracting) attributed to the Japanese - the supplier management strategy referred to earlier- is the Just-In-Time (JIT) exchange. *Delivery of necessary quantity with perfect quality as per the precise timetable* to the Original Equipment Manufacturer (OEM) are crucial elements of JIT (Frazier, Spekman & O'Neal, 1988). In attempting to deliver the precise quantities with perfect quality as per the OEM's timetable, the buyer-supplier relationship has come to be characterized by supplier tiering, negotiations based on non-price dimensions, longevity of relation with suppliers, self - regulation, high degree of functional interdependence, (zero-defect supply, JIT delivery) and, information sharing.

More importantly, the global drive for long-term contracts has been motivated by the obvious success of JIT implementation. In fact, researchers have even identified the cost advantage per car that the Japanese auto-manufacturers have been able to achieve on account of JIT (Helper, 1991). In a bid to improve their competitiveness, western firms have tried to move away from market (discrete) exchange and reap the benefits of long term association with their suppliers. These OEMs have established supplier-rationalization, better focus on quality through Statistical Quality Control (SQC), and, supplier participation in product design to improve manufacturability of parts (Womack et al., 1991; Helper, 1991; Lyons et al. 1990). However, they have not been very forthcoming by way of technical or financial assistance to their suppliers (to achieve the higher standards), nor, have they made JIT a reality for their suppliers; instead, they (OEMs) have merely passed on the inventory burden to their suppliers. While the suppliers make just-in-time deliveries, they have not been able to achieve just-in-time

production themselves - with small batch sizes and lead times (Womack et al., 1991; Helper, 1991; Helper & Sako, 1995).

1.2 Research Question

Explicit benefits of JIT exchange to the buyer include reduced uncertainty in supplies, better quality of parts, lower manufacturing overheads (such as inventory carrying cost, cost of rework) and lower product development time and costs - as is being witnessed in the automobile, aircraft and home appliance industries, to name a few. Of course, such a relationship also entails increased dependence on fewer suppliers and ensuring that these suppliers undertake innovation and cost-reducing efforts, given the reduction in competition among them. With regard to the seller, potential benefits include reduced (volume) uncertainty because of the long term focus, better planning of R&D activity etc. (Lyons, Krachenberg & Henke, 1990). Such relational exchange is, thus, a potential source of competitive advantage, as seen in the case of the Japanese *keiretsu* system and the global drive for long term contracts that it has brought in its wake.

However, the empirical evidence from both popular press and academic works suggests that buyers are potentially gaining at the expense of their sellers. While sellers have been performing on price and other non-price dimensions (such as quality, timely delivery etc.), they fear that the buyers are, in reality, not committed to a long-term association. They perceive that the buyers are still judging suppliers on short-term, invoice-price basis (Lyons et al., 1990; Helper, 1991). If bilateral trading were to persist, the buyers could use their bargaining power, engage in adversarial negotiations and expropriate the suppliers' profits. Given the detrimental effect of such negotiation on

supplier profitability, the suppliers do not have an incentive to perform along the price and non-price dimensions in the future.

Even with respect to the JIT exchange, although it is not price-driven, Japanese suppliers explicitly commit to future / target price reductions based on cumulative learning / experience and scale effects (Womack et al. 1991; Dyer & Ouchi, 1993). Further, given the manner in which JIT has been implemented in the West, the inventory burden has merely been passed on to the suppliers - without the buyers making a committed effort to smooth suppliers' production as well. Consequently, the relational exchange trend in buyer-supplier relations (both JIT and the Western version of it) raises serious questions with regard to its performance implications.

The research issue, therefore, being addressed is the role of long term vertical associations as a source of competitive advantage. More specifically, the dissertation attempts to study the effect of the distinctive features of such long term vertical relations on supplier performance. For, if the suppliers do not retain some of the surplus, they have no incentive to continue with the relationship. Given that the governance features chosen by the trading parties constitute conduct / strategy variables (per the SCP paradigm), the dissertation argues that certain mechanisms augur well for suppliers when idiosyncratic investments are made.

1.3 Preview of the Dissertation Structure

The dissertation consists of seven chapters, including this introductory chapter. The contents of each of the following chapters are discussed briefly here.

Chapter Two reviews the two theories that are crucial for the rationale and development of the research model. To begin with, this chapter looks at the key dimensions of exchange relationships and their governance mechanisms as characterized

by Transaction Cost Economics (TCE). Subsequently, it draws on the Theory of Incomplete Contracts to identify the key source of difference between two alternate mechanisms used to govern vertical relationships, namely, trilateral and bilateral governance. This source of difference is the verifiability of parties' obligations to one another.

Chapter Three develops a model based on the above-mentioned difference between the two focal governance structures to explain variations in supplier performance. To this end, it presents a series of hypotheses after an in-depth review of relevant conceptual arguments and empirical evidence. The hypotheses compare and contrast the association between verifiable aspects of trade and supplier performance and non-verifiable aspects of the relationship and supplier performance.

More specifically, the model hypothesizes that voluntary and non-verifiable commitments that both parties make to the relationship create a joint (non-adversarial) focus in negotiations and improve flexibility of respective parties. Consequently, together with information exchange, these credible but non-verifiable commitments are expected to relate to superior performance.

Chapter Four lays out the research methodology in detail. It commences with the research setting for the model in terms of industry and sample choice, followed by an analysis of the appliance industry. The next sub-section describes the development and administration of the survey instrument. Finally, it presents a discussion of the operationalization of variables.

Chapter Five begins by providing some descriptive statistics of the data. Subsequently, this chapter briefly reviews the basic statistical technique used to analyze the data, namely, OLS regression. The key assumptions of the model and corrections that need to be made for potential violations of these assumptions are then discussed. Here,

the study also explores the potential for any sample selectivity bias in the data. The next part of this chapter is dedicated to test the different hypotheses in the context of data collected from Home Appliance industry.

Chapter Six studies the implications of results found in Chapter Five. More importantly, this chapter discusses the overall message emerging from the empirical analysis - in the context of the conceptual model developed in earlier chapters.

Chapter Seven concludes the dissertation by presenting the managerial implications of the study and its contributions to academic literature. In particular, this study suggests that supplier management characterized by reciprocal investments, mutual dependence and information sharing is value enhancing for both parties. Paying attention to supplier interests is vital for such "cooperative exchange" to be a source of advantage to OEMs. This study should, therefore, add to our understanding of how to structure long term OEM-supplier relationships in ways that lead to improved profitability for the supplier and to sustainable advantage for the OEMs. The chapter also notes the limitations of this study and suggests potential areas for future research.

CHAPTER TWO

THEORETICAL FOUNDATION OF THE STUDY

2.1. Introduction

Closer long term ties with fewer suppliers has emerged as a popular method of supply chain management in many industries. Historically, the Japanese have been able to sustain these cooperative relationships by making them work to mutual (buyer and supplier's) advantage. Evidence from western markets has been mixed with regard to such supplier management practices. One main source of concern with this strategy is its performance implication for suppliers. It is quite customary for suppliers to invest in exchange-specific assets in these hybrid vertical alliances - both in Japan and in other countries. In order to understand the vast difference in Japanese and Western experiences with these JIT exchanges, it is essential to study how these relationships are governed / organized in the two regimes.

Transaction Cost Economics (TCE) provides the appropriate theoretical apparatus to guide the analysis here. This is because TCE, as an area of study, focuses on exchange relationship as its unit of analysis. Furthermore, TCE explicitly considers the effects of asset specificity on economic organization. That is, TCE identifies asset specificity (among others) as a characterizing dimension of any transaction. It argues that the level of such specificity fundamentally determines the optimal governance choice for the transaction in question. Also, Williamson (1985) and Klein et al. (1978) specifically address the role of asset specificity in vertical (buyer-supplier) exchange situations.

Given that this research focuses on vertical associations / alliances that warrant transaction specific investments, TCE clearly is an appropriate theoretical framework to ground the model in.

Besides having a common context with the research question, TCE directs the choice of governance mechanisms that would be used to address the question. That is, TCE also identifies three dimensions that characterize governance modes and makes normative predictions as to what governance choice constitutes the best fit for individual transactions. Therefore, TCE not only helps identify the relevant independent variables for the study but also predicts the nature of association between the dependent and independent variables.

Also, the research question is motivated entirely by non-integrated vertical (intermediate market) relationships, wherein the identity of the parties remains distinct. The non-trivial level of asset specificity negates focus on discrete, market exchange. Therefore, attention is centered mainly on intermediate mechanisms used to govern inter-firm relationships. The relevant mechanisms are termed "intermediate" because they lie between the two extremes of market, arms-length exchange on the one hand and vertical integration on the other. Furthermore, these relationships are potentially long-lived. The longevity of the association raises the issue of how to manage / govern the relationship under conditions of futuristic uncertainty. Long term contracting is one of the commonly used quasi - vertical integration strategies to govern such relationships. However, extensive empirical research reveals that such contracts do not always serve the parties' interests well. This, in turn, requires the study to address the efficacy of (comprehensive) long term contracts as a means of governing inter-firm relationships. More specifically, the research is rooted in a world of incomplete contracting. Theory of Contracts (in conjunction with TCE) deals with features and characteristics of optimal contracts under

conditions of uncertainty and asymmetric information. This constitutes the second crucial theoretical perspective used in modeling the problem.

While long term contracts embody strategic alliances between buyers and suppliers, they are, by definition, "incomplete" governance mechanisms. They are incomplete because it is impossible for the contracting parties to specify the uncertain future completely and in a verifiable manner (among other factors). By identifying alternate sources of incompleteness, the theory of contracts contributes significantly to this study. In particular, it directs the researcher to employ "verifiability of contractual obligations" as a means of distinguishing each of the three dimensions (independent variables) identified by TCE. More importantly, this distinction allows the study to precisely identify the value enhancing and value detracting aspects of each of these dimensions. That is, it is this theoretical tool that helps measure distinct variables within the broader dimensions specified by TCE; it also specifies the relationships among these variables and the dependent variable.

This chapter discusses the contribution of both theories in detail. The TCE arguments are presented initially. The main role of TCE is to identify mechanisms that have the potential to efficiently govern the specific vertical alliance under study. TCE further helps distinguish these mechanisms in terms of their characterizing dimensions. These dimensions, in turn, help specify the relevant variables explaining supplier performance.

2.2.0 Transaction Cost Economics

As the title suggests, TCE's basic unit of analysis is an exchange relationship or a transaction. A transaction occurs when a good or service is transferred across a technologically separable interface. One stage of activity terminates and another begins

- whether within or between firms. Hence, transactions track a product from its raw material stage until it reaches the ultimate consumer. Transaction costs are the costs of running this economic system (K. Arrow , 1969). They are the economic equivalent of friction in physical systems. Traditional micro-economic (Price) theory considers the firm as a production function, with a profit-maximizing objective. Further, any change in economic organization is technologically determined. However, as early as 1934, Commons advanced the notion that economic organization is not merely a response to technological aspects such as economies of scale , scope, etc. It often serves the purpose of harmonizing relations between parties in economic activity who are otherwise in actual or potential conflict. Coase (1937) made the classic proposition that, rather than regard the boundaries of the firm to be technologically given, firms and markets must be treated as alternative modes of economic organization.

Barnard's work in Organization Theory (1938) was pioneering in stating that "conscious, purposeful, deliberate" cooperation among men occupies a central place in formal organization. He further asserted that bounds on human rationality exist, tacit knowledge is important and opportunism is a pervasive condition of human nature. Simon carried this forward by stating that the central problem of organization is to join rational purposes with the cognitive limits of human nature. Consequently, TCE draws heavily on two behavioral assumptions of human nature :

(a) Bounded rationality

This assumption acknowledges limits on cognitive competence. Unlike neo-classical economics which maintains a maximizing orientation (wherein optimizing utility functions is ubiquitous), TCE clearly assumes that economic actors are intendedly rational, but limitedly so. An economizing orientation is elicited by the

intended rationality part of the definition, while the study of institutions is encouraged by conceding that cognitive competence is limited (Williamson, 1985).

(b) Opportunism - self-interest seeking with guile

Opportunism refers to the incomplete or distorted disclosure of information, especially with an intention to mislead, distort or obfuscate matters. It is thus responsible for real or contrived conditions of information asymmetry.

As already noted, transaction costs are the costs of running an economic system harmoniously. More specifically, transaction costs can be distinguished into ex ante and ex post costs. The former includes cost of drafting, negotiating and safeguarding an agreement. Safeguards can take several forms - the most obvious of which is common ownership. That is, the parties could substitute internal organization for market exchange. Or, ex ante safeguards can be designed to signal credible commitment to sustain integrity of the transaction - as seen in the case of non-standard contracting. Ex post costs include:

(i) maladaptation costs incurred when transactions drift out of alignment ;

(ii) haggling costs incurred in correcting expost misalignments;

(iii) set up and execution costs associated with governance structures; and,

(iv) the bonding costs of effecting secure commitments.

With respect to ex post costs, it is commonly assumed that efficient rules of law regarding contract disputes are in place and are applied by the courts in an informed, sophisticated and low-cost manner (Williamson, 1985).

The TCE approach, therefore, to understanding economic organization is one of firms having the ultimate goal of minimizing the above-mentioned transaction costs. Economizing in the context of bounded rationality takes two forms :

(a) the use of heuristic problem - solving in decision process situations;

(b) assigning transactions to governance structures in a discriminating way.

The costs of planning, adapting and monitoring transactions are expressly considered here. These costs are predicted to be particularly high for transactions subject to ex post opportunism. Governance modes that contain these costs are largely favored. Ceteris paribus, modes that make large demands on cognitive competence are not favored at all.

In determining the appropriate governance mode, Williamson (1985) argues that ex ante incentive alignment of the transacting parties is essential. However, on account of futuristic uncertainty, complexity and bounded rationality, not all future contingencies can be incorporated ex ante into the agreement. In such a context, TCE disputes that court ordering is efficient. It argues that attention, instead, needs to be focused on private ordering. The objective is not merely to resolve conflicts in progress, but also, to recognize potential conflicts and devise suitable mechanisms that forestall such conflicts. **A distinctive proposition of TCE is that ex post support institutions of contract matter.** The focus is clearly on contract execution with a long term perspective. More generally, the point made is that contracting must be studied in its entirety. Both the ex ante terms of contract and the manner in which contracts are thereafter executed are seen to be equally important. TCE posits that these two aspects of trade vary with the investment characteristics and the associated governance structures. Consequently, there emerges a need to identify the attributes of transactions and of alternate governance modes so that an optimal fit could be obtained.

2.2.1 Transactional Attributes

The three dimensions characterizing an exchange situation are:

(i) **Asset - specificity:** The term "asset-specificity" refers to durable investments that are undertaken in support of particular transactions. Such investments are specific to the exchange and have very little value in best alternate uses.

This dimension provides the basic rationale in explaining instances of vertical integration (internal organization) and non-standard contracting. The proposition that the idiosyncratic attributes of assets have large and systematic organizational ramifications first appeared in conjunction with the study of vertical integration. Asset-specificity has an inter-temporal aspect and the central question that TCE addresses is "Do the cost-savings afforded by special (specific-assets) technology justify the strategic hazards that arise as a consequence of their non-salvageable character?" The theory argues that the tradeoff varies systematically with the governance structure to which the transaction is assigned. Four types of asset-specificity are identified:

(a) **Site specificity** - this refers to instances where production units of successive stages are located in a cheek-by-jowl relation to each other so as to economize on inventory and transportation expenses. These assets tend to have prohibitive relocation costs. Once located, the parties are operating in a bilateral exchange relation for the useful life of the assets.

(b) **Physical asset specificity** - refers to a case where the specificity is attributable to the physical features / technology /configuration of an asset. Such an asset could very well be mobile. Lock in problems are less severe here.

(c) **Human asset specificity** occurs in instances of learning by doing, knowledge embedded in individual team members. Both these situations could favor common

ownership of human assets, (i.e.), an employer-employee relationship. An employment relationship rather than an autonomous contracting relationship prevails (Klein, 1988).

(d) **Dedicated assets** - such assets represent discrete investment in generalized production capacity. These investments will not be made but for the prospect of selling a significant amount of production to a specific consumer. An example would be expanding capacity on behalf of the buyer. There does exist some potential for trading hazards in this context.

(ii) Uncertainty: The basic proposition here is that governance structures differ in their capacities to respond effectively to disturbances (namely, adaptive ability). The influence of uncertainty on economic organization is seen to be conditional on the level of asset-specificity (Williamson, 1975; 1985). With regard to standardized transactions, any degree of uncertainty poses no special problems, as new trading relations can easily be forged. Continuity is of no value; discrete market contracting prevails. The term "standardized transaction" refers to transactions characterized by negligible levels of asset specificity. When asset-specificity of a non-trivial degree is introduced, increasing the level of uncertainty makes it more imperative that the parties work things out.

Empirical support for the above argument is found in studies undertaken by Heide & John (1990) and Noordewier et al. (1990). The former find that closer bilateral relationships are effective for transactions accompanied by high levels of asset specificity and uncertainty. Noordewier et al. (1990) find that the buyer firm performs better when it works closely with its suppliers under conditions of high specificity.

(iii) Frequency: While specialized governance structures are finely tuned to the governance needs of non-standard transactions, such transactions must occur in sufficient frequency to justify the costs of setting up and executing the governance mechanisms. Where frequency is low but the needs for nuanced governance are great, it is possible to

aggregate the demands of similar but independent transactions. Court ordering would be replaced by third party arbitration.

2.2.2. Alternate Governance Structures

Contracting traditions used to govern transactions can be classified into the following:

(a) Classical contracting - this emphasizes discreteness (arms-length) and comprehensive contracting, wherein all relevant future contingencies are described and discounted with respect to both likelihood and futurity. The emphasis is on legal rules, formal documents and self-liquidating transactions. Third-party participation is generally discouraged.

(b) Neo-classical contracting does not require that all future contingencies and their respective remedies be foreseen ex ante. It provides for veridical disputes between autonomous parties when state-contingent claims are made. Given the gaps in planning (attributable to "incompleteness" / uncertainty and bounded rationality) and the need for flexibility to fill these gaps, it allows for third-party arbitration. Hence, there is a need for confidence on the part of both parties with regard to the settlement machinery. The reference point for filling these gaps or making the adaptation is the original agreement between the parties.

(c) Relational Contracting is characterized by adjustment processes that are thoroughly transaction-specific and ongoing in nature. Discreteness of individual transactions is fully displaced. In contrast to the neo-classical system, the reference point for making adaptations is not the original agreement, but the entire relation as it evolves over time.

2.2.3 Fit Between Transactions and Governance Structures

Now that transactions and potential governance mechanisms have been characterized, an attempt at aligning them can be made. It is assumed that uncertainty of sufficient degree prevails to warrant an adaptive, sequential decision-making environment. Transactions are, therefore, dimensionalized along asset specificity (non-specific, mixed and highly specific investments) and frequency (occasional and recurrent). *In terms of the three-way classification of contractual frameworks, classical contracting presumably applies to non-specific, standardized transactions (whatever the frequency); relational contracting obtains for recurrent, specific (mixed and high levels) transactions, while neo-classical contracting prevails for occasional, specific transactions (Williamson, 1985).*

	Occasional	Frequent
Non-specific	classical contracting	classical contracting
Mixed specific	neo-classical contracting	relational contracting
Highly specific	neo-classical contracting	relational contracting

The dominant reasoning for reaching these conclusions is as follows:

(i) Market Governance : Synonymous to classical contracting, this is efficient when recurrent standard transactions are contemplated. Since both parties need only consult their own experience in deciding to continue a trading relationship or, at little transitional expense, turn elsewhere. Non-specific but occasional transactions are ones with respect to which the parties are less able to rely on direct experience to safeguard against

opportunism. However, since the product transacted is a standardized one, experience ratings (formal or informal) will provide incentives for parties to behave responsibly.

The assumptions of the discrete contracting paradigm work well for transactions when the specific identity of the parties is not of significance. Substantive content is determined by reference to formal terms of the contract and legal rules apply. Continuity is not imperative as, market alternatives protect each party from opportunism.

Such governance, therefore, is characterized by high-powered market incentives (or, high incentive intensity) for, each party is the residual claimant of the profits from its operations. Non-performance implies that the market would intervene and remove the business from the non-performing party. Identity of the parties does not matter. With regard to adaptive features, market governance has and requires none, for, continuity of the relationship is not essential.

(ii) Trilateral Governance: Synonymous to neo-classical contracting, the two types of transactions for which such governance is needed are occasional transactions of the mixed and highly specific kinds. Continuity of trade is valued here. Once the principals to such transactions have entered into a contract, there are strong incentives to see the contract through to completion. Neo-classical contract law has certain sought-after qualities in this context. Rather than resorting immediately to court-ordered litigation (with its transaction rupturing effect), third party assistance (arbitration) is used in evaluating performance and resolving disputes. The expansion of "specific performance" remedies together with arbitration serves the continuity purpose.

As the identity of the parties continues to remain distinct, each party retains its "residual claimant" status. As continuity is warranted, this framework must allow for adaptation over time. With regard to adaptive features, explicit adaptation provisions characterize the contract / governance mode.

(iii) Bilateral Governance: Synonymous to relational contracting, the two types of transactions for which specialized governance structures are commonly devised are recurring transactions supported by investments of the mixed and highly specific kinds.

Fundamental transformation from an ex ante competitive situation to an ex post bilateral trading situation applies because of the non-standardized nature of transactions. A condition of large numbers bidding at the outset does not necessarily imply that a large numbers bidding condition will prevail thereafter. Rivals cannot be assumed to operate on a parity once investments in specific assets are made. The original winner will enjoy (cost) advantages by reason of unique location, or learning, or acquisition of technical / managerial capabilities. Accordingly, what was a large numbers bidding condition at the outset is effectively transformed into one of bilateral supply thereafter.

Such a transformation has pervasive contractual consequences. Continuity is critical and contracting is no longer faceless or instantaneous. There is more to idiosyncratic exchange than specialized physical capital. Additional transaction specific savings may accrue as the buyer and supplier successively adapt to unfolding events and learn about each other's operations over repeated dealings. The transactions' recurrent nature allows for the costs of specialized governance to be recovered. Two kinds of specialized governance structures are identified:

(a) bilateral structures, where the autonomy of the parties is maintained ;

(b) unified structures, where the transaction is removed from the market and organized within the firm subject to an authority relation - and, hence, the TCE efficiency explanation of vertical integration.

Bilateral structures maintain high powered incentives (maximizing net income) of the market and limit bureaucratic distortions. Problems with this structure arise when adaptability and contractual expenses are considered. Inasmuch as the interests of the

parties are at variance when adaptation proposals are made, a dilemma is posed. Governance features that attenuate opportunism and infuse confidence are then needed, so that flexibility of both parties is maintained.

The advantage of unified structure /vertical integration is that adaptations can be made in a sequential manner. Where a single ownership entity spans both sides of the transaction, a joint profit maximization motive can be expected (Williamson, 1985: p 78). Unchanging identity at the interface coupled with extensive adaptability in both price and quantity is thus characteristic of integrated structures. While unified governance exponentially increases access to adaptive instruments, it is also accompanied by low-powered incentives. This is because the distinct identity of the parties is lost and one becomes the salaried employee of the other. Incentive impairments ensue as parties do not get to appropriate the net benefits from their action (loss of residual claimant status). Risk of non-performance is virtually non-existent, and efficiency reasoning may not drive investment decisions (Goldberg, 1976; Williamson, 1985). These features attenuate the motivation parties have to continuously improve operations and hence, have severe performance ramifications.

To summarize, TCE identifies asset specificity, uncertainty and frequency as the three characterizing dimensions of an exchange relationship. TCE also characterizes governance modes along the two dimensions of "Incentive Intensity" and "Adaptive Ability". It posits that an optimal fit between transactions and governance structures - categorized along the above dimensions - can be obtained.

This study's research context narrows our attention to transactions characterized by mixed and high levels of asset specificity. Also, we are particularly interested in situations wherein the identity of parties remains distinct. Two governance structures that would be applicable here are trilateral and bilateral structures. Both mechanisms retain

the residual claimant status of the parties (high incentive intensity). It is along their adaptive capabilities that they differ most. In particular, TCE distinguishes the two mechanisms along the dimension of "Conflict Resolution". That is, in case of transactions governed by trilateral structures, the parties adapt to unfolding events of the future on the basis of contractual provisions. In case of conflicts, this governance mode resorts to third party arbitration. Contrary to this scheme, TCE argues that the adjustment process between parties in bilateral structures is mutual and ongoing. Since there are no precise provisions to fall back on, in case of conflicts, parties resort to private ordering. To better serve our research objective, a less nebulous basis that can differentiate the two mechanisms along multiple aspects is needed. To this end, the ensuing section presents some relevant concepts from the Theory of Incomplete Contracts.

2.3 Theory of Incomplete Contracting

2.3.1. Context

As the dissertation focuses on exchange situations wherein the autonomous identity of the parties is maintained, this stream of literature plays a significant role in highlighting the structural attributes and performance implications of long term associations / contracts between two parties, in general, and, a buyer and supplier (vertical relationship) in particular. The purpose of this section is to provide a stronger basis for distinguishing trilateral from bilateral exchange. Longevity of association may be motivated by a variety of reasons. One reason is to transfer the risk inherent in facing true cost / demand (parameter) realizations away from the risk-averse party. Another reason is to avoid inefficient ex post bargaining on account of the information asymmetries that emerge in the course of the relationship. Consequently, it also enables parties to make efficient ex ante investment decisions (Hart & Holmstrom, 1987;

Fudenberg & Tirole, 1990). The last of these factors comes closest to TCE reasoning of why continuity is valued. Even in a "standard transaction" context, repeated interaction (continuity) between two parties can be valuable through its "reputation effects" (Kreps, 1984; Hart & Holmstrom, 1987). So long as it is possible to verify if each of the parties has performed its obligations, a reputation for fair-dealing (non-opportunistic behavior) is valuable in terms of ensuring future business. The value here turns on "information asymmetry" rather than asset-specificity.

2.3.2 Contractual incompleteness

In the context of such long-term associations, it is essential to note the conceptual distinction between "comprehensive" and "incomplete" contracts. Comprehensive contracting (or, mechanism design) frameworks assume that all possible future contingencies can be foreseen, and the parties' obligations can be specified for each such contingency (or, state of the world) (Hart, 1988). Such a notion clearly violates the "bounded rationality" assumption of human agents. It also has far reaching implications in that it totally denies the existence of transaction costs (ex post ones). Choice of governance mechanism is irrelevant, for, any rights conferred by ownership can be contracted away (Hart, 1988). However, such a world is an unrealistic one; transaction costs are "large and pervasive" (Coase, 1937; Klein, Crawford & Alchien, 1978; Williamson, 1975; 1985).

On account of uncertainty and difficulty in specifying all elements of future performance in a contractually enforceable way, contracts will necessarily be incomplete. They would have missing provisions / links that need to be agreed upon as the relationship evolves over time (Klein, 1988; Hart, 1988). This opens the door for potential disputes as unaccounted for events occur and parties disagree on mutual obligations. Third parties may be brought in to resolve them - the entire conflict

resolution process may, however, prove very expensive. Contractual incompleteness, therefore, has the potential to throw the costs of writing long term contracts out of proportion. These are the ex post costs emphasized by TCE; and, they require ex post support institutions to keep them under control. The fact that complex long term contracts (LTC) are found under some circumstances and not under others suggests that support mechanisms designed to handle incompleteness play a significant role in determining the profit-potential of the LTCs.

2.3.2. Enforceability of contractual provisions

Hart & Holmstrom (1987) identify the different sources of contractual incompleteness (and hence, of transaction costs) to be the following: (i) difficulty in anticipating the various eventualities that may occur during the life of a relationship; (ii) problem of negotiating and reaching an agreement (about mutual obligations) in dealing with such eventualities; (iii) difficulty in writing a contract that is sufficiently clear and unambiguous so that the terms of the contract are verifiable and, therefore, enforceable. Each of these sources has non-trivial costs associated with it, and therefore, can be expected to influence the structural attributes of an LTC. This dissertation, however, focuses on item (iii) to make a structural distinction between "enforceable" (trilateral governance) and "self-enforcing" (bilateral governance) contracts. Problems with specifying contractual terms in a manner that is verifiable by a third party can emerge on account of :

(a) it being difficult (and costly) to describe ex ante the contingencies or "states of the world" ($\omega \in \Omega$) in sufficient detail for an outsider (say, the courts) to verify that a particular state $\omega = \varpi$ has occurred, and so enforce the contract. This is because the ωs are multi-dimensional and their components too nebulous to be captured in detail.

(b) it being difficult (and costly) to describe the characteristics of the product being traded, or the actions that the parties must take (Hart & Holmstrom, 1987).
Also, complex provisions assume that the third party possesses sufficient knowledge and capabilities to verify their existence, which many judges / juries may not possess.

2.3.4. Adaptability and enforceability

It is important to note that the above are not problems of information asymmetry: both parties may recognize the state of the world or the characteristic of the product / investment decision. "The difficulty is in conveying this information to others; that is, it is the asymmetry of information between the parties on the one hand, and outsiders (such as the courts) on the other hand, which is the root of the problem" (Hart & Holmstrom, 1987). *Incompleteness emerges because states of the world, quality, and actions are observable (to the contracting parties) but not verifiable (by outsiders).*

Consequently, imposing the condition of verifiability on contractual support mechanisms would drastically limit the scope for adjustment / flexibility in an LTC. Parties can have open / flexible provisions only with respect to verifiable variables such as quantity, price etc. Even in case of verifiable aspects, the provisions (once made) can slap severe ex post rigidities on trading. These, in turn, could lead to very inefficient (in terms of performance of at least one party) results, litigation, and in some cases, breakdown of the very contractual relationship (Klein, 1988; Joskow, 1990). In other words, the adaptive ability of "verifiable / enforceable" support mechanisms is very limited, which in turn, can be expected to have adverse performance implications for either of the contracting parties.

In contrast to explicit, binding enforceable contracts, there are many agreements that get enforced routinely on the basis of custom, reputation etc. Even in case of a serious dispute, the parties may take great pains to resolve matters themselves - without

going to court. In case of vertical relationships, where the contracting (moral) hazards can be particularly severe on account of the interdependence (externality) between the parties and the incompleteness of the situation, bilateral conflict resolution is attractive. Such agreements constitute "self-enforcing" or "implicit" contracts. It may well be the case that there exists information asymmetry to some degree between the parties. However, it is important to note here that asymmetric information in itself does not lead to ex post inefficiencies. For, if the parties could costlessly switch trading partners, they would do so everytime a dispute occurs. It is the relation-specific investment that binds the parties together and significantly raises switching costs (Hart, 1995). Consequently, it is in the self-interest of all parties to behave "reasonably" - because of the externality that they impose on each other. Given that there is no third party arbitration, there is no need for verifiable terms of trade. This vastly enhances the scope of the support mechanisms and their ability to adapt to changing circumstances, while at the same time retaining an awareness of having to serve both parties' interests. Such support mechanisms usually take the form of "hostage exchange".

2.3.5 Summary

In conclusion, the focus is on incompleteness originating from non-verifiable nature of states of the world (parties' obligations) and the ensuing difference between enforceable and self-enforcing contracts. Enforceable contracts correspond to trilateral governance and self-enforcing contracts correspond to bilateral governance. In this context, the dissertation makes a deviation from TCE characterization of trilateral and bilateral modes of governance. Although Williamson (1985) underscores the role of third party arbitration and adaptation with respect to original agreement in the case of trilateral governance, and the role of mutual on-going adjustment processes in the case of bilateral governance, all the adaptations / adjustments are with regard to verifiable aspects of trade,

such as, quantity and pricing provisions. The rationale for limiting attention to verifiable dimensions lies in the need to minimize exposure to hazards of opportunism and to retain the parties' confidence in the governance structure (Williamson, 1985: pp 75-77). Bilateral governance, therefore represents a mechanism to resolve conflicts with respect to verifiable aspects mutually . This is borne out by the fact that Fisher Body - GM case is treated as an example of bilateral governance (Williamson, 1985, pp. 114-115; Klein, 1988). It is crucial to note here that, for the purposes of the dissertation, "verifiability" dimension distinguishes trilateral from bilateral governance.

The dissertation utilizes empirical literature on LTCs to point out the persistent use of enforceable contracts in idiosyncratic, repeated exchange situations. Coal supply to electric utilities, petroleum coke supply to oil refiners and Natural gas supply to pipelines are but a few cases in point (Joskow, 1985, 1987, 1988a, 1988b; Erickson & Goldberg, 1987; Mulhern, 1986; Masten & Crocker, 1985). Based on the above-mentioned definition, none of them would however qualify as bilateral governance. And, not all agreements have sustained successfully over time. Some have proven to be good fits to the exchange needs while other have not.

2.4 Summary and Conclusions

In addressing the question of how the structural attributes of long term vertical relations associate with supplier performance, this research uses a contractual framework to derive the basic model. To this end, it draws from two related theoretical perspectives: TCE and Theory of Contracts. A study of exchange relationships and their governance structures, TCE turns on two key behavioral assumptions: bounded rationality and opportunistic behavior of human agents. Transactions are dimensionalized along asset-specificity, frequency and uncertainty and governance structures along their ability to

provide performance incentives and to adapt to changing circumstances - with the purpose of keeping the parties' incentives aligned. A discriminating match between the transactional attributes and alternate governance modes is then sought so as to economize on the (transaction) costs of writing, monitoring and enforcing contracts (Williamson, 1985; 1988). At a time when "market power" and ex ante "franchise bidding" hypotheses held sway over public policy on natural monopoly and public utility regulation, Williamson made a seminal contribution by pointing out that an ex ante competitive exchange situation gets fundamentally transformed into an ex post bilateral monopoly situation as the exchange gets repeated over time. This transformation occurs because of the durable, transaction-specific investments made by either or both the parties (Demsetz, 1968; Williamson, 1976, 1985; Joskow, 1988). This argument is vital for the research problem under study because it is motivated by transactions characterized by non-trivial levels of asset-specificity. An efficient governance mode for these transactions is ascertained by considering not only its ability to provide ex ante incentive alignments, but also to retain the alignment as the relationship gets executed over time. It is therefore clear that a distinctive proposition of TCE is that **ex post support institutions of contract matter**, and are crucial to sustain a governance mode.

The research model developed in the ensuing chapter is primarily based on the above rationale. TCE identifies the need to include both asset specificity and governance variables in a model that seeks to explain performance. With regard to governance variables, it identifies two distinct constructs - incentive intensity and adaptive ability - as they prevail in trilateral and bilateral structures.

With regard to Theory of Contracts, the dissertation draws mainly from the stream of literature that deals with exchange situations governed by long term contracts. This stream recognizes that "comprehensive contracting" between parties, concomitant

with zero transaction costs is virtually impossible to achieve. The situation is exacerbated by the presence of durable, transaction-specific investments for they are accompanied by contracting hazards (in the form of 9opportunistic behavior by either or both of the parties) that need to be negated with (ex ante) safeguards. In other words, there is a need for some degree of ex ante agreement with regard to mutual obligations so that the integrity of the contract is maintained. Given that full contingent claims contracts are prohibitively expensive to be written and enforced in the face of uncertainty, complexity, and, bounded rationality, **long term contracts (LTC) would necessarily be incomplete and imperfect governance mechanisms** (Hart, 1988; Klein, 1988). "The more costly it is to contract on all contingencies and the greater the ex ante incentive effects of potential ex post hold up threats, the more imperfect long term contracts are likely to be" (Joskow, 1988b). Which means, the LTC's adaptive ability as events unfold will drive its success potential - in terms of contributing to the parties' profitability.

Among the many factors that contribute to contractual incompleteness, this research focuses on the difficulty of writing unambiguous contracts in a manner that is verifiable and enforceable by third parties. Imposing the condition of verifiability (to safeguard parties' risk exposure) drastically limits the scope of LTC's flexibility. It is this verifiability dimension that distinguishes trilateral from bilateral governance for the purposes of this study. Explicit, binding and enforceable contracts constitute trilateral governance and implicit, self-enforcing contracts constitute bilateral governance. Consequently, the structural attributes of these two mechanisms will systematically vary with the verifiable / non-verifiable nature of the parties' obligations. Such variations can be seen along the following dimensions (a) safeguard mechanisms for transaction-specific investments; (b) incentive intensity; and, (c) adaptive ability. These variations, in turn,

add precision to the independent variables in the model and help predict the nature of relationship among the variables in Chapter Three.

This brings us to the core of the dissertation. The above-mentioned distinction is hypothesized to be fundamental in understanding the vastly different experiences of OEMs in their supplier relations. Expanding the scope of a relationship merely along verifiable aspects of trade curtails the adaptive ability of the parties in the long run. On the other hand, non-verifiable (yet credible) commitments send a positive signal to the suppliers and elicit a more cooperative behavior. Therefore, differences in supplier performance in the Japanese and Western regimes can be captured by the differences between the two governance modes. The detailed arguments and empirical evidence used to develop the model are presented in the following chapter.

CHAPTER THREE

MODEL DEVELOPMENT AND HYPOTHESES FORMULATION

3.1 Introduction

This chapter focuses on developing the nature of the relationship among the individual constructs identified in the preceding chapter and the dependent variable. As elaborated in chapters one and two, the broad objective of developing such a model is to explain differences in supplier performance in terms of differences in governance choices. In elaborating the arguments supporting the hypothesis, this chapter also adds greater precision to the independent variables characterizing the model.

Much of the empirical literature on long term contracts (in electric utility, natural gas, oil refining, railroad industries - to name a few) provides support for the theoretical arguments developed in the preceding chapter. When accompanied by non-trivial levels of asset specificity, transactions are supported through ex ante agreements on length of the contract, pricing and quantity provisions (Joskow, 1985, 1987, 1988a; Mulhern, 1986; Goldberg & Erickson, 1987; Palay, 1984). It is crucial to note here that the safeguard and adaptation mechanisms are all verifiable by third parties. Although the pricing and quantity provisions are indexed to economic indicators - to track changing conditions - such long term contracts experience severe ex post rigidities. Litigation between the parties is not uncommon (Joskow, 1990). Such legal remedy is possible only on account of the verifiability of contractual provisions. Seen in conjunction with TCE, these LTCs are not relational contracts and do not constitute bilateral governance. They are merely

better specified than "flexible contracts" (in terms of verifiable obligations of respective parties under different contingencies). More importantly, the reference point for making adaptation is the original agreement, and, the conflict resolution / adaptation mechanism used is court (third party) ordering. All these factors indicate that LTCs constitute trilateral governance. This conceptual distinction between trilateral and bilateral modes of governance is critical in addressing the research question.

To deliver performance on price and other dimensions, both Japanese and American suppliers need to necessarily invest in specialized, transaction-specific assets - be they automated machinery, dedicated assembly lines or site-specific location of production facilities. The exchange situation under both contexts is characterized by non-trivial levels of asset specificity, frequency, and uncertainty. However, as already mentioned, there exists a mismatch between JIT as the Japanese practice it and the JIT implemented by Western OEMs. It is not as if long term associations do not govern OEM-supplier relations in the West. Researchers have drawn attention to the fact that Western industrial suppliers receive little financial or technical support to achieve higher standards of performance. Nor is JIT production a reality on the suppliers' shop floors. [The latter appears to be the case in both Japan and the U.S. (Helper & Sako, 1995).] Stock swaps, exchange of technical personnel on a temporary or permanent basis, production schedule sharing - in addition to longevity of relationship - are common practices undertaken by Japanese OEMs. These differences gain significance in light of evidence being gradually gleaned with respect to supplier (and buyer) profitability. Both Toyota and its suppliers outperform their competitors in the global automobile industry (Dyer, 1994).

To this end, this dissertation seeks to distinguish between the characterizing features of trilateral and bilateral forms of governance structures in the context of long

term buyer-supplier exchange. So that, under conditions of non-trivial asset specificity, the differential impact of distinct governance attributes on supplier profitability could be studied. Both governance structures are dimensionalized along

(i) safeguard mechanisms to protect transaction-specific investments;

(ii) incentive intensity - the motivation that both parties have to improve economic efficiency of operations; and,

(iii) adaptive / conflict resolution mechanisms - so that parties' incentives (to remain in the relationship) are aligned. These incentives need to be aligned both ex ante and ex post as the exchange unfolds over time (Williamson, 1985, 1988).

It is important to keep in mind that both governance choices represent "incomplete contracting" situations.

The aspect of incompleteness used to motivate the conceptual difference between trilateral and bilateral exchanges is "verifiability of parties' obligations". The former is "complete" to the extent that its provisions are verifiable by a third party. The latter is incomplete in the sense that it is characterized by multiple aspects of performance – some of which are difficult to be explicitly stated and may be unobservable to third parties (Hart & Holmstrom, 1987; Hart, 1988). Consequently, measures of each of the three dimensions will vary for trilateral and bilateral exchanges - based on their verifiable / non-verifiable nature - and would constitute distinct constructs. For example, "verifiable adaptive mechanisms" is conceptually and empirically different from "non-verifiable adaptive mechanisms". They would be expected to impact supplier performance differently.

3.2 Development of the model

The ensuing sub-sections are organized as follows: at the outset, the main effects of asset specificity on supplier performance is explored. From then on, the performance effects of each of the governance dimensions – in the presence of non-trivial asset specificity – is studied. The hypothesized direction of the relationship in each case reflects the fit (or the lack thereof) between the governance feature and asset specificity.

3.2.1 Asset specificity revisited

Viewing organization of economic activity from a contracting perspective, TCE places emphasis on technology (k), contractual governance / safeguards (s) and price (p) as the three endogenous variables that need to be determined simultaneously. In particular, the focus is on transactions supported by customized, durable investments (k>0). Parties generally undertake such investments because of the efficiency improvements that accompany them. The improvements may come in the form of cost savings from reduced inventory and transportation costs achieved through site specificity. Higher revenue generation may also occur on account of better product integrity and quality through specialized physical assets (Williamson, 1985; Clark & Fujimoto, 1991; Dyer & Ouchi, 1993, Dyer, 1994).

However, as has been widely observed, a **key implication of such specificity is the following :** the value generated by these investments is much lower in best alternative uses should the original transaction be prematurely terminated. This inhibitive switching cost for the investing partner vastly enhances the bargaining power of the non-investing partner. Consequently, the quasi-rent appropriable by the party not making the investment increases in magnitude. The term "quasi-rent" refers to the excess of an asset's value in its current use over its salvage value. Once the specialized

investment is made, it exposes the investing party to post contractual opportunistic behavior with regard to surplus (quasi-rent) division (Klein, Crawford & Alchian, 1978). This is particularly the case when the identity of the parties remains distinct. Even if the parties were to go in for explicitly stated, legally enforceable contracts, the investing party is always susceptible to a holdup threat when unforeseen events take place. Further, both parties would have to incur ex ante transaction costs of negotiating and drafting the agreement.

More importantly, to avoid surrendering the ex post surplus (that is its due), some of the ex post costs that the investing party has to incur would be the following:

(i) policing and litigation costs for enforcing agreements in the courts;

(ii) haggling costs when unanticipated events occur and transactions drift out of alignment;

(iii) bonding costs to correct the misalignments and secure contractual performance (Williamson, 1985).

Empirical support for the above-mentioned argument has been found at large among descriptive studies (Lyons et al., 1990; Helper, 1991; Nishiguchi, 1994: pp 165-166). A vast majority of the large sample, quantitative studies have been more concerned with the organizational implications of asset specificity - whether it improves the probability of "make" decision vis-à-vis buy decision (Monteverde & Teece, 1982; Stuckey, 1983; Masten, 1984; Anderson & Schmittlein, 1984; Palay, 1984; Walker & Weber, 1987). Parkhe (1993) does look at, among other things, the main effect of "ex ante non-recoverable investment" on performance. However, he measures "alliance performance" in terms of fulfillment of major strategic needs by the joint venture. Such a venture may not incorporate a vertical relationship at all. Artz (1995) also looks at the effect of asset specificity on negotiation costs. But, these negotiation costs are measured

from the buyer's perspective. Also, these costs are measured in terms of the buyers' (qualitative) perception of negotiation. Therefore, there clearly is a need to formally test the association of asset specificity with supplier's performance.

In the context of this study, such a test checks for the effect of asset specificity when no governance supports are in place to protect supplier interests. Consequently, the following hypothesis is made:

H1: Transaction-specific investments made by the supplier would have a negative association with its performance (main effect).

3.2.2 Asset specificity and governance choice

In conjunction with the ex post hold-up problem, asset specificity has other contractual ramifications as well:

(i) the specific identity of the parties to a transaction plainly matters;

(ii) the durable nature of the investment and the extended time horizon over which its (superior) benefits are reaped imply that continuity of the relationship is valued (Williamson, 1985).

Given that the fear of post contractual opportunistic behavior can lead to inefficient ex ante investment decisions (thereby denying buyer and supplier firms of sources of advantage), contractual and organizational safeguards emerge in support of these investments.

To govern a transaction characterized by non-trivial levels of asset specificity and in need of safeguard mechanisms to support it, the trading parties can choose from market governance, long term contracting - which embodies trilateral and bilateral forms of governance - and vertical integration. As already noted, market exchange represents a

pure form of high-powered incentive structure. That is, it requires that parties perform, provides incentives to be efficient, and, carries with it no adaptive or safeguard features. Vertical integration, on the other hand, is a pure form of sequential adaptation accompanied by very low-powered incentives (salaried compensation). It has the ability to align the parties' interests and achieve joint (revenue and cost) focus through common ownership and fiat. Such a combination could however lead to lesser innovative activity and even inefficient investment decisions (Willamson, 1985). It is therefore clear that each of these two pure forms affects firm performance very differently.

It is in this context that the evolution of non-standard contracting practices (be they trilateral or bilateral governance mechanisms) and vertical relationships such as the JIT exchange need to be studied. They represent intermediate structures located between the two extremes of discrete, market exchange and internal hierarchy. They attempt to capture some adaptive ability, while at the same time retaining a non-trivial incentive to perform. To the extent such an exchange depends on "private ordering" (as against court / third party ordering), ex post support institutions functioning as conflict resolution mechanisms gain significance. The ultimate objective in making the governance choice is to mitigate transaction costs and optimize efficiency.

Ring & Van de Ven (1992) also investigate the conditions under which intermediate structures would prove efficient. However, they relax the "opportunistic behavior of human agents" assumption of TCE and instead use the following two dimensions: riskiness of exchange (measured by availability of information, control and time) to the parties and the prevalence of trust (built through a reputation for equitable behavior and personal experience). This dissertation however adopts Williamson's line of reasoning and uses (i) safeguard mechanisms, (ii) incentive intensity, and, (iii) adaptive ability as the distinguishing dimensions of governance mechanisms. Sub-

sections 3.3, 3.4, and 3.5 develop the specific relationships between these dimensions and supplier performance. In each case, thee effects of verifiable and non-verifiable attributes are distinctly analyzed so that the efficiency implications of enforceable and self-enforcing agreements could be contrasted.

3.3 Safeguard Mechanisms

Having stated that transaction-specific investments need to be accompanied by safeguard mechanisms to serve the long run interests of the transacting parties, it follows that their association with supplier performance be addressed next. In this context, the dissertation distinguishes between the effects of verifiable and non-verifiable safeguards.

3.3.1 Verifiable safeguard mechanisms

Empirical works on LTCs have attempted to explain the co-existence of transaction-specific investment and protective contractual provisions in several industrial contexts. These studies gain significance in light of the fact that such "protective" provisions regularly draw the attention of antitrust - for serving anti-competitive, anti-efficiency, monopoly interests. Goldberg & Erickson (1987) conduct a descriptive analysis of ninety contracts between a petroleum coke supplier and eight oil refiners. They argue that the price and quantity provisions in the contracts (agreed upon ex ante) constitute safeguard mechanisms to protect supplier's interests. More specifically, they assert that such provisions are designed to deter potential ex post hold-up problems and not to serve monopoly interests. Palay (1984) finds that, even in a regulated context (Railroads), informal agreements between vertically transacting parties may emerge if either of the parties needs to make idiosyncratic investments in order to provide specialized service. As already stated, the LTCs analyzed in these contexts are (legally)

enforceable contracts, and, fall under the category of trilateral governance for the purposes of the dissertation.

In a thorough empirical analysis of 277 coal supply contracts to electric utilities, Joskow (1985, 1987) finds that site specificity, physical asset specificity and dedicated nature of assets have a positive and significant impact on contract duration (average duration of mine-mouth contracts was thirty-five years, while the all-sample average was 12.75 years). He measures site specificity in terms of mine-mouth location of power plants and physical asset specificity in terms of mid-western and western plants that are locked into mine-specific coal burning capabilities because of the large scale nature of least-cost coal production technology and high transportation costs. Also, he measures dedicated assets in terms of dedicated capacity and increased supply quantity. The lock-in effect of asset specificity, lack of spot market, heterogeneity in coal characteristics and prohibitive transportation costs remove any semblance of "commodity nature" of the coal transacted for. Any breach of contract by the buyer would leave the coal producer unable to dispose of huge quantities of coal in a profitable manner. [Symmetrically, in the case of supplier breach, the buyer is not in a position to acquire required quantity/quality of coal at short notice.] Contract duration, here, is expected to capture parties' willingness to commit themselves ex ante to future terms of trade and rely less on repeated (adversarial) negotiation over time (Joskow, 1987). Repeated adversarial negotiations are seen to have an unfavorable effect on either or both of the parties' performance.

On account of the relatively large minimum efficient scale and high capital intensity of coal production in the Western mines, agreements on longer duration allow the coal-mine owner to employ least cost technologies and reap beneficial returns. This result therefore suggests that extended contract duration, as a support mechanism for asset specificity, would impact supplier performance favorably. Mulhern (1986) obtains

more direct evidence of the (performance) effect of contract term. He finds that length of the contract significantly increases the probability of natural gas producers securing a "most favored nation" status with gas pipelines (the buyers). This in turn allows the producers to earn higher revenues and returns. Consequently, the following proposition is made:

> H2a: Transaction-specific investments by the supplier, when accompanied by extended contract duration, would have a positive association with supplier performance.

It is essential to point out here that it is the descriptive studies that directly associate longer contractual duration with better performance for the investing party. Joskow's (1985, 1987) studies and Mulhern's (1986) study indirectly link longer duration with better performance. Joskow directly tests for the co-existence of specialized investments and longer duration, while, Mulhern tests for the probability of earning MFN status. Of course, underlying both these tests is the assumption that contractual safeguards serve efficiency interests when they accompany specialized assets. Therefore, this study extends the empirical envelope a little further by directly testing for the performance effects of such co-existence.

Along with contract duration, it is not uncommon to find ex ante agreement on purchase quantity being used as support mechanisms. In the case of coal supply contracts to mine-mouth power plants, there is an extensive use of "requirements contracts" to ensure continued business for the coal mine. Requirements contracts specify that the contract is for meeting buyer plant requirements over a specific period of time. Threats by the buyer to switch to alternate suppliers then become less credible. The asset

specificity raises switching costs and breaches become easier to detect and penalize. Such provisions are particularly critical for contracts that dedicate all supplies to a single plant. Minimum take or pay provisions also characterize these mine-mouth supply contracts (Joskow, 1985, 1987).

With regard to natural gas supply to pipelines, extraction of gas requires large, durable, location-specific investments in facilities and equipment. Pipelines represent the only economically feasible mode of transportation. The latter factor creates a potential for bilateral relationships (Masten & Crocker, 1985). On account of the common pool existence of underground natural gas reserves, property rights among well owners are difficult to define and enforce. The producer's profitability is susceptible to even production delays. As a result, it is imperative to safeguard the producer from the enormous potential that the pipeline has to use "drainage" as a strategic bargaining tool.

Mulhern's (1986) analysis of 632 (pre-regulation era) contracts shows that, the producer's interests are typically served by "take or pay provisions" that specify the minimum daily quantity (as a percentage of the well's remaining reserves) that the pipeline is obliged to take or pay for. In a study of 299 contracts from the post-regulation period, Masten & Crocker (1985) also find that "take obligations" serve natural gas producer's interests by varying in the expected direction with the opportunity (next highest) value of the well's capacity. [In both studies, alternate value of the well capacity is measured in terms of number and proximity of pipelines and other producers.] Hence, the following proposition is made:

> H2b: Transaction-specific investments made by the supplier, in the presence of (minimum) ex ante quantity provisions, would have a positive association with supplier performance.

Here again, studies have used the contractual safeguard (take or pay provision) as the dependent variable in their models. The extent of contractual support increased with lesser alternate value to the wells or greater degrees of specificity. The very co-existence of the safeguard and asset specificity is taken / assumed to augur well for the suppliers. This study, by explicitly testing for the performance effects of such co-existence, adds more empirical value to the previous assertions.

3.3.2. Non-verifiable Safeguard Mechanisms

An inherent feature of the JIT version of bilateral exchange is the longevity of relationship between the trading partners. However, in terms of formal specification, the parties sign flexible contracts that are renewed periodically / annually (Nishiguchi, 1994, p. 116; Helper & Sako, 1995). These contracts provide the "general constitution" of the relationship (in terms of quality, delivery, pricing and conflict resolution policies) which is constantly adjusted and renegotiated (Dyer & Ouchi, 1993; Nishiguchi, 1994). There is very little by way of specific obligations of the parties. Consequently, they do not represent much by way of legal remedy - to protect either of the parties' interests. It is typical to find suppliers of parts, components or sub-assemblies being retained for the entire model-life of a product, which is normally four years (Helper & Sako, 1995; Cusumano & Takeishi, 1991). More importantly, in case of suppliers who meet their target requirements, the actual record of trading with the same customer has been found to be over twenty years. Over half the respondents in Helper & Sako's survey of 472 Japanese suppliers (in the automobile industry) had traded with their customer for over twenty years. Nishiguchi (1994) finds that over 30 percent of Fuji Electric's subcontractors (N=555) had done business with Fuji for over twenty years. In Dyer & Ouchi's (1993) survey of 76 Japanese suppliers, suppliers explicitly stated that the

probability of winning a contract again with a specific customer - after model changes- was over 90 percent.

Helper (1991) contrasts such implicit longevity of business relations (not specific / tied to a particular product) with legally enforceable duration of a contract. She labels the former as "informal commitment" and the latter as "formal commitment" on the part of buyers. In the context of supplier performance, her survey of 453 American suppliers (in the automobile industry) indicates that suppliers remain skeptical about being "treated fairly" by their customers or doing long term business with them. This is despite the fact that the average contract duration (formal commitment) has increased from 1.2 years in 1984 to 2.3 years in 1989.

On the other hand, an informal commitment to a long-lived business relationship has encouraged Japanese suppliers to continue making transaction-specific, efficient investment decisions. The implicit longevity provides sufficient time horizon and trade volume for the suppliers to recover their investment. Dyer & Ouchi (1993) point out that the continuity combined with efficient investments help suppliers accelerate down the experience curve and achieve higher capacity utilization (scale effects). This in turn helps them achieve significant (volume related) cost reductions.

Of course, a significant portion of the cost reductions are shared with the customer. The point being made here is that the longevity of the relationship is value-enhancing for the supplier as well. It is worthwhile to note the findings from Helper & Sako's survey here: the average contract duration of U.S. Companies has moved to 2.4 years in 1993. While over 68% of surveyed (American) suppliers perceived that their customers' commitment would last the model's life cycle (nearly four years), less than 5% of the suppliers had supplied the (same) customer for more than twenty years. As there is no notion of implicit continuity of relationship, Dyer & Ouchi (1993) find that

American suppliers are less able to fully reap the experience curve effects / benefits and are utilizing lower levels of capacity. Together with Helper's (1991) findings on "formal commitment", it could well be expected that length of relationship would have a strong association with supplier performance. Consequently, the following proposition is made:

> H3a: Where suppliers have made durable, transaction-specific investments, length of the relationship will have a positive association with supplier performance.

It is relevant to note here that all of the above-mentioned studies are conceptual and descriptive works of buyer-supplier relations in the automobile industry. As such, they do not formally test for the benefits of long-term association in the context of asset specificity. Artz (1995) does formally test for the main effect of "relationship length" on OEM's dissatisfaction with negotiating with suppliers. He finds that longer relationships increase OEM's dissatisfaction with such negotiation. However, he finds no such effect on OEM's perceived cost of negotiation. Artz (1995) also finds that an "expectation of continuity" together with OEM's specialized investments reduces OEM's perceived costs of negotiation. This finding is more in line with the reasoning of other studies – though it is from the buyer's perspective.

The focus of this study is, however, the supplier; more importantly, this study is interested in addressing the performance implications of actualized long term relations in the context of specialized investments. Therefore, this hypothesis seeks to contribute by formally testing and confirming the (historic) rationale of the other descriptive studies with supplier focus.

Another much focused upon aspect of JIT exchange (in fact, the term Just-In-Time owes its origin to this practice) is the ability of the supplier to make JIT delivery to its customer. Ideally, in the limit, this ability is expected to synchronize manufacturing, not only within each supplier plant, but also between buyer (assembler) and supplier plants. The ultimate goal of "true" JIT manufacturing is to eliminate buffer stocks from both sides (Nishiguchi, 1994). However, the remoteness of reality from the "ideal state" has given way to a heated debate on the performance implications of JIT delivery. If a supplier delivers parts just in time to the OEM in minimal quantities out of its own buffer inventory, it could still be called JIT "delivery". But, it merely shifts the inventory-maintenance burden to the supplier. In the American context, there has been a persistent mismatch between average production and delivery lot sizes of the suppliers - though the magnitude of this difference has declined over time. Prior to 1985, both lot sizes were large enough to not become a burden to the supplier. However, in 1989, the average supplier was producing in batch sizes of ten days' requirement and delivering in lot sizes of six days' requirement. By 1993, both average production and delivery lot sizes had fallen to seven and four days' needs respectively (Helper & Sako, 1995).

In the Japanese context too, average production and delivery lot sizes do not match exactly. However the magnitude of the difference between production and delivery lot sizes is much smaller @ eight hours' requirement. In other words, there is a significant deviation between the inventory levels of Japanese suppliers and their American counterparts: the average stockholding (work in progress and finished goods) of a Japanese supplier is 1.5 days' production, while that of an average American supplier is 8.1 days (Nishiguchi, 1994, p. 204). Consequently, it is not surprising that American suppliers have been skeptical about the JIT system. The improvement in delivery

schedules is not so much a move towards Lean Production System (LPS) as a means to cut assemblers' inventory carrying costs (Womack et al. 1991; Helper, 1991).

From a supplier performance perspective, for the requirement of "frequent delivery in small lot sizes" to not unreasonably increase the inventory holding of the supplier, it is imperative that the suppliers also produce in small lot sizes. For the supplier to reduce its lot size, customer delivery schedules must be stable at least for the duration of the supplier's lead time. To this end, the customer must first be willing to share its production schedules and then effect little or no alteration to them. As the supplier figures out ways and means to reduce its setup time (and hence its lead time), its minimum efficient lot size would also fall, thereby requiring the schedules to be frozen less ahead (in advance). Production and delivery in small lot sizes lead to lower stock covers and higher inventory turnovers for the suppliers; this is clearly beneficial to their bottomline. The following proposition is, therefore, made:

> H3b: Where suppliers have made durable investments, volume stability achieved through sharing of production schedules and minimizing alterations to the schedules would relate positively to supplier performance.

The buyers benefit from actualizing JIT on the suppliers' shopfloor too. For, shorter supplier lead times imply greater ability to incorporate design changes and trace quality problems (Helper 1991; Nishiguchi, 1994). These capabilities in turn allow the OEMs to be better differentiators in their product-markets. Works that have identified "sharing of production plans" with suppliers in their empirical models have typically included it as part of the "relational norm" construct (Noordewier et al., 1990; Heide and John, 1992; Artz 1995). More importantly, these works focus on how such sharing of

production plans works together with "supplier flexibility" in serving OEM needs. There clearly is a need to study the effects of such "supplier flexibility" on supplier inventory levels and profitability. In fact, this is precisely what the descriptive studies (mentioned earlier) address – based on the survey data that they have individually gathered. This hypothesis (much like H3a) adds to the literature by formally testing for the profitability effects of JIT inventory requirements. More importantly, if this hypothesis is confirmed, it also reveals what it is that suppliers require to make JIT a sustainable reality.

Relative to the verifiable and enforceable quantity provisions (such as take or pay provisions, requirements contract etc.), volume stability sought to be achieved in the JIT system is more susceptible to the volatility of the downstream market. Even if JIT is implemented at the supplier's shopfloor (thereby leading to lower stock holdings), no minimal scale of operation is promised. By definition, JIT delivery is attuned to meet the competitive needs of the downstream buyer. In the context of contractual duration and relationship length between the parties, again the supplier is guaranteed the OEM's business for the duration of the contract. Its relationship with the OEM may or may not be long-lived. Every time the contract comes up for re-negotiation, the parties have to determine if they stand to benefit from continued dealings. More generally, the verifiable mechanisms totally eliminate any risk of uncertainty. On the other hand, the non-verifiable safeguards evolve as the business relationship matures. If the parties are mutually satisfied with the association, such safeguards evolve into trade practices and prove to be long-lived. Needless to say, both kinds of non-verifiable safeguards are influenced by the vagaries of the downstream market. Therefore, the following hypothesis is made:

H3c: Verifiable safeguards are expected to have a more beneficial association with supplier performance than non-verifiable ones.

To the best of this researcher's knowledge, such a hypothesis has not been tested under conditions of asset specificity – either from the buyer's or the supplier's perspective. In fact, there is a substantial stream of literature tracing the coexistence of transaction-specific investment and contractual safeguards. This stream consists of both descriptive and empirical works. However, as more industries get deregulated and become more competitive, a number of non-verifiable safeguards emerge as trade practices in similar vertical contexts. The high profile of the auto industry and the turbulence it has experienced over the past two decades merely highlight these trends. It is therefore quite relevant (strategically) to assess the relative significance of verifiable and non-verifiable safeguards – as they pertain to quasi-vertical integration and its ability to serve as a source of competitive advantage.

3.4.0 Incentive Intensity

As already mentioned, one of the crucial reasons that parties retain their distinct identity (and not vertically integrate) is to enjoy the benefits of "residual claimant" status with respect to returns from operations. This status provides the incentive to perform and to continuously seek efficiency improvements. In particular, when innovations with proprietary, non-imitable benefits are introduced, the supplier may choose to make the durable, transaction-specific investments, rather than favor unified governance with the OEM. Under unified governance, appropriation rights to benefits from such innovation are no longer available solely to the supplier. In other words, maintaining some vestige of market structure serves "Incentive Intensity" purposes.

3.4.1 Cost plus pricing

There prevails a stark contrast between enforceable and self-enforcing contracts in this regard. In case of enforceable contracts, the non-trivial nature of the specialized investment does not allow the market to intervene under conditions of non-performance. Third party intervention does alleviate, to some extent, the hold-up problem originating from the non-performing party. Since the latter remedy emanates from ex ante provisions of the contract, performance along an unprovided for dimension (incompleteness of the contract) becomes a sticky issue - as seen in the case of Fisher Body and General Motors. Therefore, "incentive intensity" becomes a moot point.

More importantly, the high incidence of "cost plus" pricing (or a variant of it, namely, Base price Plus Escalation - BPE) provisions in LTCs has a "double edged sword" effect for the transacting parties. With regard to supplier interests, it guarantees a specific (could be labeled "normal") rate of return on investment. As this profit component is built into the pricing formula, it is subject to legal or third party remedy (because price is a verifiable variable). As a result, it quite effectively eliminates the risk of buyer's non-performance. That is, the buyer has to pay the contracted price. However, as widely acknowledged, cost plus contracts do not provide adequate incentive for the supplier to operate efficiently. They constitute low-powered incentive instruments. The LTC prices may, in due course, not reflect or track market demand and supply conditions. Such an exchange leads to over and inefficient employment of capital - the Averch-Johnson effect (Goldberg, 1976). Further, it does not motivate the supplier to engage in process innovations or invest in cost-reducing equipment. In other words, the competitiveness of downstream buyers (and subsequently, the supplier itself) is gravely threatened.

Empirically, Rate of Return (ROR) or cost plus pricing arrangements between buyers and suppliers are pervasive, particularly in regulated industries. Joskow (1988a) has conducted a thorough analysis of pricing provisions in 247 coal-supply LTCs - active through 1981. The BPE pricing formula - most commonly used in these contracts - attempts to incorporate market effects by using "current" (namely, the time at which the contract is written) market prices as base prices and linking the escalation formula to market-level indices. Joskow finds very clear evidence that LTC prices (i) are determined as per the contractual provisions; (ii) are flexible and track market conditions quite closely, so long as the changes are linked to cost of production. In other words, the suppliers have been able to renegotiate pricing provisions to allow for increases in material, labor, fuel cost and overheads (the latter resulting from regulatory changes). To this end, coal suppliers have credibly been able to appeal to "gross inequity" clauses and threaten breach of performance if prices were not renegotiated. A case in point would be the pre-1971 contracts whose provisions did not anticipate input (such as fuel) price increases as actually witnessed in the mid and late 1970s. Consequently, it is clear that transaction prices do not suffer from upward price rigidities.

This lack of upward price rigidity clearly protects supplier interests and is not unique to regulated industries. In Industrial Markets, component purchasers purportedly use competitive price bidding to pressure the suppliers into lowering prices. Researchers, however, have not failed to highlight the supplier practice of winning bids on the basis of "below (marginal) cost pricing" and then resorting to price increases over the duration of the contract (Asanuma, 1988b; Womack et al. 1991). The following proposition is therefore made:

H4a: The incidence of cost plus pricing would relate positively with supplier performance.

To reiterate a point made before, it is definitely acknowledged that such pricing policies however do not augur well for the long run competitiveness of either buyer or supplier firms. It is the empirical evidence rather than conceptual reasoning that supports the hypothesized direction of the relationship.

With regard to relevant empirical literature in this area, works on long term contracts (and quasi-vertical integration) are the ones that have been primarily concerned with the effects of pricing policy on buyer-supplier relationships. These include Joskow (1988a, 1990), Klein (1993) to name a few. However, these studies are mostly descriptive and focus on "movements in LTC prices" and their ramifications on the association. Large sample, quantitative works on relational norms in OEM-supplier relations have typically not focused on pricing issues. This is probably because most of these studies are concerned with the effect of asset specificity and relational norms on OEM interests. Therefore, this hypothesis (and study) would expand the horizon by directly addressing the performance implication of different pricing policies in a vertical relationship. More importantly, it attempts to point out that retention of the distinctive identity of the parties is not sufficient to guarantee a "high incentive" to perform. External suppliers could be as unresponsive (and uninnovative) as in-house ones so long as they are guaranteed a return on their investment. Differences in verifiability of pricing obligations, together with distinctive identity of the parties, largely influence the incentive intensity of a governance mechanism. This hypothesis, thus, aspires to contribute conceptually and empirically.

3.4.2. Target pricing

In striking contrast to the wide prevalence of cost plus pricing in vertical supply contexts in Western markets, the Japanese industrial buyers practice "target pricing". The complexity and asset specificity of the "systems / sub-systems" necessarily imply lack of comparable market prices for the products traded. Competitive bidding cannot be used to ascertain the price of these parts. In its place, "Value Analysis" (VA) techniques have come to be widely used, so that increasingly complex cost structures could be decomposed and cost-sensitive elements identified and disaggregated (Nishiguchi, 1994). In this context, buyers commonly set a target sales price for a new model and arrive at the price for each part in a "Market-price Minus" manner. These workings are based on the VA results. (Of course, for VA to be used, OEMs need to obtain detailed cost information from the suppliers. The factors that help / motivate suppliers to provide such data would be discussed in the next section). This, in principle, is the antithesis of cost plus pricing.

Typically, buyers expect the suppliers to achieve gradual cost reductions through investments in cost-reducing equipment, processes and, benefits from experience curve effects (Cusumano & Takeishi, 1991; Dyer & Ouchi, 1993). The longevity of the association and residual claimant status (with respect to portion of the cost savings) provide the economic motivation for suppliers to undertake such investment decisions. Although the suppliers do not commit to a specific percentage decline in costs and prices of the components, there exists an incessant pressure to innovate and achieve "targeted" price. Prices are brought up for "rectification" (which usually translates into reduction) every six months. To this end, the buyers employ "forced competition" between the few chosen suppliers. This is accomplished by following a two-vendor policy and providing technical / managerial assistance to the weaker of the two suppliers. The weak supplier

could then improve its production techniques and remain in the race (Dyer & Ouchi, 1993). Also, the price paid to each supplier is, at times, made dependent on relative performance. This system rarely allows for increases in material / fuel costs to be passed on to the buyer (Helper & Sako, 1995). Furthermore, it is not always that buyers negotiate productivity-sharing arrangements with suppliers. The cumulative effect of these practices would be:

H4b: Target pricing practices would relate negatively with supplier performance.

Cusumano & Takeishi's (1991) survey of U.S., Japanese, and Japanese transplants in the automobile industry indicates that Japanese buyers enjoy prices even lower than the targeted ones. On the other hand, American assemblers not only take above-target prices, but also allow for periodic cost increases.

Even though researchers seem to agree that target pricing places substantial pressure on the supplier (Nishiguchi, 1994; Helper and Sako, 1995), little has been done to formally substantiate its association with supplier profitability. This hypothesis (together with hypothesis nine) seeks to empirically validate the reasoning found in other descriptive works of buyer-supplier relationships.

3.5.0 Adaptive Ability

As mentioned in the Theory Section, discrete market exchange has no need for adaptive features for continuity is not valued and the identity of the parties is immaterial. Vertical integration ensures sequential, adaptive decision-making through common ownership. It is only in the case of trilateral and bilateral governance that explicit attention needs to be given to "Conflict Resolution Mechanisms" / adaptability features.

This is because the transactions that accompany these governances are characterized by relation-specific investments, longevity of association and futuristic uncertainty. Over long time horizons, as anticipated and unanticipated eventualities occur (for example, changing demand and supply conditions), it is but natural that parties' incentives may drift out of alignment. It is here that (ex post) support mechanisms instituted by the trading parties come into play to serve "conflict resolution" purposes. Trilateral and bilateral governance structures take very diverse paths in achieving this objective.

3.5.1 Credible commitment and adaptive ability

By definition, enforceable contracts rely on verifiable aspects of trade (such as quantity, price) to incorporate flexibility into the long term exchange. This way, third party arbitration / court ordering could be resorted to in case of disputes. But, a tradeoff exists between the degree of flexibility in a contract and the ease with which it can be implemented. "A single contractual stipulation is relatively straightforward for courts to enforce in comparison to multiple contingent claims" (Masten & Crocker, 1985).

Even with respect to verifiable obligations, LTCs may suffer from significant rigidities. In a sequel to his 1988 study, Joskow (1990) traces 123 coal supply contracts through 1984-85. The in-depth analysis points very clearly to the following conclusions :

(i) LTC-BPE provisions are "inflexible" to the extent that they are incapable of absorbing demand side shocks. At a time (mid-80s) when nominal and real coal prices were falling, coal supplied as per the LTCs (contracted before 1984-85) were traded for higher prices in accordance to the BPE provisions. Furthermore, the LTC price trends for 1982-84 were on the incline.

(ii) More importantly, this sharp deviation between market and LTC prices (which allowed the LTC coal suppliers to earn above-normal returns at least temporarily) did not lead to significant breach and litigation activities. Those power plants which did manage

to renegotiate lower prices had to agree to higher minimum-take quantities. Consequently, it is fair to conclude that significant downward rigidities prevailed in the LTC prices.

It is also worth noting that, in contrast to the Electric Utilities market, the Natural gas supply market witnessed a high incidence of contract breaches when transaction prices differed sharply from market prices. This evidence merely cements the argument that "switching costs" for the thermal power plants must have been prohibitive enough for them to continue abiding by the BPE clauses. The above study, together with Masten & Crocker's (1985) and Mulhern's (1986) studies of natural gas industries, points to a critical structural attribute of long term agreements. The parties' interests are very much at variance even when voluntary renegotiations are sought. Commitment on the part of the buyer in terms of longer duration and "take or pay" provisions merely represent collateral to earn a preferred status with the supplier. The benefits of such preferred status include premium stream of revenues accruing from the relation-specific investments made by the supplier. On account of being locked into the specialized assets, the supplier may have a higher cost of production than the rest of the market. The supplier therefore has to sell at the contracted price to earn normal returns. The buyer on the other hand is being forced to pay prices much higher than the market rates. As a result, neither party makes super-normal returns (Klein et al. 1978). While the goal of introducing flexible features is to keep incentives aligned, the basic framework used by the negotiating parties is a "non-cooperative" or an adversarial one. In other words, there is no joint profit or collaborative focus to the exchange relationship.

This notion ties in well with the observation made by researchers with regard to "Mature Mass Production" practices. Not only are the OEM-buyers demanding lower invoice prices, but they also want zero defects and JIT delivery (Lyons et al., 1990;

Womack et al., 1991; Helper, 1991; Dyer & Ouchi, 1993). The OEMs are making these demands without paying attention to whether suppliers have achieved any cost reduction at all. This is clearly an adversarial, zero-sum situation, not promising much by way of profit potential for the supplier firms.

In case of self-enforcing agreements, contractual flexibility and integrity are sought to be maintained not through third party arbitration, but through bilateral adjustment processes. Each party is willing to adjust and accommodate the other's priorities because of the support mechanisms put in place to increase their equity in the association. What motivates the parties to behave "reasonably" (and not opportunistically) in this process is their own self-interest as they recognize their mutual interdependence. Besides the vertical nature of exchange that contributes to the externality parties impose on each other, exchange partners (may) voluntarily invest / engage in activities that enhance this mutual reliance. An essential attribute of these reciprocal activities is that they have little value outside the relationship and hence signify "credible commitment" to the alliance. The reciprocity guarantees that no expropriation hazards crop up, thereby vastly diminishing ex post hold up threats.

Simply stated, it is this bilateral effort to enhance buyer-supplier symbiotic dependence that constitutes "hostage exchange" (Williamson, 1985). Hostage exchange (in the economic sense) serves adaptation / conflict resolution purposes because:

(i) it brings "private ordering" into play and obviates the need for third-party arbitration. As mentioned in Section 2.2.4., *LTCs are incomplete and imperfect governance mechanisms* because they require that the contractual provisions be verifiable in order to be enforced by a third party. However, several trading issues and disputes emerge with regard to non-verifiable aspects as well. Consequently, LTCs typically suffer from ex

post rigidities and maladaptation problems. By introducing private ordering, these bilateral commitments allow the parties to mutually agree on non-verifiable (but observable to the respective parties) aspects of trade -as they occur over time. The hostages exchanged serve as mechanisms to not only handle incompleteness (emerging from non-verifiability) but also to support exchange between the specific parties.
(ii) An important implication of symbiotic bilateral investments (as the term "symbiotic" suggests) is that the reciprocity yields a joint focus on operations. The orientation shifts from one of adversarial bargaining to that of collaborative, joint problem solving (Williamson, 1985; Nishiguchi, 1994).

The ability of "hostage exchange" practice to provide ongoing adaptive ability (through private ordering), support exchange and, create a collaborative orientation has very significant performance implications. For, all these abilities operate in the service of efficiency. **In a repeated context,** efforts to continuously improve (or maximize) joint profits are pareto-efficient relative to any non-cooperative returns that either the buyer or the supplier can individually achieve. Therefore, the following hypothesis is made:

H5: Reciprocal, credible commitments on the part of the OEM would relate positively with supplier performance.

It is relevant to note here that relation-specific investments made by the supplier represent its credible commitment to the exchange relationship. The significance of reciprocal OEM commitment has been recognized in descriptive works on supplier relations (Dyer and Ouchi, 1993; Nishiguchi, 1994; Dyer, 1996). However, the large sample empirical studies do not pay much attention to any reciprocal commitment that OEM-buyers need to make to the association (Noordewier et al. 1990; Heide and John,

1992). They do identify solidarity, joint information exchange, supplier flexibility etc. as relational norms that characterize some buyer-supplier associations. However, rarely do they address the issue of "how to develop such solidarity and joint focus?" This hypothesis is more in line with the reasoning found in the descriptive studies mentioned earlier. The objective here is to provide a strong theoretical argument and an empirical validation of the strategic significance of credible commitment on the part of the OEMs..

3.5.2 Buyer Dependence

In addition to making explicit commitments to support exchange with a specific partner, buyers can also engage in subtle (but equally enduring) practices that increase their dependence on specific suppliers. This dependence guarantees ***steady demand realizations for the supplier.*** In the manufacturing context, the widely prevalent practice of "outsourcing" components / sub-systems is a case in point. Pioneered by the Japanese in the 1960s, "outsourcing" is also accompanied by supplier-tiering, specialization and concentration of orders (Womack et al., 1991; Nishiguchi, 1994).

The original objective of "outsourcing" strategy was to take advantage of the knowledge accumulated by suppliers with regard to their respective parts. Subsequently, from a situation where the suppliers were provided with detailed designs/blue prints, there was a gradual transition to early supplier participation in achieving improved product design. The OEMs sought supplier inputs to enhance product quality as well as to reduce production costs. As the subcontractors delivered performance and retained a portion of the cost savings, their incentive to innovate sky-rocketed. Over time, this process, ultimately, evolved into **"black box" designing** - wherein, the customers merely specify performance and size requirements of the component/sub-system and the

subcontractors used their technical expertise to perform the detailed design, engineering and manufacturing work.

This outsourcing strategy has two crucial effects: *while it vastly reduces the complexity of product development and management tasks of the buyer, it also simultaneously makes the customer completely dependent on specific suppliers.* Of course, this is worthy of attention only in industry contexts where the value added by the specialized / differentiated supplier would be significant. The OEM can lose track of certain (non-commodity) parts/components in terms of their design, engineering specifications, technological significance etc. This can be particularly hazardous when a component is not seen to be of "strategic (competitive) significance" today , but, can later become significant on account of technological developments. That is, the firm, when seen as a bundle of resources, becomes incapable of handling technological uncertainty. **This is the hollowing effect with respect to architectural knowledge** (Ravi Venkatesan, 1992). Many researchers have argued along the same vein: they hold that companies that judge competitiveness primarily in terms of the price performance of end products are inviting the erosion of core competencies. Embedded skills that give rise to the next generation of competitive products cannot be "rented in" by outsourcing. Firms surrender core competencies when they cut internal investment in favor of outside suppliers (Prahalad and Hamel, 1990; Davis, 1992).

From a supplier-performance viewpoint, the customer's technological / product design dependence on its subcontractors fits in well with "resource dependence" arguments. It is necessary to keep in mind that this dependence is enhanced when the suppliers provide differentiated parts/sub-systems that have current strategic significance (Nishiguchi, 1994, p. 118). It is an extremely powerful hostage that the customer places in support of exchange with specific suppliers. As a result, this dependence is a source of

premium returns for the subcontractors, with mobility barriers / switching costs for the customer being prohibitive. Therefore, the following proposition is made:

> H6: Buyer's technological (design, engineering and manufacturing process) and overall dependence on the supplier would relate positively with the latter's performance.

As in the previous hypothesis, descriptive works have identified black box designing, concentration of orders among a few top-tier suppliers as the support mechanisms that encourage suppliers to continue making specialized investments. Among the empirical works done from the buyer's perspective, Artz (1995) does control for the customized nature of the supplier's product. He finds that supplier customization increases OEM's perceived costs of negotiation.

The hypothesis attempts to contribute in two ways: conceptually, it argues that buyer's technological or overall dependence on the supplier does serve the purpose of signaling buyer's credible commitment to the exchange. Furthermore, it lays the foundation for forthcoming hypotheses on information exchange. That is, the buyer firm stands to benefit from increasing its dependence on the supplier. Such dependence encourages the supplier to share production-related information with the OEM, which in turn is crucial for applying value analysis techniques. Therefore, this hypothesis, along with others, helps explain how "solidarity, adaptability and information exchange" are fostered in the vertical relationship. Empirically, it seeks to echo the above rationale as well as the reasoning of other descriptive works in terms of supplier profitability.

3.6.0 Information Exchange

This dimension of JIT exchange, probably, has proved the most elusive to those OEMs attempting to replicate the Lean Production System (LPS). In the Japanese context, what makes the "target-cost" method of new product development and outsourcing operate as sources of advantage is the ability of the manufacturers to rigorously apply VA (Value Analysis) and VE (Value Engineering) techniques (Nishiguchi, 1994). VA refers to improvements for ongoing components while VE refers to component and cost planning of new models. VA and VE in turn require the OEM to be totally familiar with the cost structure / economics of their subcontractors' production processes.

Despite raising contract periods and rationalizing supplier-base, only 19% of suppliers in the American automobile industry have been willing to share cost information (of their production processes) with the OEMs (Helper, 1991; Womack et al. 1991). The percentage of suppliers providing their customers with a detailed breakdown of process steps has however moved from 38% in 1984 to 80% in 1993 (Helper & Sako, 1995). If the customers were to treat the suppliers of a specific part as equally replaceable (that is, market exchange logic prevails) and indulge in periodic competitive, invoice-price bidding, a tone of power based, adversarial bargaining is set. Researchers' proclivity to categorize attempts at implementing LPS as "Mature Mass Production" has already been mentioned. JIT delivery has come to mean increased inventory burden for suppliers. The customers have not been forthcoming by way of technical or financial support. The situation is further exacerbated on account of durable investments that the suppliers have had to undertake to achieve lower invoice prices, total quality and JIT delivery. It is, therefore, not surprising that suppliers are wary of sharing true cost information with their customers. Low level of commitment and high degree of

information exchange is an untenable combination (Helper, 1991). Therefore, the following proposition is made:

H7: Production information exchange on the part of the supplier will have a negative association with supplier performance.

The purpose of this hypothesis is to provide empirical (formal statistical) support for the reasoning of other descriptive works mentioned here. Quite a few empirical works have studied the impact of information exchange from the buyer's perspective. Noordewier et al. (1990) find that any information that the buyer exchanges with supplier (per se) does not promote buyer interests in terms of increasing on time and acceptable deliveries from the supplier. Heide and John (1992) similarly find that information exchange does not enhance buyer control over supplier operations. However, both works find that information sharing together with uncertainty or buyer's specialized investments does serve OEM interests – as defined in their respective studies. Artz (1995) finds evidence that information sharing and solidarity (collaborative efforts) clearly reduce OEM's (perceived) cost of negotiation, under conditions of asset specificity. Therefore, the intent of this hypothesis is to ascertain the main effects of information exchange empirically from the supplier's perspective.

3.6.1 In direct contrast to the above-mentioned adversarial negotiations, when the Japanese attempted to implement VA/VE techniques in the 1960s, there was a joint focus on "total manufacturing costs" (of both the buyer and the supplier). Other factors that provided the incentive for subcontractors to share detailed cost information were:

(i) the general tendency towards long term contractual relationships;

(ii) early involvement of suppliers in product design;

(iii) implementation of profit-sharing rules as early as late 1950s;

(iv) concentration of orders among few direct (first tier) suppliers;

(v) allowing for significant dependence on specific subcontractors through black box designing concept, and, providing technical / managerial support to weaker suppliers;

(vi) the gradual (by early 1970s) development of bilateral decision-making with regard to price determination (Nishiguchi, 1994).

This sets the stage for joint profit maximization. Self-enforcing agreements incorporate adaptive decision making and market incentives (on account of retaining distinct identity), without incurring the administrative cost of internalization. Truthful revelation of cost / demand parameters is essential for maximizing joint profits. It is important to note here that, provided ex ante incentives exist for the supplier, it is very much in the interest of the supplier to reveal true cost parameters. Share of the maximized joint profits is obtained. As discussed earlier, suppliers do not mind sharing their cost information because they enjoy steady, future demand realizations through reciprocal commitments and dependence on the part of the buyer. Not only do the firms get higher profits, but the consumers benefit too in the form of higher output levels and lower prices. That is, social welfare (consumer surplus plus profits) is unambiguously improved and efficiency purposes served. If the supplier fails to share and distorts information, double marginalization (adversarial bargaining) comes into play, which yields lower levels of individual firm profits, output, and higher prices (Scherer & Ross, 1990).

In a static, one-shot context, either of the two firms could do better by not cooperating (the buyer will not have to make reciprocal commitments or share profits or could play suppliers off against each other, while the supplier could not meet "target

cost"). However, in the context of repeated exchange, reputation effects and competition, it is crucial for the downstream producer to solicit the cooperation of the supplier, so that revenue and profit levels can be increased. In other words, "a see- through value chain" and open information exchange is essential to minimize total manufacturing costs and create sustainable, significant economic value (Dyer & Ouchi, 1993).. Therefore, the following proposition is made:

H8: When there exists credible commitment on the part of the customer, sharing of cost information would have a positive association with supplier performance.

This hypothesis constitutes the most central contribution of this study. It represents an addition to existing work both conceptually and empirically. As mentioned earlier in hypothesis six, this hypothesis explains the value enhancing potential of OEM's credible commitment to the exchange. It provides both theoretical and historic arguments as to how buyer's commitment encourages supplier to share information. More importantly, the idea here is that the co-existence of these two features increases the adaptive ability and collaborative focus of both parties. These in turn make the association more valuable to both the buyer and the supplier. Consequently, they vastly improve the competitive value of quasi-vertical integration (self-enforcing agreements) as an organizational strategy. Empirical support for this hypothesis would help explain why American suppliers are hesitant to share production information, despite being awarded more verifiable safeguards – in the form of longer contracts.

3.6.2 Target pricing and information exchange

The above discussion on information exchange warrants a second look at target pricing effects. Section 3.3 provides a detailed analysis of the main effects of target pricing on supplier's profits. However, target pricing does not exist in isolation. It is a crucial component of the multifaceted system of supplier management developed by the Japanese OEMs. In fact, a target price can be arrived at only after extensive value analysis (VA) and value engineering (VE) applications. Further, such a price is arrived at only after providing for normal returns to the supplier. Any future reductions in the targeted price are expected to be based on cost savings achieved by the supplier, and not on reduced profit margins. Of course, the cost savings come predominantly from scale economies and process innovations.

For VA or VE to be a reality, the OEMs must have detailed knowledge of supplier's production processes and costs. Clearly, the supplier has an incentive to share its cost structure only when there are support systems in place that guarantee stable long term demand for its products. These support systems include long term relationship with the buyer, buyer's technological dependence on the supplier, concentration of the OEM's business among one or two competitors, and any technical or financial support provided by the OEM. Therefore, it seems reasonable to conclude that suppliers, in the first place, would not share any production related information unless there are support institutions in place that make them trust the OEM. Secondly, when target prices are arrived at based on both parties' cost structures, supplier margins tend not to be sacrificed. Furthermore, the end-product target price arrived at this way tends to be very competitive, yielding substantial volume advantage to both the OEM and the supplier. This trend has been repeatedly enjoyed by Toyota in the automobile industry and Matsushita in the electronic goods industry. The increased volume helps reduce their costs even further, supporting

their generic low cost strategy extremely well. Therefore, the following proposition is made:

H9: Target pricing together with production information exchange would relate positively with supplier performance.

This hypothesis also represents an extension of existing research conceptually and empirically. Very little formal work has been done to validate the efficacy of target pricing from the supplier's perspective. Descriptive research on lean production system and supplier relations has generally viewed target pricing practices with some skepticism (Helper and Sako, 1995; Dyer and Ouchi, 1993). It is not always clear if such practices serve supplier interests. Two-vendor policy together with a perennial expectation of cost savings constitutes substantial performance pressure on the supplier. However, it is the very same mechanism that provides the high incentive to perform. The conceptual reasoning used in developing this hypothesis is that, if cost structures are accurately taken into account, supplier profitability would not be threatened. Target price arrived at without considering supplier's ability (in terms of existing costs) to allow such price is the kind that harms supplier profitability. Part of the skepticism regarding target pricing could be on account of such implementation. Empirical testing of the hypothesis would help check if the data do support the above rationale.

3.7 Summary and Conclusions

This chapter helps identify dimensions along which trilateral and bilateral governance can be characterized. These dimensions include (a) safeguard mechanisms

(b) incentive intensity and (c) adaptive/conflict resolution mechanisms. In particular, "verifiability of parties' obligations" is used to differentiate the two governance alternatives along these dimensions. The ultimate objective is to develop a research model that predicts the relationship of these two distinct governance arrangements with supplier profitability. This way, the mechanism which better serves supplier interests can be identified.

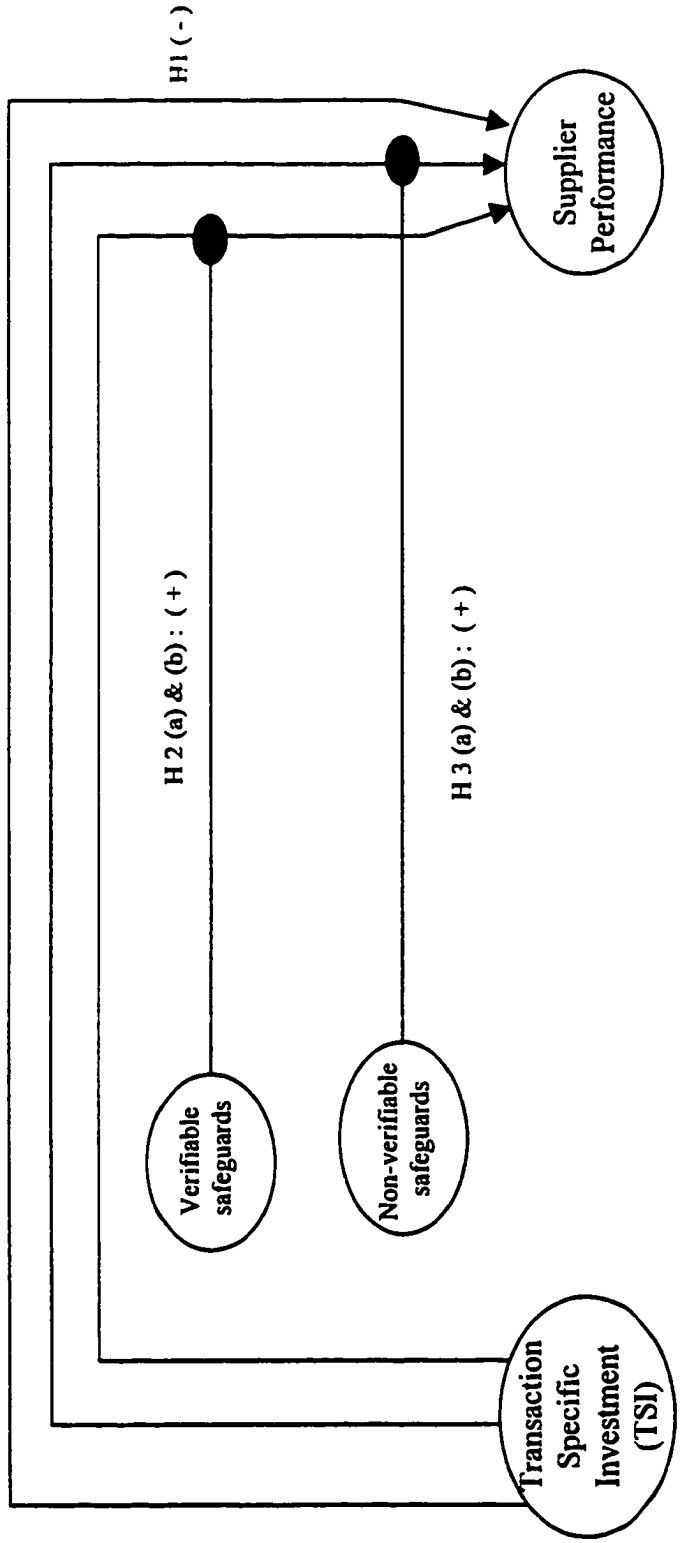
Since the motivation for the study comes from durable, relation-specific investments that suppliers are expected to make, the modeling commences with the main effects of such investments on supplier profitability. Transaction-specific investments, per se, are expected to have a negative association with supplier profits. The purpose of this hypothesis is to serve as a "control / base prediction" so that the effects of ensuing (and more important) predictions can be contrasted against the main effects. When transaction-specific investments of the supplier are accompanied by (contractually) verifiable safeguards, such investments are expected to promote supplier returns. Verifiable safeguards include contract duration and any specific quantities that the OEM-customer has agreed to purchase ex ante from the supplier. The underlying rationale here is that the supplier reaps some of the efficiency benefits of its specialized assets when the buyer guarantees stability in future demand. Following the same logic, transaction-specific investments, when accompanied by non-verifiable safeguards, are expected to have a positive association with supplier profitability. Non-verifiable safeguards enjoyed by the supplier include long term business dealings with the customer and the customer's willingness to share its production schedules ahead of time with the supplier. The latter feature, together with few alterations to the schedules, significantly stabilizes shopfloor activities for the supplier. Consequently, it enables the supplier to implement JIT techniques in its manufacturing tasks, thereby reducing its cost structure substantially.

With regard to incentive intensity, the model hypothesizes that cost plus pricing would favor the supplier while, the practice of target pricing (main effects) would harm the supplier's profitability. However, it is much more meaningful to the study to analyze the effect of target pricing in the presence of production information exchange between the parties. For target pricing does not prevail in isolation. It is part of a multifaceted supplier management regime practiced by the Japanese. It is argued that target pricing, together with information exchange, would have a positive association with supplier profitability.

With regard to adaptive ability, it is argued that any financial, R&D or capital investment that the OEM makes in the supplier's operations serves as a credible commitment to the exchange. Consequently, it is hypothesized that credible commitment on the part of the buyer would enhance supplier profitability. Furthermore, the OEM can signal its commitment to a long-term relationship with the supplier by increasing its overall (and technological) dependence on the supplier. Buyer dependence is therefore expected to have a positive association with supplier profitability. The third and most important element of these JIT relationships is the production-related information that parties share with each other to achieve overall cost and price reductions. It is hypothesized that any production related information that the supplier shares with the OEM (unilaterally) would have a negative association with its profits. However, all the above mentioned elements co-exist in these modern supplier strategy regimes. It is therefore more important to check for their joint effects. Buyer dependence together with information exchange is expected to have a positive and significant association with supplier performance. It is important to highlight the following here: the two joint effects (dealing with information exchange, target pricing and buyer dependence) are the most fundamental hypotheses of the study. Reciprocal activities undertaken by the buyer such

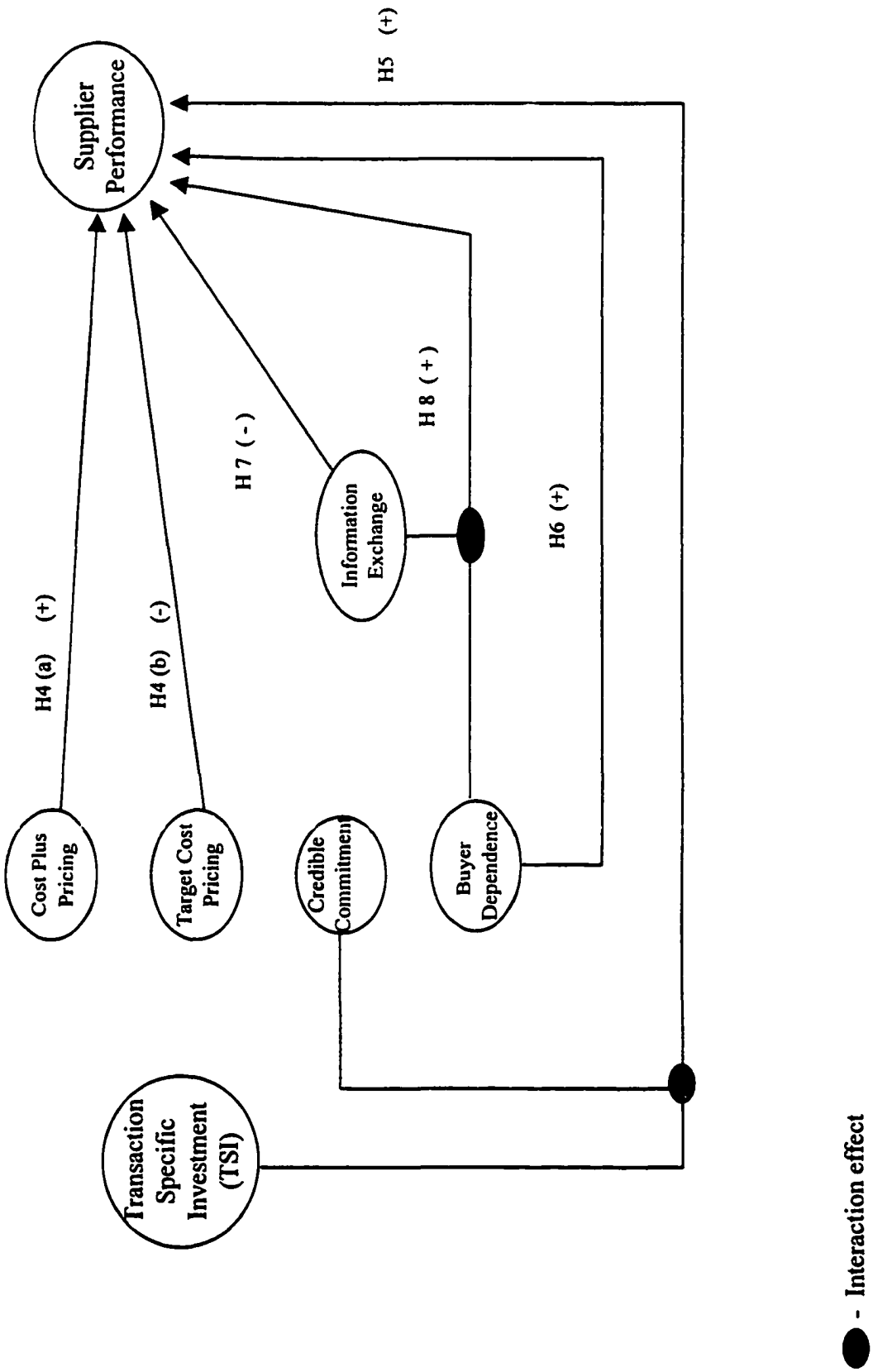
as credible financial commitments, enhanced technological dependence are features that evolve over the duration of the buyer-supplier relationship. They are not legally provided for in any contract and are clearly not part of trilateral or enforceable contract regime. It is however these features that vastly improve the flexibility of the parties and prove vital for supplier firm's sustained financial health. Therefore, it is along the dimension of "adaptive ability" that self-enforcing contracts prove superior to enforceable contracts and better serve supplier interests.

Development of Propositions - Figure 3.1

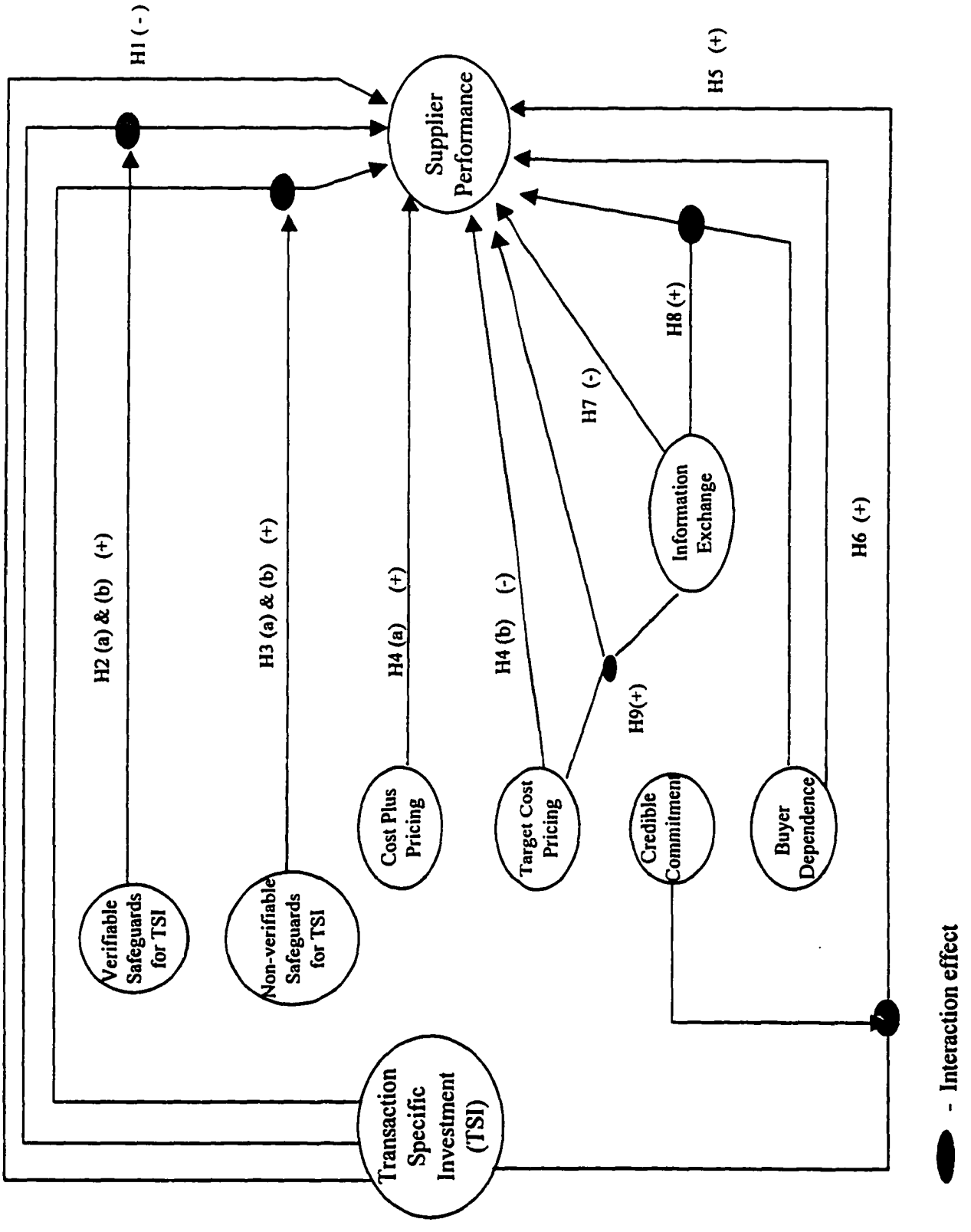


● - Interaction effect

Development of Propositions - Figure 3.2



Development of the Model - Figure 3.3



CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 Introduction

The purpose of this chapter is to choose an appropriate empirical context for validating the model developed in the preceding chapter. The central focus of this model is to explain differences in supplier performance emerging from the vastly varied relationships that suppliers develop with their OEM-customers. In industrial markets, it is quite common for buyers and suppliers to develop norms and practices that are unique to specific parties, norms which reflect evolution of the relationship over time. As a result, it is appropriate and imperative to use a specific buyer- supplier association as the basis for gathering information/data on supplier performance as well as product, pricing and contracting policies. More detailed discussion of the choice of unit of analysis follows in the ensuing subsection (4.2). An equally important choice is the one with regard to the industrial setting in which the hypotheses will be tested. While the hypotheses are grounded in theoretical reasoning and hence can ideally be tested in any context, the strategic significance of supplier management may vary across industries. In other words, the performance effects reflected by the model can be observed better in some industries than in others. Also, given the detailed nature of relationship-specific

information required by the model, data availability could pose another constraint in choosing an appropriate research setting. Discussion on the choice of industrial context is provided in subsection 4.3. Having chosen an appropriate industry in which to test the model, subsection 4.4 deals with the use of key informants and industry experts in operationalizing some of the constructs. It also discusses design and development of the questionnaire and the data collection process at length. Finally, sub-section 4.5 provides an in-depth rationale of the operationalization of variables used in this study.

4.2 Unit of Analysis

The motivation for this study clearly emerges from the need to look at supplier side of the equation in order for long-term relationships to serve as efficient governance mechanisms for buyer-supplier exchanges. The relevant dependent variable for the model is supplier performance. Previous studies in this area operationalize supplier performance in terms of the cost/quality/delivery capabilities (achievements) of suppliers. That is, the supplier's performance is measured from the buyer's (OEM's) perspective (Noordewier et al. 1990; Clark 1989; Clark et al. 1987). However, the purpose of this study is to (a) ascertain the effect of these new, long-term associations on supplier firm's health and, (b) thereby identify governance features that favor supplier interests. Therefore, for the purposes of this study, supplier performance refers to a measure of supplier's profitability such as return on sales, return on investment, etc.

This in turn raises a very fundamental question as to the relevant unit of analysis for the study. The two potential alternatives are measuring performance at the aggregate,

firm level and measuring it at the disaggregate, client level. The latter option consists of measuring supplier returns with respect to a specific OEM-client's business. Two factors will determine the appropriate unit of analysis here: the context implicit in the arguments used to develop the hypotheses/independent variables and data availability. The following discussion addresses these factors in detail.

In trying to explain why it is that long-term associations with suppliers have worked to OEMs' benefit in Japan and not in Western economies, the model essentially contrasts the performance effects of different contracting/governance arrangements. In other words, the hypotheses attempt to explain differences in supplier performance because of differences in contracting, product, pricing and investment arrangements that the suppliers have developed with their OEM-customers. Asset specificity, contract duration, length of relationship with the OEM-customer, pricing policies, OEM's technological dependence on the supplier are some of the defining variables along which such differences are measured. It is crucial to recognize here that the above-mentioned elements of exchange vary with different OEM-customers. That is, the vector of independent variables is distinct and unique to each OEM-client that the supplier does business with. The explanatory variables are, therefore, being measured in the context of a specific OEM-supplier relationship. It is important to bear in mind that, even though the OEM-supplier exchange association becomes the appropriate unit of analysis for the study, the focus is on the performance of only one of the exchange partners , namely the supplier. In fact, each of the explanatory variables is assessed only from the supplier's perspective.

The next factor to be considered is whether the supplier's profits from a specific client account can be obtained (i.e., data availability). Feedback from industry experts and respondents reveal that suppliers do indeed keep track of earnings at the client-level in terms of gross margin, return on sales, etc. More conventional earnings measures such as ROI and ROE are however hard to obtain and may not even be available/calculated at the client level. For the purposes of this study, it is more important to have a broad measure of supplier's earnings from each OEM-customer's business than to have a fine-tuned sophisticated profit measure that is (however) available at the firm level. Combining independent variables measured at the disaggregate level and supplier performance at the more aggregate firm level creates a fundamental mismatch that detracts from the validity of the study. Comparing the supplier's OEM-specific contracting and pricing policies with the supplier's overall financial performance is tantamount to assuming that overall firm profitability well represents the returns from individual clients accounts. Such a sweeping assumption may not be realistic and warranted because supplier's overall profitability is a weighted average of returns from individual OEM businesses. To maintain the validity of the study and perform meaningful empirical analysis, it is very critical to measure the dependent variable (namely, supplier profitability) also at the OEM-supplier relationship level.

Consequently, the relevant unit of analysis for the study is a specific OEM-supplier association that the supplier will be reporting on. The independent variables naturally relate to details of the supplier's association with a specific OEM-customer. The dependent variable will also be measured in terms of the supplier's returns from the

OEM-business. It is however true that accounting procedures adopted by supplier firms could vary vastly with regard to overhead and interest allocations before arriving at return on sales figures. More detailed discussion of the alternative ways of measuring supplier's earnings at the client level can be found in subsection 4.5.

4.3 Research Setting:

In order for the model developed in the earlier chapter to have meaningful strategic implications, it is very important to choose an appropriate industry setting. An appropriate industry is one where the following conditions prevail:

(i) the OEM's end-product in the industry must be a configuration of several, interdependent parts that work in unison;

(ii) customer satisfaction (and value) with the end-product largely depends on the inherent features of the parts;

(iii) the OEMs tend to compete on the basis of new product and process developments so as to differentiate their products better or provide more quality at lower cost to the consumer. In this context differentiation and innovation at the supplier stage become critical, for, the quality/appeal/cost of the OEM's final product largely depend on the parts provided by the suppliers.

The above-mentioned conditions are commonly found in industries such as the automobile industry, aircraft/aerospace industry, earth moving equipment industry and home appliance industry, to name a few.

Historically, the automobile industry in Europe and the U.S. has been among the first and worst hit by the competitive effects of relatively poor and ineffective supplier

management strategy. Japanese automakers very swiftly gained market share at the expense of the Big Three companies through the introduction of high quality / low cost cars. Much has been written about the strategic advantage that Japanese automakers have come to enjoy mainly because of their visionary management of supplier activities. Given the extensive damage sustained by U.S. automakers and the high profile nature of the automobile industry in the U.S., many American car manufacturers have attempted to replicate some Japanese supplier management practices, with little success. Consequently, the automobile industry does indeed provide an appropriate empirical setting for testing the model. However, as mentioned earlier, this industry has also been the focus of a multitude of studies in this area. In fact, much of the empirical evidence used to develop the model in chapter three comes from such studies. This study will contribute better to research in vertical alliances if the model could be found useful in other similar industrial contexts.

A not so well known fact about Japanese supplier management is that close coordination with suppliers and delegation of significant operational autonomy to suppliers is not limited to the automobile industry. They are equally well practiced in electronic goods, household appliance and other manufacturing industries (Nishiguchi, 1994). An initial investigation of the appliance industry's business journals clearly indicated that JIT practices, closer technical and design coordination with suppliers are becoming popular in the American context as well. Also, executives at the Association of Home Appliance Manufacturers (AHAM), the leading industry association, and industry experts did confirm the topical significance of JIT supplier alliances in the industry. In

fact, annual meetings of AHAM members regularly hold sessions on how to build closer, cooperative ties/relations with suppliers. Executives at the Supplier Division of AHAM also emphasized the relevance of this study to their industry given the increasing pressure they face in terms of providing higher quality/lower cost JIT deliveries to OEMs. In fact, AHAM members specifically noted that the industry would stand to benefit significantly if its OEMs could build relations with their suppliers in such a way that they avoid the pitfalls faced by their OEM counterparts in the automobile industry.

As a result of this very promising and encouraging response from the industry, the home appliance industry has been chosen as an appropriate research context for the empirical validation of the model. The following section provides a detailed review of the past and current trends in the household appliance industry.

4.3.1: Household Appliance Industry: Past Trends

The major home appliance industry covers OEMs engaged in the manufacture of household cooking equipment (such as stoves, ranges, and ovens), dishwashers, refrigerators and freezers, laundry equipment (washers and dryers), electric housewares and fans and vacuum cleaners (SIC Codes 3631-3635). The past trends in each of these distinctive segments is discussed below:

4.3.1.1 Cooking equipment segment

Household cooking equipment (SIC Code 3631) is part of the estimated $17 billion appliance market in the United States. The appliance market includes white goods such as washing machines, refrigerators, vacuum cleaners and dishwashers. Like white goods, cooking equipment is dependent on the housing economy and previous housing

slumps have impacted the industry rather severely. This category can be described to be in the "mature" stage of its life cycle, with much consolidation occurring among the major appliance manufacturers. Demand for replacement of old and worn-out appliances drives the market, since most major appliances last ten to 15 years. White goods sales peaked in 1987 with 38 million units sold, but the industry endured a slowdown during the early 1990's.

Five major corporations dominate the household appliance industry and imports make up more than 50 percent of the domestic market for small appliances like microwave ovens. An objective of many of the main appliance manufacturers is to expand their markets globally. Many firms have accomplished this by opening factories in Europe and Asia. The top industry leaders of household cooking equipment are: Whirlpool Corp., General Electric Company (GE), White Consolidated Industries Inc., Sony Electronics, Inc., Maytag corp., Sharp Electronics Corp., Washington Energy Co., and Sunbeam-Oster Company, Inc. Whirlpool has been the major supplier of Sears, Roebuck & Co.'s Kenmore household cooking range line. Market share differs among the industry leaders depending on the household equipment category.

In terms of gas ranges, Maytag has held the most market share of nearly 25 percent, followed by General Electric, and White Consolidated Industries with twenty four percent each. Raytheon's Amana brand lost two percentage points from 21 percent in 1992. Market share in electric ranges has experienced more shifts in share. GE leads here, but has lost four percentage points to 39 percent in 1992. Whirlpool moved up one point to 19 percent of the electric range market, followed by White Consolidated

Industries with 18 percent and Maytag with 14 percent. Raytheon had a five percent share in 1992.

Countries with traditionally lower wages, like South Korea and China, continue to be major suppliers of small appliances. Microwave ovens still represent the majority of imported appliances, but in recent years, demand for microwaves has tapered off.

4.3.1.2: Refrigerator and freezer segment

As the household refrigerator and freezer industry entered the 1990s, it was dominated in the United States by five companies – Whirlpool, General Electric, Maytag, Electrolux (Frigidaire), and Raytheon (Amana). By the beginning of the 1990s, several decades of consolidation had left an industry with little room for growth domestically. There were no smaller companies left for the large corporations to buy. According to *Appliance* magazine, this segment has been a mature industry with 99.9 percent of American households possessing refrigerators. Nearly 33 percent of homes contained a freezer. The refrigerator industry, however, had a steady market for replacements and units for new homes. Each company sells appliances in three different price ranges, with low-end products offering the least profit margin. With the shaky economy of the early 1990s, sales of low-end refrigerators performed more strongly than top-of-the line models. The big five of this industry have all instituted programs to improve productivity. The industry is considered one of the most efficient in the country, leaving little room for foreign products to take any significant market share as they have in the car and electronics industries. In addition, prices of American refrigerators and freezers have remained reasonable.

U.S. manufacturers are under serious environmental pressure in the 1990s to increase recyclability of refrigerators, reduce energy consumption and eliminate chlorofluorocarbons as the refrigerant in refrigerators and freezers. The U.S. Department of Commerce predicts that shipments of household appliances would increase by nearly 2.5 percent a year through 1996. Whirlpool and General Electric each produce 30 to 35 percent of all appliances shipped, followed by Frigidaire, Maytag, and Amana. These five companies account for more than 95 percent of all appliances made in the United States. Shipment of refrigerators represents the largest share of the appliance industry and General Electric is the leader in this category, followed by Whirlpool. According to Standard and Poor's industry survey, brand loyalty is strong in the replacement market. Although percentages shift from year to year, it is unlikely that any manufacturer would take a serious bite out of another manufacturer's market share.

Whirlpool, which started out making washing machines only, became a full-line appliance manufacturer in the 1950s and 1960s. At that time, it also became the principal supplier of the Sears Kenmore brand and still was in 1993. In 1986, Whirlpool acquired KitchenAid, a high-end producer of appliances, including refrigerators. In 1991, Whirlpool completed its acquisition of Philips, the second largest appliance company in Europe. It also had partners in Eastern Europe, Brazil, Argentina, Mexico, Italy, and India. The Philips acquisition boosted Whirlpool's global presence and made Whirlpool one of the top two appliance makers in the world, along with Electrolux.

Domestic appliance makers have become more active in the European market in search of growth. In 1991, Europe accounted for nearly a third of Whirlpool's sales and

15 percent of Maytag's sales. Whirlpool also acquired partners in eastern Europe and South America to continue to stretch its market.

There is little concern that foreign manufacturers would gain any significant hold on the U.S. refrigerator-freezer market because the U.S. industry offers good value, service, and durability. Electrolux, the parent company to Frigidaire and other brands, is a Swedish company. But it is the only foreign presence in the American market and it has been selling American-made brands. Further, as seen in the next sub-section, Electrolux has been steadily losing ground in the American market.

4.3.1.3: Laundry equipment segment

Only since the 1950s have gas and electric-powered laundry equipments achieved widespread use. By the early 1990s, over 70 percent of all U.S. homes had both a washer and a dryer. Furthermore, producers have been shipping nearly 12 million new units each year with a market value of approximately $3 billion. Over 16,000 Americans were employed in the industry in 1993.

Positive demographic trends and healthy housing starts have helped boost household laundry equipment sales by more than 50 percent between 1980 and 1990. Although industry participants suffered the effects of recessed construction markets and economic malaise in the early 1990s, sales have rebounded going into the mid-1990s. Analysts predict that shipments would continue to grow at a rate of one to three percent through the end of the decade. To boost sales and profits, washer and dryer producers in 1994 are striving to develop new and better appliances to spur replacement sales. They

are also scrambling to comply with new federal environmental regulations. Most are seeking growth overseas, in regions such as Asia and Mexico.

Household laundry equipment represents nearly 17 percent of the overall U.S. household appliance industry. It is America's second largest appliance segment, by revenues, following refrigerators. The market for first-time purchasers of washers and dryers is relatively saturated, with the exception of first-time home buyers. As a result, the industry is highly dependent upon sales of replacement appliances. Most laundry equipment has a life span of 10 to 16 years. However, several factors may influence the replacement rate of washers and dryers. An increase in sales of existing homes, for example, boosts replacements because new occupants are more likely to buy new appliances. Likewise, heightened remodeling activity also spurs replacements. Increases in repair costs in relation to price of new units can also shorten replacement cycles. Finally, because appliances are discretionary purchases that can be postponed, industry revenues are closely tied to the health of the overall economy.

The three major household laundry product categories are electric washing machines, electric dryers, and gas dryers. Washers are of two types; top-load and front-load. Like the other segments, the laundry equipment industry is very consolidated, with Whirlpool dominating the industry. As the vigorous growth of the late 1960s, 1970s, and early 1980s waned, producers have tried to achieve economies of scale through merger and acquisition. By the end of the 1980s only 16 competitors remained, compared to over 25 at the start of the decade. In fact, the top two companies control nearly 70 percent of the market, and the top four manufacturers accounted for about 80 % of sales.

Laundry industry sales grew about three percent in 1993. Unit volume, moreover, leapt by nearly six percent. Increased sales were largely the result of an increase in housing starts and escalating consumer expenditures following the recession. Besides baby-boom patterns, overall U.S. household formations are expected to rise during the 1990s, from 93.1 million in 1990 to 106 million in 2000. This should result in steady growth of first-time appliance buyers. Furthermore, because a large percentage of existing washers and dryers were purchased in the early 1980s, some observers expect replacement sales to increase in the latter part of the 1990s. The industry is also expected to benefit from low interest rates, a reduction in inventories in 1994, more strategic inventory management in the future, and export growth.

As mentioned earlier, the laundry equipment industry is highly consolidated. The top four companies account for nearly 80 percent of all shipments. Whirlpool, the industry behemoth, captured over 50 percent of the U.S. washer and dryer market in 1993. General Electric Corp. and Maytag Corp. each garnered about 17 percent of overall sales. Electrolux, of Sweden, met approximately 13 percent of U.S. demand. Maytag is credited with giving birth to the industry, and has a proven reputation for supplying high quality washers and dryers.

Whirlpool overtook General Electric in 1993 to become the world's largest appliance manufacturer. Leading edge production techniques and improved product quality helped Whirlpool achieve a record $205 million profit in 1992 from $6.3 billion in sales. After realizing growth of 14 percent annually during the 1980s, Whirlpool has

been concentrating on global expansion in the 1990s. In particular, it has been investing heavily in Asian and European markets.

4.3.1.4: Small electric housewares

The 1992 *Ward's Business Directory of U.S. Private and Public Companies*, lists Allegheny International Inc. as the largest firm in the electric housewares industry. However, that firm has since passed through a difficult two-year bankruptcy struggle to re-emerge as Sunbeam-Oster Company, Inc. By 1993, Black & Decker U.S. Inc. of Baltimore, was no longer the largest electric housewares manufacturer, relinquishing its title to Sunbeam-Oster. Black & Decker is, however, ranked the largest producer of electric irons and portable electric mixers, holding 48 percent and 36 percent market shares, respectively.

The 1990 merger of Hamilton Beach and Proctor-Silex has moved the companies up as the third largest electric housewares manufacturer. The company is a subsidiary of HB-PS Holding Co., Inc. According to the 1992 *Business Rankings Annual*, it led the industry in sales of electric toasters, commanding a 30 percent market share. The industry slowdown of the 1980s prompted some firms to look beyond the United States for future markets. As the U.S. dollar weakened compared to European and Japanese currencies, American exports cut into the market share of European products by pushing their relative costs up by as much as 25 percent.

4.3.1.5: Vacuum cleaner segment

The four primary categories of household vacuums are upright, canister, stick, and handheld models. Following solid industry growth during the 1960s and 1970s, the

household vacuum cleaner industry has realized steady expansion during the 1980s. Prodded by new product introductions and positive demographic trends, vacuum cleaner sales rocketed form $775 million in 1982 to $1.87 billion in 1990, reflecting an average annual growth rate of more than ten percent. Stick and handheld vacuums have been the fastest growing product segments during this period.

Economic recession sent industry revenues tumbling below $1.7 billion in the early 1990s. A recovery entering the mid-1990s, however, buoyed earnings and promised to revive struggling manufacturers. Overall unit shipments are expected to rise as much as four percent in 1994, with stick and upright vacuums leading industry growth.

Nearly 25 U.S. companies manufactured vacuums in the early 1990s. The largest manufacturer was the American division of Electrolux Corp. Hoover Co., of Ohio, was the second largest producer. Other industry leaders included Scott Fetzer Co., of Ohio, and Eureka Co., of Illinois. In the mid-1990s, vacuum makers were trying to boost sales with new high-tech products. Eureka, for example, introduced a line of environmentally-friendly vacuums that were designed to filter out 99 percent of the dust and dirt that enters the vacuum.

Dishwasher sales also have risen significantly in the 1990s. Sales have moved up from 3.5 million units in 1991 to 4.84 million units in 1996. As in the case of electric ranges, GE and Whirlpool dominate this market with forty and thirty-seven percent market shares respectively (in 1996). Maytag is a distant third with 19% market share and Electrolux follows with a mere four percent share. It is interesting to note that

Electrolux has lost substantial portions of its market share to Whirlpool and Maytag. Between 1991 and 1996, its share went down from 20% to 4%.

4.3.2: Current trends in the appliance industry

For the year 1996, sales of major home appliances (excluding vacuum cleaners) reached an all time high of 53.711 million units, topping the 1994 record of 53.483 million units. Room air conditioners, dishwashers and refrigerators have contributed substantially to this strong showing. For the two year period 1994-96, room air-conditioner shipments increased by more than ten percent and dishwasher sales went up by five percent. The strong performance in 1996 represents a 2.4% gain over 1995. The following table shows the changes for each category:

Shipments of major appliances and vacuum cleaners ('000s of units)

Product Category	1997 *	% Change	1996 **	% Change	1995
Electric Ranges	4147	-0.9	4185	+3.4	4048
Gas Ranges	2863	+1.0	2834	-0.7	2854
Microwave Ovens	8915	+1.9	8750	+1.8	8596
Laundry Equipment	12470	+0.6	12,395	+2.2	12,126
Refrigerators	8838	+0.5	8790	+1.4	8671
Room A/C	3891	-14.8	4566	+6.2	4300
Dishwashers	4816	+0.1	4813	+5.7	4554
Vacuum cleaners	16,800	+5.0	16000	+7.4	14,900

** Estimates * Projection

Source: Appliance Manufacturer, January 1997

Cooking products, with their new innovative choices, are seen to have high growth potential for 1997. While sales volume has been strong, OEMs are closely monitoring their profit margins. An important reason for the success of the domestic OEMs (in retaining their stronghold on the American market and keeping foreign competition at bay) is their ability to provide value to their consumers. While prices for all products have risen fifty two percent in the past decade, appliances prices went up only by 0.3% . In particular, new automobiles have taken a 40% price increase, while refrigerator prices have gone up by only nine percent.

Vacuum cleaners have experienced the fastest growth among all household appliances (major and non-major) in the past five years. Shipments for 1996 were of the order of sixteen million units, representing a 7.4% increase over the 1995 figures. Growth in this segment is expected to persist through the decade. Advanced technology, new product introductions and demographic trends are expected to fuel this growth.

With regard to market share, GE Appliances has consolidated its position as the leader in the cooking equipment category. Between 1991 and 1996 GE has garnered an enviable 40% and 49% market shares in the gas and electric range markets respectively. Most of its growth has been at the expense of Electrolux, Maytag and Whirlpool. In the refrigerator market, GE Appliances again leads the herd with a 37% market share in 1996. However, Whirlpool is a closer follower here with 27% market share in 1996. Both these companies have again grown at the expense of Electrolux. In the washer and dryer segment, Whirlpool is the clear leader with 52% market share in 1996. It has retained its leadership position through the '90s. Maytag and GE Appliances are a distant

second with 18% and 17% market shares respectively. In the upright vacuum cleaner segment, Hoover leads the pack with a 37% market share followed by Eureka with a 24% share and Matsushita with a 12% share. Finally, in the small electrical housewares market, Procter& Silex is the leader with 33% market share, followed by Black & Decker with 19% share and Sunbeam-Oster with 12% share.

4.4: Questionnaire Development and Data Collection

The nature of dependent and independent variables developed in the model in chapter three is such that information is needed at the OEM-supplier relationship level to test the model empirically. Section 4.2 establishes that the optimal unit of analysis for empirical validating the model is the exchange relationship/association between OEM and the supplier. Such information is not typically available from secondary sources. Data on the relevant variables need to be directly collected from individual firms through a questionnaire survey. Such a survey is in line with other studies in this area or research (Helper 1991; Helper and Sako 1995; Artz 1995). In order to gather data through primary sources the following aspects of the research design need to be addressed at length.

4.4.1: Key Informant

Given that data need to be gathered from individual firms, it is very important that the appropriate respondent(s) in the firm be identified for the survey. Such a respondent, also known as the "key informant" must be familiar and very knowledgeable about the different aspects of the supplier's dealing with the OEMs. These aspects include supplier's profitability from the business with the OEM, transaction-specific investments

made by the supplier, pricing policy, etc. Knowledge with regard to these variables typically rests in the Chief Executive Officer of the firm or the marketing executive responsible for the OEM's business. Consequently, these executives have been chosen as the key informants for the study. Furthermore, in order to minimize informant bias and to assess the competence of individuals responding to the survey, two post-hoc questions have been included in the survey. These questions pertain to (a) the number of years the respondent has worked for the company and (b) the time period for which he/she has held their current position in the firm. It is reasonable to assume that greater the time spent by the respondent in the current position and firm, the greater will be his/her knowledge on the subject matter.

Research studies that rely on questionnaire survey for data collection at times use more than one key informant in each target firm as respondents. The purpose of using multiple informants is to increase the validity and objectivity of data so gathered. The greater the convergence/correlation of the information provided by multiple respondents, the more reliable is the information. However, this study depends on data obtained from single respondent (per firm) for the following reasons:

(i) the detailed nature of the information needed on the supplier's relationship with a specific OEM-customer makes it difficult for more than one person in the supplier organization to be equally knowledgeable on such details. Typically, one employee is assigned to handle the strategic and operational aspects of the client's (OEM's) business (Artz 1995). It is the continued interaction with the OEM client (over time) that makes this employee an expert with regard to the client.

(ii) Furthermore, even if there are other equally informed employees with respect to the specific OEM's business, interviews with potential respondents made it clear that a request for multiple informants to the survey would severely reduce the response rate to the survey.

Consequently, this study relies largely on obtaining information from a single informant in respondent firms. The next significant task in this process is to identify the target respondent firms for the survey. The following section discusses selection of this target sample.

4.4.2: Identification of Target Sample:

Section 4.3 discusses the choice of industry as well as recent developments in the industry at length. Suppliers to these OEMs that manufacture household appliances (SIC Codes 3631-35) such as cooking ranges, refrigerators, vacuum cleaners, etc., therefore constitute the population for the study. It is imperative for the purposes of the study to focus on a single industry and its suppliers. The importance of suppliers and their products/inputs varies across industries. Using a sample of suppliers across industries, therefore, will not isolate the differences in governing OEM-supplier relationships and their effect of suppler profits. Such a cross-sectional sample will capture other inter-industry differences as well. It is important to control for these variations before testing the model empirically.

Industry journals such as Appliance and Appliance Manufacturer publish annual directories of such suppliers. These directories are quite comprehensive and are not based on supplier subscription to either of the journals. As a result the problem of self-

selection (with regard to supplier listing) is minimized and, it would be reasonable to conclude that these directories provide a listing of the supplier population to the industry. Suppliers are typically categorized into these groups: processed material suppliers, component and subsystem suppliers and capital equipment suppliers. Clearly, the OEM's dealings with suppliers of capital/production equipment can be expected to be substantially different from its relationship with suppliers of materials and components. The latter items are purchased on an on-going basis to manufacture the appliances. Capital equipment, on the other hand, is purchased infrequently and involves significant financial investment on the part of the OEM. As this study is motivated by the OEM's association with suppliers whose products are used as inputs in the final product, suppliers of capital equipment need to be excluded from the target sample.

A random sample of 1000 suppliers from the remaining two groups of suppliers has been chosen as the target sample for the study. The target sample size has been limited to 1000 mainly because of costs involved in conducting the questionnaire survey. Care has been taken to equally represent both processed materials and component suppliers in the target sample. It is important to note here that suppliers of materials such as processed steel, plastics and glass play an equally significant role in the assembly of the final product as component suppliers.

Among the 1000 firms in the sample, 110 are members of the Supplier Division of AHAM. As a result, it has been possible to determine the identity of the Chief Executive or Marketing Officer of these 110 firms from the association's membership directory.

Having information on the respondent's identity is expected to vastly improve the response rate to the survey.

Also, the target sample has not been controlled for supplier firm size in any manner. Independent supplier firms as well as supplier division spin-offs such as GE Plastics have been included in the sample. [GE Plastics is currently an independent enterprise, spun-off from GE Appliances – where it was an internal supplier to the appliance OEM]. Larger suppliers or supplier divisions of large corporations may be perceived to have greater clout than smaller ones a priori. However, prior research in this field has provided no indication that "supplier size" could prove to be a significant explanatory factor. In fact, smaller suppliers may actually have an edge over larger firms in terms of lower production costs, access to advanced technology through specialization or being more responsive to customer needs. Consequently, the target sample consists of small, medium and large suppliers. It will however be interesting to see if the responses vary systematically with supplier size.

4.4.3: Questionnaire Development:

The next step in the data collection process was the designing of the survey instrument itself (Appendix 1). The mail survey for the study was conducted in two stages: the first stage consisted of mailing out a comprehensive questionnaire (seeking information on all the independent variables) to the entire target sample of 1000. The second stage involved the mailing of a follow-up survey **only** to the respondents of the earlier phase. The follow-up survey focused mainly on questions pertaining to the

suppliers' financial performance in relation to the OEM-account. The ensuing sub-section will discuss the development of both questionnaires.

The first-stage questionnaire has been designed on the basis of mail and telephone survey principles laid out in Dillman (1978). The first phase in the development of the survey was to compile a set of questions that captured all aspects of the OEM-supplier association that are relevant to the study. The second, more important phase was the pre-testing of this instrument. The purpose of pre-testing any questionnaire is to ensure that

(i) it is easy to read and comprehend for the target respondents, and,

(ii) it seeks accurate and relevant information.

To this end, pre-testing of the survey instrument was conducted using multiple sources. Initially, academic faculty at Purdue University who have prior experience with survey research provided feedback on the wording and formatting of the questions. Following this, local suppliers to the industry as well as members of the Supplier Division of AHAM were extensively interviewed on the contents of the questionnaire and their relevance to the dominant issues in the appliance industry. Three/four field interviews with local industry suppliers and six telephone interviews with the members of AHAM were conducted in all (Appendix 2). Both local suppliers and AHAM members made significant contribution towards the final drafting of the survey. In the process of responding to the questionnaire, they helped simplify the language and format of the questions and cover letters - from the perspective of a target respondent. Also, they pointed out areas that could potentially hurt the response rate. These include information that a respondent may not have access to or may not be able to recall quickly. In fact, all

of these experts clearly indicated that a request for multiple informants to the survey could drastically bring down the response rate.

In particular, the AHAM experts were approached through Special Projects Division of AHAM. On account of the support and involvement of Special Projects Manager (Larry Forsberg), these experts made an effort to understand this study's background and perspective before participating in the pretest. Subsequently, because of their expertise in this industry, they even suggested alternate ways of measuring some theoretical concepts developed in the research model. In their perception, these alternate measures better captured the concepts' essence in the specific context of the appliance industry. As a result, the final draft of the questionnaire used in the study had been revised and altered to include these experts' suggestions. This study has indeed greatly benefited from the contribution of industry experts during this crucial phase of data collection. The follow-up survey consisted of five questions seeking information on suppliers' financial performance in relation to the specific OEM-customer they had earlier reported on (Appendix 1). Alternate performance measures used in this survey included sales and earnings growth rate over a period of five years and average return on sales that the supplier had earned on the OEM's business over past three years. The choice of these measures has been discussed in greater detail in section 4.5

Material and component suppliers in the appliance industry were typically privately-held firms. Researchers have often found it difficult to gather data on their financial performance (Dess & Robinson, 1984). This problem was also mentioned by some of the experts who participated in the pre-testing of the first stage survey.

Consequently, questions on financial performance were kept to a minimum so as to not hurt the response rate. Once the responses to the earlier survey were received and analyzed, the follow-up survey was mailed only to the actual respondents. The second survey was sent along with the results from the first phase of the study. This procedure helped build the confidence of the respondents (in the study) before requesting information on their financial figures. The ultimate objective of this research design was to obtain relevant, but difficult to get data without taking a substantial drop in the response rate.

4.4.4: Survey Administration

The first questionnaire's mail survey was accomplished through three mailings. The first mailing, which included the first questionnaire, a postage-paid return envelope and a detailed cover letter, was sent out to all the thousand respondents in the target sample. The cover letter provided a brief introduction to the study – its purpose, motivation and relevance to the appliance industry. In particular, it emphasized the growing JIT trends in OEM-supplier relationships in the appliance industry and their long run effect on supplier firms. The cover letter also informed the target audience that a summary of results from this survey would be mailed to the actual respondents a few weeks after its completion. Experts in mail survey techniques (Dillman, 1978) greatly emphasize the significance of providing some (token) incentive for the target audience to respond.

With regard to the questionnaire, the cover sheet provided detailed instructions to the respondents on choosing an OEM-customer to report on. For the purposes of the

study, it was important that the respondent had done business with the chosen customer for a sustained period of time. More importantly, pre-testing revealed that it was necessary to remind the informant to use the same OEM-customer (as a referent) throughout the process of answering the survey. Also, since the study required intricate information on several aspects of the supplier's association with OEM, it was essential that the informant be very familiar with the client's account. As a result, respondents were given the following criteria for customer selection.

Firstly, the informant was asked to use only one specific external OEM-customer as a referent while answering the survey. Secondly, the respondent was requested to choose a customer that was an on-going, major client of his/her firm. This criterion ensured that the respondent would report on a customer with whom his/her firm had a well-developed (preferably long term) association. The longer the supplier's association with the chosen customer, the more likely it is that the issues raised in the survey will be relevant and actually experienced by the respondent. Thirdly, the informant was asked to report on a customer that he/she was most familiar with. This condition was vital for gathering high-quality responses. The more familiar the informant is with a specific customer account, the more information he/she can provide regarding the OEM. Finally, all the target respondents were reassured that they did not have to reveal the identity of the customer they so selected. This statement was essential to build the confidence of the potential respondents which, in turn, was expected to enhance the response rate. Also, the study or the data would not be compromised in any manner if the identities of OEM-customers remained unknown.

The second mailing was done a week from the first one and consisted of a postcard reminding the target sample to respond to the survey. The postcard thanked respondents who had already answered the survey and stressed the significance of responding to those who had not. The third and final mailing was done three weeks from the date of first mailing and was sent only to non-respondents. It consisted of a cover letter, a copy of the questionnaire and a postage-paid return envelope. The cover letter in this mailing explained the importance of the suppliers' response to the research and emphasized the confidential nature of the information. It also encouraged the potential respondents to contact the researchers in case of any questions.

The second questionnaire was sent out only to the respondents of the first one. It was administered through two mailings. The first mailing contained a cover letter, a three-page summary of results from the first survey, a copy of the second questionnaire, and a postage-paid return envelope. The cover letter thanked the respondents for participating in the first survey and briefly explained the purpose of the second survey. The respondents were also reminded to use the same customer that they had selected for the first survey as their referent for the second survey. The respondents were again guaranteed complete confidentiality of their information.

The second mailing also included a cover letter, a copy of the second questionnaire and postage-paid return envelope. This was sent out two weeks after the first one and only to non-respondents. The cover letter conveyed the significance of their response to the research. It stressed the researchers' appreciation of the time taken by the respondents to participate in the survey. The second mailing was undertaken to improve the response

rate (and thereby the number of valid observations) for the study. Samples of the cover letters used in each mailing (of both surveys) have been provided in Appendix 2.

4.5 Operationalization of Variables:

The purpose of this section is to develop measures of variables identified in the research model. The unit of analysis, as discussed earlier, is the (vertical) exchange relationship between a supplier and its OEM-customer. Consequently, the relevant measures of the dependent and independent variables are operationalized in the context of specific supplier-customer relationships. Measurement of the dependent variable is discussed initially followed by that of independent variables.

4.5.1 Dependent Variable:

The fundamental motivation of the study is to ascertain exchange and governance characteristics which will explain variations in supplier performance. These in turn will help identify conditions that favor supplier interests and contribute to the vastly different experiences in supplier relations. Supplier performance is therefore the dependent variable to be measured. By "supplier performance" is not meant the cost-quality-delivery performance that OEM customers expect of their suppliers. Instead it refers to the overall financial performance achieved by the supplier firm in relation to the specific customer's account.

Firm performance has been measured in numerous ways in Strategic Management literature, ranging from objective measures such as ROI, ROE, return on sales, sales growth, market share, market share growth, etc. to subjective measures such as top

management's satisfaction with performance and its evaluation of the firm's performance relative to competition (Chandler and Hanks, 1993).

The most appropriate measure(s) for this study is one that serves the research purpose and is available in the unique context of the research setting. With regard to purpose, the main focus of the research is the supplier firm's financial performance in relation to a specific OEM-customer's account. With regard to research setting, the majority of suppliers to the OEMs in the home appliance industry are privately held with no obligation to divulge performance information. There are three factors, namely, unit of analysis, accounting differences and data availability that narrow our choice down to return on sales. During the pre-testing stage of the questionnaire, potential respondents clarified that they could quite readily recall figures at the individual customer level. To the extent that accounting for firm's assets is not relevant here, accounting differences across firms are minimized. Therefore, the profit margin generated by the OEM-customer's business is the measure chosen to operationalize supplier performance.

Return on sales can be measured at the pre-interest and post-interest stages. The after-interest, pre-tax ROSA, defined by [(PBT(after interest)/sales)] better serves the research objective. It will be higher for suppliers that receive cheap loans or equity financing from OEM-customers and lower for those who do not. Pre-tax measures are considered once again to reflect the basic profitability of the OEM-business without allowing for differences in tax policies and accounting.

Accounting measures such as ROI / ROA / ROSales would best suit the study's needs in terms of being anchored to objective criteria and therefore having content

validity. Sales growth and market share growth are alternative popular measures of performance. However, they are not used to operationalize performance for the following reasons:

(a) while a supplier's sales/revenue growth does indicate growth in size, it need not necessarily be accompanied by an increase in supplier profitability. The supplier could very well take a cut in its margin to retain/sustain business volume.

(b) Market share is difficult to be ascertained in the first place because the suppliers' products range from off-the-shelf to highly customized parts. At this stage in the production chain, the market is highly fragmented with numerous small players. Besides the measurement problem, any increase in market share again merely reflects volume effects and does not capture the profitability aspect of the supplier's operations. Subjective measures mentioned earlier are not as relevant in this study's context.

With regard to research setting, as already mentioned, the majority of suppliers are privately held firms with no obligation to divulge performance information. Therefore, access to such data is largely restricted and not publicly available. Owners and top management, very sensitive to releasing any performance related data, are the sole gatekeepers to such information (Dess and Robinson, 1984). Obtaining accurate financial information from such firms is therefore a problem and the only attainable source of data here is a self-administrated questionnaire. Admittedly, the probability of varying accounting procedures among these firms is rather high. Variation in organization forms (sole proprietorship, partnership, corporation, etc.) can cause artificial

differences. Different accounting treatments of owner compensation also pose some problems.

Another important factor for the study is the unit of analysis. It is extremely crucial to obtain performance data for the specific OEM-customer account that the supplier is reporting on. This is because it is natural for the suppliers to report on the details of their firm's relationship with a specific OEM-customer. In other words, data for the independent variables are available at the disaggregate, customer level. It is imperative to match the dependant variable and independent variables' unit of analysis for the results to have meaningful implications. Measures such as ROI/ROA are typically available at the aggregate, firm level. It might be difficult to distribute the financial value of assets among difficult OEM accounts. Even if the supplier firms have management accounting systems (as internal control mechanisms) in place to make ROA available at the customer level, such systems could vastly vary among the firms. Consequently, it may no longer be meaningful to compare the ROIs/ROAs across individual firms.

4.5.2 Transaction Specific Investments:

This dissertation attempts to capture any specific investment that the supplier has undertaken in relation to the OEM-customer's business. As mentioned in chapter two, asset specificity refers to any durable investments made in support of particular transactions where in such investments have very little use in implementing jobs for other customers. Williamson (1985) identifies four kinds of asset specificity - site, physical asset, human asset specificity and dedicated assets. The following subsection discusses the measurement of each kind of specificity in detail.

4.5.2.1: Site specificity

This refers to the location of production facilities of successive stages in close proximity to each other so as to economize on inventory carrying and transportation costs. The main feature of such specificity is that, once located, the production facilities/assets are immobile - with prohibitive relocation and setup costs. Specificity here is created by the geographic proximity of the facilities. The closer the units, the greater the specificity. It therefore follows that the distance (in miles) between the supplier and OEM plants will serve as a good measure of site specificity (reverse-scaled). The smaller the distance between the plants, the greater the proximity and site specificity and vice versa. Geographic distance is a commonly used measure of site specificity in supplier-relations literature. Dyer (1996), in studying the relationship between site specificity and joint investment in inventories by suppliers and automakers, uses distance to measure site specificity. Nishiguchi (1994), in comparing the supplier relations of Japanese and British consumer electronics OEMs, also uses distance between the plants to measure site specificity.

4.5.2.2: Physical asset specificity

This refers to investment in durable assets such as CAD/CAM /CNC or R&D equipment, machinery that cannot be used to process jobs for other customers. While these assets may be mobile, they have very little value outside the relationship with a specific OEM-customer. The lesser the redeployable value of the asset, the greater is its physical asset specificity. To obtain a direct measure for this variable, the researcher needs to ascertain the scrap value of the supplier's capital assets that are used for a

specific OEM-customer's jobs. Dyer (1996), in studying the relationship between physical asset specificity and product quality, uses information from his supplier respondents on the percentage of assets that would need to be scrapped if the supplier were to stop doing business with this specific OEM-customer. It is important here to note that the data demands are rather high. Not only is the top management/owner of the supplier firm the only source for such data, but it might also be difficult for the supplier respondent to estimate and report such a figure. It is however, possible to measure non-redeployability of assets in other ways which would potentially not lower the response rate.

In studying the effect of asset specificity on buyer's negotiation costs, Artz (1995) has developed a multi-item scale for measuring the physical asset specificity construct. As noted earlier, it is essential for the respondent to identify to what extent its durable investments are specific to the customer. This can be accomplished by developing a multi-item construct on the Likert scale (1-5), with questions regarding supplier's investments in equipment, machinery, R&D, advanced design systems, systems & procedures, etc. that are specialized to the needs of the customer. Such a measure captures the extent of specificity without harming the response rate to the survey. The validity and reliability of this scale are discussed in the following chapter.

4.5.2.3 Human asset specificity

It relates to knowledge and skills embedded in the suppliers' employees because of their prolonged association with the customer. These personnel develop specialized expertise in managing the client through learning-by-doing and repeated dealings. This

process consumes a great deal of employee time and effort. Further, such client-specific expertise may not be readily applicable to other clients. Nishiguchi (1994) uses a proxy measure of human asset specificity by dividing the total number of supplier's employees by the number of its regular customers. This measure provides an indirect rough estimate of the number of employees that a supplier firm assigns to each of its customers. Dyer (1996) employs more direct and precise measures of human asset specificity in assessing its effect on product quality and new product cycle times. In his interviews with suppliers' top management, Dyer collected information on the number of sales and engineering personnel that work directly and regularly with OEM-customers.

This study obtains information from respondents on the number of supplier R&D, engineering and manufacturing personnel that work regularly with the OEM customer. The greater this number, greater is the supplier's human asset investment in the client's business.

4.5.2.4: Dedicated assets

These assets correspond to investments by the supplier in generalized capacity to serve the needs of a specific customer. These assets are specific in the sense that the supplier firms will not have installed the additional capacity had it not been for the customer. Unlike physical asset specificity, such assets could very well be deployed for other purposes as well. Joskow (1987), in his study of long term relationships between coal suppliers and electric utility plants, uses annual quantities of coal contracted for to measure dedicated assets. While it is true that as this quantity increases, the more difficult it will be for the supplier to dispose of unanticipated stock if buyer breaches, the

measure would better serve the purpose if it is normalized for total plant capacity. Dyer and Ouchi (1993), in analyzing the specialized investments that Japanese suppliers make for the benefit of their customers, consider the percentage of supplier plant's output dedicated to a specific customer in measuring the construct. This study follows suit and measures dedicated assets as the percentage of supplier's production dedicated to a specific customer.

4.5.3 Safeguard Mechanisms

As discussed in detail in chapter three, this research argues that suppliers will be compensated for the durable investments that they make specifically for a customer by contractual and other credible commitments on the part of the customer. Such buyer commitments that safeguard the supplier's interests could either be legally enforceable ones or implicit, time-proven ones. This subsection develops measures for these explicit & implicit safeguard mechanisms.

4.5.3.1 Contract Duration

As the term suggests, it refers to the time period for which a contract is signed by the buyer and supplier. Typically, buyers sign longer term contracts with suppliers who make relation specific investments rather than with other generic suppliers.

The extended duration and the accompanying sales volume allow the suppliers to recoup their initial investment. Joskow's (1985, 1987) in-depth study of coal supply contracts to electric utilities clearly provide empirical support to the argument that contract duration increases with asset specificity. For the purpose of this study, contract duration is measured in terms of the number of months that parties sign the contract for.

4.5.3.2 Quantity Agreements

Another typical way in which suppliers get compensated for making relation-specific investments is the ex ante quantity provisions in the contract. Joskow's (1985, 1987) studies clearly reveal that electric utilities agree to the minimum annual quantities that they would take from the coal mines in the contract. In fact, 169 of the 277 contracts analyzed by Joskow are of mines dedicated 100% to the utility. Masten and Crocker (1985), in their study of gas supply contracts to pipelines also find that minimum take or pay provisions play a significant role in contract negotiations. Regardless of what form such quantity agreements take, these provisions serve two explicit purposes:

(a) provide legally enforceable volume stability to the supplier;

(b) protect the supplier from ex post opportunistic bargaining on the part of the buyer.

In the context of the home appliance industry too, traditional contracting norms allow for quantity provisions in the contract. Based on the feedback from industry experts at the pre-testing stage of the survey, quantity agreement has been operationalized as "the percentage of customer's requirements to be met by the contract."

4.5.3.3: Duration of Relationship

This is the first of the two implicit safeguards that the model attempts to capture. This variable refers to the total time period for which the parties have been engaged in trade. Therefore, it could potentially encompass any number of contracts and their durations. For example, a supplier may sign annual (12 month) contracts with its OEM-customer. While the contractual terms may get altered, it is not uncommon to find the contract getting renewed every year. Consequently, contract and relationship durations

are not only two different measures but they also represent two very different aspects of the relationship.

The significance of this variable is highlighted in Cusumano & Takeishi's (1991) study of buyer-supplier relations in the automobile industry in the U.S. and Helper and Sako's (1991, 1995) detailed study of the same in the U.S. and in Japan. Helper and Sako use this construct to illustrate the contrast in supplier management practices in the two countries. While the legally enforceable contract in Japan is rather nebulous and does not extent beyond twelve months, suppliers in Japan tend to do business with the same OEM-customer for over twenty years. The corresponding figure for American suppliers is much lower at four years. This finding is, in fact not unique to the automobile industry. Nishiguchi (1994) finds similar evidence in the Japanese appliance and electronic goods industries.

Though very significant, this variable can very simply and directly be measured by "the number of years for which the supplier has done business with supplied parts to the specific OEM-customer."

4.5.3.4: Volume Stability

This variable identifies the extent to which OEM-customers are willing to stabilize their supplier's production process, when they (buyers) are not in any way legally bound to do so. Unlike regulated industries, the manufacturing sector is characterized by highly competitive conditions. Sweeping take or pay provisions are unlikely to prevail under such circumstances. More importantly, agreeing to take certain quantity is quite different from smoothening the supplier's production process. While the

former does guarantee a minimum annual volume, the actual supplier schedules can vary substantially in terms of volume, mix and time table. Further, if the buyer expects just-in-time suppliers, the supplier firm could very well get overburdened with high inventory levels. The latter on the other hand involves steady and unaltered flow of production schedules from the OEM-customer so that the supplier can optimize its production planning and minimize its inventory carrying costs. This difference gains particular cost significance if the buyers expect JIT supplies. This difference between the two measures, therefore, has fundamental cost and profitability implications for the supplier. There is no dearth of literature on the "inventory burden" that suppliers face and its effect on their performance.

Helper (1991) and Womack et al. (1991) pay significant attention to this issue in the automobile industry. In the context of the JIT system, volume stability refers to sharing of production schedules by the buyer and the extent to which it (the buyer) provides stable unchanging schedules. For the purposes of this study, the construct has been measured both in terms of

(i) whether the OEM-customer shares production schedule (binary variable); and

(ii) the percentage of these schedules that get altered.

The lesser the number of schedules altered, the greater the stability for the supplier's operations. We can obtain the percentage of schedules that do not get altered by deducting the response for (ii) from 100.

4.5.4 Incentive Intensity

This is the second dimension intended to capture the difference between "enforceable" and "self-enforcing" contracts. As discussed at length in chapter three, the pricing provisions in any contract provide the basic incentive to perform. Enforceable contracts have clearly laid out pricing provisions that are enforceable by third parties. Structurally, implicit contracts are less precise about pricing. The parties periodically negotiate the price so that it best reflects the prevailing conditions. The following sub-section discusses the manner in which different pricing practices are measured.

4.5.4.1 Cost Plus Pricing

In the case of coal supply and natural gas contracts, explicit cost plus provisions in the form of "base price plus escalations" clause are very common. In the manufacturing context, suppliers typically win contracts of the basis of bids. However, in the course of the contract period, they also appeal for price increases on account of increases in their material or production costs. Womack et al. (1991) focus on this common practice to point out that component prices rarely go down under the mass production system. It will be reasonable, therefore, to conclude here that an indirect cost plus pricing is very much in place in the industrial markets. Following this rationale, incidence of cost plus pricing is measured in two ways in this study:

(i) whether suppliers negotiate fixed (cost-based) prices for specific time periods or agree to fixed (cost-based) price with periodic allowances or input price increases. Both these instances directly measure the practice of cost plus pricing.

(ii) The number of price increases that the customer has allowed for the product in the past five years.

The latter method is an indirect measure of the extent to which suppliers are able to pass on their cost increases to the customer, without making an effort to achieve reductions in the area of controllable costs.

4.5.4.2: Target Pricing

Quite different from cost plus pricing, this term refers to a system wherein suppliers constantly target/aim to achieve price reductions through lower costs. Fundamental to this pricing regime is the notion that costs of manufactured parts can be reduced over time through improvements in technology, raw material mix, production process etc. One popular means by which OEM-customers motivate their suppliers to target price reduction is by allowing them (the suppliers) to retain a portion of the cost savings.

Consequently, in this study, the supplier respondents were explicitly asked whether the pricing terms consist of achieving a "target price" over fixed or continuous time horizons, with cost saving incentives. The questions also allow for differences in price negotiations such as allowance or lack of them with regard to material cost increases. This measure is binary in nature, coded '1' if target pricing is practiced and '0' otherwise.

4.5.4.3: Market Pricing

This variable refers to the consistent practice of pricing the supplier's products at the prevailing market rates. This method is particularly relevant if the parts are off-the-

shelf, commodity items. Inclusion of this pricing mechanism allows the study to analyze the relative effects of cost plus and target pricing. The variable is measured by asking the respondent whether the product is sold at market price or not.

4.5.5 Adaptive ability

This is the final dimension along which enforceable and self-enforcing contracts will be distinguished. It is also the fundamental factor determining the success potential of long term contracts in general and vertical relations in particular. This is because it is very difficult to contract on all of the parties' obligations ex ante. As unforeseen contingencies occur, the parties need to adapt to the changes in a mutually acceptable manner so that the benefits of the association are not jeopardized. In order to enhance their respective adaptive orientations and achieve joint goal congruencies, parties undertake specific actions that signal their commitment to the association. These measures are operationalized in the following subsections.

4.5.5.1: Joint price determinations

Much of the price rigidity arguments in the case of enforceable contracts emerge from the "inflexible" nature of their pricing provisions in terms of tracking the market conditions. This is particularly ironical considering the fact that such provisions are intended to enhance the flexibility of the contracting parties. In general, TCE reasoning holds that pricing adjustments have more of a zero-sum property than do quantity adjustments and therefore foster adversarial orientation. On the other hand, Japanese OEMs and their JIT suppliers have engaged in joint price determinations since the 1970s. The term "joint" here refers to the fact that prices are not unilaterally ascertained by the

customer based on the subcontractors' quotations but are jointly determined by both parties using VE techniques (Nishguchi 1990, p. 125).

Consequently, this variable is measured by asking the respondents whether they engage in bilateral price negotiation with their OEM-customer base on production and cost information that they share with each other. This measure is also binary in nature coded '1' if the supplier answers yes, '0' otherwise.

4.5.5.2: Credible Commitment:

This term refers to actions undertaken by the buyer to signal its commitment to a long-term association with the supplier respondent. The source of "credibility" of these actions is their inherent value and the long-term perspective they bring with them rather than their legal enforceability. The credible commitment on the part of the supplier has already been measured by its TSIs. Historically, Japanese OEMs have reciprocated by providing their suppliers with cheap long-term loans or making an equity investment in the supplier firm. Of course, the OEMs do not extend these facilities to all suppliers, but only to those with whom the OEMs have long-term partnerships (Dyer and Ouchi, 1993). Alternately, the OEMs may invest in specific capital intensive R&D projects or equipments that are set up to serve their specialized needs.

The study, therefore, measures buyer's credible commitment in terms of

(i) Buyer's (percent) equity investment in supplier firm, if any;

(ii) soft loans provided by the buyer to the supplier; and,

(iii) buyer's percent investment in R&D projects or equipment.

Each of these measures serves a significant purpose of achieving goal congruence between the parties. While the investment itself may not be significant (in dollar terms), it has a very symbolic significance. It joins/aligns both parties' interests in such a way that their adversarial orientation is slowly replaced by a joint, cooperative focus.

4.5.5.3: Buyer Dependence

While financial and personnel transfers reduce adversarial orientation of the parties, there is an equally potent mechanism that buyers can and do use to signal / reaffirm their commitment to a long-term partnership. This device is the gradual but increasing dependence of the OEM on its suppliers. Once the OEM is satisfied as to the capability and trust-worthiness of the suppliers, it gradually relinquishes the designing and engineering of parts to such suppliers (Asanuma, 1989). Over time, the OEM comes to provide merely the broad specifications allowing the supplier to decide on the detailed design and manufacturing aspects of production. This process often results in the supplier accumulating design, engineering and manufacturing skills. The natural outcome of this evolution in the supplier's role has been the creation of "black-box parts". The term black box refers to the fact that the OEM has limited or no knowledge of the production technology of the part. Furthermore, some supplier firms with high degrees of technological capability and innovativeness also supply parts based on their own proprietary technology.

Consequently, this technological dependence of the buyer is measured on an ordinal scale in terms of the design and engineering activity undertaken by the supplier. The lowest end of the scale (with rank 1) consists of the OEM providing the detailed

design and drawings for the part. This is followed by both the supplier and the OEM jointly designing and engineering the part. The next position is occupied by "black-box parts" and the upper end of the scale (occupying rank 4) consists of parts based on supplier's proprietary technology. This operationalization is largely based on Asanuma's (1989) classification of parts and suppliers in his study of manufacturer-supplier relationships in Japan.

Another related measure of customer dependence is based on whether a given part is tailored or designed to the specific needs of a customer or whether it is generic enough to serve the needs of multiple OEMs. In addition to being a black-box part, if the part is customized to a specific model/OEM, the customer's dependence on the suppliers is further intensified. It would be very difficult, if not impossible, for the OEM to switch to another supplier under such circumstance. This is because the OEM has no detailed knowledge of the part's design, engineering or manufacturing requirements (Dyer and Ouchi, 1993). Therefore, the second measure of buyer dependence is measured as a categorical variable:'1' if the part is customized to the OEM; '0' if it is an off-the-shelf part.

In addition to being technologically dependent on the supplier, the OEM may further rely heavily on the supplier for making JIT, zero defect supplies of the part. As the two parties engage in trade repeatedly, the supplier develops relation-specific skills that allow it to cater to the customer's special needs in a timely and responsive manner. The OEM-customer comes to depend on such high-performing suppliers for non-technological reasons as well (Asawuma, 1989). Consequently, the final measure of

buyer dependence attempts to capture the OEM's overall dependence in the supplier in terms of "the number months it would take another supplier to fully replace the current one."

4.5.5.4: Information Exchange:

Fundamental to the success of the JIT system of supplier management is the exchange of production information between the buyer and supplier. Both value analysis and engineering techniques require the parties to share their respective production process and cost information so as to improve the quality and profitability of the final product. The OEM-customer's credible commitment to a long term association with the supplier together with its technological dependence on the supplier not only creates a congenial negotiating environment but also vastly enhances the flexibility and adaptive ability of both parties. The replacement of an adversarial orientation by a more cooperative, joint-interest orientation represents the culmination of the above-mentioned processes in OEM-supplier relationship. A significant outcome of such an evolution in the OEM-supplier relationship is the nature and frequency of information exchange between the parties. It is essential to point out here that historically American OEMs have not been able to elicit production-relation information from their suppliers. This is despite the fact that the OEMs have gradually increased their contract durations from twelve months to over thirty months. However, the trend in the 1990s has been encouraging in this regard (Helper and Sako, 1995).

Two distinct kinds of production-related information are crucial for improving the quality and pricing of the final product. One has to do with sharing the detailed steps of

the part's production process. This allows design / productivity / quality improvements to be made to the supplier's process so that they can become more efficient and compatible to the OEM's processes. The other information pertains to the supplier's costs of these production processes. This is equally vital because it allows both parties to jointly identify those aspects of the part's manufacturing process and the product's final assembly process that can yield significant cost reduction. Identification and implementation of cost-reducing processes vastly improve the final marketability of the product.

Consequently, this study uses two distinct measures of information exchange. One measure identifies the extent to which a supplier actually provides a breakdown of the production process steps to the OEM-customer. This variable is measured on an ordinal 5-point Likert Scale (Helper, 1991). The second measure determines if the supplier shares the costs of the above-mentioned production processes with the OEM-customer. This measure is binary in nature, coded '1' if suppliers answer yes, and '0' otherwise.

The questionnaire also has more detailed question on the nature of the cost information that suppliers share with their OEMs. However, these variables are not analyzed at length in the dissertation because of their significantly lower response rate compared to the others.

4.5.6: Control Variables

The primary objective of the study is to explain variations in supplier performance (profitability) in the context of its relationship with an OEM-customer. Consequently, the hypotheses in the model deal with the basic/fundamental aspects of contracting

mechanisms. However, since the dependent variable of interest is profitability, it is essential to include variables that have traditionally explained differences in firm-level performance. These variables are therefore introduced as control variables in the model to isolate their effects from those of variables central to the research question. As the unit of analysis for the study is a specific OEM-supplier association, the controls are also measured with regard to the same OEM-customer as the other independent variables.

The variables of primary interest to this research are the safeguard, incentive and flexibility mechanisms incorporated by both parties to maintain the value-creating capability of the relationship. As mentioned earlier in this chapter, these mechanisms represent conscious, deliberate actions on the part of the parties to retain or enhance the attractiveness of vertical contracting strategy. To the extent that they represent conscious choices, these variables qualify as "conduct" variables in the context of the exchange relationship. The research model, consequently, is a detailed configuration of theoretically guided conduct variables. Therefore, what needs to be controlled for in the model is the structural context that accompanies the exchange. The terms "structure" and "conduct" variables used here refer to the SCP paradigm traditionally employed to explain firm performance. The operationalization of structure variables here is based on Porter's (1980) five-forces model.

4.5.6.1: Number of Competitors

This variable is measured as the number of firms supplying a similar product (to that of the supplier respondent) to the OEM-customer. The purpose of this measure is to capture the degree of incumbent competition/rivalry that the supplier faces in doing

business with the customer. This measure is also expected to approximate the role of "concentration ratio" often used in industry-level studies of firm profitability. The greater the competition, the lesser is the supplier's expected profitability from the specific customer's business. As a result, this variable can be expected to have a negative association with supplier performance.

4.5.6.2: Threat of Replacement:

The second control variable introduced in the study is the bargaining power of the OEM-customer over the supplier. This variable is measured in terms of the time it would take the supplier to replace OEM's business. As the model explicitly considers OEM's dependence on the supplier (hypothesis 6, sec 4.5.5.3), it is essential to control for the supplier's dependence on the OEM in the model. Clearly, the greater the dependence of the supplier (i.e. longer it takes to replace the OEM), higher is the OEM's bargaining power over its supplier. As its bargaining power increases, the OEM can be expected to extract greater value from the suppler. This variable is therefore expected to have a negative association with supplier profitability.

4.5.6.3: Nature of the Supplier's Product:

Discussion with industry experts and response to the first-round of questionnaire surveys reveal that differences exist in the nature of OEM's relationships with material suppliers and with parts suppliers. The requirements and concerns of the two supplier categories turn out to be quite distinct. Consequently, a binary variable is introduced in the model to control for these differences. It is coded '1' for component/part suppliers and '0' for material suppliers such as suppliers of steel, plastic, glass, etc.

4.5.6.4: Size of the Firm:

One of the traditional arguments in strategy has been that larger firms differ fundamentally from smaller firms in their ability to respond to environmental shifts, bargain with suppliers and buyers and, make strategic responses to competitors' actions. These differences could have a substantial effect on firm current and future profitability. Therefore, this study incorporates firm size to control for variations among suppliers on account of differences in their sizes. Firm size is measured by the logarithm of number of employees in the respondent supplier's firm. If this control variable has a significant association with the dependent variable, it implies that other things remaining equal, a bigger suppler firm can be expected to reap returns from their business with the OEM-customer quite different from the returns of a smaller supplier.

Summary Table – 4.1

Variables	Measures	Variable Name
Supplier performance **(Dependent variable)**	ROS : PBT / Total Sales w.r.t OEM account only	OEMROSA
Independent Variables		
Transaction Specific Investments (TSI)		
Site specificity	Distance between supplier & buyer plants	A_PLDIST = Ln (PLDIST)
Physical asset specificity	OEM-specific investments made by the supplier with respect to - tooling, equipment, R&D; - systems & procedures; - cross-functional teams; - advanced design equipment such as CAD/CAM/CNC.	SC_ASP : Ranked data - scale of 0 to 5 (on four items)
Human asset specificity	Number of supplier's R&D / engineering /manufacturing personnel working regularly with OEM.	TECHAS_N
Dedicated assets	% of supplier plant's output dedicated to a specific OEM-customer.	PRDDED
Safeguard mechanisms:		
Length of contract	Number of months for which a contract signed;	CONT_DUR
Quantity agreements	- minimum take obligations; - % of customer requirements to be met by the specific contract / agreement;	SPQPRC
Duration of relationship	Number of years for which supplier has done business / supplied parts to a customer;	REL_LN

Summary Table – 4.1

Volume Stability	- % of these schedules that do not get altered;	VOLSTB
Incentive Intensity		
Incidence of Cost Plus Pricing	Whether prices are arrived at on a cost plus basis	COSTPR
Incidence of Target cost Pricing	- whether the pricing terms consist of achieving "target price" - over fixed or continuous time periods.	TGTPR Binary variable
Market pricing	- whether the product is sold at market price (at any point in time) or not;	MKTPR - Binary variable
Adaptive Ability		
Joint focus	- whether bilateral price determination - based on information exchanged b/w the parties - exists;	BILPRC
Credible commitment	- buyer's % equity investment in supplier firm; - buyer's % investment in R&D projects or capital equipment;	
Buyer Dependence	- supplier role in design & engineering of the product (black box part);	_BBOX : Ranked data
	- number of months it would take a competitor to replace the supplier;	SSREPTME
	- customized or off-the-shelf part	CUSTOM
Information Exchange	-whether and to what extent supplier provides breakdown of production process steps;	ACTPDINF

Summary Table – 4.1

	- whether supplier provides detailed cost information on these steps.	PDCSTYN
Controls:		
Product category	Material or Component (parts) supplier	P_ASP Binary variable
Supplier dependence on the OEM:	- time it would take to replace the OEM's business;	OEMREPTM
Structure variable:	- number of other firms supplying a similar product to the customer;	OTSSCU
Size of supplier firm	- Ln (number of employees)	SIZE_1

CHAPTER FIVE

ANALYSIS OF RESULTS

5.0 Introduction

The purpose of this chapter is to discuss the data collected from the two surveys and analyze if (and to what extent) they support the hypotheses proposed in chapter three. To begin with, this chapter presents a profile of the respondents to the survey in terms of respondent firm as well as informant characteristics. This is followed by a brief discussion of the methodology adopted to analyze the raw data. Subsequently, the extent to which the data support each of the hypotheses is studied in detail.

5.1 Survey Response and Respondent Profile

The initial questionnaire had been mailed out to a target audience of over 1000 respondents to ensure a sufficiently large data pool for the purposes of analysis. A reasonably large dataset serves two purposes: (a) it allows the use of advanced statistical techniques that rely on a sample size of over thirty and (b) it improves the generalizability of results.

Over 300 supplier firms responded to the first survey resulting in a response rate of 30%. Of these eleven were eliminated because of missing data, leaving a sample of

289 firms. While this response is sufficiently large to draw statistical conclusions, it is not so large as to warrant a simple generalization of OEM-supplier association in the appliance industry based on this study's results.

During the sample selection process, care was taken to equally represent materials and component suppliers in the sample (chapter four). However, of the responses received, only one-third were from material suppliers and the remaining two-thirds were from component suppliers. Earlier discussions with members of AHAM revealed that the two groups had rather different expectations of their associations with OEMs. This is despite the fact that the industry as such was moving towards JIT practices and similar expectations of its suppliers. It is, therefore, considered more informative and useful to compile and present the respondent profile here in terms of material and component suppliers.

Component suppliers in the sample appear to be considerably smaller in terms of employee size than material suppliers. The average number of employees in component supply firms is 1049 while that in materials supply firms is 2383. However, the median number for both groups is 200. Also, 81% of the firms have less than 1000 employees and 96% have less than 5000 employees. Consequently, it seems reasonable to conclude that both category firms are equivalent in size and the vast differences in their averages is primarily on account of outliers. The proportion of material suppliers' sales (in dollar terms) accounted for by the OEM-customer (that they are reporting on) is close to six percent, while the average component supplier has chosen to report on a customer who accounts for 15% of their total sales. This is an interesting and significant difference in

terms of the importance of the client to the supplier. However, both groups have reported on a customer with whom they have had long term association. The average duration of material suppliers' association with the OEM is 14.5 years while that of component suppliers is 15.6 years. The above-mentioned data seem to suggest that the respondents have reported on an on-going client's business but not necessarily a major one.

Surprisingly, the supplier's pre-tax profitability from the specific OEM's business (in terms of pre-tax return on sales) is very much the same for both groups. The average return from the specific account to the respondents is found to be 13.8% and 13.3% respectively for material and component suppliers. It is significant to note that the overall firm-level pre-tax return on sales for both groups was much lower than their client-specific returns. The average firm-level return on sales for material suppliers is 9.5% while that for component suppliers is 11.7%. It is clear, therefore, that the respondents are reporting not only on long term buyers but also the more lucrative ones. Alternately, the drop in the firm-level returns could be on account of corporate overheads, not allocated at the client-level. The statistically significant difference between the firm-level returns of the two groups should not be surprising since it is reasonable to expect the component suppliers to add more value (and thus earn higher margins) than raw material suppliers.

With regard to investments made by the suppliers specifically for the benefit of the OEM-customer, both groups average approximately 10 points on a scale of 0-20. Both groups assign three technical personnel on average for supporting the OEM's needs. However, in terms of percentage of total production dedicated to the chosen client,

component suppliers dedicate significantly higher proportions of the production capacity (15%) to the customer than do material suppliers (7%). These figures corroborate the conclusion made earlier (based on % sales to OEM) that component suppliers, on average, have reported on a more important client than the material suppliers. Furthermore, the mean number of deliveries made per week by both groups is approximately 3.5, a figure substantially lower than some automobile parts suppliers. It is, however, quite shocking to find that both groups of suppliers carry close to thirty days' production in processed stock. Such high levels of inventory together with fairly frequent deliveries made to the customer do suggest that JIT is in no way a reality on the suppliers' shop floor. A related issue that further supports this view is the fact that, on average, 31% of component suppliers' production schedules get altered periodically by the customer. The corresponding figure for material suppliers is 22%. Viewed together, these figures do indicate that suppliers experience substantial fluctuations in their production plans and need to hold buffer stocks to cater to these variations. Holding such high and inefficient levels of inventory clearly harms the suppliers' profitability. Formal testing of these effects is performed in sub-section 5.3.

With regard to contractual aspects, the mean time period of formal contracts with the OEM for both groups is approximately ten months. These contracts typically come up for renewal and negotiation every twelve months. Also, both material and component suppliers report that customers, on average, contract to purchase a minimum/specific quantity from them. It is typical for the customers to agree ex ante to purchase 13%-16% of their requirements from the supplier. Further, material suppliers predominantly (70%

of them) negotiate price on "cost plus" terms, while commodity suppliers tend to use both cost plus (56%) and target pricing (30%) techniques. Both groups also report that, on average, they have been able to negotiate two price increases - over a five year period - with this customer.

With regard to any production information - pertaining to their processes or costs - that the suppliers may share with their customer, both supplier groups average 2 on a scale of 1-5. The lower end of the scale represents very little exchange of process-related information by the supplier while the higher end represents total disclosure of such information by the supplier. Component suppliers engage more in joint product design activity with their customers than do material suppliers. As a result, it is not surprising to note that OEMs will find it more difficult to replace their component suppliers than their material suppliers. In the component suppliers' perception, it will take close to eight months for a replacement to come up to par in supplying the specific product. The corresponding time period for material suppliers is significantly lower at five months. Also significant is the difference in the material and component suppliers' dependence on the OEM's business. The mean replacement time of the OEM-customer is close to twelve months for materials suppliers while it is much higher at 18 months for parts suppliers. These numbers repeatedly corroborate the earlier conclusion that parts suppliers are reporting on a major account that they are quite dependent on, while material suppliers are much less dependent on their chosen customer. It is equally interesting to note that, for both groups, it takes twice the time for a supplier to replace its customer compared to the time it would take the OEM to replace this supplier.

The first survey has also gathered demographic information on the respondents. Over 86% of the respondents hold a college degree and nearly 30% have a graduate degree. The average employment duration of the respondent is twelve and a half years in the supplier firm, and the average time period for which the respondent has been in his/her current position is six and a half years. Clearly, both in terms of their education and tenure in the supplier firm, the respondents seem to be highly reliable sources of information. Furthermore, their long experience in the firm and in their jobs strongly suggests these informants are very knowledgeable on the matters/customers that they are reporting on. Descriptive statistics discussed in this section are reported in tables 5.1 and 5.2.

5.2 Methodology

In order to formally test the hypotheses developed in chapter three, the data need to be analyzed with appropriate statistical methods. It is important to recognize at the outset that the dependent variable in the research model takes on real values and hence can be treated as a continuous random variable. Consequently OLS estimation is the appropriate regression technique for testing the model. However, it is essential to verify that the assumptions underlying the OLS technique are satisfied to ensure the validity of the results. In particular, current research in this area indicates that there exists a potential for "self-selection" of the sample and data (Masten, 1993). If such sample selection problem exists, the independence assumption of OLS estimation stands to be violated. For the purposes of this study, this issue becomes relevant while testing hypothesis one.

Remedial measures suggested by econometricians in the form of two-stage estimation have been performed to check for this potential bias. Application and results of this techniques are discussed at length in sub-section 5.3. Also, wherever appropriate, correlations among the relevant variables have been analyzed to provide better insight into the results. The results of the correlation analysis are provided in table 5.3. The remainder of this sub-section presents the OLS assumptions and the diagnostics used to check if these assumptions are satisfied.

5.2.1 OLS Regression and its assumptions

The general linear regression model can be stated as follows:

$$Y_\iota = \beta_0 + \beta_1 X_{1\iota} + \beta_2 X_{2\iota} + \ldots\ldots + \beta_\kappa X_{\kappa\iota} + \in_\iota$$

where, Y_ι is the value of the dependent/response variable in the 'ι^{th}' trial

$\beta_0, \beta_1, \ldots, \beta_\kappa$ are the parameters

$X_{\iota 1}, X_{\iota 2}, \ldots, X_{\iota\kappa}$ are known constants, (i.e.) the values of the independent variables for the ι^{th} trial and

$\in\iota$ are identically and independently distributed $N(0,\sigma^2)$ $\iota=1\ldots\eta$.

This regression model is said to be linear in parameters and linear in independent variables. In the context of this study, the model includes interaction effect of relevant independent variables which would make it non-linear in independent variables.

The term "least squares" is associated with this regression because of the manner in which the parameters ($\beta_1, \beta_2, \ldots, \beta_k$) are estimated. These parameters are estimated to minimize the (squared) distance between the observations and the regression line. Furthermore, provided the conditions of the regression model hold, these least squares

estimators are the best (minimum variance) linear unbiased estimators among all kinds of linear estimators (Hogg and Craig, 1992). As a result, if any of the regression conditions / assumptions is violated, the parameter estimates would no longer be the best ones (in terms of being unbiased or minimum variance estimators). Also, such regression estimates may not represent the true linear relationship between the dependent and independent variables. It is therefore important to verify if the assumptions are validated by the data before performing any analysis.

5.2.2 Regression Diagnostics:

The OLS assumptions are typically verified by conducting some diagnostics on the data. The following are the relevant ones:

5.2.2.1 Diagnostics of the dependent variable

As mentioned in the previous sub-section, an important assumption of OLS estimation is that all variables are normally distributed. Violation of this assumption may make the parameter estimates imprecise and even irrelevant. Univariate analysis of the dependent variable – OEMROSA - has therefore been performed to check for normality. In case of significant deviations from normality, the dependent variable needs to be transformed so as to make it a normally distributed variable.

OEMROSA has a mean of 13.46 and a standard deviation of 11.25. All observations, excepting one, fall within three standard deviations on either side of the mean. The box plot has equally-long whiskers, revealing that the data are well distributed around the quartiles. However, the median is 10, which is a little lower than the mean. This indicates that OEMROSA is not symmetric, but is skewed a little to the left. In fact,

there is a single outlier with a value much higher than that of other observations. The histogram does confirm that the distribution is skewed slightly to the left. This skewness however does not signify any major deviation from normality. The normal probability plot of the dependent variable shows no major deviations from linearity. It is therefore quite reasonable to conclude that the dependent variable, OEMROSA, is well-behaved and, does not violate the normality assumption.

5.2.2.2 Diagnostics for residuals

Direct diagnostics of the dependent variable are not too useful in the regression context because the values of the dependent variable are a function of the values of the independent variable. It is more useful to examine the behavior of the residuals instead. The residual $e_i = (Y_i - \hat{Y}_i)$. This residual can be regarded as the observed error, as against the unknown true error ε_i. If OLS modeling is appropriate for the data in hand, the observed residuals e_i must reflect the properties assumed on behalf of ε_i. It is this principle that that makes an analysis of the residuals useful. In particular, the residuals are used to examine the following departures from OLS assumptions:

(I) the regression function is not linear

(II) the error terms do not have constant variance

(III) the error terms are not independently and normally distributed.

In order to determine if a linear regression is appropriate for the data being analyzed, a plot of residuals against the fitted values or independent variables is used. Alternately, a scatter plot of the dependent and independent variables can also be used.

But, on account of the scaling of the variables, the Y_is may appear very close to the fitted values - $\hat{Y}_i$ s - even when a potentially non-linear relationship exists. A residual plot, on the other hand, can clearly show any systematic deviations around the regression line (Neter, Wasserman and Kutner, 1990). When the residuals fall within a horizontal band centered around zero, a linear model can be considered appropriate. The residuals must display no systematic pattern around zero.

With regard to this study, the residual plots against fitted values of the dependent variable as well as against the independent variables display no systematic pattern around zero. The residuals are located randomly around the (e=0) line.

Plots of residuals against the fitted values or the independent variables can also be used to check for constancy of error term variance. Just as in the case of linearity, when the residual plot does not exhibit any systematic pattern (but falls in a random manner within a horizontal band around zero), it is reasonable to conclude that the error term variance is constant. Departures from homoskedasticity (constant error term variance) tend to take several patterns. It is common to find the residuals increase in absolute value with increasing levels of fitted values. Alternately, it is also possible to find error terms decreasing with increasing levels of fitted values. As in the test for linearity, the residual plot for this study's data does not exhibit any systematic pattern at all. All the error terms fall within a horizontal band around zero. Therefore, it is reasonable to conclude that the data do not suffer from non-constancy of variance.

Finally, it is important to check for the normality of the error terms. As such, small departures of the residual term from normality do not constitute serious problems

(Neter, Wasserman and Kutner, 1990). Normality of error terms can be examined informally through a univariate analysis of the residuals. Box plot provides summary information regarding the symmetry of the residuals and existence of any outliers. A more sophisticated technique is the normal probability plot of residuals. Here, each residual is plotted against its expected value – where the expected value is calculated under the assumption of normality. A plot that is nearly linear suggests normality of the residuals, while a plot that is substantially non-linear suggests that the error term distribution is non-normal.

The stem and leaf plot of the residuals shows a remarkable resemblance to the normal curve. The standard deviation of the residual is 8.21 (and of course the mean is zero). All residuals fall within three standard deviations of the mean. The box plot reveals no significant outliers. The median is 0.58 for the residuals, indicating a very small skewness to the right. The whiskers on either side of the first and third quartiles are a little unequal, again suggesting a little skewness to the right. The normal probability plot is very close to being completely linear. All of the above evidence clearly suggest that the error term for the research data is normally distributed.

5.2.3 Outlier analysis and Influential cases

Outlying cases are those observations that have values very different from other observations. Residual outliers can be identified from box plots and residual plots against fitted values of the dependent variable. Outlying cases may have large residual values and may have dramatic effects on the fitted least squares regression. It is therefore essential to check for outliers and determine if they should be retained or eliminated.

5.2.3.1 Outliers with regard to X values

The "hat matrix – H" from multivariate regression is used to identify cases that are multivariate outliers with regard to the X values. Hat matrix is given by:

$$H = X (X' X)^{-1} X' \quad \text{where, X is the vector of independent variables.}$$
(nxn)

The diagonal elements of this hat matrix, h_{ii} , always have values between zero and one. Further, the sum of all the diagonal elements equals the number of regression parameters in the regression function – including the intercept. This diagonal element h_{ii} is useful in a multivariate setting to determine if the 'ith' case is an outlier with respect to the independent variables or not. It can be shown that h_{ii} is a measure of the distance between the X values for the 'ith' case and the means of the X values for all *n* cases. Thus, a large leverage value h_{ii} indicates the 'ith' case is distant from the center of all X observations. A leverage value is considered large if it is more than twice the mean leverage value, $\bar{h}$. The formula for $\bar{h}$ is:

$$\bar{h} = \frac{\sum_{i=1}^{n} h_{ii}}{n} = \frac{p}{n}$$

where 'p' is the number of regression parameters including the intercept and
'n' is the number of observations.

Hence, leverage values greater than [2*p/n] are considered indicative of outlying cases with regard to X values.

5.2.3.2 Outliers with respect to Y values

The detection of outlying Y values is based on examining the residuals. The studentized deleted residual, denoted by d_i^* is given by:

$$d_i^* = [d_i / s\{d_i\}] \quad \text{where} \quad d_i = [e_i / (1 - h_{ii})] \text{ and,}$$
$$s\{d_i\} = \text{estimated standard deviation of } d_i$$

Each studentized deleted residual d_i* follows a t-distribution with (n-p-1) degrees of freedom. The d_i*s are however not independent (Neter et al., 1990). To identify an outlying Y value, the studentized residuals are examined for large absolute values. Then the appropriate t-distribution can be used to determine how far in the tails are these large studentized residuals located.

5.2.3.3 Influential Cases

Once the outliers with respect to X and Y values are identified, the next step is to determine which of these are influential cases. An observation is considered influential if its omission causes major changes in the regression estimates. A measure of the influence that case 'i' has on the fitted value $\hat{Y}_i$ is given by:

$$(\text{DFFITS})i = \frac{(\hat{Y}_i - \hat{Y}_{i(i)})}{\sqrt{MSE_{(i)}\, h_{ii}}}$$

where,

$\hat{Y}_{i(i)}$ is the predicted value for the ith case when the ith case is omitted in fitting the regression function

$MSE_{(i)}$ is the mean squared error when the ith case is omitted from the regression Calculation, and

h_{ii} is the leverage value for the ith observation mentioned in sub-section 5.2.3.1

The denominator allows the difference in the fitted values to be standardized so that DFFITSi represents the approximate number of standard deviations that the fitted value $\hat{Y}_i$ changes when the ith observation is removed from calculations. An outlier is considered influential if the absolute value of DFFITSi exceeds one for small datasets and exceeds $[2\sqrt{p/n}]$ for large data sets (Neter et al. 1990). Two such influential cases have been found in this study. Both these cases have large, outlying values for the plant distance (PLDIST) measure. Since there is no a priori reason to believe that the distances are incorrect, a logarithmic transformation of PLDIST has been used throughout the analysis to dampen their effects.

5.2.4 Multicollinearity Issues

The term 'multicollinearity' refers to a condition wherein the independent variables used in the regression analysis are highly correlated to each other. High correlation among the explanatory variables has a drastic effect on the hat matrix, yielding potentially collinear vectors of observations. This in turn yields the following symptoms in the regression results:

(i) the estimated standard deviations of the parameter estimates tend to have large values;

(ii) the estimated regression coefficients tend not to be statistically significant, even though a definite statistical relationship exists between the dependent variable and the set of independent variables.

A formal method for detecting the presence of multicollinearity is the use of variance inflation factors (VIFs). These factors determine to what extent the variances of the regression coefficients are inflated compared to a situation where the independent variables are not linearly related at all. The VIF for the 'kth' coefficient is given by

$$(VIF)_k = (1 - R_k^2)^{-1}, \qquad k = 1,2, \ldots\ldots\ldots, (p-1)$$

where R_k^2 is the coefficient of multiple determination when X_k is regressed on the other (p-2) X variables in the model. The $(VIF)_k$ is equal to one when R_k^2 is zero, i.e., when X_k is not linearly related to the other independent variables in the model. When $R_k^2 \neq 0$, $(VIF)_k$ becomes greater than one, indicating an inflated variance for the kth coefficient b_k. When X_k has a perfect linear association with the other independent variables (so that R_k^2 equals one), $(VIF)_k$ becomes unbounded.

For diagnostic purposes, the largest VIF value among all the explanatory variables in the model is used as an indication of the severity of multicollinearity. A maximum VIF value in excess of ten is considered large enough to unduly influence the parameter estimates (Neter et al. 1990). For the same reason, a mean VIF value greater than one is considered indicative of mutlicollinearity. Large VIF values, on average, yield large differences between the estimated and true standardized regression coefficients. With regard to this study's data set, there are no coefficients with VIFs significantly greater than ten. This is true for all the reduced models as well as the final full model. There are two coefficients in the full model with VIFs of 12.5 and 11.7. Given the number of reduced models run and the number of parameters estimated in the full model, it appears

very reasonable to conclude that the data set is inherently clean of any multicollinearity problems.

5.3 Hypothesis Testing:

This sub-section discusses the statistical support (if any) found in the data for each of the hypotheses developed in chapter three. In testing the model, the hypotheses have been grouped into three categories initially. The first group consists of transaction specific investments and safeguard mechanism hypotheses. The second set of hypotheses deals with the effect of different pricing policies on supplier profitability and the final (and most important) set of hypotheses deals with the effects of reciprocal commitments and information exchange on supplier performance. With regard to statistical testing of these effects, a multivariate regression has been estimated for each group individually followed up with a full model that includes all the hypothesized relationships. The rationale for adopting this procedure is as follows:

(i) Running a reduced model with only the group-specific variables runs parallel to the logic and arguments used to develop the hypotheses in the first place. Each group represents a governance dimension along which enforceable and self-enforcing contracts differ. As a result, any statistical effects found at the group level will highlight the differences between the two governance modes.

(ii) Each of these groups is a building block in enunciating the fundamental differences between the two contractual frameworks. It is therefore essential to

look at the differences at each level before looking at their combined/joint effect on supplier performance.

Keeping this rationale in mind, each hypothesis is tested for statistical significance at the reduced model and full model levels.

5.3.1 Asset Specificity and Supplier Performance

Hypothesis one states that any (OEM) transaction specific investment undertaken by the supplier will have a negative association with supplier performance (main effect). From chapter four we know that supplier performance is measured in terms of the supplier's three-year average Return On Sales from its business with the chosen OEM. OEM-specific investments of the suppliers are measured along the four dimensions of site-specificity, physical asset specificity, human asset specificity and dedicated assets. The corresponding variables or measures include

(i) logarithm of the distance between the OEM and supplier plants (A_PLDIST),

(ii) a scale of four items measuring the supplier's technical, R&D, inventory management and systems investments for the sole use of the OEM-customer (SC_ASP),

(iii) the number of technical and manufacturing personnel assigned by the supplier for the specific OEM's needs (TECHAS_N) and

(iv) percentage of supplier plant's production dedicated to the OEM in 1995 (PRDDED).

All of the above variables, excepting SC_ASP are continuous variables measured on a nominal scale. With regard to SC_ASP, this four-item scale has a coefficient alpha of

0.74, indicating a high degree of internal consistency and reliability. Furthermore, exploratory factor analysis of the four items reveals only one eigen-value greater than 1 (actual value = 2.28). Also, all the factor loadings have values of 0.70 or more. Clearly, this indicates a high level of convergent validity among the items. It appears, therefore, reasonable to conclude that SC_ASP is a meaningful construct of physical asset specificity.

Both SC_ASP and A_PLDIST as measures of transaction specific investment strongly confirm hypothesis one. SC_ASP has a negative beta coefficient significant at the 1% level. Given that A_PLDIST is a reverse-scaled measure of site-specificity, it has a positive coefficient significant at the 5% level. The term "reverse-scaling" refers to the fact that A_PLDIST is an inverse measure of site specificity. The greater the plant distance the lower is the site specificity and vice versa. Therefore, the positive coefficient for A_PLDIST implies that greater the plant distance (and lower the site-specificity), the higher is the supplier profitability, all else remaining equal. However, both TECHAS_N and PRDDED have a positive and significant beta coefficient each. These estimates do not support the hypothesis.

The physical asset specificity measure (SC_ASP) has been interacted with the component supplier dummy variable (P_ASP) to check if the material and component suppliers are affected differently by such investments. The interaction term does not have a statistically significant coefficient, making it reasonable to infer that the main effects of OEM-specific investments are the same for materials and component suppliers. While this interaction term tests for difference in slope of SC_ASP for both categories, mere

introduction of the supplier dummy P_ASP in the regression will check for difference in the intercept terms of the two groups. However, when so tested, P_ASP does not have a coefficient significantly different from zero.

Sample Selection Bias and Performance Effects

Recent works in this area have debated the relevance of governance choices and transaction costs theory in explaining firm performance. One main criticism has to do with the difficulty in empirically testing what the theory proposes. Also, among the empirical studies done to test the theory, results have been inconclusive at best (Masten, 1993). These problems emerge because costs associated with alternate governance choices are inherently difficult to observe and measure. To circumvent this problem, researchers have linked observable transactional attributes to the choice of organizational form in establishing the relevance of the theory. Monteverde and Teece (1982), Masten and Crocker (1985), Masten (1984), Joskow (1985) are but few of the leading works in this stream. However, these empirical studies do not directly test the performance / efficiency arguments laid out by TCE. That is, the differences in firm profits/costs arising on account of different governance choices - for a given set of transactional attributes - are not directly addressed by them.

One potential method for direct testing of these relationships is to include the main effects of transaction attributes and organizational variables as well as their interaction effects in the model - with performance as the dependent variable. In order for this model to yield minimum variance, unbiased estimates, it is necessary to assume that the governance (organization choice) term is a random variable. This assumption is

essential for the error terms to be independent. However, such an assumption may not be a reasonable one conceptually. Clearly, choice of a specific organizational form will be influenced by the nature of the transaction, which means that the governance variable is endogenous to the system (Masten, 1993). In other words, the choice of governance is systematically influenced by transactional attributes. This in turn would make the observed data not a random sample, but a sample with selection bias. It is therefore important to check whether the sample suffers from such selectivity bias.

The appropriate econometric technique to be used in this context is a two- stage regression model with endogenous switching. Here, results from estimating the governance choice decision are used to control for the potential selection bias in performance estimation (Masten et al, 1991). The first stage estimation contains the transactional attributes as determinants of organizational choice. The second stage performance model retains the same transactional attributes as independent variables while introducing the inverse Mill's ratio (IMR) from the first stage governance choice estimation. For the purposes of this study, the first stage estimation has been performed using a binary Probit formulation and the second stage model has been estimated as an OLS regression. Therefore, if the IMR coefficient is statistically significant it implies the existence of selection bias in the data. The two stage process therefore consists of the following:

$$\Pr(G = G_0 / Xi) = \alpha' Xi + u_i \text{ which yields } \lambda i \qquad (1)$$

$$Po \text{ (given } G=Go) = \beta' \mathbf{X}j + \theta \lambda j \qquad (2)$$

Where **Xi** is the vector of transactional attributes for i=1...n;

G_o, G_1 are the two organizational choices in the data;

u_i is the error term in the probit model: $u_i \approx N(o, \sigma_u^2)$;

λi is the inverse Mill's ratio calculated from (1) for each i=(1...n);

P_0 is the dependent performance variable for those observations that have chosen G_0 ($j \neq i; j < i$).

The performance model in (2) needs to be estimated separately for each organizational alternative G_0 and G_1.

The results from the above estimation are reported in Table 5.5. The governance choice probit model itself is quite significant at the 1% level. The dependent variable TRIGOV is coded 1 if the OEM and supplier pursue cost plus pricing and 0 if these parties pursue target pricing. All the independent variables are in the expected direction and very significant. The second stage least squares regression, which includes the inverse Mill's ratio as LAMBDA variable, has an adjusted R-squared of 0.15 for the cost pricing group. Although the asset-specificity variables are in the expected direction, they are not statistically significant. In fact, neither is the LAMBDA coefficient significant. For the target pricing group, the asset specificity variables all have positive coefficients (not in the hypothesized direction). However, neither these variables nor the LAMBDA coefficient are statistically significant.

The non-significance of the LAMBA coefficient in both groups seems to suggest that the data used in this study do not suffer from any serious selectivity bias. With regard to the main effects of transaction specific investments, the results have changed

substantially after introducing the inverse Mill's ratio in the base model in sub-section 5.3.1. The sign of SC_ASP (the physical asset specificity) measure remains negative in the hypothesized direction, but is not statistically significant in the two-stage estimation. As for the other three measures (A_PLDIST, TECHAS_N and PRDDED), coefficient signs have changed and their statistical significance has virtually disappeared. While relevant literature in this area (Masten, 1993) suggests that significance levels could drop on account of the endogenous switching, these results are neither conclusive nor enlightening. The second stage estimation for both groups provides no information on the relationship among the variables. It appears as if, at best, this two-stage model clears the data of any potential selection bias. It further implies that, after accounting for governance choice decision, asset specificity variables have no main effect (linear) relationship with firm performance.

5.3.2 Verifiable Safeguards and Supplier Performance

Hypothesis two of the model states that when verifiable safeguards accompany specialized assets of the supplier, such assets will have a positive association with supplier performance. In fact, hypothesis one serves the purpose of highlighting the importance of hypotheses two and three. Furthermore, hypothesis two identifies two specific kinds of safeguard mechanisms commonly used in buyer-supplier contracts, namely, contract duration and ex ante quantity agreements.

For the purpose of statistical testing, SC_ASP (physical asset specificity) is being used as the relevant measure of TSIs. As a measure, it has very strong construct validity and does not suffer from the reverse-scaling aspect of A_PLDIST. Also, from a

theoretical perspective, it represents substantial and direct/explicit investments made by the supplier for the sole benefit of the OEM. Hypothesis two has being tested by introducing the interaction terms of SC_ASP and contract duration (INTCNT2) and SC_ASP and quantity agreements (INTSPQ2) into the regression. The regression also retains the main effects of A_PLDIST, SCASP and TECHAS-N. Contract duration, together with SC-ASP, does have a positive beta coefficient but not one that is statistically different from zero. Ex ante quantity agreements provided for in the contract, together with SC_ASP, however has a negative and insignificant parameter estimate. In order to check if these effects are common to both material and component suppliers, a third order interaction term using P_ASP has been used. However, neither is this term significant. It is therefore quite clear that both hypotheses 2(a) and 2(b) receive no support at all. The implications of this result are discussed at length in chapter six.

5.3.3 Non-verifiable safeguards and supplier performance

Hypotheses 3(a) and 3(b) of the research model deal with the relationship between non-verifiable safeguards that the parties have developed over time and the supplier firm's performance. Specifically, hypothesis 3(a) states that, where the supplier has made OEM-specific investments, the length of such supplier's association with the OEM will relate positively to its performance. As in the case of hypotheses 2(a) and 2(b), this effect is tested by introducing the interaction term of asset specificity (SC_ASP) and relationship length (REL-LN) – INTREL2 - in the regression model, while retaining the main effects of asset specificity terms. The coefficient of the interaction term is actually negative in sign, and is statistically significant at 5% level. However, when the third

order term generated with the commodity supplier dummy P_ASP is included in the model, both terms become insignificant. The third order term checks if the effects are different for the two supplier groups. Therefore, there is no prima facie reason to conclude that a long-term association with the OEM guarantees superior/better returns to the supplier. Further, it appears that this is equally true for both material and component suppliers.

Hypothesis 3(b) states that, when suppliers have undertaken transaction specific investments, volume stability achieved through fewer schedule alterations will have a positive association with supplier performance. The relevant interaction term here is that of physical asset specificity (SC_ASP) and volume stability (VOLSTB), namely INTSCH2. The beta coefficient is positive in sign - in the hypothesized direction – and is statistically significant at the 1% level. The component supplier dummy's interaction with the above term (COMP_SCH) is insignificant both in magnitude and in direction. It, therefore, appears that achieving volume stability is of importance to both supplier groups when they have undertaken non-trivial investments for the benefit of the OEM. The contrasting results from H3(a) and (b) will be discussed in greater detail in chapter six. The results from the reduced-form models testing hypotheses one, two and three are tabulated in Tables 5.4(a) and 5.4 (b).

At this point, it is equally essential to test the relative importance of verifiable and non-verifiable safeguards to the suppliers, as indicated by H3(c). This comparison is useful in determining the relative merits of enforceable and self-enforcing contracts from the supplier's perspective. The central thesis of this study is that self-enforcing contracts

better serve supplier interests than do enforceable contracts, and hence the significance of H3(c). Hypothesis 3 (c) has been tested at three levels: one test for the overall sample, one test for the material supplier group and another for component suppliers. The purpose of these individual tests is to check if the two groups structurally differ in terms of the protective mechanisms they require (to continue investing in specialized assets).

For the entire sample, verifiable contract duration (INTCNT2) has a greater (and positive) influence than long term association (INTREL2) on supplier performance. At the same time, volume stability (in the form of production schedule sharing and effecting fewer alterations in them) has a much greater (and positive) association with supplier performance than any contracted duration. In order to better understand these perplexing results, the group level tests were performed. These tests reveal very interesting differences between the two groups. For the material supplier group, contractual duration has utmost significance. Its association with performance is greater (and positive) than that of long term association at the 10% level – as in the all sample case. However, volume stability is no greater an influence than contract duration. That is, coefficient of INTSCH2 is not statistically different from that of INTCNT2.

The exact converse is true for component suppliers. That is, volume stability is of utmost importance for this group's performance. Its effect far exceeds that of contract duration at the 1% level. Furthermore, contract duration is no different from relationship length in terms of its influence on performance. That is, the coefficient of INTCNT2 is not statistically different from that of INTREL2 for this group. This is despite the fact

that INTREL2 has a negative coefficient. This difference between the two groups is fundamental and its strategic significance is discussed at greater length in chapter six.

5.3.4 Incentive Intensity and Supplier Performance

The second set of hypotheses deals with the relationship between pricing policies (Incentive Intensity) and supplier profitability. Hypothesis 4(a) proposes that cost plus pricing of supplier's products will boost supplier performance. Hypothesis 4(b) proposes that the practice of target pricing harms supplier interests (direct effects). These effects have been tested in two reduced form models. The first model simply includes the pricing policy variables as the independent variables and P_ASP and SIZE_1 as control variables. The purpose of this model is to capture the most dramatic effects, keeping all else constant. The second model includes the asset specificity variables, interaction terms of verifiable and non-verifiable safeguards with SC_ASP and the pricing variables. That is,

$$OEMROSAi = Intercept + Costpr_i + Tgtpr_i + Tgtinf_i + P\_ASP_i + Size\_1_i + \varepsilon_i \quad (1)$$

$$OEMROSAi = Intercept + A\_Pldist_i + Sc\_asp_i + Techas\text{-}n_i + Prdded_i + Intcnt2_i + Intspq2_i + Intrel2_i + Intsch2_i + Costpr_i + Tgtpr_i + Tgtinf_i + Size\_1_i + \varepsilon_i \quad (2)$$

$$\{ i = 1..n \}$$

The purpose of the second model is to check if pricing policy variables continue to have any explanatory power once the independent variables from hypotheses one, two and three have been included.

In model (1), cost pricing variable (COSTPR) does have a positive coefficient, as predicted in H4(a). The main effect of target pricing (TGTPR) has a negative beta

coefficient, also as hypothesized in H4(b). However, neither of these effects is statistically significant. Hypothesis nine however suggests that target pricing is part of a larger cooperative management system in place to better serve the parties' interests. Therefore, the main effect of TGTPR alone will not reveal its role in the process. The conceptual reasoning behind the use of target pricing (to serve a mutually beneficial purpose) is that, when the buyer and supplier share all production related cost information, price targets can be set without harming either's interests. Therefore H9 suggests that target pricing, together with production/cost information exchange, will be positively associated with supplier performance. Both models (1) and (2) indeed bear out this prediction. The interaction term representing the co-existence of target pricing and information exchange - TGTINF1 - has a positive coefficient, significant at 10% level in the first model.

With regard to model (2), results support the hypotheses more strongly. Cost pricing still has a positive coefficient, but not a significant one. Target pricing, on the other hand, is negative and significant at the 5% level. The interaction term TGTINF1, is positive and significant again at the 10% level. Model (2) has an overall adjusted R^2 of 0.21. The significance of these results, together with those of model (1), is discussed in greater detail in chapter six. The results from models (1) and (2) are tabulated in Table 5.6.

5.3.5 Adaptive Ability and Supplier Performance

The final set of hypotheses deals with adaptability features in OEM-supplier relationships and their effect on supplier performance. To the extent that enforceable

contracts lack on-going flexibility, they will vastly curtail the ability of the parties to be responsive to each other's priorities. Self-enforcing agreements, on the other hand, enjoy some built-in mechanisms that allow the parties to be adaptive to the other's concerns as well as to any changes forced by the environment.

Hypothesis five proposes that any reciprocal, credible commitment on the part of the buyer (OEM) will be positively associated with supplier's profitability. Reciprocal commitment by the OEM is measured in terms of any long term loan, equity or capital investment that the OEM has made for financing supplier's specialized assets such as CAD/CNC/CAM equipment. Interestingly, only five supplier respondents have non-zero responses for these measures. As a result, H5 cannot be tested statistically. However, the very fact that these practices (reciprocal investments) do not prevail in the U.S. appliance industry is itself significant. It reflects the imbalance inherent in the supply relationship.

Hypothesis six suggests that OEM's (technological or overall) dependence on the supplier will be favorably associated with the latter's performance. This study uses three distinct measures for capturing OEM's dependence on the supplier. The first measure, BBOX reflects the extent to which supplier uses proprietary (black box) technology to make its products. The second measure CUSTOM is a binary variable that determines if the supplier's product is generic or customized to the specialized needs of the OEM. The third measure SSREPTME identifies the overall time that it would take the OEM to replace this supplier with another equally competent one. While BBOX and CUSTOM are tied to the technological and product characteristics, SSREPTME measures the OEM's overall dependence on the supplier. Besides technological skills, the supplier

might possess superior research and managerial skills which in turn would make the supplier more adaptive to the OEM's needs. The beta coefficients of both BBOX and CUSTOM are negative (not in the hypothesized direction) but not significant. However, SSREPTME has a positive and very significant coefficient (at the 1% level), thereby providing strong support for H6. These three measures cannot be combined into one common factor/scale because they represent different aspects of the OEM's dependence. Such a scale would lack sufficient convergent/construct validity.

Hypothesis seven deals with the role played by information exchange in determining supplier's performance. As in the case of target pricing, this hypothesis initially tests the direct/main effects of any information shared by the supplier (unilaterally) on its own profitability. Two measures of information exchange are used in this study. One measure deals with any production related information (such as the individual production processes and steps) that the supplier provides to the OEM (ACTPDINF). The other measure deals with any cost information on the above-mentioned processes that the supplier provides the OEM (PDCSTYN). The coefficient for ACTPDINF is negative in the hypothesized direction and is significant at the 11% level. However, PDCSTYN's beta coefficient is positive and not significant at all.

However, the practices of target pricing, information exchange, OEM's reciprocal investment in supplier's operations, and OEM's dependence on the supplier all represent inter-connected elements of a cooperative, non-arms length relationship with the supplier. These features work in unison to create a more flexible environment, while at the same time serving both parties' interests in an enduring manner. Of course, the most

distinctive feature of these practices is that they are not contracted for in a legally enforceable manner. They are simply practices that both parties engage in to further their common goals. Consequently, it is central and more important to this study to test the joint effects of information exchange (on the part of the supplier) and OEM's dependence on supplier performance. Hypothesis eight states precisely this: information exchange, together with buyer's dependence would however be positively associated with supplier performance.

Hypothesis eight has been tested by introducing two interaction terms into the model: one of production information exchange (ACTPDINF) and black box parts (BBOX) - INFBOX1, and another of ACTPDINF and supplier replacement time (SSREPTME) - INFREP1. The beta coefficient of INFBOX1 is positive in the hypothesized direction and significant at the 5% level. However, INFREP1 has a negative coefficient and a significant one at 1% level. The significance of these contrasting results is discussed in detail in chapter six. To summarize, the model used to test hypotheses seven and eight is as follows:

$$OEMROSAi = Intercept + BBOXi + CUSTOMi + SSREPTMEi + ACTPDINFi + PDCSTYNi + INFBOXi + P\_ASP + SIZE\text{-}1i + \varepsilon i$$

The adjusted R-squared for this model is 0.24. It is essential methodologically to include the main effect (or first order effect) in a model before introducing interaction terms (second order effects). This way, the second order terms will not capture any direct, linear association between the relevant variables. As a result, hypotheses six, seven and eight have been tested in one model. The results from this reduced model are

provided in Table 5.7. The second joint effect core to this study (that of target pricing and information exchange) presented in hypothesis nine has already been discussed along with pricing policy hypotheses.

Having stated that the joint effects are more crucial to this study, it seems a logical extension to check if the second order effects outweigh the main effects of these variables. That is, it would prove interesting to test if the synergy that the interaction terms represent has a greater impact than the sum of the individual effects. As stated earlier, cooperative alliances with suppliers are multifaceted. For the supplier, close ties with the OEM imply better part designing, just in time deliveries, and improved customer support. For the OEM, closer ties with its supplier imply greater dependence on the supplier, longer contracts and providing financial or technical assistance where necessary. It is when all these elements co-exist that a collaborative (as against adversarial) environment is created. Further, it is this cooperative context that yields the benefits of (a) increased adaptability on the part of the parties, and (b) willingness to share production and cost information. Therefore, the superior value of synergy and value analysis emerges from the co-existence of these bilateral efforts. Taken individually, neither OEM dependence nor information sharing yields the above-mentioned benefits. Since the benefits accrue primarily on account of the joint efforts, it is reasonable to expect the interaction term to have a greater influence on supplier returns than the sum of the individual effects. For, the interaction term better captures the joint effect (and its dynamics) than the sum of the elements, taken one at a time. Therefore, the relevant hypotheses are:

Ho: INFBOX1 = BBOX1 + ACTPDINF (1)

Ha: INFBOX1 > BBOX1 + ACTPDINF

Ho: INFREP1 = SSREPTME + ACTPDINF (2)

Ha: INFREP1 > SSREPTME + ACTPDINF

The first pair tests if the joint presence of information exchange and black box parts has a greater effect than the individual effects of information exchange and supply of black box parts. Similarly, the second pair tests if the interaction of supplier replacement time and information exchange has a greater effect than their respective individual effects. These hypotheses strengthen the case made in hypothesis eight. If these effects hold, they not only imply that the joint effects are significant and value adding to the supplier, but they also suggest that the dynamics evolving from the co-existence of the relevant features contribute more to this process than the individual features taken one at a time. The F-tests performed to check for these effects reveal that INFBOX1 coefficient is indeed greater in magnitude than the sum of the individual coefficients. This difference is significant at the 10% level. However, INFREP1's coefficient is significantly lower than the sum of the individual coefficients (ACTPDINF and SSREPTME). This finding is in line with the fact that INFREP1 has a very significant negative coefficient. The implications of these findings together with those of hypotheses eight and nine are discussed in greater detail in the following chapter.

5.3.6 Full model effects

As mentioned in the beginning of this section, the hypotheses have been tested using both reduced and full models. The full model incorporates all of the proposed effects and control variables. With regard to support for the hypotheses, all of the results discussed in the previous sub-sections are echoed in the full model, without loss of significance. The direct effect of SC-ASP is negative and significant at the 10% level. None of the other asset specificity measures has statistically significant coefficients, even though A-PLDIST and PRDDED have coefficients in the hypothesized direction. The interaction term of SC-ASP and contract duration (INTCNT2) is positive but not significant. In fact, even though the interaction term of SC-ASP and relationship length (INTREL2) has a negative coefficient, it is no longer significant. Volume stability, together with SC-ASP, continues to be very significant –at the 1% level – and positive. The last two results obviate the conflicting story in the reduced model (Table 5.4) and, clearly indicate the relevance and appropriateness of the model. Non-verifiable safeguards, in the form of volume stability, are of utmost importance to suppliers. In fact, achieving volume stability is more important than any formal contractual duration to them. Furthermore, these results are equally valid for material and component suppliers.

With regard to pricing effects, COSTPR is no longer significant. Target pricing (TGTPR) continues to have a strong negative coefficient. However, together with information exchange (TGTINF1), it has a positive and very significant (at the 1% level) association with supplier profitability. OEM dependence measures, BBOX and CUSTOM, do not have significant main effects. However SSREPTME – measuring

OEM's overall dependence on the supplier – has a very positive and significant coefficient as hypothesized. Information exchange measures, ACTPDINF AND PDCSTYN, do not have any significant coefficients. However, the crucial joint effects, INFBOX1 and INFREP1, both remain significant. As in the reduced model, INFBOX1 is positive as hypothesized while INFREP1 is negative. Finally, the two control variables used in the full model - SIZE-1 and OTSSCU – are not significant at all. The full model has an adjusted R-squared of 0.353. These results have been provided in Table 5.8.

5.3.7 Control Variables

Three control variables have been used to account for any extraneous effects on supplier firm's profitability. The purpose of using control variables is to isolate the effects of "variables of interest" to the study from the effect of other irrelevant variables. While the latter group may not be of any interest to the study, it could potentially have significant power in explaining the dependent variable. Therefore, it is essential to include these variables in the analysis while at the same time keeping their effects separate from those of variables in the research model.

Three control variables are included in this analysis. The first one pertains to the category that respondents belong to, namely materials or component supplier groups. This distinction has played a very important role throughout the data analysis performed in this chapter. In fact, the first set of hypotheses dealing with specialized investments, verifiable and non-verifiable safeguards makes specific use of this variable to test for structural differences between the groups. There appears to be unambiguous evidence in the data that the two groups have fairly different priorities in their relationships with the

OEMs. It is in the context of pricing policy hypotheses and adaptability hypotheses that the supplier category variable P-ASP plays the role of a control variable. Its purpose is to control the effect that product type has on supplier's performance. This way, the data become more homogenous and the results become equally applicable to materials and component suppliers. Both in the pricing model and the adaptability model, P-ASP has a negative coefficient, but it is not statistically significant. Therefore, the effects that pricing, OEM dependence and information exchange variables have on supplier performance apply equally to both materials and component part suppliers.

The second control variable used in this study is firm size (SIZE-1) measured by the natural logarithm of respondent firm's employee size. This variable has been used in all the reduced models as well as the full model. Even though there is no formal hypothesis relating size to performance, it seems reasonable to expect it to have a positive association with performance. Larger firms have access to financial capital, state of the art product and process technologies and, more importantly, have greater ability to absorb volatility in sales and profits. However, the results are consistently to the contrary. All the reduced models have negative coefficients for SIZE-1. The coefficient is significant at 10% level only in the model testing the adaptability hypotheses (numbers six, seven and eight). The full model also has a negative coefficient for SIZE-1, but it is not statistically different from zero. Therefore, it appears that firm size does not explain any of the variation in supplier profitability in the context of its relationship with the OEM.

The third control variable is the structure variable measured by the number of other suppliers in the market dealing with a product similar to that of the respondent (OTSSCU). This variable has been included in the full model. It has a positive coefficient but not one that is statistically different from zero.

To summarize these results, it appears that only P-ASP has a strong role to play in explaining differences in supplier performance. Even then, as a control variable, product category does not seem to have any significant results. It appears as if the research model variables have a substantially more important role in explaining variations in the dependent variable.

5.4 Summary and Conclusions

This chapter is primarily concerned with empirical validation of the research model developed in chapter three. Descriptive statistics of the data suggest that it would be useful to distinguish between materials and component parts suppliers. While both groups have reported on a long-standing OEM association, component suppliers have reported on a customer more significant than have the materials suppliers. That is, the specific OEM accounts for a substantially higher proportion of the component supplier's sales than materials supplier's sales. The former group also engages in greater joint product design activity with their OEM-customer and is subjected to a greater level of target pricing. As a result of this non-arms length relationship, these component (or sub-assembly) suppliers also invoke greater dependence on the part of the OEM.

With regard to more formal testing of the hypotheses in the model, in all twelve hypotheses have been tested using OLS regression. A summary of the hypotheses and the support they receive form the data are reported in Table 5.9. The first set of hypotheses deals with the importance of verifiable and non-verifiable safeguards in explaining variations in supplier performance. To the extent that supplier's investments in specialized assets are not accompanied by any protective mechanisms, the supplier's interests are harmed. The data reveal that verifiable safeguards such as longer contractual duration or an ex ante agreement to take specific quantities from the supplier in support of "their specialized investments" do not boost supplier's profitability. With regard to non-verifiable safeguards, interestingly, long term associations significantly hurt the suppliers. On the other hand, volume stability (achieved through sharing of production schedules and effecting few alterations in them) significantly promotes supplier's interests. Materials and component suppliers differ considerably in their sensitivity to these aspects. While volume stability is of utmost importance to parts suppliers, materials suppliers are more affected by the duration of their enforceable contract. This difference in the relevance of verifiable versus non-verifiable safeguards for the two groups appears to be a fundamental structural difference in their relationships with the OEMs.

As for pricing policies, cost plus pricing per se has a positive (but not significant) association with suppliers' performance while target pricing in itself has a negative coefficient. However, as explained in the chapter, it is more meaningful to test the effect

of target pricing when it co-exists with any information that the parties might exchange with regard to production processes and costs. This interaction term proves to be very beneficial to the supplier's bottom line. As can be expected, the main effect of OEM's overall dependence on the supplier has a positive coefficient while any production process/cost related information that the supplier provides the OEM has a strong negative association with profitability. However, as in the case of pricing effects, it is more important to study if the coexistence of OEM dependence and information exchange would prove beneficial to the supplier. This interaction term (INFBOX1) does indeed have a positive coefficient. Another measure of the same effect (INFREP1) however has a significant negative coefficient. The implications of these contradictory results are discussed at length in the following chapter.

It is clear from the results that a majority of the hypotheses receive strong support from the data. Also, the R-squared of the reduced models ranges from 0.22 to 0.29, while that of the full model works to 0.48. Therefore, despite being based on self-reported data, it appears as if the research model has substantial explanatory power and empirical value. There could be some potential concern regarding the control variables used in this study. Even though these controls have little or no explanatory power, there is not much depth to them. There are other "structure" variables that have proven to better explain variations in profitability such as economies of scale, scope, absolute cost advantage etc. However, there is an inherent trade-off with respect to the length of the survey and response rate. Gathering information on the relevant "conduct" variables alone made the

questionnaire twelve pages long. Including more detailed questions would have reduced the response rate even more. Despite these response rate considerations, it is probable that a stronger set of control variables would increase the explanatory power of the model.

Data analysis: Table 5.1 (a)
Variable definition

VARIABLES : Measure	RANGE OF VALUES	COMMENTS
PLDIST : Site Specificity	0 to 4000	Continuous variable
SC_ASP Physical asset specificity	1 – 20	Ranked data: ascending order of scale
TECHAS_N Human asset specificity	0 to 30	Continuous variable
PRDDED : Dedicated assets	0 to 100 (percentage)	Continuous variable
CONT_DUR Contract duration	0 to 144 (in months)	Continuous variable
SPQPRC % quantity -take requirement	0 to 100 (percentage)	Continuous variable
REL_LN Duration of relationship	1 to 58 (in years)	Continuous variable
SCHPRC % schedules altered	0 to 100 (percentage)	Continuous variable
VOLSTB % schedules **unaltered**	0 to 100	Calculated as (100 – SCHPRC)
MKTPR Market pricing	0 or 1	Binary variable: derived from PR_POL (Qn. 11)
COSTPR Cost plus pricing	0 or 1	Binary variable: derived from PR POL (Qn. 11)
TGTPR Target pricing	0 or 1	Binary variable: derived from PR_POL (Qn. 11)
BILPRC Bilateral price determination (cost - based)	0 or 1	Binary variable (Qn. 18)
_BBOX Black box parts	0 to 4	Ranked data: ascending order of scale
CUSTOM Customized parts	1, 1.5, 2	Categorical variable – with three possible values
SSREPTME Supplier replacement time for the buyer	0 to 60 (in months)	Continuous variable

Table 5.1(a) (contd.)

ACTPDINF Actual production (process) information shared by the supplier	0 to 5	Ranked data: ascending order of scale
PDCSTYN Production cost info. shared by the supplier	0 or 1	Binary variable
SIZE_1 = log(# employees)		
OEMROSA Past three year average (PBT/ Sales) that the supplier has earned from the OEM's business	-10 to 90 (percentage)	Continuous variable
OEMSALES = sales to OEM in 95 (in $ '000)	10 to 500000	Continuous variable

Descriptive Statistics - Table 5.1 (b)
Comparison of Means

Variable	Material suppliers	Component suppliers	Comments
TYRPBT (%) Past 3-year average (PBT/ Sales) of the supplier firm	9.55	11.68	*
OEMROSA (%) Past 3-year average (PBT/ Sales) that the supplier has earned from the OEM's business	13.84 (n = 41)	13.27 (n = 88)	Not significantly different
OEMSHR (%) (sales to OEM / supplier's total sales)	5.75	15.14	***
EMP_N Number of employees in supplier firm	2383	1049	*
SLCHPRC % change in sales to the OEM over the past 3 years	7.55	23.75	*
SC_ASP Physical asset specificity	10.25	10.6	Not significantly different
TECHAS_N (#) Number of employees assigned to work with the OEM regularly - Human asset specificity	2.8	3.02	Not significantly different
PRDDED (%) Dedicated assets	7.38	15.25	***
CONT_DUR Duration of contract (in months)	9.31	10.7	not significantly different
SPQPRC (%) % quantity that the OEM is required to take	13.28	16.31	- do -
REL_LN Duration of relationship with OEM (in years)	14.49	15.62	- do -
SCHPRC (%) % schedules altered	22.6	31.1	**
N_PRINC (#) Number of price increases allowed by the OEM	2.03	1.67	not significantly different
SSREPTME Time to replace the supplier in months	5.34	7.98	***

Table 5.1(b) (contd.)

ACTPDINF Extent to which supplier exchanges production information with the OEM	1.68	1.78	not significantly different
OEMREPTM Time to replace the OEM customer (in months)	11.84	17.69	***
WKDEL_N (#) Number of deliveries made in a week	3.49	3.21	not significantly different
STKINVST Supplier's investment in stock (in days' production)	29.69	30.13	- do -

Table 5.1(C)

Categorical variables	Materials suppliers	Component suppliers	Comments
_BBOX extent to which OEM assists in part design	Proprietary tech : 25% joint design activity: 30%	------- 17% ------- 55%	
PRICING	Market pricing 15% Cost plus pricing 70% Target pricing 14%	------- 14% ------- 56% ------- 30%	
PRODN. PROCESS STEPS Sharing of information	None 38% detailed information18%	------- 38% ------- 18%	
PRODN. COST INFORMATION	Yes 18%	Yes 25%	
N	90	180	

Note: Ongoing, but, not major customers * - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Data Analysis and Results: Table 5.2
Profile of Respondents

EDUCATION	Over 86 % have a college degree; 28% hold a graduate degree
# YEARS IN FIRM	12.5 years
# YEARS IN THE POSITION	6.5 years

Data analysis and results: Table 5.3
Correlation matrix of independent variables

	Mean	S.D.	Pldist	Sc_asp	Tech_n	Prdded	Cont_dur	Spqprc	Rel_ln	Schprc	Mktpr
Pldist	623.6	630.7	1.000								
Sc_asp	10.48	5.09	-0.139 **	1.000							
Tech_n	2.6	3.27	-0.061	0.329 ***	1.000						
Prdded	12.56	16.43	-0.047	0.265 ***	0.209 ***	1.000					
Cont_dur	10.28	17.95	-0.008	0.216 ***	0.166 ***	0.100	1.000				
Spqprc	15.61	33.84	0.009	0.154 **	0.090	-0.026	0.355 ***	1.000			
Rel_ln	15.21	10.64	-0.058	0.045	0.140 **	0.162 ***	0.044	0.012	1.000		
Schprc	28.35	29.36	0.002	0.124 **	0.034	0.024	0.097	0.026	-0.049	1.000	
Mktpr	0.13	0.34	-0.041	-0.032	-0.049	-0.090	0.011	-0.023	0.019	0.000	1.000
N_princ	1.8	1.55	-0.023	-0.178 ***	0.014	-0.129 **	0.013	0.163 ***	-0.080	0.042	-0.020
Tglpr	0.275	0.45	0.017	0.275 ***	0.221 ***	0.194 ***	-0.014	-0.020	0.004	-0.068	-0.242 ***
Bilprc	0.264	0.49	0.178 ***	0.169 ***	0.074	0.173 ***	0.248 ***	0.161 ***	-0.056	0.179 ***	-0.100 *
_Bbox	2.19	1.07	0.172	-0.038	0.043	-0.046	0.083	0.074	-0.047	-0.012	-0.005
Custom	1.16	0.34	0.046	-0.200 ***	0.163 ***	-0.096 ***	0.002	-0.013	0.049	-0.077	0.055
Ssreptme	7.19	8.04	0.088	0.244 ***	0.146 **	0.202	0.217 ***	0.134 **	0.065	-0.016	-0.103 *
Actpdinf	1.75	1.76	-0.068	0.385 ***	-0.036	0.194 ***	0.091	0.057	0.053	0.122 **	-0.045
Pdcstyn	0.23	0.42	-0.027	0.150 **	0.023	0.143 **	0.017	-0.083	0.073	0.096	-0.161 ***
Size_1	7.94	2.62	-0.125 **	0.308 ***	0.306 ***	-0.092	0.179 ***	0.157 ***	0.200 ***	0.006	0.002 ***
N	261										

p-value < 0.01 ***
p-value < 0.05 **
p-value < 0.01 *

Table 5.3 (contd.)

	N_princ	Tgtpr	Bilprc	_bbox	Custom	Ssreptme	Actpdinf	Pdcstyn	Size_1
Pldist									
Sc_asp									
Tech_n									
Prdded									
Cont_dur									
Spqprc									
Rel_ln									
Schprc									
Mktpr									
N_princ	1.000								
Tgtpr	-0.192 ***	1.000							
Bilprc	-0.004	0.076	1.000						
_Bbox	0.085	-0.012	-0.034	1.000					
Custom	0.139 **	-0.034	-0.084	0.218 ***	1.000				
Ssreptme	0.104 *	0.148 **	0.204 ***	0.066	-0.057	1.000			
Actpdinf	-0.284 ***	0.134 **	0.123 **	-0.079	-0.157 ***	0.035	1.000		
Pdcstyn	-0.085	0.104 *	0.271 ***	-0.129 **	-0.135 **	0.128 **	0.268 ***	1.000	
Size_1	0.056	0.127 **	0.108 *	0.022	-0.014	0.156 **	0.123 **	0.057	1.000
N									

p-value < 0.01 ***
p-value < 0.05 **
p-value < 0.01 *

Data Analysis and Results : Table 5.4 (a)
Dependent Variable: Return on Sales made to OEM

Variable	Hypothesized Direction	**Module 1** Standardized Coefficients (t – statistic)	
Intercept		-	
Main effect of TSI:			
A_PLDIST Log (plant distance)	(+)	0.1598 (1.84)	*
SC_ASP Physical asset specificity	(-)	-0.3223 (-2.39)	***
TECHAS_N Human asset specificity	(-)	0.1584 (1.63)	*
PRDDED Dedicated assets	(-)	0.2181 (2.19)	**
Interaction terms			
SC_ASP*CONT_DUR Physical asset specificity * contract term	(+)	0.0679 (0.70)	
SC_ASP*SPQPRC Physical asset specificity * quantity take requirement	(+)	-0.0151 (-0.17)	
SC_ASP*REL_LN Physical asset specificity * length of relationship	(+)	-0.2293 (-2.1)	**
SC_ASP*VOLSTB Physical asset specificity * volume stability	(+)	0.4728 (3.93)	***
SIZE_1 Log (number of employees)	(+)	-0.088 (-0.90)	
N		129	
R-squared		0.24	
Adjusted R-squared		0.18	

NOTE: **1. All significance levels relate to one-tailed tests, unless otherwise specified**

* - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Data Analysis and Results : Table 5.4 (b)
Dependent Variable: Return on Sales made to OEM

Variable	Hypothesized Direction	**Module 1** Standardized Coefficients (t – statistic)	
Intercept		-	
Main effect of TSI:			
A_PLDIST Log (plant distance)	(+)	0.1257 (1.42)	*
SC_ASP Physical asset specificity	(-)	-0.3272 (-2.4)	***
TECHAS_N Human asset specificity	(-)	0.249 (2.67)	***
Interaction terms			
SC_ASP*CONT_DUR Physical asset specificity * contract term	(+)	0.1849 (0.67)	
SC_ASP*REL_LN Physical asset specificity * length of relationship	(+)	-0.3354 (-1.55)	
SC_ASP*VOLSTB Physical asset specificity * volume stability	(+)	0.4878 (2.53)	***
sc_asp*cont_dur*p_asp additional effect for commodity suppliers using the dummy interaction	(+)	-0.135 (-0.48)	
sc_asp*rel_ln*p_asp additional effect using commodity supplier dummy	(+)	0.1873 (0.78)	
sc_asp*volstb*p_asp additional effect using commodity supplier dummy	(+)	-0.001 (-.005)	
SIZE_1 Log (number of employees)	(+)	-0.144 (-1.55)	
N		129	
R-squared		0.21	
Adjusted R-squared		0.14	

NOTE: **1. All significance levels relate to one-tailed tests, unless otherwise specified**

* - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Sample Selectivity bias results: Table 5.5

Governance choice probit model : Dependent variable: TRIGOV

Variable	Probit Coefficients (t – statistic)	
Constant	0.9968	
Main effect of TSI:		
PLDIST Plant distance	-0.0005 (-0.97)	
SC_ASP Physical asset specificity	-0.167 (-2.24)	**
TECHAS_N Human asset specificity	-0.249 (-2.23)	**
PRDDED Dedicated assets	-0.0406 (-2.03)	**
N	187	
U-squared	0.24	
Chi-squared goodness of fit	***	

Sample selection model: Second stage regression

Dependent variable: OEMROSA

Variable	TRIGOV=1 Sub-sample Coefficients (t – statistic)		TRIGOV=0 Sub-sample Coefficients (t-statistic)	
Constant	9.093		-5.259	
Main effect of TSI:				
PLDIST	-0.0341 (-0.39)		0.011 (0.44)	
SC_ASP	-1.608 (-0.94)		0.4687 (0.69)	
TECHAS_N	-1.0863 (-0.252)		0.458 (0.40)	
LAMBDA	52.759 (1.08)		-8.637 (-0.60)	
N	64		29	
r-squared	0.21		0.02	
goodness of fit based on F-statistic	***		-	

* - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Data Analysis and Results: Table 5.6
Dependent Variable: Return on Sales made to OEM

Variable	Hypothesized direction	Module 2 Standardized Coefficient (t-statistic)		Module 2 Standardized Coefficient (t-statistic)	
COSTPR Cost plus pricing	(+)	0.1049 (0.82)		0.0245 (0.19)	
TGTPR Target pricing	(-)	-0.1593 (-1.00)		-0.2992 (-1.9)	**
TGTPR*ACTPDINF Target pricing * production information exchange	(+)	0.1664 (1.283)	*	0.177 (1.415)	*
A_PLDIST Log (plant distance)	(+)			0.1661 (1.93)	**
SC_ASP Physical asset specificity	(-)			-0.3195 (-2.40)	***
TECHAS_N Human asset specificity	(-)			0.1652 (1.73)	*
PRDDED Dedicated assets	(-)			0.2101 (2.13)	**
Sc_asp * cont_dur Physical asset specificity * contract term	(+)			0.0421 (0.43)	
Sc_asp * spqprc Physical asset specificity * quantity take requirement	(+)			-0.0453 (-0.49)	
Sc_asp * rel_ln Physical asset specificity * length of the relationship	(+)			-0.2345 (-2.14)	**
Sc_asp * volstb Physical asset specificity * volume stability	(+)			0.5027 (4.23)	***
P_ASP Supplier category variable		-0.0404 (-0.45)			
SIZE_1 Log(number of employees)		-0.1242 (-1.41)	*	-0.066 (-0.68)	
N		129		129	
R- squared		0.05		0.29	
Adjusted R-squared		0.01		0.21	
Overall significance of the model based on F value		-		***	

NOTE: **All significance levels relate to one-tailed tests, unless otherwise specified**
* - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Data analysis and results: Table 5.7
Dependent variable: Return on sales made to OEM

Variable	Hypothesized direction	**Module 3** Standardized coefficients (t-statistic)	
_BBOX extent to which part is a black-box part	(+)	-0.0332 (-0.31)	
CUSTOM Customized or off-the-shelf part	(+)	-0.0227 (-0.27)	
SSREPTME Supplier replacement time	(+)	0.6193 (5.98)	***
ACTPDINF Extent to which supplier shares production information	(-)	-0.2455 (-1.22)	
PDCSTYN Does the supplier share production costs or not	(-)	0.0772 (0.84)	
_BBOX*ACTPDINF (black-box part * production information exchange)	(+)	0.3698 (1.66)	**
SSREPTME*PDCSTYN (supplier replacement time * cost information exchange)	(+)	-0.503 (-3.38)	***
SIZE_1 Log (number of employees)		-0.1061 (-1.30)	
P_ASP Supplier category variable		-0.128 (-1.50)	*
N		129	
R- squared		0.29	
Adjusted R-squared		0.21	
Overall significance of the model based on F value		***	

Note: All significance levels are based on one-tailed tests unless otherwise specified

* - $p < 0.10$; ** - $p < 0.05$; *** - $p < 0.01$

Data analysis and results: Table 5.8
Dependent variable: OEMROSA

Variable	Hypothesized Direction	Standardized Coefficients (t – statistic)	
Intercept		-	
Main effect of TSI:			
A_PLDIST Log (plant distance)	(+)	0.0622 (0.74)	
SC_ASP Physical asset specificity	(-)	-0.2235 (-1.64)	**
TECHAS_N Human asset specificity	(-)	0.0256 (0.27)	
PRDDED Dedicated assets	(-)	-0.007 (-0.07)	
Interaction terms			
SC_ASP*CONT_DUR Physical asset specificity * contract term	(+)	0.0865 (0.34)	
SC_ASP*REL_LN Physical asset specificity * length of the relationship	(+)	-0.3255 (-1.56)	
SC_ASP*VOLSTB Physical asset specificity * volume stability	(+)	0.4662 (2.64)	***
Sc_asp*cont_dur*p_asp Additional effect for commodity suppliers using the dummy interaction		-0.185 (-0.69)	
Sc_asp*rel_ln*p_asp Additional effect using commodity supplier dummy		0.129 (0.50)	
Sc_asp*volstb*p_asp Additional effect using commodity supplier dummy		-0.076 (-0.40)	
COSTPR Cost plus pricing	(+)	-0.033 (-0.25)	
TGTPR Target pricing	(-)	-0.427 (-2.76)	***
TGTPR*ACTPDINF Target pricing * production information exchange	(+)	0.425 (2.85)	***
_BBOX extent to which part is a black-box part	(+)	0.0183 (0.16)	
CUSTOM Customized or off-the-shelf part	(+)	-0.059 (-0.67)	

Table 5.8 (contd.)

Variables	Hypothesized direction	Standardized coefficients	
SSREPTME Supplier replacement time	(+)	0.6495 (5.31)	***
ACTPDINF Extent to which supplier shares production information	(-)	-0.2423 (-1.14)	
PDCSTYN Does the supplier share production costs or not	(-)	0.0843 (0.89)	
_BBOX*ACTPDINF (black-box part * production information exchange)	(+)	0.2891 (1.27)	*
SSREPTME*PDCSTYN (supplier replacement time * cost information exchange)	(+)	-0.571 (-3.61)	***
SIZE_1 Log(number of employees)		-0.0383 (-0.41)	
OTSSCU Number of other suppliers providing a similar part to the customer		0.042 (0.52)	
N		129	
R-squared		0.48	
Adjusted R-squared		0.35	

*** - p < 0.10 ; ** - p < 0.05 ; *** - p < 0.01**

Data analysis and results: Table 5.9
Summary of hypotheses and findings

Hypotheses / variables	Hypothesized direction	Findings (based on full model)	Comments
1. Transaction-specific investments (TSI) have a negative association with supplier profits (SC_ASP)	(-)	-0.2235 (**)	Hypothesis supported
2(a) TSIs, together with contract duration would have a positive association with supplier performance (SC_ASP*CONT_DUR)	(+)	Not significant	
2(b) TSIs, together with ex ante quantity agreements would have a positive association with supplier performance (SC_ASP*SPQPRC)	(+)	Not significant	
3(a) when accompanied by TSIs, length of the relationship would have a positive association with supplier performance (SC_ASP*REL_LN)	(+)	Not significant	
3(b) when accompanied by TSIs, volume stability would relate positively with supplier performance (SC_ASP*VOLSTB)	(+)	0.4662 (***)	Hypothesis supported
3 © verifiable safeguards would be more beneficial to suppliers than non-verifiable safeguards		Mixed support	Varies for materials and component suppliers
4(a) Cost pricing would have a favorable association with supplier performance (COSTPR)	(+)	Not significant	

Table 5.9 (contd.)

Hypotheses / variables	Hypothesized direction	Findings (based on full model)	Comments
4(b) target pricing would have a negative association with supplier performance (TGTPR)	(-)	0.427 (***)	Hypothesis supported
9. Target pricing, together with information exchange, would have a positive association with supplier performance (TGTPR*ACTPDINF)	(+)	0.425 (***)	Hypothesis supported
5. Reciprocal commitment on the part of the buyer would have a positive association with supplier performance	(+)	No data	
6. Buyer dependence on the supplier would enhance supplier performance			
BBOX	(+)	Not significant	
CUSTOM	(+)	Not significant	
SSREPTME	(+)	0.6495 (***)	Hypothesis supported
7. Production information exchange by the supplier would have a negative association with its performance			
ACTPDINF / PDCSTYN	(-)	Not significant	
8. Information exchange, together with buyer dependence, would have a positive association with supplier performance			
(SSREPTME*BBOX)	(+)	0.29 (*)	Mixed support
(SSREPTME*ACTPDINF)		-0.57 (***)	

*** - p < 0.10 ; ** - p < 0.05 ; *** - p < 0.01**

CHAPTER SIX

DISCUSSION OF RESULTS

6.1: Introduction

The purpose of this chapter is to discuss and interpret the results presented in the previous chapter. To begin with, the performance implications of specialized investments and protective mechanisms are analyzed. Here, the main effect of asset specificity is contrasted with its effect when accompanied by safeguards. In particular, the relative importance of verifiable and non-verifiable safeguards to the suppliers is assessed. Secondly, module two hypotheses on the significance of pricing policies are discussed. Finally, the adaptive features that characterize self-enforcing contracts and their association with profitability are examined. It is essential to point out here that enforceable contracts, by definition, do not feature such adjustment mechanisms. To the extent that adaptive features promote flexibility and prove vital to the supplier, enforceable contracts are much less valuable than self-enforcing agreements. The effects of all three modules, as captured in the full model, are summarized in Figure 6.1.

6.2 Transaction-specific investments, safeguard mechanisms and supplier performance

Initial analysis of the correlation matrix of independent variables suggests that both verifiable and non-verifiable safeguards are positively associated with specialized

investments of the suppliers. In particular, contract duration has a very strong and positive association with physical asset specificity - SC_ASP ($r = 0.22$, $p<0.01$) and human asset specificity – TECHAS_N ($r = 0.17$, $p<0.01$). Specific quantity provisions also has a strong, positive relationship with SC_ASP ($r = 0.15$, $p<0.01$) and TECHAS_N ($r = 0.09$, $p<0.10$). There is, therefore, clear evidence that enforceable protective mechanisms accompany specific investments that the supplier has to undertake. More importantly, these results strongly support the empirical literature on the relationship between asset specificity and "protective" mechanisms. Joskow (1985, 1987), Mulhern (1986), Master and Crocker (1985) and Palay (1984), are among the researchers who have found strong empirical evidence on the co-existence of specialized investments and contractual safeguards.

With regard to non-verifiable safeguards, the data provide mixed support on their association with TSIs. There exists a very strong positive association between human asset specificity - TECHAS_N and relationship length - REL_LN ($r=0.14$, $p<0.05$). There is also a positive association between TECHAS_N and suppliers' expectation of a long term relatiionship - FUT_REL ($r=0.09$, $p<0.10$). These figures seem to suggest that OEMs pursue long term relations with suppliers who dedicate their technical personnel for OEM - assistance (human asset specificity). This conclusion is further warranted by the fact that suppliers perceive that they will have a sustained future association with the OEM if their (supplier) level of technical support increases. It therefore appears that non-verifiable safeguards also accompany higher levels of specialized investments on the part of the suppliers.

With regard to volume stability, the bivariate ($r=-0.12$, $p<0.05$) correlation between SC_ASP and VOLSTB is significantly negative. Higher levels of physical asset specificity on the part of the supplier are inversely related to stability in OEM's production schedules. This negative association could very well be disguising the volatility in the downstream (end product) market over which the OEM has very little control. It appears premature to draw any conclusions here regarding suppliers' motivation in making these investments. This is particularly so given the nature of regression results linking supplier profitability, asset specificity (SC-ASP) and volume stability.

The first set of hypothesis in this study deals with the main (performance) effects of TSIs. Theoretical arguments based on "opportunism hazards" clearly indicate that any OEM-specific investment - unaccompanied by safeguards - does not augur well for supplier's profits (Klein et al.,1978; Williamson 1985). Descriptive studies of the automobile industry also indicate that greater supplier specialization, unaccompanied by reciprocal commitment by the OEM - buyer, has had an adverse effect on supplier returns (Helper 1991; Lyons, et.al. 1990). Regression results of reduced models reported in chapter five (tables 5.4(a) and (b)) provide mixed support for hypothesis one. Measures of physical asset specificity and site specificity clearly support the preceding rationale. However, the human asset specificity measure has a positive and statistically significant coefficient in the reduced model. In the context of the appliance industry, it appears as if investments in specialized physical assets and close location to the OEM's plant are most susceptible to ex post bargaining hazards. The suppliers are able to retain their share of surplus generated by dedicating technical personnel to the OEM. It seems that OEM

customers not only provide long term business to suppliers who provide them with superior technical support but also share in the surplus emerging on account of this support. The OEM may however, reward the supplier by paying a premium price rather than signing any profit sharing agreements.

The full model results (Table 5.8) support hypothesis one more uniformly than the reduced models. It is only the physical asset specificity measure that has a statistically significant main effect and its coefficient is negative in sign. The coefficients of A_PLDIST and TECHAS_N retain their sign from the reduced model but are not significant. It would therefore be reasonable to conclude here that the data do support the argument underlying hypothesis one. That is, unilateral investments made by the supplier in OEM specific assets- unaccompanied by any safeguards- do not augur well for supplier profits. In this industry it appears however that human asset specificity is more beneficial to the suppliers than site and physical asset specificity. It is necessary to emphasize here that these specialized investments are by themselves, sources of additional rent. It is the superior bargaining power of the OEM and the ensuing hold up threat that preclude the supplier from sharing in this rent.

The second set of hypotheses in this study deals with the value that verifiable safeguards bring the supplier. Researchers have long argued that protective contractual clauses do not exist in isolation. These clauses function as safeguards for parties making specialized investments, thereby serving efficiency (and not anti-competitive) interests. As mentioned earlier, extensive empirical support has been found for the coexistence of contractual safeguards and highly specific assets (Joskow 1985, 1987; Masten & Crocker 1985). However, none of these works directly tests for the profit implications of such

coexistence of protective mechanisms and TSIs. To the extent that this study tests for such effects directly, it would contribute to the relevance of above-mentioned efficiency arguments.

Results from Tables 5.4 (a), 5.4 (b) and 5.8 reveal that both contractual duration and ex ante quantity provisions do not have any statistically significant association with supplier performance. This is the case for both materials and component parts suppliers. This is despite the fact that OEM customers, on an average, purchase nearly 14% of their requirements from these suppliers. It is also interesting to recall here that both CONT_DUR and SPQPRC have strong and positive correlations with SC_ASP. All these figures appear to imply that, even though contractual safeguards tend to accompany specialized assets, they do not in any way guarantee increased supplier profits. At least, this seems to be the case in the home appliance industry. It could very well be that their absence might deter suppliers from even making such investments. That is, verifiable safeguards are necessary but not sufficient to boost supplier returns.

The third set of hypotheses deals with non-verifiable safeguards and the role (if any) they play in support of TSIs. Non-verifiable safeguards are measured here in terms of the duration of OEM's relationship with the supplier and the volume stability provided by the OEM. On an average, suppliers responding to this survey have reported on an OEM customer with whom they have conducted business for over fourteen years. Extensive research on the U.S. and Japanese automobile industry suggests that suppliers rely on and cooperate with OEMs that are more likely to conduct business with them in the long term. Longevity of business dealings guarantees suppliers sufficient volume to enjoy scale economies and to benefit from experience curve effects. More importantly,

sustained demand allows them to recoup their investments profitably which, in turn, makes them more willing to undertake investments specialized to the needs of the OEM (Dyer & Ouchi, 1993, Nishiguchi, 1994). As the supplier is not contractually guaranteed the OEM's business for long time horizons, it is the supplier's perception of fair treatment by the OEM (with regard to future contracts) that is of importance here (Helper 1991, 1995). In other words, a supplier's history of long term association with the OEM could be the outcome of one of the two following paths:

(a) the supplier has periodically won the OEM's business after being repeatedly subjected to arms length negotiation and market competition.

(b) alternately, the OEM is quite satisfied with the supplier's track record in product quality, price and delivery capabilities and is implicitly committed to retaining the supplier.

It is the later scenario that better motivates the supplier into making investments specific to the needs of the OEM.

Regression estimates reported in Tables 5.4 (a) and (b) for the interaction effect of SC_ASP and REL_LN (INTREL2) are negative and statistically significant. This implies that in this industry, longer relationships in which the supplier invests in OEM-specific assets do not augur well for supplier profitability. It is interesting to note from Table 5.4(b) that, when the component supplier dummy is introduced into the estimation, its coefficient is positive in sign if not statistically significant. This could possibly imply that materials suppliers are worse off than component parts suppliers in this context. It also appears as if, in the appliance industry, suppliers tread path one (discussed in the previous paragraph) in pursuing a long-term relationship with the OEM.

Discussions with AHAM members and industry experts do reveal that arms length negotiations continue to dominate the landscape of OEM-supplier relations. More importantly, these experts indicate that the industry suffers from excess capacity problems because of sluggish growth in the demand for major appliances. Consequently, the suppliers are willing to live with lower or decreasing margins (return on sales) so long as they can sustain volume. It is essential to note here that supplier returns are measured in terms of net margin (return on sales) in this study and not in terms of ROI. While a long- lived association in itself may not help supplier margins, it may pave the way for stable volume realizations in the future. Achieving volume and sales growth targets are crucial for survival in this industry. Therefore, what the supplier loses in margin may to some extent be offset by stable or increasing sales.

In line with the above reasoning, empirical results show that volume stability plays a very critical role in boosting supplier margins. Hypothesis three (b) states that, when suppliers have invested in OEM-specific assets, volume stability would have a positive association with their profitability. In return for making substantial capital outlays for the benefit of the OEM, suppliers not only need reduced demand uncertainty but also require smooth production flows. An important part of OEM-supplier relations today is the just in time delivery that OEMs expect of their suppliers. While this practice for sure reduces stockholding levels of the OEM substantially, it does not bode well for the supplier firm. As explained at length in chapter three, this requirement in many industries has translated into suppliers holding buffer stocks of finished goods, supplying on a daily or twice a week basis to the OEM's plant. Researchers have identified that an average auto component supplier in the U.S. holds 8.1 days' production in WIP and

finished goods stock. Further, production lot size runs to seven days' requirement while average delivery lot size runs to four days' needs (Nishiguchi 1994; Helper and Sako 1995). In fact, Helper's 1991 study clearly reveals that this OEM-specific delivery requirement most troubles suppliers and makes them distrust a closer, cooperative relationship with the OEM-customer.

For stocks to not pile up on the supplier's shopfloor and for suppliers to deliver just in time, it is vital that OEMs share their production (and delivery) schedules ahead of time with the supplier. It is equally critical that the OEM not alter these schedules. Having fairly stable schedules in advance would enable the supplier to better manage its production and inventory flows. The importance of this stability is further enhanced if the supplier has dedicated assets to manufacture a tailor-made product for the OEM customer. For, if the OEM does not cooperate, the supplier is forced to pile up stock that it cannot otherwise liquidate.

Empirical results from this research (Tables 5.4 (a), (b) and 5.8) clearly support the significance of volume stability to the suppliers. The coefficient of the interaction term (SC_ASP * VOLSTB) INTSCH2 is positive and statistically significant at the 1% level in the reduced and full models. Also, it has the highest magnitude among all the estimated beta coefficients. Clearly, the sustained significance and magnitude of this term reveals its importance to supplier profitability. All else remaining the same, a unit increase in INTSCH2 results in a 0.47 increase in supplier's net margin (return on sales). This effect is equally true for materials and component suppliers for, the supplier dummy interaction term (COMP_SCH) is not significantly different from zero.

The magnitude of volume stability's importance should not be surprising, given the high levels of processed and finished goods stocks that suppliers in this industry carry. The average stockholding levels of both supplier groups are 30 days' production, which is nearly 3.76 times the stock that auto part suppliers carry. It is not as if appliance manufacturers extend any soft loans to their suppliers. These inefficient inventory levels not only prevent the suppliers from turning their stock around quickly, but also force them to maintain high levels of working capital and pay excessive interest charges. This study, therefore, provides strong statistical support to the claim made by other descriptive studies (Helper 1991; Helper and Sako 1995) that the production and delivery flows from the supplier's factories need to be balanced.

A comparison of verifiable and non-verifiable safeguards further reinforces the above- discussed findings. Hypothesis 3(c) argues that verifiable safeguards would better serve supplier interests than non-verifiable ones. The main advantage that the former has over non-verifiable mechanisms is that it completely eliminates any downstream uncertainty the supplier has to face. However long the OEM does business with the supplier and whatever its effort to not alter production schedules, under the JIT system, both OEMs and the suppliers are subject to the vagaries of the competitive end product market. Volatility in demand in turn destabilizes the income stream of the supplier.

Surprisingly, one-tailed tests of equality of the coefficients of INTCNT2, INTREL2 and INTSCH2 reveal that volume stability has the strongest and most significant association with the supplier profitability. As mentioned in chapter five, neither contract duration nor quantity agreement has a beta coefficient significantly different from zero. This would seem to suggest that the data do not support hypothesis

3(c). That is, in the context of the appliance industry, verifiable safeguards do not play a direct role in boosting supplier profits. However, the "equality of coefficients" tests do not quite confirm this. In fact, the two supplier groups (materials and parts suppliers) reveal very distinctive traits in their preference for protective mechanisms.

In the case of **materials suppliers**, formal contract duration has a significantly greater association with performance than long term association (INTREL2). It is more interesting to find that volume stability has no greater an influence on supplier performance than enforceable contract period. That is, the coefficient of INTSCH2 is not statistically greater than that of INTCNT2.

Clearly, longer durations of formal and enforceable agreements bring greater benefit to this group than do prolonged associations based on informal consensus. Also, such contractual duration is just as important to materials suppliers as volume stability. These results further support the reasoning (made earlier) that long-term dealings with the OEM-customer do not in any way reflect a supportive, cooperative relationship between the partners. These suppliers have traded with the OEM for over a decade only because they have repeatedly been able to win the OEM's business in a competitive environment. As a result, it is only extended periods of legally enforceable contracts that would allow the suppliers to recoup any capital invested in specialized assets. In other words, a long term relationship here provides no guarantee that the OEM would choose to do business with the same supplier in the future. The OEMs probably pay little attention to the quality of supplier's past services in their decision making process (Dyer, 1996). Alternately, the materials supplied by the supplier firms are sufficiently generic that the OEMs see no benefit in comparing suppliers on dimensions other than price.

However, in the (Japanese and American) automobile industry, suppliers in very similar situations evolved into sub-systems suppliers, contributing to product and process design activities of the OEM (Nishiguchi, 1994; Asanuma 1988). These contributions in turn have allowed the OEMs to reduce their production costs as well as to better differentiate their products. It therefore seems very reasonable to conclude here that the relationship between material suppliers and their OEM customers in the appliance industry is an arms length, market based one. Despite a long history of business dealings with the same suppliers, the OEMs do not involve the former in any product design or manufacturing activities. Such a situation is the very antithesis of what prevailed in the automobile industry. Any close ties, if they exist, in management or technology-related activities between the buyer and supplier are rudimentary at best. Introducing JIT delivery requirements into this context has obviously meant a substantial increase in the supplier's inventory levels. There exists no infrastructure in this industry setting for sophisticated coordination of production flows between supplier and OEM plants. Therefore, any move to stabilize stock flows would vastly improve supplier profitability as indicated by the overwhelming significance of the "volume stability" variables. Where the OEM expects the supplier to undertake specialized investments either to make JIT deliveries or to supply innovative, cost reducing materials, it is not surprising at all that suppliers require verifiable guarantees in the form of extended commitment from the OEM-customer. Given the industry setting and lack of evolution in buyer-supplier relations, verifiable safeguards carry as much strategic significance to the materials suppliers as non-verifiable ones.

The priorities of **component or parts suppliers** appear to be quite the opposite. To begin with, long term association with the OEM customer is not as harmful to this group as it is for the materials suppliers. Secondly, formal contract duration has no greater significance to this group's profitability than long term association. That is, coefficient of INTCNT2 is no greater than that of INTREL2 for this group. This is despite the fact that INTREL2 has a negative coefficient. Finally and most importantly, volume stability (INTSCH2) has a far greater association with supplier performance than enforceable contract duration (INTCNT2).

Clearly, non-verifiable safeguards are of greater significance to this group than to materials suppliers. Furthermore, this group does not stand to gain particularly from enforceable safeguards. It appears that this group's relationship with its OEM-customers has evolved more in line with the experience in the automobile industry. These suppliers tend to work more closely with the OEM in product / part design activity. They also commit themselves more to target pricing than do materials suppliers (see Table 5.1). More importantly, parts suppliers accommodate even greater production schedule changes (31%) than materials suppliers (22.6%). These close ties with the OEM together with the supplier's ability to accommodate OEM's specific requirements seem to generate greater revenues for parts suppliers than for materials suppliers. On the average, component suppliers have experienced 24 % increase in sales from the same OEM-customer (over the past three years) while the corresponding number for materials suppliers is 7.55%. All of the above features indicate that pasts and sub-assembly suppliers enjoy a non-arms length, path dependent relationship with their OEMs. That is, quality of supplier's past service, reputation and technological capability play a pivotal

role in the OEM's decision to retain / not retain the supplier. In this context, non-verifiable safeguards do signal OEM's proclivity to do business with the supplier in the long run. Not only does the supplier's current profitability hinge on the OEM's willingness to accommodate supplier needs but also the overall strategic significance of the relationship to the OEM's (and supplier) product market performance evolves from such reciprocity. This process probably explains the much less harmful relationship between long-term association and performance under conditions of asset specificity. Verifiable safeguards such as contractual duration and quantity requirements merely serve to cement the underlying cooperation between the parties. By themselves, enforceable terms of trade do not signal OEM's commitment to the supplier.

The overwhelming significance of volume stability to parts suppliers warrants special attention here. As mentioned earlier, nearly a third of every production order from the OEM gets altered for this group of suppliers. In accommodating these changes, the suppliers also pile up their inventory levels to nearly a month's production. It should therefore not be surprising that any effort made by the OEM-customer to stabilize the flow of shipments would drastically reduce supplier inventory levels and boost its profit margins.

To summarize the above discussion, it appears that where suppliers make specialized investments to serve OEM interests, materials suppliers rely on enforceable as well as non-verifiable protection mechanisms. They are better served in terms of their profitability by such verifiable terms of trade. On the other hand, data on parts and sub-assembly suppliers do ratify the central thesis of the study. That is, self-enforcing arrangements better serve supplier interests than legally verifiable ones. In particular,

non-verifiable mechanisms signal to this group commitment on the part of the OEM customer to a long-lived association. Regardless of what group a supplier belongs to, it is very clear from the study that volume stability is vital to enhance the efficiency and profitability of supplier operations.

It is also worth noting here that, although substantial work has been done on the coexistence of specialized investments and "protective" mechanisms in several industry settings, this study extends the envelope by examining the performance implications of such coexistence. In particular, this study is able to throw more light onto the relative merits of verifiable and non-verifiable safeguards.

6.3.0 Incentive intensity and supplier performance

Pricing arrangement represents the most powerful means a buyer can use to influence the supplier's incentive to perform. As explained in chapter three, cost plus pricing represents the extreme of low-powered incentives. Since the supplier is guaranteed a specific rate of return, it has no incentive to be innovative or to invest in cost-reducing/efficiency enhancing processes. Target pricing on the other hand represents a high-powered incentive mechanism. It consists of continuous price reductions targeted by the OEM and the supplier. More importantly, the price reductions emerge primarily from cost reductions achieved by both. The OEM is able to motivate the supplier into being innovative and making cost reducing investments by offering the supplier a share in the cost savings.

An initial examination of the correlation matrix reveals an interesting association among specialized investments and pricing variables. Physical asset specificity

(SC_ASP) and human asset specificity (TECHAS_N) have a strong, positive and very significant correlation with the adoption of target pricing. Conversely, there prevails a significant, negative association between cost pricing and asset specificity measures (SC_ASP). The above figures support conventional wisdom that, where the supplier is guaranteed a specific rate of return, it has very little incentive to invest in specialized assets for the benefit of the OEM-customer. Also, supplier firms paid on the basis of target pricing systems exhibit greater tendency to invest in efficiency enhancing assets. It is equally interesting to note that, while 30% of component suppliers engage in target pricing, only 14% of materials suppliers do so.

With regard to the research model, hypothesis four (a) predicts that cost plus pricing would have a positive association with supplier profitability. As supplier margin is built into the price in a verifiable manner, this variable would obviously be positively associated with performance. The variable COSTPR, measured as a binary variable, indeed has a positive but not statistically significant coefficient. In other words, H4(a) is not supported by the data. Furthermore, hypothesis four (b) predicts that the main effect of target pricing would be negative. Empirical results indeed support this claim: TGTPR, a binary variable, does have a negative coefficient, significant at the 5% level (Table 5.6)

As noted earlier, cost plus pricing is a low-powered incentive instrument. Even though it guarantees current profits, it does not encourage the suppliers to make efficient investment decisions (Goldberg, 1976). This lack of motivation to improve production equipment and processes in turn affects the competitiveness of OEM-customers who compete in the downstream markets. This has very much been the experience of suppliers and OEMs in the American automobile industry. However, the non-beneficial aspects of

this pricing mechanism are more likely to be captured in time series data. Even in case of this study's cross-sectional data, it is quite noteworthy that the coefficient of COSTPR is not statistically different from zero. This is despite the fact that, by definition, cost plus pricing incorporates the profit margin of the supplier. Clearly, suppliers (in this industry) do not require the complete "blanket security" of such pricing to remain competitive or profitable.

With regard to target pricing, the main effect of TGTPR is certainly not beneficial to the supplier. However, as mentioned in Chapter five, the practices of setting price targets and attempting continuous price reductions do not exist in isolation. Under the ideal system, both the supplier and the OEM share their respective production and cost information. The purpose of such information exchange is to identify cost sensitive aspects of the product and its manufacturing process. The parties then agree on a target price based on their individual cost structures. More importantly, any targeted price reduction does not eliminate either of the parties' margins. Instead the price reductions, if any, come primarily from targeted cost reductions. Therefore, in the ideal state, VA, VE and target pricing cannot be practiced unless the supplier shares production-related information with the OEM-customer.

To truly understand the profit impact of target pricing, its effect needs to be tested jointly with that of production information exchange. This is precisely what H9 is set up for; in fact, H9 predicts that price-setting based on OEM's knowledge of supplier's production parameters would prove beneficial to supplier profits. Results presented in Table 5.6 clearly support the hypothesis. The coefficient of (TGTPR*ACTPDINF) is positive and significant at 10% level in the reduced model. The full model results

presented in Table 5.8 provide even stronger support for this hypothesis, with the coefficient being significant at the 1% level.

Taken together the results of H4(a), H4(b) and H9 seem to indicate that suppliers can benefit vastly from setting prices in cooperation with the OEM-customer. In particular, undertaking VA & VE practices before targeting price reductions does not appear to harm the suppliers at all. In fact, joint price determination, with knowledge of both OEM's and supplier's production parameters, benefits suppliers substantially. However, it is equally important to point out here that target pricing per se - without considering supplier's cost structure and margins - is bound to be harmful to them. Where OEMs mandate continuous price reduction - without taking into account intricacies of the supplier's production process, the cost-volume parameter it supports- neither party is likely to benefit. More often than not, this has been the experience in the U.S. Automobile industry. Automobile manufacturers, with little knowledge of supplier's production and cost parameters, often demand price cuts. The OEMs back up their demands/threats by playing suppliers off against each other. In fact, the negotiating environment is so plagued with mistrust that suppliers have not been willing to share any production information with the OEMs (Lyons et al 1990; Helper 1991). This is another instance where the JIT system of close coordination with suppliers has been implemented without an awareness of what really makes it work and be sustainable. This incessant pressure on the supplier to reduce prices - regardless of its effect on supplier margins - is in a way analogous to expecting JIT delivery, without considering its effects on supplier stock levels.

Another significant finding in the study is the relative insignificance of cost plus pricing. For reasons explained in chapter three, it would appear that a pricing system based on "cost plus margin" would vastly benefit the supplier. However, it provides no incentive for the supplier to improve its operational efficiency or innovativeness. As a result, a sustained regime of "cost plus pricing" may do more harm than good to both OEMs and suppliers who operate in competitive markets. The empirical results from this study support the latter rather than the former reasoning. That is, being paid on a "cost plus" basis does not particularly boost supplier profitability. It appears quite reasonable to conclude here that it is very much in the supplier's interests to cooperate with the OEMs in VA and VE exercises. Any target prices arrived at based on these cost planning exercises would not eliminate supplier margins. Instead, the results suggest that such pricing practices would prove very beneficial to the suppliers.

6.4.0 Adaptive ability and supplier performance

The dissertation primarily focuses on this dimension of governance to highlight the relative merits of self-enforcing contracts. In any long-term contracting situation, a main concern for both parties is to protect their respective interests as the uncertain future unfolds. In particular, both parties are highly price-and- profit sensitive to any demand volatility imposed by the environment. Both trilateral and bilateral forms of governance (as defined in this dissertation) accommodate this need for flexibility in very disparate ways. Enforceable agreements (or, trilateral governance) incorporate future terms of trade (quantity and price provisions) in a verifiable and legally enforceable manner. This way, both parties' obligations for future contingencies are laid out. Any disputes pertaining to

these obligations are resolved through third party arbitration as the terms are verifiable and enforceable. Self-enforcing contracts, on the other hand, make no attempt to specify the terms of trade for alternate contingencies. Instead, some ex post support mechanisms are built into the relationship to ensure smooth adaptation to future events.

This study (chapters two and three) greatly emphasizes the merits of such non-verifiable support mechanisms compared to any "comprehensive contracting" in the trilateral regime. The arguments made in favor of the former are

(i) they enhance the value of the association for both parties;

(ii) by introducing private ordering, they expand the scope of (real and potential) business disputes that the parties can mutually resolve between themselves

(iii) this increased symbiotic dependence translates to a more a collaborative negotiating environment rather that a non-cooperative one.

Each of these factors is hypothesized to add to the flexibility and adaptability of both parties.

The results from the study, to a large extent, support the effects theorized in chapter three. To begin with, it is very interesting to note that most suppliers in the appliance industry receive no financial support from their OEM-customers. Of the nearly 300 respondents to the survey, only five reported having received direct assistance in the form of equity or long term loans from their OEM-customer. Nearly twenty other respondents have indicated that the OEM-customer participated in a one-time capital investment such as CAD / CAM / CNC equipment. In fact, a board member of the AHAM –Supplier Division reveals that suppliers are expected to fund a great deal of the working capital (not just inventory) in the pipeline.

This is quite unlike the experience in the Japanese and American automobile industry. This is despite the fact that OEMs in the appliance industry are just as consolidated as the ones in the automobile industry. It could very well be that the suppliers are not completely dependent on a single OEM as is sometimes the case with Toyota, Nissan or GM. Also, it is possible that the OEMs are quite unaware that such reciprocal investment on their part would pave the way for a much more collaborative and lucrative association with the supplier in the long run.

Hypothesis six tests for the association between OEM's dependence on the supplier and supplier profits. Here, OEM's technological and overall dependence on the supplier represent a more subtle, but very real, commitment on the part of the OEM to an enduring association with the supplier (Asanuma, 1988). The more dependent the OEM is on the supplier for its components or sub-systems, the more difficult it is for the former to replace such a supplier. OEM's dependence has been measured in three different ways in this study. The variable BBOX measures the extent to which the supplier uses proprietary technology for its parts. The more independent and proprietary the supplier's technology, the greater is the OEM's dependence on it. The variable CUSTOM measures if the supplier custom-makes the part for the OEM. If the part is indeed customized to the OEM's specific requirements, it would be more difficult for the OEM to replace the supplier. The variable SSREPTME measures the time it would take the OEM-customer to replace the current supplier with an equally competent new one. This last measure captures the OEM's overall dependence on the supplier. Not only does it encompass technological dependence on the supplier, but it also captures the supplier's ability and

willingness to meet OEM needs quickly, supplier's managerial flexibility, competence etc.

Empirical results displayed in Table 5.7 indicate that neither BBOX nor CUSTOM has a statistically significant coefficient. The variable SSREPTME, on the other hand, has a very strong and positive coefficient - significant at the 1% level. Given the broader scope of what SSREPTME measures, this result represents clear support for H6. Therefore, increased dependence of the OEM boosts supplier profitability and, probably, its bargaining power as well.

Hypothesis seven postulates that any production - related information that the supplier unilaterally shares with the OEM does not bode well for its profitability. In an adversarial bargaining context, the more knowledge the OEM has on supplier operations, the more likely it is that the OEM will use this knowledge to bring prices down or play suppliers off against each other. Sharing of production information by the supplier is measured in two ways in this study. The first measure, ACTPDINF, captures the extent to which suppliers provide a breakdown of production process steps to the OEM. The second measure, PDCSTYN, ascertains if the supplier provides production cost information to the OEM.

Results presented in Table 5.7 indicate that ACTPDINF is marginally significant and has a negative coefficient as hypothesized. The coefficient of PDCSTYN is not significant at all. Both variables have negative coefficients in the full model as well (Table 5.8) but neither is statistically significant. These results imply that neither of the information exchange variables has a direct, linear association with supplier returns. Therefore, there is little empirical support to the argument that any operational

information that the supplier unilaterally shares with the OEM is bound to hurt the former (H7). However, it is just as much a reality that it is this aspect of OEM-supplier relations that is vastly different in the U.S. and in Japan. Studies have suggested that suppliers in American industries are unwilling to share any production-related know-how with the OEM for fear of being taken advantage of (Helper 1991; Lyons et.al 1990). However, Helper's subsequent study shows that the percentage of suppliers in the automobile industry sharing information on process steps has dramatically increased in the 1990s from 40% in 1984 to 80% in 1993 (Helper & Sako, 1995). With regard to the appliance industry, only 18% of this study's respondents provide detailed information on their production processes to the OEM.

While sharing of process or cost details with the OEM per se may not be harmful, it could very well be that, together with a constant pressure to reduce prices, deliver just in time and achieve total quality, it does not raise supplier confidence in the new regime. Also, the fact that the OEMs do not provide any financial or technical assistance in this move to a non-market, close relationship does not help. The common perception among suppliers is that the regime has disproportionately increased their performance requirements (in terms of zero defeats, lower prices and JIT delivery) without any reciprocal increase in OEM's commitment. Such a shift in OEM-supplier relations is destabilizing and does not encourage the suppliers to share production information for performing VA or VE techniques. In fact, it is the existence of support mechanisms such as financial and engineering assistance from the OEM, profit-sharing agreements etc. that has spawned the success of VA and VE techniques in Japan (Nishiguchi 1994).

It would therefore be enlightening to assess the influence of information sharing in the presence of some reciprocal OEM commitment. As discussed at length in chapters three and five, neither target pricing nor information exchange exists in isolation. Ideally, closer, non-arms length relation with OEM implies greater customer responsiveness for the supplier. This could take the form of superior quality/price combinations, JIT practices, information exchange and designing superior parts to meet customer specification. For the OEM, closes ties with a supplier means greater dependence on the supplier for customized parts, longer duration of business relations, and providing financial / technical assistance if necessary. It is the coexistence of all of the above - mentioned features that allows the new regime to be more efficient (in cost, quality and profit term) than the market-based, traditional arms length relationship. In reality, it appears as if the transformation has occurred more at the supplier end than at the OEM - end of the relationship.

As stated earlier, such efficiency implications can be studied by assessing the influence of information exchange in the presence of reciprocal commitment on the part of the OEM. In fact, this is precisely what hypothesis eight tests. It is the culminating and most central proposition of this study. Since OEMs in the appliance industry do not provide long term financial or technical aid to their supplier, the only measure of OEM commitment is its dependence on the supplier. Of the three measures of OEM dependence, black box parts (BBOX1) and supplier replacement time (SSREPTME) have been chosen to interact with information exchange (ACTPDINF) to test hypothesis eight.

The two relevant interaction terms are INFBOX1 (ACTPDINF*BBOX1) and INFREP1 (ACTPDINF*SSREPTME). The third measure CUSTOM has been omitted because of multicollinearity problems.

Results for these tests are presented in Table 5.7. The implications of findings pertaining to INFBOX1 are initially discussed followed by those of INFREP1. It is quite noteworthy that, while the main effect of BBOX1 is not significant at all and that of ACTPDINF is only marginally significant, their interaction effect is positive and significant at the 5% level. This result provides strong and convincing support for hypothesis eight. That is, it is very much in the interest of the supplier to share information on production parameters so long as it is accompanied by OEM's credible commitment to the relationship. The OEM's commitment here takes the form of technological dependence on the supplier.

More generally, the coexistence of the above features of self-enforcing agreements very much serves efficiency interests of the supplier. Taken individually, neither OEM's technological dependence (as measured by BBOX1), nor sharing of information particularly helps the supplier. However, their joint presence, as measured by their second order effect, does significantly elevate the profitability of the supplier. Further statistical support for this conclusion comes from testing if the first and second order coefficients are equal. The F-test performed to test for equality of INFBOX1's coefficient with the sum of the individual coefficients reveals that the interaction term is greater in magnitude. The combined presence of these factors creates a symbiotic context which, in turn, generates a synergy superior in value. The transformation from an adversarial to a cooperative negotiating environment occurs because of these bilateral

efforts undertaken in support of the exchange. It is essential to reiterate here that bilateral efforts such as information sharing, increased OEM dependence, target pricing etc. evolve as non-verifiable support mechanisms. Neither party contracts to undertake such efforts in a legally enforceable manner.

The transformation that these non-verifiable supports facilitate adds value in the following manner:

(a) the symbiotic context allows the parties to be more flexible in all aspects of trade, thereby enhancing their ability to adapt to unforeseen environmental shifts;

(ii) the parties are more willing to share information pertaining to production processes and costs. This "see through value chain" eliminates double marginalization and allows both the supplier and OEM to be more competitive. This increased competitive strength in turn allows them to boost sales and profits, as seen in the case of Toyota and its suppliers (Dyer & Ouchi, 1993).

With regard to the second interaction term testing H8, namely INFREP1, both the reduced model (Table 5.7) and full model (Table 5.8) yield a very strong and negative coefficient for INFREP1. The coefficient is significant at the 1% level and therefore negates the hypothesis. While the interaction coefficient is lower in magnitude than the first order coefficient of SSREPTME, the overall effect for the supplier is quite disturbing. For a given level of SSREPTME (i.e., given the time it takes the OEM to replace the supplier), as the supplier shares more detailed information with the OEM, the more adversely it is likely to be affected. That is, if 'b_{ss}' is the parameter estimate for SSREPTME and 'b_{int}' is the estimate for INFREP1, the total effect of SSREPTME is given by:

$OEMROSAi = Intercept + b_1(Bbox1_i) + ... + SSREPTME_i(b_{ss} + b_{int}\ ACTPDINFi)$

Substituting the results form Table 5.7 makes this

$OEMROSAi = Intercept + ... + SSREPTMEi\ (0.62 - 0.5 * ACTPDINFi)$

Therefore, SSREPTME influences supplier profitability positively only for very low values of ACTPDINF (i.e., 0 or 1). As the supplier enhances the level of detail (i.e., as ACTPDINF increases in value), its profitability tends to decline. Also, tests conducted to check for equality of the joint effect and sum of the individual effects clearly reveal that first order effects far exceed the interaction effect. That is, the sum of ACTPDINF and SSREPTME's coefficients is far greater than the coefficient of INFREP1. This implies that the supplier enjoys no synergistic value on account of the coexistence of high replacement time and information sharing. In fact, their joint presence has been found to be detrimental to the supplier.

To reconcile the very positive influence of INFBOX1 and the negative influence of INFREP1, it is vital to understand the dynamics embodied in these terms. As mentioned while discussing H6, SSREPTME does represent a comprehensive measure of OEM's dependence on the supplier. It measures the time it would take the OEM to replace the current supplier with an equally competent one. However, if the supplier shares details of its production processes with the OEM-customer, the latter is in a position to pass this information on to other suppliers. In fact, the practice of "two-vendor policy" and playing suppliers off against each other is not new to OEMs in Japan or in the U.S. (Nishiguchi, 1994; Helper & Sako 1995). This practice in turn reduces the OEM's dependence on the first supplier and, makes it easier for the OEM to replace it

(the first one). In other words, sharing of process details by the supplier potentially increases imitation by competition and brings down the time it would take the OEM to replace it. Clearly, the presence of an equally competent rival drives down the supplier's bargaining power and hence its profitability. Therefore, far from creating a cooperative environment, the dynamics of information sharing and high replacement time may actually generate a more adversarial negotiating context.

In contrast to the dependence-reducing effect that information sharing has on supplier replacement time, it does not seem to weaken the OEM's technological dependence on the supplier. The dependence emerging from BBOX is primarily technological. As the supplier increasingly undertakes independent design, engineering and research activities with respect to its products, the OEM gets further distanced from the product's architecture. Ultimately, when the part is based on supplier's proprietary technology, the OEM's architectural dependence is almost complete. Consequently, any information that the supplier may provide regarding its manufacturing process does not erode the OEM's dependence on it. More knowledge of the supplier's production process is not sufficient to help competitors imitate the supplier's products.

This brings us to the fundamental difference between the dependence captured by BBOX and by SSREPTME. The design and engineering prowess reflected in the black box and proprietary parts cannot be easily imitated by competition. They represent the supplier's core competence accumulated over years of research and development. As a result, even if the supplier shares production process details, such information does not attenuate the supplier's position or the OEM's dependence. The variable SSREPTME,

on the other hand, seems to be capturing the kind of dependence that can be easily eroded by competitive imitation.

This brings the discussion to the question of whether the data support hypothesis eight - given the seemingly contradicting results of INFBOX1 and INFREP1. To this end, it is first essential to recall that H8 is based on the premise that OEM dependence on the supplier is a good measure of the OEM's commitment to the association. Sustained OEM dependence is as much a "hostage" as any financial commitment that the OEM makes to the supplier. It is therefore argued that, given OEM's dependence (i.e. credible commitment), information sharing would prove value - adding to the supplier. However, for the reasons discussed earlier, the dynamics underlying INFREP1 do not foster a credible commitment on the part of the OEM. The OEM can easily share its knowledge of the current supplier's manufacturing process with other vendors and develop competent rivals. It is only INFBOX1 that creates and sustains dependence that is in any way credible. It is credible commitment together with information exchange that creates a symbiotic environment. From this perspective, the effect of INFBOX1 is more relevant than that of INFREP1. As has been discussed earlier, the findings on INFBOX1 very much support hypothesis eight's claim. From the supplier's perspective, the strategic benefit accruing from its non-imitable competence in product architecture is more sustaining than any benefit coming from a superior production process.

6.5 Summary and conclusions

This chapter focuses on interpreting the empirical results in the context of the model developed in Chapters Two and Three. In particular, it is concerned with the implications

of this study's findings for suppliers. As the data for the study come from the home appliance industry, it would be meaningful to commence the discussion with an overview of OEM-supplier relations in this industry.

Both descriptive statistics and formal testing reveal that "supplier management" strategy in this industry is not as advanced as the one in automobile industry. The average contract duration between OEMs and suppliers is ten months, while that in the automobile industry is over two years (Helper & Sako, 1995). Also, there is no evidence that the OEMs undertake supplier tiering to simplify their managerial tasks. Almost no OEM provides long term loans or equity financing to promote closer ties with suppliers. However, it is just as true that the industry as a whole is trying to emulate the more successful attributes of JIT supply chain management.

Suppliers do undertake specialized investments for the benefit of their OEM-customers. Furthermore, correlation analysis shows that contractual safeguards tend to accompany such investments. This finding is in line with the extant empirical literature on the relationship between asset specificity and protective mechanisms. More formally, results on hypothesis one suggest that supplier's investment in OEM-specific physical assets –unaccompanied by safeguards – is detrimental to its profitability. However, the results also indicate that suppliers who dedicate technical personnel and support to the OEMs are amply rewarded.

For the purposes of the study, it is more important to assess the profit implications of asset specificity when accompanied by protective mechanisms. The traditional TCE reasoning is that such safeguards serve efficiency interests when one of the parties has invested in non-redeployable assets. It is interesting to find that, while verifiable

safeguards do accompany supplier's specialized investments, such coexistence does not boost supplier profitability. It is quite possible that, in the appliance industry, contractual safeguards serve as deterrents and are not sufficient to increase supplier profits. With regard to non-verifiable safeguards, it appears that longer relationships, in which supplier makes OEM-specific investments, do not augur well for suppliers. This effect is substantially mitigated in the full model results. The suppliers do however benefit significantly from volume stability, wherein minimal alterations are made to their production schedules. This finding should not be surprising, given the exorbitant stock levels they carry to meet OEM demands for just in time delivery.

The more interesting feature about this industry is the structural dichotomy in the OEM-relations of materials and component suppliers. Materials suppliers such as steel, rubber, plastic and glass suppliers value contractual duration as much as volume stability. Component suppliers, on the other hand, engage in joint product design activity and target pricing exercises; they value volume stability more than any legally enforceable safeguard. This provides further evidence that cooperative vertical market ties are still at a rudimentary stage in this industry. In particular, it would be accurate to characterize the dealings between materials suppliers and their OEMs as an arms-length, market governance. It is worthwhile to note here that their counterparts in the automobile industry have benefited substantially by shifting to a more collaborative association.

The findings with regard to pricing policies are quite as hypothesized. Where OEMs mandate (targeted) price reduction, with no appreciation of suppliers' production parameters, supplier profitability is significantly harmed. On the other hand, where the target prices are based on information on supplier's production parameters, it works

significantly to the supplier's advantage. The detailed cost planning that target pricing ideally entails is possible only when production information is exchanged. Of course, there exist quite a few support mechanisms in the relationship to induce the supplier to share such information. What form some of the support systems take is discussed below.

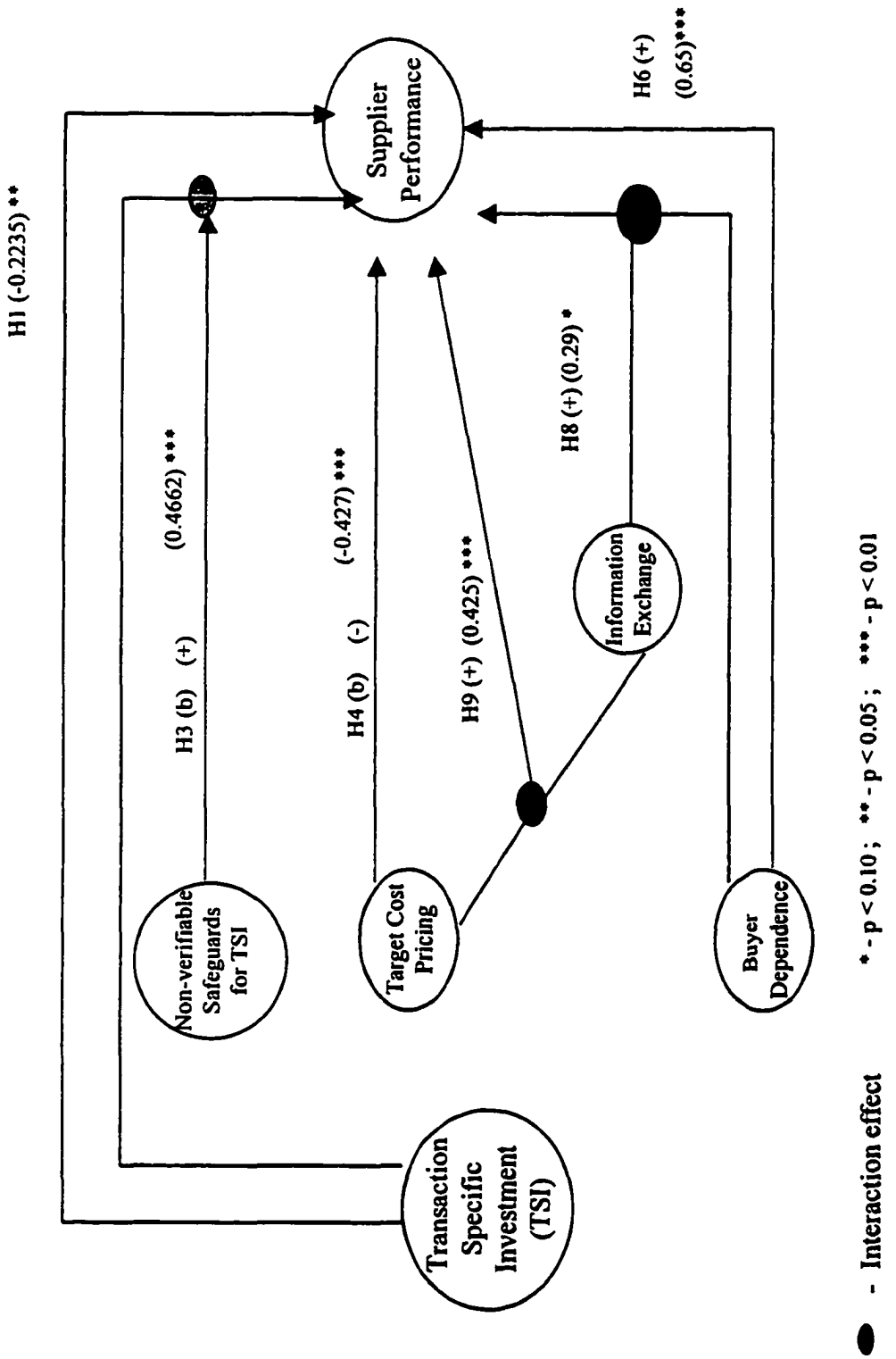
Support mechanisms signify credible commitment made by either party in support of the exchange. This study characterizes OEM's credible commitment to doing business with the supplier in terms of long term financial assistance and enhanced dependence on the supplier for its products. In the context of the home appliance industry, the majority of the OEMs do not undertake any equity / capital asset investment in supplier firms, nor do they provide any long term loans to these suppliers. In fact, discussion of this issue with a Board member of the AHAM - Supplier division reveals that suppliers are expected to fund a great deal of the working capital (not just inventory) in the pipeline. This again reflects a situation very far from a cooperative one; more than one credible source of reciprocal commitment is lost. Where suppliers do share production information with the OEM-customer without any reciprocal activity on the part of the customer, the supplier's performance is negatively affected.

However, it is encouraging to find a trend of increased dependence on black box / customized parts of suppliers. This technological dependence does convey reciprocal commitment to the supplier. This brings the discussion to the culminating hypothesis of the study: buyers' long term financial commitment or technological dependence in itself or supplier's information sharing in itself results in adversarial, imbalanced bargaining contexts. What sustains self-enforcing contracts as stable, competitive mechanisms is the coexistence of all three : OEM's investment, dependence and, information sharing. It is

the combined presence of these factors that produces a symbiotic context in the vertical market, thereby expanding the adaptive ability of the parties. The results do justify this rationale. Not only is the coefficient of the interaction term positive and significant, but the magnitude of this coefficient (standardized beta) is significantly greater the sum of the individual coefficients. That is, (BBOX*ACTPDINF) has a greater influence than the sum of BBOX and ACTPDINF's individual coefficients.

It would therefore be reasonable to conclude that the study demonstrates that some governance mechanisms serve supplier interests better than others. More specifically, the unverifiable protective mechanism of "volume stability" serves supplier interests much better than the verifiable ones. Also, the practice of target pricing, with an appreciation of supplier's production parameters, proves more beneficial to the suppliers than cost-based pricing. Most important of all, the prevalence of non-verifiable support mechanisms in bilateral governance (and the lack thereof in enforceable contracts) in the form of reciprocal dependence is value enhancing for the supplier. The very absence of these adaptive features in enforceable contracts makes them less flexible and detracts from their value-enhancing potential. It is quite clear from all three dimensions of governance that self-enforcing contracts are far superior to enforceable, long-term contracts from the supplier's perspective. Also, this section completes the explanation with regard to the competitive sustainability of enforceable contracts.

Full Model Results: Significant Estimates Figure 6.1



CHAPTER SEVEN

CONTRIBUTIONS AND LIMITATIONS OF THE STUDY, AREAS FOR FUTURE RESEARCH

7.1: Introduction

This chapter concludes the dissertation by identifying the contributions, practical relevance and limitations of the study. To begin with, the contributions to academic research on the strategic significance of just in time supply chain management is explored. Next, the managerial relevance of this study to practitioners in the home appliance industry is addressed. The third sub-section assesses some limitations of the study and lastly, potential areas of future research that build on this study are identified.

7.2 Contributions to strategic management literature :

Research with respect to intermediate governance modes is of significance to strategic management because it deals with choices relating to firm scope and the performance implications of these choices (Zaheer & Venkatraman, 1995). While joint ventures, horizontal alliances, licensing etc. constitute intermediate governance alternatives, this research focuses on "vertical exchange" (buyer-supplier) situations. In particular, when firms enter into vertical alliances, they can the share the benefits of vertical integration without having to incur the costs and risks associated with it. These vertical alliances take the form of long-term contracts and cooperative relationships

wherein both parties jointly seek ways to lower costs and improve quality. As a result, these alliances can also be referred to as "quasi-vertical integration" strategies.

In this context, transaction costs theory is the predominant economic perspective used to analyze inter-firm governance choices. Much of the empirical testing of TCE propositions has focused on "make or buy" decisions of manufacturing firms (Monteverde & Teece, 1982; Masten, 1984; Anderson & Schmittlein, 1984; Walker & Weber, 1984; 1987; Joskow, 1988b). Among the works that apply TCE reasoning to the study of long term contracts, some have analyzed the structural aspects of these contracts in a detailed, descriptive manner (Stuckey, 1983; Palay, 1984; Erickson & Goldberg, 1987; Joskow, 1990). Others who have done large sample, quantitative analyses focus on contract duration, quantity or take provisions as dependent variables (Masten & Crocker, 1985; Joskow, 1987; 1988a). That is, considerable work has been done to show the co-existence of asset specificity and contractual safeguards. There appears to be a gap in this literature stream with regard to studying the effect of LTC's structural attributes on supplier / buyer performance.

In the emerging manufacturing strategy literature on competitive effects of buyer-supplier cooperation, quite a few works focus on the "relational exchange" attributes (Davis, 1992; Dwyer et al., 1987; Frazier et al., 1988; Cusumano & Takeishi; 1991). Of the works that address the performance implications of such long term vertical nexus, many are concerned with its effects on buyer performance / competitiveness. This is the case at both conceptual (Kamath, 1992; Landeros & Monczka, 1989; Spekman, 1988; Stuckey & White, 1993) and quantitative (large sample analysis) levels (Clark et al., 1987; Noordewier, John & Nevin, 1990; Artz, 1995). In fact, the term "supplier

performance" often refers to the supplier's ability to deliver low cost, high quality and innovative products and, not to supplier profitability.

Some works have paid attention to the effects of long term associations on supplier performance at the conceptual, descriptive level (Womack et al., 1991; Lyons et al., 1990; Helper, 1991; Nishiguchi, 1994; Helper & Sako, 1995). Here again, there is a gap / need to study analytically the impact of (the structural features of) closer, JIT association on supplier profitability. Such an analysis would help understand what it is that suppliers need to succeed in their operations under the JIT regime. This, in turn, would help measure the concept of "attention to supplier performance" and the role it plays in sustaining long term supplier relationships as a competitive tool for buyer firms. It has been repeatedly pointed out that, despite buyers offering longer contracts and rationalizing their supplier-base, they (buyers) have not been able to obtain production process / cost information from their suppliers - to implement value-analysis techniques. Nor are the suppliers convinced that they benefit from such JIT associations (Lyons et al., 1990; Helper, 1991). Comprehending what sustains the JIT exchange from the supplier's perspective is, therefore, very essential for **both** parties to make better use of it.

It is in this attempt to address the gaps in literature that the **dissertation seeks to contribute in the following ways:**

(a) This study provides a theoretical framework of what makes some vertical alliances more competitive than others. The fundamental hypothesis of the study is that self-enforcing contracts are more sustainable and competitive than enforceable contracts for governing vertical market exchange. In particular, informal contracts are characterized by non-verifiable support mechanisms that are crucial to enhance the

adaptability and collaborative focus of both parties. The joint focus, in turn, allows the parties to share information on production parameters for performing value analysis techniques. It is this joint effort that yields the benefits of vertical integration without having to incur its bureaucratic costs. Formal contracting regimes typically lack these above-mentioned features and hence, do not facilitate long-term collaboration of the parties.

Inasmuch as self-enforcing agreements are important, this thesis contributes conceptually to TCE and contracting literature as well. Traditional TCE reasoning holds that so long as the parties retain their distinct identity and "residual claimant" status, they have a high incentive to perform and not shirk. However, external suppliers could be as unresponsive (and uninnovative) as in-house suppliers so long as they are guaranteed a return on investment – as cost plus pricing does. It is the verifiability of pricing terms that contributes to the shirking of external suppliers here. Pricing practices based on prior performance, value analysis and productivity sharing, on the other hand, do encourage the suppliers to perform. Therefore, differences in verifiability of pricing obligations together with retention of distinctive identity of the supplier contribute to the incentive intensity of a governance mechanism. That is, pricing practices that evolve as (informal) norms over the course of the relationship between the external supplier and the buyer may be accompanied by higher levels of incentive intensity than "cost plus" pricing terms with an external supplier.

Also, a review of empirical literature suggests that studies typically focus on verifiable support mechanisms – to measure the degree of flexibility in a vertical alliance (Joskow, 1988a; Klein, 1993). However, verifiability of parties' obligations places a

limit on the degree of flexibility that parties can achieve. This limited flexibility, in turn, increases the governance costs of "incompleteness" inherent in long-term contracts and, reduces its viability as an alternative to vertical integration. The overwhelming (empirical) message from this study is that non-verifiable supports neutralize these problems emerging from "incompleteness" significantly. By enhancing the adaptability of both parties, non-verifiable support mechanisms increase the value of self-enforcing agreement as a viable alternative to vertical integration. This is an important reason why scholars need to pay more attention to informal, non-verifiable norms / aspects of vertical trade.

(b) This study also provides empirical validation of some of the above-mentioned arguments. In particular, it contrasts the performance implications of enforceable and self-enforcing contracts from the supplier's perspective. A major finding of this study is that supplier (vertical market) management characterized by reciprocal commitment, mutual dependence, and information sharing is a value enhancing capability. These factors create superior value because they promote a symbiotic environment between the parties. Such a collaborative context allows the parties to be more flexible, share information mutually, and focus on joint interests (such as lowering total costs as against maximizing individual profits). These features, in turn, complement the supplier's transaction-specific investments and improve both parties' performance.

(c) Another much debated aspect of these vertical alliances is the practice of target pricing. Researchers are not convinced that this practice actually benefits suppliers. The results from this study however show that, where target prices coexist with production information exchange, such pricing proves beneficial to the suppliers. These results

provide empirical support to the reasoning that target prices based on "see through value chain" (or alternately, exchange of production parameters) do not harm supplier interests. Instead, this pricing policy actually enhances supplier performance. This finding is significant in the sense that it provides unequivocal empirical support to a rationale that has been widely contested.

(d) A methodological contribution of this study is to check for sample-selectivity bias or endogeneity problems in the data. Some scholars in this line of work have argued that governance choices that firms make are endogenous to the system (Masten, 1993). That is, transactional attributes influence the choice of governance mechanisms and hence, governance variables cannot be treated as being independent of asset specificity variables while performing the statistical analysis. However, results from a two-stage regression analysis do not confirm the prevalence of such sample selection bias in this study. A much larger issue related to this idea is one of "direction of causality" among performance variables, transactional attribute variables, and governance variables. While it is reasonable to expect asset specificity and governance choices to influence performance, it is equally plausible for performance to influence governance norms and parties' choice of investments. That is, reverse causality could be an important issue in the relationship among these variables. Alternately, there could be an altogether different construct that simultaneously affects all these variables, thereby confounding the relationships being studied. Access to time-series data is essential to pursue these questions empirically.

(e) This study also extends the envelope by directly testing the profit implications of the coexistence of asset specificity and safeguard mechanisms. Merely increasing the

contract duration is not sufficient to serve supplier interests. In return for investing in specialized assets for the benefit of the OEM, suppliers require volume stability from the OEM – as a support to the exchange. Interestingly, this is not the approach taken by most American OEMs in their dealings with suppliers. Volume stability allows the supplier to realize the cost economies associated with just-in-time inventory management.

Literature on long-term (vertical) contracts has consistently argued that "protective" contractual provisions emerge in support of specialized investments undertaken by either party. Underlying this argument is the TCE reasoning that higher levels of asset specificity warrant such protective mechanisms to (minimize transaction costs, or) maintain the profitability of the investing party. Therefore, the prevalence of efficiency benefits is inferred from the very co-existence of these two features. However, results from this study reveal that verifiable safeguards do not particularly enhance the performance of the investing party (i.e., the supplier). Neither contract duration nor specific quantity agreements contribute to the profitability of the supplier.

Furthermore, an extended relationship with the OEM-customer does not augur well for the supplier in the appliance industry. This is quite surprising, given the extensive literature on the automobile industry (Helper, 1991; Nishiguchi, 1994; Dyer & Ouchi, 1993). Researchers have typically argued that the informal commitment embodied in a long-term association allows the supplier to recoup the capital invested in specialized assets. Long duration of business generates sufficient volume for the supplier to benefit from high capacity utilization, economies of scale and experience curve effects. However, the formal testing performed in this study does not support such a rationale. As discussed in detail in chapter six, a long-term relationship in this industry might

merely represent an accumulation of formally contracted business. It does not in any way guarantee the supplier a prolonged term of business with the OEM-customer in the future. This appears to be particularly the case with materials suppliers. An equally interesting and related finding pertains to the structural difference in the expectations of materials and component suppliers. In contrast to component suppliers who require volume stability to improve their profitability, materials suppliers require both an extended duration of formal contract and volume stability. Clearly, the verifiable mechanism of "contract duration" seems to better serve the materials supplier's interests than length of any relationship with the OEM-customer. This industry's unique context makes these results both interesting and surprising.

To conclude, it is very much in the OEM's interest to pay attention to supplier needs. It is this attention that transforms "cooperative" alliances into sources of advantage for the OEMs. From an OEM's perspective, new product and process innovations of suppliers affect manufacturing productivity, cost of production and, the OEM's ability to utilize automation in the production process (Clark et al., 1987). Long term financial health of suppliers is vital for them to make continued investments in these innovations. Also, product designing and process automation abilities are distinctive to, and embedded in, specific partnerships in the form of engineering know-how, information systems and supplier management skills. While this study attempts to observe and measure some of these skills, it does not imply that such capabilities can easily be replicated (Dyer, 1996). These skills and knowledge are not easily imitable in the short run as they represent deliberate investments made over time (Dierickx & Cool, 1989). And hence to date, Japanese vertical exchange practices continue to be "strategic

capabilities", aiding firms like Toyota (and its suppliers) earn sustained above-normal returns.

7.3 Contributions to Practitioners

Within the specific context of the Home Appliance industry, industry executives are keen to learn what the norms of others in the industry are (with regard to supplier relationships) and how these norms are changing. More importantly, the results of this project would be placed in a comparative context with supplier relations of other industries such as the automobile industry. Automobile assemblers have learned the hard way that "attention to supplier performance" is a necessary condition for reaping benefits from these cooperative alliances.

The Association of Home Appliance Manufacturers (AHAM) and its supplier division conduct OEM-supplier forums in their annual meetings. These forums and other association sponsored events focus on identifying how to make the OEM-supplier relations more smooth and cooperative. The association officers have informed this study's researchers that this issue is of topical priority to the industry. In particular, industry experts are keen that none of the mistakes made by the automobile industry is repeated here. Industry trade journals pay significant attention to the new, evolving role of suppliers in OEM's product management activity. Suppliers are making customer-specific investments in order to improve the appliance's product positioning. In light of this intended industry-wide strategy of promoting closer OEM-supplier ties, this study and its findings make the following specific contributions to practitioners.

The survey finds that the average duration of the OEM's contract with suppliers is ten months. The corresponding figure in the automobile industry is two and a half years. While it is true that respondents have reported on fifteen-year old customers (on an average), this study finds that formal contract duration is just as important to materials suppliers as volume stability. Longer contractual duration reduces volume uncertainty for suppliers. The guaranteed volume that accompanies longer contract term allows the supplier to recoup any investment in specialized assets. As a result, increasing contracting duration under conditions of asset specificity signals OEM's commitment to the association. The supplier, in turn, would be motivated to cooperate with the OEM in value analysis and engineering endeavors. Therefore, it is in the interest of the OEMs to increase formal contract duration with suppliers.

A resounding result of the study is the one on supplier stock holding levels. Both materials and component suppliers carry, on an average, thirty days' production in processed and finished goods. While the average supplier makes 3.5 deliveries per week, some 15% of component suppliers make nearly 2.5 deliveries per day. Furthermore, nearly a third of parts suppliers' production schedules and over one-fifth of materials suppliers' schedules get altered by the OEMs. Statistical analysis clearly indicates that greater volume stability would improve supplier profitability for both groups. Therefore, any attempt by the OEM to stabilize schedules as far ahead as possible would vastly reduce the inventory burden of the suppliers. This in turn would significantly improve the suppliers' profitability and morale.

Also, the study reveals that only twenty of nearly three hundred respondents received any financial support from their OEMs for investments in capital assets. Where

OEMs expect their suppliers to step up their R&D / engineering capability and participate in new product design and value analysis, this lack of financial support proves detrimental to both parties. Recent industry trends do indicate that the OEMs expect their suppliers to develop cost efficient and quality enhancing materials and components. To develop these capabilities, the supplier has to invest in specialized assets such as CAD / CNC / CAM equipment. Financially strong suppliers such as Dow Chemicals are an exception rather than the rule in this industry. The OEMs on the other hand include firms such as Whirlpool, GE Appliances, Maytag etc. Therefore, any financial support from such strong customers would not only improve supplier productivity but would also increase supplier commitment to the relationship. This is because, long term loans or cheap equity signal reciprocal commitment on the part of the OEM to the exchange. Suppliers would then not hesitate to improve their innovativeness (for the benefit of the customer) or to share cost information with the OEM. Given the experience of the automobile industry, purchasing managers of appliance manufacturers would very much be serving OEM interests by promoting the practice of financial support for vital suppliers.

Finally, the study's analysis appears to indicate that materials suppliers have a very different association with their OEM-customers than component suppliers. Both descriptive statistics and regression analysis suggest that materials suppliers have an arms-length, market based relationship with their OEMs. Even though these suppliers have reported on OEMs who have been their customers for over fourteen years (on an average), it seems that the former have to win the OEMs' business repeatedly in a competitive environment. It could be that the suppliers' products are considered to be

generic "commodities" (such as steel, plastic, resin etc.) that can be distinguished only on the basis of price. However, it is essential to point out here that very similar (processed materials) suppliers in the automobile industry evolved into first-tier suppliers because of the value they added to the exchange. Even within the appliance industry, there is increasing pressure to develop better performing materials that improve the quality and cost of the final products. Consequently, the appliance OEMs may be pleasantly surprised by the cooperative inputs from suppliers if they (the OEMs) move to a closer, collaborative association with materials suppliers. Statistical analysis of the data suggests that materials suppliers may particularly value extended contract duration with the OEMs. Therefore, as observed earlier, OEMs (and their purchasing managers) need to explore the possibility of increasing their contract duration from ten months to over a two-year period.

7.4 Limitations of the study:

A main limitation of this study is the size of the final sample used for statistical analysis. Even though the sample is large enough to perform multivariate analysis, it is not so large as to permit generalization of the study's results. In particular, a larger sample would facilitate stronger assertion of the results on the two supplier groups.

A second shortcoming of the study is that it is a cross-sectional one. That is, data on all the relevant measures have been gathered at a single point in time. As a result, it is only possible to make predictions regarding relationships between variables. It is essential to have time series data in order to ascertain if these relationships truly bear out. Ideally, if the data are gathered over repeated periods of time, it would also be possible to

obtain a clearer picture of the inherent dynamics. Most of the hypotheses in this study are based on the TCE reasoning of a good fit between transactional attributes (in terms of asset specificity) and governance features – so as to minimize transaction costs. Cross-sectional data however cannot identify if the supplier has undertaken specialized investments after establishing a productive relationship with the OEM-customer or, if a cooperative association emerged after the supplier committed to investing in specialized assets. In other words, the data do not throw any light on the evolution of the association and the time-sequencing of events. Time series data, in this context, would make it possible to check for cause-effect relationships. This way, researchers could learn more about antecedents that promote the development of productive vertical alliances in any industry. In fact, many descriptive works on long-term contracts analyze contracts written over five to ten- year periods.

Another limitation of the study is that it is a single-industry one. Besides the issue of sample size, this characteristic places a significant constraint on the generalizability of its results. In particular, the study's relevance is limited to industries with similar contexts. That is, the buyers' activity in the production chain must be one of assembling all the parts that make up the final product. It is in this situation that supplier activity gains strategic significance. The inherent quality of the end-product is largely dependent on the quality and performance capability of its components. More generally, this study and its findings are pertinent to industries where the relative value-added by supplier inputs is quite high (Harrigan, 1983).

However, there are some industrial contexts where these conditions do not apply. That is, the value added by the buyer to the product is higher than that of the supplier.

These are industries where the buyers process the supplier's materials (using technology) to create the end-product. Consequently, the performance of this downstream product may largely be dependent on the processor's technology. Examples include pharmaceutical companies that use extensive research to make medical drugs from commodity chemicals and firms that manufacture microprocessor chips. It is not as if suppliers are not essential in these cases. But, such suppliers do not directly affect the competitiveness of downstream companies.

The research model in this dissertation focuses mainly on governance choices of both buyers and suppliers that translate to "conduct" variables. Some "structure" variables used in the model as controls include size of the supplier firm, OEM replacement time, and number of firms that compete with the supplier for the OEM's business. As mentioned in Chapter Four, it would be helpful to have additional measures of "structure" variables to add to the explanatory power of the model. In particular, it would be appropriate to include structural measures that explain variations in supplier profitability. Choice of relevant governance mechanisms to smooth trade between the two parties is only one source of efficiency in the vertical market. Suppliers may be able to enhance their competitiveness by reaping economies of scope or by having access to cheaper factors of production. Also, volatility in the industry in terms of demand fluctuations and speed of technological change can be expected to influence supplier's performance. Inclusion of measures that capture production efficiencies and industry parameters would therefore add to the significance of the model.

Finally, critics can easily argue that this study addresses only one side of the equation, namely, the supplier's side. All the data on explanatory variables (pertaining to

the OEM-supplier exchange) have been gathered from the supplier's perspective. If the same information can be obtained from the OEM's perspective as well, it would add to the objectivity of the data. This in turn would add to the reliability of the results. However, from a practical standpoint, the supplier respondents may not be willing to reveal the identity of their OEM customers. Therefore, surveying distinct or independent groups of suppliers and OEMs would be the only alternate method of data collection. A potential problem here is that the OEM and supplier may not be reporting on a one-to-one basis; (i.e.) the data do not represent matched-pair sample. Also, the objective of this research is to ascertain the association of new buyer-supplier regimes with supplier profitability. In particular, it aims to determine what mechanisms suppliers need in order to participate in a collaborative exchange with the OEMs. Gathering data from the supplier's perspective serves both of these purposes.

In this context, it is essential to point out that the study directly assesses the value of these close alliances with OEM-customers only from the supplier's perspective. While conceptual arguments are made as to the benefits of these alliances for OEMs, no empirical evidence of these benefits has been obtained. Benefits enjoyed by OEMs usually take the form of better product quality, design, lower inventory costs on account of just-in-time inventory, and lower manufacturing costs on account of value analysis. However, since data from the OEMs have not been gathered, the actual costs and benefits from their perspective are not represented in this study.

7.5.0 Areas for future research:

Some of the limitations mentioned in the previous sub-section also generate opportunities to undertake further research in this area. In particular, a study of immediate interest would be one where data on the contents of this survey are collected for a subsequent time period. Such a study (within the appliance industry) would serve the purpose of creating a time series dataset on the relevant variables. Also, such a follow-up survey would be in line with other works in this area. The survey used in Helper (1991) and Helper and Sako (1995) is a case in point.

Having a time series dataset would prove beneficial to explore other important (related) questions in this area. One such research question relates to the sustainability of enhanced performance accruing from such strategic vertical alliances. The results of the current study reveal that non-verifiable safeguards, increased buyer dependence, and information exchange serve to improve supplier profitability. Therefore, it justifies any specialized investment that the supplier might undertake for the benefit of the OEM-customer. A very important issue to address here is if these effects persist. Time-series data would allow for testing the persistence of these effects. The more persistent the above-mentioned effects, the more valuable long term vertical alliances are for suppliers. A second question that needs to be addressed is the perplexing nature of results on verifiable safeguards and relationship length in this study. Results indicate that contract duration and quantity-take requirements do not directly influence supplier performance, while a long-term association with the OEM-customer actually harms supplier interests. Longitudinal analysis of these effects would enhance the researchers' understanding of buyer-supplier dynamics in this industry. In particular, it is essential to ascertain if these

effects persist. It would also be interesting to see if the norms in this industry have changed to incorporate longer contract terms – as seen in the automobile industry.

Addressing the above-mentioned issues makes it relevant for the researchers (to use the time-series data) to study the accompanying causal linkages in this industry. As mentioned in sub-section 7.4, a limitation of this study is that all the hypothesized relationships are tested with cross-sectional data. Analyzing the cause-effect relationship among these variables would contribute significantly to a better comprehension of the surprising findings of this study. In particular, it is important to assess if investments in OEM-specific assets motivate the OEM-customer to treat the suppliers better – in terms of longer contracts, quantity agreements, and volume stability. Alternately, it is possible that suppliers undertake specialized investments only for those OEMs that treat them fairly or with whom they have a good working relation. Fair treatment or good working relationship could be measured in terms of contract term, length of association, pricing flexibility, early supplier involvement in product design, joint price determination etc. More generally, the issue here is whether certain governance attributes encourage / cause high levels of asset specificity or, do requirements of asset specificity determine OEM's choice of governance mechanism. Establishing a clear causality in the relationship between these variables (through structural equation modeling or path analysis) would help managers make more efficient choices. In the context of verifiable safeguards, a unilateral effort on the part of OEMs to increase contract duration or to provide technical / financial support might motivate the suppliers to invest in value-enhancing specialized assets. Also, one guiding theme of this research is that the presence of reciprocal commitment and dependence on the part of the OEM-customer encourages the supplier

firm to share information on production parameters. [Of course, the joint presence of both these factors contributes to superior supplier performance]. Again, the availability of time-series data would help establish the causality in the relationship among these constructs.

Another extension of this research is to ascertain the effect of vertical alliances on alternate outcomes of the exchange. That is, given that the unit of analysis is "buyer-supplier" exchange, the effect of its attributes on other dependent variables can be assessed. In particular, it would prove interesting to study the effect of changing safeguards (such as increased contract duration) and target pricing on supplier innovativeness. In order for the OEM to benefit from this alliance, it is very vital that the supplier contributes in terms of improved production process or product design. Therefore, a key parameter that the OEM would use to evaluate the performance of the supplier would be the latter's innovative capability. In fact, such capability would also, to a large extent, determine the sustainability of vertical alliance as a viable alternative to vertical integration.

A second outcome to study would be the effect of information exchange and use of target pricing on end-product performance. The conceptual reasoning behind the use of information exchange and target pricing is that they enable the creation of a "see through value chain". This in turn allows the parties to jointly reduce costs and avoid double marginalization. It would prove useful to back this reasoning with some empirical evidence on the performance of the downstream product. In particular, with the availability of longitudinal data, the product cost and pricing effects of target pricing and information exchange can be well ascertained. A third question to address would be: has

OEM-commitment to suppliers changed over time in terms of financial and technical support? Given the current (profound) lack of financial assistance from the appliance OEMs, this would be an important issue to keep track of. In particular, it would then be possible to check whether supplier profits actually improve if they share their cost information under conditions of increased OEM commitment to the exchange.

Another feasible extension of this study is to survey the OEMs on the very same issues. In fact, such a survey would probably increase OEM awareness of the significance of some of the support mechanisms. As mentioned earlier, information from the OEM's perspective would make the study more well-rounded, given that the unit of analysis is OEM-supplier exchange.

A broader conceptual extension of this work would be to focus on other sources of contractual incompleteness and the role they play in determining the viability of these long-term vertical relations. It is "incompleteness" accompanying these relationships that proves to be a primary source of transaction costs – both ex ante and ex post costs. As a result, incompleteness also determines when the limit to this intermediate form of governance is reached. The source of incompleteness focused in this study is "verifiability of parties' obligations". Other sources include ability to specify future contingencies and negotiating an agreement on them (Hart and Holmstrom, 1987). Just as informal mechanisms minimize the problems emerging on account of "verifiability" requirement, some mechanisms (and concomitant literature) must prevail to improve negotiation of an agreement. Exploring these venues would contribute to our understanding of how to make strategic vertical alliances more viable and sustaining.

In conclusion, addressing the intricacies of governing buyer-supplier exchange is very relevant and topical for many modern corporations. Different industries have developed distinctive norms and practices that characterize this exchange. Both practitioners and researchers have a lot to gain from studying this area.

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APPENDICES

APPENDIX A

A RESEARCH STUDY OF THE PERFORMANCE IMPLICATIONS OF LONG TERM OEM-SUPPLIER NEXUS

** DIRECTIONS **

The purpose of the survey is to better understand the inherent aspects of OEM-supplier relations in the Home Appliance Industry and to study their impact on supplier performance. For the purposes of the study, the following definitions hold:

OEM:	Original Equipment Manufacturer
Exchange Relationship:	An on-going trading / business association between your firm and **a particular, external** OEM-customer.
Component(s):	Manufactured item(s) provided by your firm that are installed as parts of an intermediate or end product.
Black box component or system:	A component or system whose broad performance requirements are provided by the OEM-customer, while the detailed design and engineering tasks are undertaken by your firm.

In this survey, you will be asked to report on various aspects of your firm's relationship with one specific, external OEM-customer. To this end, we would like you to focus on one such customer that satisfies the following criteria:

(i) An on-going, major OEM-customer of your firm;
(ii) A customer, whose business with your firm, you are most familiar with.

For the chosen OEM-customer, if you sell multiple products, consider only one product that is typical and representative of your firm's activities in answering the questions. Also, if your company has multiple divisions / profit centers, please respond with respect to ONLY ONE SUCH DIVISION you are party to.

This OEM-customer would be your referent for the survey. You are not required to reveal the identity of the customer or the product anywhere in the questionnaire. Please answer **all the questions,** even if it means having to make some estimates. If you wish to comment on any question or qualify your answers, please use the margins or the last page so that we can incorporate these issues in our study.

As the survey is being mailed to a select set of firms, **your participation is quite crucial for the successful completion of the study**. It will take you approximately fifteen minutes to complete the questionnaire. **All participating firms will receive summary results of the study on its completion. The survey results will also be published in APPLIANCE magazine.**

If possible, please return the completed survey within ten days of receiving it. **We would like to thank you in advance for your cooperation!** If you have any questions about the survey, please feel free to contact:

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*** PLEASE DETACH THIS SHEET WHEN MAILING THE SURVEY BACK ***
THANK YOU !

SECTION - 1: EXCHANGE RELATIONSHIP

In this section, we would like you to respond to questions on the basic features of your firm's association with the OEM-customer:

1(a) For how many years has your firm had a supply relationship (of any part / component) with the OEM-customer?

_____ YEARS

(b) In your perception, how long will your firm continue to do business - with regard to any part / component - with this customer? (please circle the number of your answer)

1 ONE YEAR OR LESS
2 MORE THAN ONE YEAR UPTO FOUR YEARS
3 FIVE TO TEN YEARS
4 MORE THAN TEN YEARS

2(a) Does there exist a written, binding (formal) agreement between your firm and this OEM-customer? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, please indicate the duration of the current agreement / contract with this OEM-customer:

_____ MONTHS

3. What was the duration of your firm's agreement / contract with this OEM-customer five years ago? [If your firm did not do business with this customer five years ago, please indicate the length of the earliest contract signed]

_____ MONTHS

4(a) Does the current agreement contain any "specific quantity" that the OEM-customer is obligated to take from your firm? (Please circle the number of your answer)

1 YES
2 NO

(b) If YES, and the "specified / minimum quantity" is expressed in the contract as a percentage of the customer's requirements, please indicate such percentage:

_____ PERCENTAGE POINTS

(c) If YES, and the required quantity is specified any other manner, please indicate the requirements in such manner:

5. What is the annual total dollar value of your division's / firm's sales (of all products) to this OEM-customer?

$ _____

Product Development

6. What kind of activity does your firm undertake in its supplying function? (please circle the number of your answer: you may circle more than one)

1 Contract assembly of a complete product
2 Assembly of a sub-system for a complete product
3 Manufacture of a component to be fitted into a sub-system
4 Supply of processed materials such as metals, plastics, resin etc.
5 Discrete treatment using special technology such as heat treatment, machining, plating, metal stamping, fabricating, press work, forging, welding, casting etc.
6 Discrete tools such as fasteners, wires, rivets, etc.
7 Others (please specify)

7. With regard to the product you supply this particular OEM-customer, which of the following best applies to the design activity? (please circle the number of your answer: you may circle more than one)

1 OEM-customer provides detailed design / drawings of the part;
2 Both the customer and your firm contribute equally to the design and engineering of the part;
3 Black box part
4 The part is entirely based on your firm's proprietary technology
5 Others (please specify)

8. In your perception, how many other firms are currently:

supplying a product similar to your product to this customer _____ NUMBER
producing a product similar to your product in the market _____ NUMBER

9. What is the nature of the product your firm supplies? (please circle the number of your answer)

1 Customized to the particular OEM-customer's needs
2 Standardized, off-the-shelf product
3 Any other (please specify)

Pricing Policy

10(a) For the version of the product you currently supply this OEM-customer, has your firm ever been allowed price increases? (please circle the number of your answer)

1 YES
2 NO

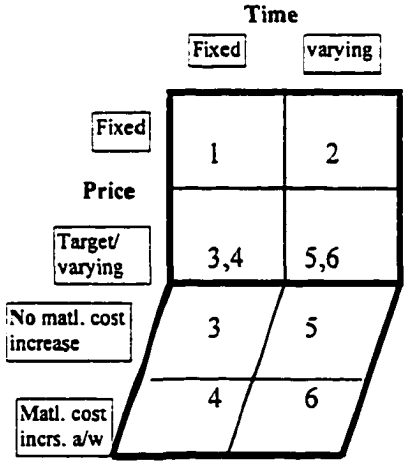
(b) If YES, in the past five years, how many price increases has this customer allowed for the product in question?

_____ NUMBER

(c) Which of the following items do the price increases typically relate to? (please circle the number of your answer; you may circle more than one)

1 Increases in Material / Energy costs
2 Increase in design / engineering costs
3 Increases in plant labor or overheads
4 Increases in administrative or marketing costs
5 Increases in interest costs
6 any other (please specify)

11. Which of the following best characterizes the pricing terms in your business dealings with this OEM-customer? (please circle the number of your answer)



0 MARKET price at any time
1 FIXED (cost-based) price over fixed time periods
2 FIXED (cost-based) price with PERIODIC allowances for input price increases
3 TARGET Price to be achieved over fixed/given time, with cost saving incentives, but no allowances for material cost increases
4 TARGET Price to be achieved over fixed/given time, with cost saving incentives, and allowances for material cost increases
5 TARGET pricing, with continuous price improvements & cost saving incentives, but no allowances for material cost increases
6 TARGET pricing, with continuous price improvements & cost saving incentives, and allowances for material cost increases
7 Any other (please specify)

12. What was the actual sale price of your product to this customer five years ago?

$ _____ SALE PRICE

(Use your conventional unit of sale: e.g., per unit / per '000 / per ton etc.)

13. Please indicate the actual sale price of the product to this OEM-customer in 1995, and the (targeted or fixed) price agreed upon for 1995 in your current contract:

$ _____ ACTUAL SALE PRICE IN 1995
$ _____ PRICE AGREED FOR 1995 (if applicable)

(Use the same unit of sale as in Question 12)

SECTION - 2: PRODUCTION INFORMATION EXCHANGE

In this section, we would like to ask you a few questions regarding the information your firm and the OEM share with each other, as this is a critical aspect of an on-going business association.

14. Does the OEM-customer provide you with a product requirement release / schedule in advance to assist your production planning? (please circle the number of your answer)

1 YES
2 NO

15(a) On an average, does the customer make any alterations to the product requirement it gives your firm? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, on an average, what percentage of these product requirement schedules get altered?

_____ PERCENTAGE POINTS

16. Please indicate your firm's position with regard to each of the following: (circle one)
Answer categories: 0 - Not at all 1 - To a very little extent 2 - to a little extent
3 - to some extent 4 - to a large extent 5 - to a very large extent

Is your firm expected to provide a breakdown of the various production process steps to the OEM-customer?	0	1	2	3	4	5
Does your firm actually provide a breakdown of the production process steps to the OEM-customer?	0	1	2	3	4	5

17(a) Does your firm provide cost information with regard to the above-mentioned production process steps to the OEM-customer? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, what kind of cost information do you share with the OEM-customer? (please circle the number of your answer: for this question, you may circle more than one)

1 Material / Energy cost
2 Design & Engineering costs
3 Production process step costs (in terms of direct and indirect labor, inventory carrying costs, plant overheads)
4 Administrative and Marketing overheads
5 Interest costs
6 Others (please specify)

(c) With regard to each of the above, in your perception, how proprietary is the nature of cost information shared?
Answer categories: 0 - Not at all proprietary 1 - Least proprietary 5 - Very proprietary

1	Material / Energy cost	0	1	2	3	4	5
2	Design & engineering costs	0	1	2	3	4	5
3	Production process step costs (in terms of direct and indirect labor, inventory carrying costs, plant overheads)	0	1	2	3	4	5
4	Administrative and Marketing overheads	0	1	2	3	4	5
5	Interest costs	0	1	2	3	4	5
6	Others	0	1	2	3	4	5

18. Does your firm and the OEM-customer make use of the above information in arriving at the sale price of your product through a bilateral negotiation process? (Please circle the number of your answer)

1 YES
2 NO

SECTION - 3: INVESTMENT IN EXCHANGE RELATIONSHIP

Having understood the operational aspects of your firm's association with the OEM-customer, we would now like to learn about the investments that both firms make in this exchange relationship.

19. Please indicate the percentage of your production dedicated to this OEM-customer in 1995:

_____ PERCENTAGE POINTS

20(a) Does there exist any Electronic Data Interchange (EDI) between your firm and the OEM-customer? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, what percentage of the total expense incurred to set up the EDI linkage was borne by your firm?

_____ PERCENTAGE POINTS

21. What is the approximate (to the closest thousand) dollar value of your investment in setting up the EDI linkage? (please circle the number of your answer)

1 LESS THAN $ 5,000
2 5,000 - 10,000
3 10,000 - 25,000
4 25,000 - 50,000
5 50,000 - 100,000
6 OVER $ 100,000

22. Please indicate the level of your firm's investment for each of the following: (circle one for each question): Answer categories: 0 - Not at all 1 - Very little extent 2 - Little extent 3 - Some extent 4 - Large extent 5 - Very large extent

Has your firm made investments in tooling, equipment, or R&D projects that are specialized to the needs of this customer?	0	1	2	3	4	5
Has your firm developed systems (inventory and production planning) or procedures that are unique to the needs of this customer?	0	1	2	3	4	5
Has your firm set up cross-functional teams within the organization to better serve the needs of this customer?	0	1	2	3	4	5
Has your firm undertaken investment in CAD/CAM/CNC or any other technique to participate in the design stage of customer's product development activities or to provide technical support to the customer?	0	1	2	3	4	5

23(a) With regard to any one time investment such as CAD/CAM/CNC equipment, special machinery, or, software package, does the OEM-customer participate in such investments? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, please indicate the portion of such one-time capital expenditures borne by the OEM-customer (as percentage of total expenditure):

_____ PERCENTAGE POINTS
(% OF TOTAL INVESTMENT)

24. What is the distance between your plant / warehouse and the OEM's major plant that it supplies?

_____ MILES

25(a) Has the OEM-customer given any long-term loans or soft loans (loans with subsidized interest rates) to your firm? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, please indicate the approximate dollar value of such loans to the closest thousand:

_____ ($, in '000s)

26(a) Has the OEM-customer made any equity investment in your firm? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, please indicate the approximate percentage of your firm's equity owned by the customer:

_____ (PERCENTAGE POINTS)

27. If the OEM-customer were to switch its business from your firm, in your opinion,

(a) how long would it take for your competitor to start making regular supplies suited to the needs of the OEM?(consider redesign of component, retooling of equipment)

_____ MONTHS

(b) how long would it take your firm to replace this OEM-customer with another customer?

_____ MONTHS

28. If your competitor were to offer a lower price for a product of equal quality as yours, in your opinion, will the OEM-customer (please circle the number of your answer)

1 help you match the competitor's effort
2 switch to the competitor as soon as is technically and legally feasible
3 any other (please specify)

SECTION - 4: PERFORMANCE REQUIREMENTS

An important aspect of the project is to study the effect of OEM-Supplier relationship attributes on supplier performance. In this regard, we would like to ask you the following questions:

29(a) How many deliveries per week of this product does your plant make to the OEM's plant?

_____ (NUMBER)

(b) IF your plant supplies on a DAILY basis, please indicate number of deliveries made to the OEM's plant per day:

_____ (NUMBER)

30. On an average, what are your plant's (the plant which supplies this OEM-customer) inventory holding levels?

WORK-IN-PROGRESS _____ (days' production)
FINISHED GOODS _____ (days' production)

31(a) Does your firm provide on-going technical assistance to this OEM-customer? (please circle the number of your answer)

1 YES
2 NO

(b) If YES, on average, how many of your R&D / engineering / manufacturing personnel work regularly on technical issues or are in communication with the customer?

_____ (NUMBER)

SECTION - 5: BACKGROUND DATA

Finally, to aid us in the interpretation of results, please provide the following information about your firm and yourself.

32. What is the total number of employees in your firm? _____ (NUMBER)

33(a) How many regular customers does your firm have? _____ (NUMBER)

(b) What percentage of total annual sales do your number one through number three customers account for? _____ (PERCENTAGE POINTS)

34. What is the approximate 1995 unit market price of the OEM-customer's end product that contains the materials / component / system that you supply?

$ _____

35. Over the past three years, on an average, what has been your firm's before tax (after interest costs) profit as a percentage of sales?

_____ (% OF SALES)

36. What is the total dollar value (to the closest thousand) of your firm's investment in physical assets such as land, building, plant, machinery, CAD/CAM/CNC and other software equipment, and working capital for the year 1995?

_____ ($, in '000s)

37. What is the total dollar value (to the closest thousand) of your firm's total sales in 1995?

_____ ($, in '000s)

38. What is the highest level of education you have completed? (please circle the number of your answer)

1 SOME HIGH SCHOOL
2 COMPLETED HIGH SCHOOL
3 SOME COLLEGE
4 COMPLETED COLLEGE
5 SOME GRADUATE WORK
6 GRADUATE DEGREE

39. How many years of work experience have you had in the following two instances :

With the current firm _____ YEARS
In the current position _____ YEARS

Your contribution to this research effort is greatly appreciated. Please detach the top sheet (pages 1 and 2), and return the questionnaire in the enclosed, self-addressed, postage paid envelope.

Additional Comments are welcome:

We would like to sincerely thank you for the time and effort you have taken to complete this survey!

** DIRECTIONS **

The purpose of this follow-up survey is to help us identify links between the inherent features of OEM-supplier relations and supplier performance. **As this part of the project builds on your previous responses, we would like you to use the same OEM-customer that you used as your referent for the earlier survey.** You are not required to reveal the identity of the customer or your product anywhere in the questionnaire. Please answer **all** the questions; if you wish to comment on any question or qualify your answers, please use the margins so that we can incorporate these issues in the study.

As we are mailing this follow-up questionnaire only to respondents of the earlier survey, **your participation is critical for the successful and meaningful completion of the study.** We would like to thank you in advance for your cooperation!

1. Please indicate your firm's position with regard to each of the following: (circle one)
   Answer categories: 1 - Decreased to a large extent 2 - Decreased to a small extent 3 - stayed the same
   4 - Increased to a small extent 5 - Increased to a very large extent

Over the past 3 years, how has your firm's sales to this OEM-customer changed?	1	2	3	4	5
Over the past 3 years, how has the per unit production cost of the product you supply this OEM-customer changed ?	1	2	3	4	5
Over the past 3 years, how has the margin that your firm makes in relation to this OEM-customer's business changed ?	1	2	3	4	5
Over the next 3 years, how do you foresee your firm's sales to this OEM-customer changing ?	1	2	3	4	5

2. How would you compare the (pre-tax) return on sales from this OEM-customer's business with your firm's overall (pre-tax) return on sales ? (please circle one)

   1 - 20% to 10% **lower** than overall firm profitability
   2 - 10% to 5% **lower** than overall firm profitability
   3 - About the **same** as overall firm profitability
   4 - 5% to 10% **higher** than overall firm profitability
   5 - 10% to 20% **higher** than overall firm profitability
   6 - Any other **(please specify)**

3. Over the past three years, on an average, what has been the pre-tax profit (after allocated overheads) relating to this OEM-customer - **as a percentage of sales?**

   _____ (PERCENTAGE POINTS)

4. Over the past three years, on an average, by what percentage has your sales to this OEM-customer changed? (Please fill up one blank)

   _____ (PERCENTAGE INCREASE)
   _____ (PERCENTAGE DECREASE)

5. By what percentage do you expect your firm's sales to this OEM-customer change over the next three years? (Please fill up one blank)

   _____ (PERCENTAGE INCREASE)
   _____ (PERCENTAGE DECREASE)

APPENDIX B

PURDUE UNIVERSITY

SCHOOL OF MANAGEMENT
KRANNERT GRADUATE SCHOOL OF MANAGEMENT

«FirstName» «LastName»
«JobTitle»
«Company»
«Address1»«Address2»
«City» «State»

May 10, 1996

Dear Respondent «LastName»:

We are writing to you about a research project on OEM-Supplier Relations and Supplier Performance that we are undertaking at the Krannert Graduate School of Management, Purdue University. The term "supplier performance" typically refers to the supplier's ability to deliver low cost, high quality, and innovative products to the OEMs. Very little attention has been paid to the effect of increasingly popular JIT practices on supplier's competitiveness (in terms of market share, profitability etc.). As an executive working in the area of OEM-supplier interface you may well be grappling with these issues on a day-to-day basis. In this project, we expressly address these issues, and underscore the need to pay attention to supplier performance / operations for such cooperative alliances to be a source of mutual advantage.

The enclosed survey is a crucial part of the project, and it is being sent to select firms serving as suppliers to OEMs in the Home Appliance Industry. **APPLIANCE magazine is very interested in the project, and will publish the survey results.** The project, in its entirety however, is the sole responsibility of the concerned staff / faculty of Purdue University. Specific issues of the OEM-Supplier relationship that would be focused on include operational aspects such as duration of the relationship, product development activities, pricing policy, and production information exchange between the OEM and the supplier. Relationship-specific investment made by both the parties and the performance requirements of the supplier are the other two main areas of study. It is, therefore, critical that an executive involved in strategic activities for your firm (such as the Marketing Director or the CEO) complete the questionnaire. However, if you feel someone else in your organization is better equipped to answer the questions, please pass the survey on to such a person.

As the survey is being mailed to a limited number of firms, **your participation is of utmost importance for the successful completion of the study.** It will take you approximately fifteen minutes to complete the questionnaire. **All participating firms will receive summary results of the study on its completion.**

PURDUE UNIVERSITY

SCHOOL OF MANAGEMENT
KRANNERT GRADUATE SCHOOL OF MANAGEMENT

We also guarantee complete confidentiality of the information you provide. The responses to the survey will be used for academic research purposes only. Your firm's identity will not ever be reported. The identification number on your questionnaire is for mailing purposes only. All company names will be removed from the data even for academic reporting. The focus would instead be on mean responses in the industry. Also, only the undersigned will ever have access to the data.

We would greatly appreciate it if you could complete the questionnaire and return it in the enclosed self-addressed envelope within ten days of receiving it. Please feel free to call us at (317) 494-4441 or (317) 743-4216 if you have any questions. Thank you in advance for your time and effort.

Sincerely,

Raji Srinivasan
Project Director

Thomas Brush
Assistant Professor of Strategic Management

PURDUE UNIVERSITY

SCHOOL OF MANAGEMENT
KRANNERT GRADUATE SCHOOL OF MANAGEMENT

«FirstName» «LastName»
«JobTitle»
«Company»
«Address1»«Address2»
«City» «State»

May 17, 1996

Dear Respondent «LastName»:

Last week, we mailed you a questionnaire seeking your response on various aspects of your firm's relationship with an OEM-customer. Your firm was chosen because of it being listed in the Appliance Industry Purchasing Directory (January 1996), published by APPLIANCE magazine.

If you have already completed and returned the questionnaire, please accept our sincere thanks. If not, we would appreciate it if you could so at your earliest convenience. The questionnaire has been sent to a limited, but representative, set of firms listed in the Directory. It is, therefore, very important for your response to be included in the study if its results are to accurately represent OEM-Supplier practices in the Appliance Industry.

If you have not received the questionnaire, or if it has been misplaced, please call us at (317) 743-4216, and we shall mail you one immediately. Thank you for your time and assistance. We appreciate your participation in Purdue University's OEM-Supplier Relations Study.

Sincerely,

Raji Srinivasan
Project Director
e-mail:
srinivar@mgmt.purdue.edu

Thomas Brush
Assistant Professor of Strategic Management
brusht@mgmt.purdue.edu

«FirstName» «LastName»
«JobTitle»
«Company»
«Address1»«Address2»
«City» «State»

June 06, 1996

Dear Respondent «LastName»:

About three weeks ago we wrote to you seeking your response on various aspects of your firm's association with an OEM-customer. As of today, we have not received your response. We hope that you would take a few minutes to complete the enclosed questionnaire.

Our OEM-Supplier Relations Study attempts to help business practitioners and academics understand how JIT (just-in-time) practices affect some supplier firms differently than others and, how some firms are better than others at making buyer-supplier alliances work to mutual competitive advantage. Individuals such as yourself have, over time, developed a unique perspective on what makes some buyer-supplier associations work better than others.

We are writing to you again because of the significance that your response has to the usefulness of the study. This survey was mailed to only select firms serving as suppliers to OEMs in the Home Appliance Industry. For the study's results to be truly representative of OEM-Supplier practices in the Appliance Industry, it is very important for your response to be included in the study. If you think it would be more appropriate for a colleague in your firm to complete the survey, we would be grateful if you could pass it on.

You are assured of complete confidentiality. Neither your nor your company's identity will ever be revealed as respondents to the survey. The focus instead would be on mean responses to the study.

If you have any questions with regard to the enclosed questionnaire, please call us at (317) 743-4216. We will be happy to answer any questions you have. **Your cooperations is greatly appreciated.**

Sincerely,

Raji Srinivasan
Project Director
e-mail:srinivar@mgmt.purdue.edu

Thomas Brush
Assistant Professor of Strategic Management
brusht@mgmt.purdue.edu

VITA

VITA

Raji G. Srinivasan

Education

Ph.D.	Purdue University December 1998
1992-98	Major: Strategic Management
	Minor: Industrial Organization Economics
P.G.D.M*	Indian Institute of Management, Calcutta
1988-90	Major: Accounting and Finance
	* Degree equivalent to an M.B.A
B.Com	Madras University, India
1985-88	Major: Accounting

Dissertation Topic

Long term vertical alliances and supplier performance

The dissertation seeks to explain the vastly different experiences in OEM-Supplier relations in Japan and in Western economies in terms of differences in the manner in which these vertical relationships are organized in the two regimes.

Research and Teaching Interests

Strategic Management; Inter-firm organization strategies, Entrepreneurship

Publications

"Performance Determinants of Male and Female Entrepreneurs," with Arnold C. Cooper and Carolyn Y. Woo, 1994, Frontiers of Entrepreneurship Research

Work Experience

1998-99	Visiting Assistant Professor, Department of Management, University of South Carolina
1997-98	Lecturer, Strategic Management, Washington State University
1992-97	Graduate Assistant, Krannert Graduate School of Management, Purdue University

Industry Experience

1990-92 Management Accountant, Beverages Division, Lipton India Ltd. Unilever Group of Companies India

Responsible for providing cost and profit projections to the Business Head; job involved on-going coordination with marketing, sales and factory personnel to determine actual and projected figures