

Causes of Inflation in Turkey: A Literature Survey with Special Reference to Theories of Inflation

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Abstract

Turkey has experienced high and persistent inflation for more than twenty years. This paper attempts firstly to survey the extremely broad literature on theories of inflation, in order to be able to classify, understand and discuss the dynamics of inflation more carefully. It is mainly argued that inflation may be interpreted as a net result of sophisticated and continuous interactions of demand–side (or monetary) shocks, supply–side (or real) shocks, price–adjustment (or inertial) factors and political processes (or institutional factors). The second aim of the paper is to compare the existing empirical studies on Turkish inflation, by considering their sample period, data frequency, empirical methods, modeled macroeconomic variables and main results. Most of the studies reviewed here seem to have focused primarily on demand–side determinants (e.g., monetary growth and budget deficits), and partially on some supply–side factors (e.g., nominal exchange rates and oil prices). On the other hand, the components, degree and effects of inflation inertia need to be investigated in more detail. It is also noted that, in the future, the modeling attempts of the inflationary dynamics in Turkey would profit from the so–called “new political macroeconomics” because the role of the political process and institutions is not a weak explanatory factor of inflation that is easily ignored.

**MUTUAL COMMITMENT TO SUPPORT EXCHANGE:
SPECIFIC IT SYSTEM AS A SUBSTITUTE FOR MANAGERIAL HIERARCHY**

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**Mutual Commitment to Support Exchange:
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ABSTRACT

This paper examines the effects of Information Technology (IT) on the governance structure of vertically-related firms that are applying IT in search of competitive advantage via superior efficiency. By adopting transaction costs and resource-based perspectives on IT and governance, this paper examines how different types of IT systems change the boundary of the firm.

It is proposed that a highly relation-specific IT system in inter-firm transactions plays a key role in the resulting inter-firm governance as a mutual sunk-cost commitment, in terms of both less integration (i.e., change in governance mode as a first-order effect) and a smaller number of suppliers (i.e., change within a governance mode as a second-order effect). As a result, this specific IT system can be an alternative governance mode of *electronic integration* as a substitute for managerial hierarchy. In addition, if a firm-specific IT system improves efficiency of internal transactions complementarily with other firm-specific resources, it can result in a larger scale of operations conducted within the firm as a co-specialized asset.

From a strategic management perspective, this paper provides transaction costs and resource-based explanations for the organizational boundary decision and for sustainable competitive advantage of the firm. The strategic intent of searching for improved governance in acquiring and processing information while simultaneously managing economic incentives effectively continues to provide challenges for strategic management. By analyzing the effects of a relation-specific IT system on the governance of supplier-buyer relationships, this paper extends studies in organizational economics and strategic management.

MUTUAL COMMITMENT TO SUPPORT EXCHANGE: SPECIFIC IT SYSTEM AS A SUBSTITUTE FOR MANAGERIAL HIERARCHY

"Flawed" modes of economic organization for which no superior feasible mode can be described are, until something better comes along, winners nonetheless" (Williamson, 1985: 408).

"Even though technology advances breathlessly, the economic principles we rely on are durable. The examples may change, but the ideas will not go out of date" (Shapiro and Varian, 1999: x).

INTRODUCTION

This paper examines the ways in which Information Technology (IT) are changing the governance structure of vertically-related firms that are applying IT systems in search of competitive advantage via superior efficiency. More specifically, this paper analyzes the effects of information attributes that characterize vertical relationships, and the effects of different types of IT systems that are being used to complete the transactions efficiently by substituting or supporting other governance modes through "*electronic integration*."¹

Although there has been considerable discussion of the relationship between IT and organization structure, the specific mechanisms by which IT affects organization structure have not been explained in a systematic manner (Fulk and DeSanctis, 1995; Henderson and Venkatraman, 1994). The extant literature presents seemingly contradictory results, and empirical studies have produced few reliable

¹ Zaheer and Venkatraman define electronic integration as "a specific form of vertical quasi-integration achieved through the deployment of proprietary information systems between relevant actors in adjacent stages of the value chain" (1994:549). Similarly, in the current paper, electronic integration is defined as a vertical relationship through a highly relation-specific IT system that constitutes one type of hybrid governance mode.

generalizations (Attewell and Rule, 1984; Brynjolfsson, Malone, Gurbaxani, and Kambil, 1994). Thus, in order to analyze the relationships between IT and governance, the characteristics of IT and the characteristics of transactions should be examined simultaneously in a systematic way.

By adopting contractual economic perspectives on IT and governance, this paper examines the attributes of information and the role of IT in changing inter-firm relationships. For this purpose, the current paper draws from research literatures on *information economics*, *transaction costs theory*, and *dynamic resource-based theory*. First, information economics considers the economy as a system of structured information flows and provides the relative economic efficiency of the firm in terms of information searching, transferring, and processing (Arrow, 1974; Malmgren, 1961). Second, transaction costs theory, focusing on the degree of various types of asset specificity (Williamson, 1991) and coordination costs (Malone, 1987), provides governance implications for the role of IT in changing efficient firm boundaries and contractual relationships. Third, dynamic resource-based theory extends static cross-sectional explanations of the sources of competitive advantage into dynamic longitudinal explanations of the sources of ‘sustainable’ competitive advantage (Ghemawat and Leventhal, 2000; Mahoney and Pandian, 1992).

From these theoretical perspectives, the central strategic question addressed in the current paper is how IT influences vertical relationships with adjacent value-chain members in search of improved governance and competitive advantages via superior efficiency.² This research question is related to the fundamental issue of why and how two independent organizations coordinate across organizational boundaries in their value-chain activities for economic value creation.

² This efficiency approach contrasts with the "market power" explanation that emphasizes the role of monopoly power over price.

In the current paper, an IT system of a business organization is defined as a computer-based network of information that is needed to create, control, and maintain the organization's transactions efficiently, either within a firm or between firms. An IT system differs in its specificity of the investment, and depending on the relative economic costs of switching, IT systems can be categorized into two types: a “general IT system” or a “specific IT system.” Accordingly, it is argued that when the cost of switching the IT system is high due to limited inter-operability, the investment in the specific IT system constitutes a sunk-cost commitment.³

In a “*discrete structural analysis*” of alternative governance modes, Williamson (1991) emphasizes the difference between first-order economizing – i.e., getting the governance mode right – and second-order refinements – i.e., adjusting at the margins within a governance mode. In a similar vein, the use of IT may leverage a firm's capability to do business differently and create new ways to coordinate and influence inter-firm relationships through *first-order* (change in governance mode) and *second-order effects* (changes within a governance mode).

Table 1 shows definitions of four governance outcomes that are examined in the current paper along with the four corresponding propositions. Suppose t_1 represents the time of the IT investment and the period of observation is set from t_0 to t_2 . Vertical integration is defined as the change of governance mode from the Market at t_0 to the Firm at t_2 , and outsourcing is defined as the change from the Firm at t_0 to the Market at t_2 . We examine to what extent IT changes the efficient boundary in the vertical relationship as a first-order effect. When the governance mode remains as the Market, we examine to what extent IT increases the number of suppliers as a second-order effect.

³ In practice, this specific IT system is observed as an exclusive IT-based network with its unique computer software and database, like Saturn's real time automotive management IT system with member retailers.

Table 1. Definitions of Vertical Integration and Outsourcing

| | Firm t_2 | Market t_2 |
|--------------|--|--|
| Firm t_0 | Number of Employees [Proposition 2] | Outsourcing [Proposition 1] |
| Market t_0 | Vertical Integration [Proposition 3] | Number of Suppliers [Proposition 4] |

At t_1 is the time of the IT investment.

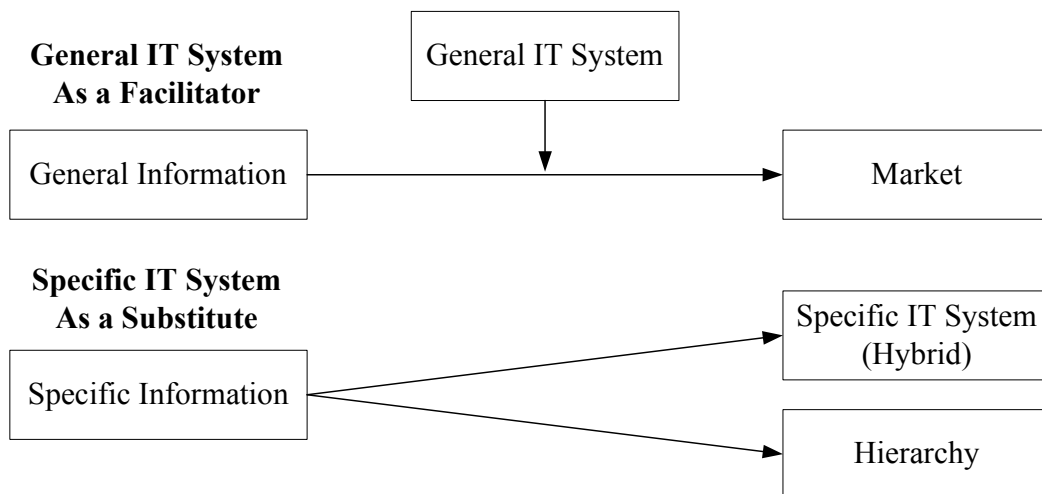
Different types of information, which characterizes the transactions, have different governance implications. General information, such as the inventory level in retail stores, is characterized as easily codifiable and separable from the agent. However, it is relatively more difficult or costly to codify or to transfer specific information, such as R&D and skills. In the case of general information that indicates low switching costs between partners, minimizing information costs will be a major concern for first-order economizing. As a result, the market will appear as a dominant governance mode that has often been observed in the vertical relationship between retailers and commodity manufactures. In the case of specific information, however, the efforts of minimizing transaction costs lead to the use of hierarchy as a dominant governance mode that has been witnessed, for example, in vertically-integrated automobile manufacturers in the United States. In this respect, the *ex post* organization structure of vertically-related firms represents an adaptive response to the information attribute of *information specificity*, which characterizes the transactions in question.

According to Williamson's (1991) *discriminating alignment hypothesis*, governance modes that are between market and hierarchy, such as franchising and joint ventures, are often referred to as hybrids. In this respect, electronic integration through a relation-specific IT system can be considered as one type

of hybrid governance mode. As presented in **Figure 1**, it is proposed here that a specific IT system *substitutes* for managerial hierarchy since it changes the current governance mode of market to a unique hybrid (through electronic integration) rather than hierarchy (through vertical integration). Thus, *a specific IT system is considered a unique governance mode* as a task of first-order economizing (i.e., a change in governance mode from market to hybrid).⁴

The current paper proceeds as follows. Section 2 provides a review of related studies in organizational economics and strategic management. In section 3, theoretical propositions are developed from information economics, resource-based theory, and transaction costs theory. Section 4 provides discussion and conclusions.

Figure 1. Hypothetical Relationships between IT and Governance Modes



⁴ Compared to previous studies on the role of general IT, the current paper focuses on the governance implication of a specific IT system as a sunk-cost commitment.

REVIEW OF THE LITERATURE

Information technology is believed to change the method and the ability to search, capture, store, and transfer information, and thereby affects the management system and organization structure (Rockart and Morton, 1984). With this important change, managing information can be viewed as a critical source of firm capabilities in inter-firm relationships, and, as a result, there has been extensive research in this strategic area.

Coordination Costs and Vertical Integration

Several studies on IT and governance structures in economics and strategic management adopt a coordination costs perspective. Some studies focus on the information costs of transacting in terms of search and communications costs (e.g., Malone, Yates, and Benjamin, 1987), while others emphasize the economic incentive costs in terms of moral hazards and opportunistic behaviors (Clemons, Reddi, and Row, 1993; Gurbaxani and Whang, 1991). For instance, Malone et al. (1987) argue that because IT leads to an overall decline in coordination costs in terms of searching and communicating with transacting parties, a reduction in coordination costs without sacrificing potential economic efficiency in production costs will generally favor external procurement over vertical integration. Both Gurbaxani and Whang (1991) and Clemons et al. (1993) propose that IT reduces transaction risks such as the contractual hazards of shirking and opportunism through improved monitoring and reduced specificity in coordination.

In order to relate these studies to the research questions of the current paper, it is useful to divide the costs of coordination into two distinct categories: internal and external coordination costs. Internal coordination costs represent the economic costs incurred for communications, data transfer, and other

economic expenditures on managing dependencies between activities. External coordination costs represent the economic costs of locating suppliers, writing contracts, and other costs of maintaining market procurement.

An IT system can reduce the economic costs of internal coordination within the firm by improving the quality and speed of information processing and management's decision making, leading to more centralized management. At the same time, an IT system can also provide management with the ability to reduce agency costs through improved monitoring capabilities and evaluation schemes, inducing decentralization of decision making. With respect to external coordination costs, IT can directly reduce market transaction costs by providing cost-effective means to access and process market information. IT also has the potential to reduce market transaction costs, since it facilitates closer inter-firm links through information sharing and mutual monitoring. Therefore, the efficient boundary of the firm is determined by trading off external coordination costs and internal coordination costs. A cost-effective IT system can reduce external coordination costs and can lead a firm to increase its use of markets. However, IT can also reduce internal coordination costs and provide management with the ability to manage a large organization more effectively. Thus, Gurbaxani and Whang correctly note that the "net effect of IT on firm size varies from situation to situation, depending on the cost structure of the firm and the modes of synergy generated by integration" (1991: 71).

Clemons et al. (1993) emphasize that IT has the ability to lower external coordination costs without increasing the contractual risks associated with market transactions, leading to more outsourcing and a less vertically-integrated firm. More specifically, lower asset specificity of IT investments and better monitoring capabilities imply that firms can more safely invest in IT for inter-firm coordination than in traditional investments for vertical coordination such as co-located facilities or specialized

human resources. Firms are therefore more likely to coordinate with suppliers rather than vertically integrate to reduce the transactional risks. This IT-based coordination also enables these firms to benefit from production economies of large specialized suppliers. In this respect, an IT system as a general-purpose investment has a disproportionate economic effect on reducing the external coordination costs, thereby favoring market procurement.

In sum, the impact of IT on vertical integration is determined by the degree to which IT changes the economic costs of internal coordination, external coordination, and production. Since production costs are generally believed to be lower for external procurement because of economies of scale and/or specialization, a more vertically-integrated firm can be viewed as having accepted higher production costs and internal coordination costs in return for lower external coordination costs. Similarly, a less vertically-integrated firm economizes on production and internal coordination costs, but incurs increased external coordination costs.

A related issue in the coordination costs approach is how IT affects the number of contractual relationships in the value chain without changing its governance mode of market transactions. Conventional economic wisdom suggests that a firm would benefit by increasing the number of its suppliers, thereby broadening the range of its choice. This number, however, is limited by organizational and technological considerations, such as the economic cost of searching and setting up a relationship.

Thus, the optimal number of suppliers is determined by trading off the economic costs of further searching against the expected economic benefits from identifying a better supplier. When a buyer can select among many suppliers, as in a market, it can secure a low production cost because of production efficiencies and competition, but it must incur relatively high coordination costs in the process. However, a single-supplier relationship restricts the buyer's choice, and the resulting long-term relationship

reduces information costs by eliminating the need to search and process information about many suppliers. Consistent with this economic logic, Malone et al. (1987) suggest that IT will facilitate a move from single-supplier arrangements to multiple-supplier arrangements, because it reduces the economic costs of external coordination with suppliers.

Several empirical studies have examined these relationships using various statistical approaches. Brynjolfsson et al. (1994) find evidence that increased IT investment is associated with decreasing firm size measured by employees per firm, sales per firm, and value added per firm. These empirical results are interpreted as decreased vertical integration, which is consistent with coordination costs arguments. Dewan, Michael, and Min (1998) also find that less vertically-integrated firms have a higher level of IT investment. Dewan et al. (1998) report that the level of IT investment is positively related to the degree of firm diversification, reflecting the greater need for coordination of resources within diversified firms. Hitt (1999) observes that an increased use of IT is associated with a substantial decrease in vertical integration. In a comparative assessment, Hitt (1999) finds that the effect of IT on lower external coordination costs is greater than the effect of IT on lower internal coordination costs.

Previous studies in the coordination costs approach, however, assume away the asset specificity of IT systems in inter-firm relationships, and ignore the potential economic costs of market transactions from the contractual hazards of holdup. These potential contractual hold-up hazards are discussed below.

Holdup Problems and Mutual Commitment

Given the prohibitively high economic costs of specifying, monitoring, and enforcing all elements of economic performance for all possible contingencies, the contractual parties resort to an incomplete contract. Because *ex ante* difficulties in contracting tend to reduce the completeness of any

contract reached, they often form part of the reasons for *ex post* difficulties in managing the resultant contractual relationship (Williamson, 1975). Thus, coordination of these *ex ante* non-contractible aspects requires frequent joint decision-making through *ex post* renegotiations between the contracting parties.

Previous studies on the economic costs of renegotiations associated with joint decision-making have recognized a specific set of conditions under which *ex post* bargaining costs increase. Specifically, at least three sources of bargaining costs have been identified: a mismatch of negotiation strategies, asymmetric information about contingencies, and uncertainty about each other's preferences (Milgrom and Roberts, 1990). These asymmetries give rise to bargaining behavior that is intended to improve one's own position at the expense of the other party's position but often erodes the total size of the pie to be divided. In particular, coordination between firms involved in the transactions of rare and idiosyncratic resources can be severely hampered by the contractual hazards of holdup and can often end up with market failure (i.e., no market exchange).

The potential remedies for the contractual hazards of holdup can be classified into two types. The first type of remedies intends to achieve a unified control, and the second type of remedies intends to build effective deterrence to holdup. When specialized assets are required due to interdependency with an adjacent stage of the value-chain, the remedy called for is to integrate into the next vertical stage to attain unified control over economically interdependent resources. Such vertical integration, however, will be very costly and is thus likely to be a sub-optimal economic solution when the (strategic) resources that the firm wants to acquire are subject to high mobility barriers (Chi, 1994).⁵

⁵ The benefit of unified control may still be partially attained through quasi-integration – i.e., the extension of a firm's control rights to a subset rather than all of the assets employed in a vertically-related operation (Monteverde and Teece, 1982). However, when there still exists significant asset interdependency between the two contractual parties under such an arrangement, quasi-integration can only reduce but cannot completely eliminate the contractual hazards of holdup.

When it is too costly to vertically integrate or to eliminate the conditions of interdependency, a firm involved in the transaction of specialized assets might try to build effective economic deterrence to contractual holdup. The key to effective deterrence is to give each contractual party sufficient means to respond to any opportunistic behavior of the other party (Williamson, 1985). There will be insufficient deterrence, however, if the economic gain that one contractual party can get from opportunistic behavior more than offsets the economic penalty the other can possibly impose. Such a situation can be remedied if the favorably- positioned contractual party provides the vulnerable party with an economic bond to support exchange (Williamson, 1983).⁶ For example, Klein and Leffler (1981) argue that franchisees may be required to make sunk-cost investments in transaction-specific capital as a way to safeguard the franchise system against free-riding and consequent quality shading.

Reciprocity transforms a unilateral relation into a bilateral relation, where both contractual parties understand that the transaction will be continued only if economic reciprocity is observed. In other words, one way to avoid contractual holdup and support exchange is for the buyer and supplier to devise a mutual reliance relationship. For example, a joint venture in which both contractual parties provide substantial amounts of sunk-cost investment can be considered as a mutual sunk-cost commitment. Thus, reciprocity or mutual commitment can serve to equalize the risk exposure of the contracting parties, thereby reducing the economic incentive of any contractual party to behave opportunistically in the exchange process.

In sum, Williamson's (1983) economic "*hostage model*" examines a market transaction in which self-enforcing agreements (Klein, 1985; Telser, 1980) involve credible mutual (sunk-cost) commitments.

⁶ Contrary to legal centralism, Williamson (1983) refers to such a contract as a "private ordering" where reliance on third-party enforcement is minimal.

One way to avoid market imperfections is to expand the contractual relationship by devising a mutual-reliance relationship, in which the potentially opportunistic contractual parties reciprocally invest in relation-specific assets that have economic value only in the market exchange in question. If the non-salvageable value of the (sunk-cost) commitment is substantial for both the buyer and the supplier, an efficient exchange outcome is to be (justifiably) expected.⁷

The key theoretical proposition offered in the current paper is that *ex ante* mutual sunk-cost investments in a relation-specific IT system undertaken by vertically-related firms result in an improved governance mode to complete the transaction efficiently as a remedy for the contractual hazards of holdup. In other words, reciprocal exposure to commit credibly to the contractual agreement is accomplished through *ex ante* sunk-cost investment in a relation-specific IT system in which high switching costs are strategically incurred if any attempt is made to change contracting parties or to opportunistically renegotiate contracts.

The Modern Property Rights Approach

The modern property rights approach elaborated by Grossman and Hart (1986) and Hart and Moore (1990) – sometimes referred to as “GHM models” – provides a formal framework for analyzing the distribution of control rights. As in transaction costs theory, GHM models assume that contracts are necessarily incomplete in the sense that the allocation of control rights cannot be specified *ex ante* for all future states of the world. In the presence of positive transaction costs, control over the productive assets cannot be affected through contractual stipulation alone, and economic efficiency depends on the ownership of the asset. Following legal convention, ownership is defined as the possession of residual

⁷ We provide a game-theoretic illustration of Williamson’s (1983) mutual hostage model in the Appendix.

rights of control, which are the rights to decide the uses of assets under contingencies that are not specified precisely in the contract. In other words, all residual rights to an asset not expressly assigned in the contract accrue to the party who owns the asset. According to this property rights approach, it is the control rights that determine the boundary of the firm, where a firm is defined as a jointly determined bundle of property rights.

In GHM models, the distinction between an inter-firm contract and an intra-firm contract turns on who owns the physical assets that are necessary for the transaction. An independent contractor owns his physical assets that are alienable while an employee within a firm does not. The importance of asset ownership derives from the fact that the willingness of an agent to undertake a non-contractible investment in human capital that is specific to the asset depends on who owns the asset. The economic allocation of the residual rights of control also has an important economic effect on the bargaining position to the contract since a contractual party that owns the essential asset will be in a favorable bargaining position to capture the economic benefit from the transaction by threatening to withhold the asset. According to Hart and Moore (1990), in order to avoid under-investment problems, the contractual party who is to make the most economically important non-contractible asset-specific investment in human capital should own the asset.

Complementing research studies in the transaction costs approach (Williamson, 1985), modern property rights theory provides a clear definition of the boundary of the firm in terms of asset ownership, and provides a theoretical direction for answering the question of who should integrate with whom. However, property rights theory does not provide much guidance concerning *ex post* governance since property rights theory maintains that mutual economic benefit can be brought about by reallocating residual rights of control but changes in organization structure are not likely to have such economic

consequences. From the property rights perspective, integration, quasi-integration, and deterrence-building all aim to achieve an economically efficient assignment of control rights. Economic efficiency depends on ownership and/or ready-access to the relevant assets. This property rights interpretation is similar to the effect of residual rights of control over valuable assets, where the concept of residual control rights incorporates not only an ownership title but also effective decision rights that each party holds in making and implementing strategic decisions for economic value creation from the relevant resources (Kim and Mahoney, 2002).

Following Brynjolfsson (1994), we treat the information that the contracting parties have as an economic asset that they own but can be alienable at different costs. This property rights approach enables us to examine how differential alienability and contractibility affect the boundary of the firm and inter-firm governance. Depending on its alienability, information can be embodied either in employees, like knowledge and skills, or codified like documents and files. In addition, some information, such as inventory and shipment in the retail industry, is fairly contractible. Advancement in information technology has led to the creation of numerous alienable and contractible information assets, leading to new economic and strategic approaches to the organizational problem of co-locating information and decision rights for superior decision-making.

When the information can be made alienable, it is natural to consider single ownership of both the physical assets and the information. In certain economic circumstances, it may be more economically efficient to move the information asset than to shift ownership of all the physical assets to the informed contractual party. Sometimes, however, it may be difficult or costly to transfer the information to the other contracting party, not only because of difficulties in codifying and transmitting information, but also because of economic incentive problems in trading information (Arrow, 1974).

Therefore, when the information cannot be owned by the other contracting party, but is necessary for the full productivity of the physical assets, the economic incentive considerations suggest that the next best economic solution to support the exchange will generally be to give ownership of the physical assets to the contractual party who has the information. In the absence of contractibility, the same party should own the complementary assets (Hart, 1995), and this ownership requirement necessitates giving control of the alienable physical assets to the owner of the inalienable information assets. However, if the economic value created under the alternative ownership structure, when information is alienable, is higher than the economic value created under the constrained allocation, transforming information in a tradable form through an IT investment can be a positive NPV project. Economic incentives for advancing an IT system in ways that make information alienable will be strongest if the economic value of alienability is high. However, if the economic value is marginal, due to the characteristics of the information in question, the constrained allocation should be a superior mode of governance.

If information can be made fully contractible, then there are no residual rights and thus the ownership approach of the information is economically irrelevant. The same party who owns physical assets does not need to control the complementary information because there is no longer a potential contractual holdup problem. Thus, making information alienable improves economic incentives by making a new ownership pattern feasible, but it still falls short of the best economic solution since any contractual party not getting control of the alienable information asset is potentially subject to contractual holdup. In contrast, making information contractible based on the use of a highly sophisticated IT system could potentially give each contractual party the optimal economic incentives, leading to superior governance via an inter-firm relationship.

Resource Complementarity and Competitive Advantage

One of the challenges to the earlier optimism concerning IT's potential for creating competitive advantage is developed in resource-based theory (Mahoney and Pandian, 1992). Whereas strategy research in the Industrial Organization (IO) tradition has focused on advantages derived from industry and competitive positioning, the resource-based approach has focused on competitive advantages stemming from firm-specific, intangible resources (Hall, 1993; Itami and Roehl, 1987). According to resource-based theory, unlike product attributes and strategic positions, which competitors often replicate, or render obsolete, unique resources tend to be protected by isolating mechanisms such as resource complementarity and causal ambiguity, offering sustainable competitive advantage (Wernerfelt, 1984). Focusing on the relationships between firm-specific resources and sustainable competitive advantage, resource-based theory advances two key assumptions. First, firms are heterogeneous with respect to their resources and organizational capabilities on which they base their strategies. Second, the resources and organizational capabilities are not perfectly imitable across firms, resulting in sustained heterogeneity (Peteraf, 1993).

In the early resource-based contributions, there was little explicit distinction between resources and capabilities,⁸ although Amit and Shoemaker (1993) suggest that resources are assets that either are owned or controlled by a firm, while capabilities refer to the firm's ability to utilize and combine resources through organizational routines in order to accomplish its objectives. Teece, Pisano, and Shuen (1997) offer a comprehensive framework of the concept of dynamic capabilities that reflects a firm's

⁸ The earlier resource-based approach is often called the *Ricardian resource-based view*, emphasizing heterogeneity of resources that have differential productivity. As Mahoney (1995) points out, this Ricardian perspective has been complemented by the Schumpeterian perspective that is often called the dynamic-capabilities view, emphasizing the importance of capabilities embedded in the organization and its processes.

capabilities to achieve new and innovative forms of competitive advantage. These dynamic capabilities include organizational and managerial processes, specific asset positions, and path dependencies, “that which is distinctive cannot be bought and sold short of buying the firm itself, or one or more of its subunits” (Teece et al., 1997: 518).

In a resource-based analysis of IT and firm economic performance, Clemons and Row (1991) advance *a commodity view of IT*, arguing that competitive imitation eventually erodes most IT-based advantages, and that above-normal returns to the IT eventually vanish. Clemons and Row conclude: “Examples of using information technology to achieve sustainable advantage through either barriers to imitation or first mover advantages do exist, but they are far less common than a trusting first scan of the MIS literature would imply” (1991: 278).

The notion that IT systems *per se* do not generate sustainable competitive advantages has received increasing support in recent IT research, and has produced a perspective known as *the strategic necessity hypothesis* (Kettinger, Grover, Guha, and Segars, 1994; Powell and Dent-Micallef, 1997). This hypothesis consists of two propositions: (1) IT systems provide economic value to the firm by increasing coordinating efficiencies, and thus firms that do not adopt IT systems will have higher cost structures; and (2) firms cannot expect IT systems to produce sustainable competitive advantages because most IT systems are readily available to all competitors in competitive resource factor markets.

According to this strategic view, firms would appear to have only three feasible paths to IT-based competitive advantage: (1) reinvent IT advantages perpetually through continuous, leading-edge IT innovation; (2) move first and develop isolating mechanisms for first-mover advantages; and/or (3) embed IT systems in organizations in such a way as to produce valuable resource complementarity (Powell and Dent-Micallef, 1997). The first two paths have proven insecure. Perpetual innovation may

hypothetically produce competitive advantages, but these advantages vanish if innovation either ceases or stumbles, and such advantages are haunted by ever-shortening IT development cycles. First-mover IT advantages seem more promising, particularly those involving proprietary systems customized to utilize firm-specific strengths or opportunities. As Westland and Clark (1999: 145-146) note, IT systems developed and deployed only within a single firm are relatively easy to duplicate over time and have generally only provided temporary advantages to adopting firms. But IT systems that create linkages and interdependencies outside of a single organization can become difficult for competitors to duplicate or overcome. Furthermore, if the adopted inter-organizational IT system is incompatible with alternative contracting parties, it is even more difficult to duplicate and the competitive advantage achieved from the IT systems could be sustained. Thus, resource-based theory focuses on resource complementarity as the most likely path to IT advantage (Keen, 1993; Teece, 1986).

The 'resource-based' strategic necessity hypothesis does appear to fit the emerging empirical evidence (Levy and Murnane, 1996; Powell and Dent-Micallef, 1997), and its resource-based origins provide a solid theoretical foundation for investigating the conditions under which IT may produce sustainable competitive advantage. Particularly, this theory points toward a co-specialization perspective (Teece, 1986) that emphasizes the possibility of sustainable competitive advantages arising from strategically combining unique IT systems with other complementary firm-specific resources.

THEORY AND PROPOSITIONS

Information Economics

One of the traditional assumptions of neoclassical economics is that of perfect information – i.e., information that is equally available to all market participants at zero transaction costs. Much of the early work done in information economics challenged this neoclassical assumption by exploring the economic costs of attaining information, and by exploring the economic problems concerning information asymmetries among market participants (Alchian and Demsetz, 1972; Arrow, 1974; Malmgren, 1961; Spence, 1973).

Alchian and Demsetz (1972: 793), for instance, suggest that internal organization possesses informational advantages over market interactions: “the firm serves as a highly specialized surrogate market. ... The employer, by virtue of monitoring many inputs, acquires special superior information about their productive talents ... Opportunities for profitable team production by inputs already within the firm may be ascertained more economically and accurately than for resources outside the firm. Superior combinations of inputs can be more economically identified and formed from resources already used in the organization than by obtaining new resources (and knowledge of them) from the outside.”⁹

Arrow (1974) considers the uncertainty of information as a fundamental driver of market frictions and one of the driving economic forces behind the formation of organizations: “Organizations are a means of achieving the benefits of collective action in situations in which the price system fails... There is one particular failure of the price system to which I want to stress, one that is absolutely central

⁹ In a somewhat different vein, Williamson (1985) argues that information about production costs is more reliably obtained within the rubric of authority than in communication between autonomous market agents, and that, by comparison with the firm, markets lack a rich and common rating language. Similar language and communication issues are discussed by Nelson and Winter (1982).

to the understanding of organizations. I refer to the presence of uncertainty” (p. 33) and “the organization as a processor of information... the scarcity of information-handling ability is an essential feature for the understanding of both individual and organizational behavior.” (p. 37).

Coupled with Coase’s (1937) transaction costs theory,¹⁰ Malmgren (1961) extends the earlier information-costs view in order to examine the economic rationale of decentralized decision making in a market economy. In the information-costs view, the transaction costs of using the price mechanism are mostly costs of searching, acquiring, and processing information on relevant sets of events. If there are non-trivial transaction costs of searching, acquiring, and processing information on the events, particularly in a market where transactions are heterogeneous and the search for a buyer or seller may be lengthy, there may be an economic incentive to combine a number of events or activities into one bundle by arranging long-term contracts. "As a result, events would be made to behave according to plan, in the sense that closely allied activities are isolated from the market and balanced one against another in a planned system" (Malmgren, 1961: 402).

Malmgren’s (1961) focus centers on the interaction between information and uncertainty concerning the current and future states of events as “*converging expectations*.” The firm predicts the costs of production of its commodities better than the market could over its set of economic activities by eliminating the divergence of expectations that may arise when interdependent decisions are taken by independent decision-makers. It is because of the lack of information on a range of events that firms are

¹⁰ Coase (1937) emphasizes the transaction costs of using the price system – in particular, that of discovering the relevant prices – and argues that transactions can sometimes be undertaken more cheaply by replacing a set of separately negotiated economic exchanges with a long-term contract in which one party is given the right to determine the use of the resources of the others without repeated renegotiation of the terms of the exchange.

put together, where long-term contracts and regulated markets for clearly-defined services can be developed. Then, multi-person and multi-process firms arise in a market economy for a number of reasons corollary to the existence of information costs. This organizational choice of the firm in turn provides a large amount of “controlled information” – not only are a number of events predictable over the duration of the entire production plan, but also less information is required to describe that set of events for coordination and control purposes.

More recently, Putterman (1995) argues that firms often have a comparative advantage both in recognizing and in eliciting differentiation of input characteristics, and that these informational advantages of firms are a product of their capability to support long-term association by providing for mutually beneficial sharing of the information and the economic rents of joint production by suppliers of co-specialized resources. Similar to the discussion of resource-factor market imperfections (Barney, 1991), Putterman (1995) points out that, when detailed resource characteristics cannot be ascertained except through prolonged use, resource owners will be unable to represent themselves credibly in the market as possessors of specialized resources. In this economic situation, market trade will tend to be restricted to resources with easily ascertained qualities, and to uses in which the precise type is unimportant. For these economic and strategic reasons, the firm will be associated with richer resource knowledge than the market.

The logic of the information advantage of the firm over the market is sustained when it is applied to explain the role of IT on governance choice. As suggested in the information economics literature, when the use of a firm-specific IT system can successfully lower the information costs for its internal transactions within a firm, it further facilitates the firm’s creation of converging expectations and controlled information internally. In this case, in order to enhance its information advantage through

developing converging expectations and controlled information, firms will not pursue outsourcing but rather will increase internal transactions based on the use of a firm-specific IT system.

***Proposition 1:** (Controlling for the initial governance mode being the firm) The use of a specific IT system within a firm is negatively related to the degree of outsourcing.*

Resource-Based Theory

In its treatment of IT-based advantages, resource-based theory emphasizes sustainability protected by resource complementarity and co-specialization. Resource complementarity represents an enhancement of resource value that arises when a resource produces greater economic returns in the presence of another resource than it does alone. Complementary resources are co-specialized if one resource has little or no economic value without the other bilaterally (Teece, 1986).

The current paper extends the idea of complementary resources to the development of dynamic capabilities of the firm through co-specialization of an IT system and unique resources. Accordingly, we propose that in order to be a source of sustainable competitive advantage, a firm-specific IT system requires complementary investments for co-specialization with other unique firm resources, such as IT trained employees, leading to an increase in the scale of operation conducted within the firm.

According to resource-based theory, a complementary interaction between firm resources typically enhances the economic value for both complementary resources. For example, an EDI system may enable a firm to enhance its procurement activities, while the pre-existing routines maximize EDI's inherent information-sharing capabilities. In this way, even a commodity resource, such as an off-the-shelf EDI system, if combined with management processes, can become an embedded, mutually reinforcing rent-generating resource (i.e., property rights) bundle. Therefore, a firm-specific IT system,

as a result of a sunk-cost investment to develop a co-specialized IT system with critical complementary resources, satisfies resource-based criteria for sustained competitive advantage – i.e., firm-specific, tacit, idiosyncratic, and embedded in the organization – and thereby constitutes a dynamic capability of the firm (Teece et al., 1997).

In the information systems literature, Zaheer and Venkatraman (1994) provide a comparative analysis of the impact of general versus specific inter-organizational information systems (IOS) on performance. Zaheer and Venkatraman (1994) point out that the impact of IT in a setting characterized by a common IOS infrastructure is significantly different from a setting characterized by one or more unique, proprietary IOS. In the case of unique, proprietary IOS, individual firms commit resources to create firm-specific IT-based capabilities, and such dynamic capabilities provide enhanced opportunities for restructuring their relationships with chosen business partners.¹¹ However, within a common IOS, since all firms have the opportunity to use the same IOS capabilities, the extent of firm-specific technology-generated benefits is limited.

From the empirical investigation of the role of IT systems in the retail industry, Powell and Dent-Micallef (1997: 395) conclude that: (1) an IT system (as a commodity product) has become pervasive and relatively easy to acquire in competitive factor markets; (2) most retailers have not merged IT with the requisite human and business complementary resources; (3) IT systems do not merge themselves automatically with human and business resources; and (4) the more economically valuable the resource complementarity, the more difficult it is to achieve. Although the industry has invested sufficiently in IT systems, only those firms that merged IT with complementary resources, particularly

¹¹ According to Keen: “The wide difference in competitive and economic benefits that companies gain from information technology rests on a management difference and not a technical difference. Some business leaders are somewhat better able to fit the pieces together than others” (1993: 17).

firm-specific resources, could gain IT-related advantages. In a similar vein, Kettinger et al. state that: “the information resources of a firm must be driven by business strategy and integrated into the product and process dimensions of the enterprise based on an understanding of core competencies” (1994:50),

Levy and Murnane (1996) support the strategic necessity hypothesis by examining the impact of computers on skill demands in the banking business in two channels, changes in the numbers of different occupations and changes in the content of individual occupations. The empirical evidence shows that computerization has increased the bank’s demand for college graduates. Levy and Murnane (1996) further report that an increased demand for skilled labor means redesigning the jobs themselves to maintain the interest of higher-skilled workers, and that simply computerizing a job does not redesign it automatically.

Advocating a more ‘human-centered information management’ in practice, Davenport recommends that IT systems need people to make them productive because, “Most of the information in organizations – and most of information people really care about – isn’t on computers. Managers prefer to get information from people; people add value to raw information by interpreting and adding context” (1994: 122).

In sum, sustainable IT-based competitive advantage depends on utilizing *relationships among complementary resources* to create a co-specialized firm-specific IT system as a dynamic capability of the firm. Thus, if IT alone is not enough and should be supplemented with complementary assets for a co-specialized IT system to achieve sustainable competitive advantages, we can expect to observe an increase in the complementary assets – particularly human resources – with an increased use of IT

systems.¹² This prediction is also consistent with the prediction based on transaction costs theory, since an internal IT system can facilitate the use of the firm (first-order economizing) if the IT system is highly specific to its internal use, favoring disproportionately internal coordination over external coordination. This economic efficiency gain occurs when a highly firm-specific IT system is embedded in the organizational process through a co-specialization investment with other firm-specific complementary resources, such as human resources. In this business case, this specific IT system contributes to an increased scale of operations, in terms of the number of employees (a second-order refinement). This theoretical development leads to the following proposition:

Proposition 2: *(Controlling for the initial governance mode being the firm) The use of a specific IT system within a firm is positively related to the number of employees of the firm (who serve as complementary resources).*

Transaction Costs Theory

Since many early applications of computers have focused on internal systems rather than inter-organizational systems, IT would affect internal coordination costs more than external costs. If the IT system reduces the economic costs of external coordination more than that of internal coordination, however, we would expect to see firms buying more items externally. In this case, the degree of vertical integration should decrease (Dewan et al., 1998; Hitt, 1999). Therefore, without considering the characteristics of the IT system in the business context, we cannot predict which effect predominates and

¹² For example, if GM's CAD system is highly specific to GM's own product line with its skilled workers but it can not be extended efficiently into the parts production of outside suppliers, GM may increase its internal production of required parts without relying on independent suppliers in order to maximize the potential economic benefits of co-specialization of GM-specific CAD systems with the trained employees.

whether a resulting shift is of an economically significant magnitude. In other words, the efficient boundary implication of an IT investment depends on the characteristics of the information and the technology in question.

As Shapiro and Varian (1999: 21) point out, one of the key characteristics of information is that “information is costly to produce but cheap to reproduce.” Thus, once a firm installs an IT system, it can extend its economic benefit by reproducing its IT system in another transaction at marginal costs. There could be even more potential to reproducing it with another contracting party in market transactions at marginal costs, especially in the case of a standardized general IT system with wide use. In addition, the firm is able to access alternative contracting parties with a superior production system, thereby reducing its production costs. Therefore, due to more applicability of a general IT system along with positive network externalities, mostly through standardization, we expect that an accelerated decrease of external coordination costs leads to less vertical integration. In other words, with a general IT system, the lowered external coordination costs will outweigh the lowered internal coordination costs, leading to more extensive use of the market, which is consistent with the coordination costs explanations.

However, when the IT system used in the market transaction is highly relation-specific to the contracting parties, the coordination costs logic with a general IT system no longer applies. The dilemma of providing economic incentives to the contracting parties when the contract is incomplete can be mitigated if those parties are assured a significant share of the output they produce by providing them with the *ex post* bargaining power inherent in asset ownership in terms of the residual rights of control (Brynjolsson, 1994). As shown by Holmstrom and Milgrom (1994), efficient contracting requires the removal of certain decision-making discretion from an agent when it is too expensive to provide the right economic incentive via residual claimancy for the agent to refrain from costly opportunism. Masten

(1988) suggests that the economic problem of optimal contracting in the case of contractual holdup can be formulated as one of minimizing the expected economic value dissipation resulting from the two parties' contractual holdup activities. Since the two contracting parties in general both have the potential to engage in *ex post* opportunism, the assignment of residual control needs to balance the holdup hazards posed by both contractual parties. Since a given contractual holdup hazard can often be lowered by removing or reducing the potential offender's control over certain decisions, we can expect that a contractual party will be given less residual control when that contractual party could pose a particular contractual holdup hazard.

From the property rights perspective, IT affects the efficient boundary choice of the firm both through its impact on the distribution of asset ownership and the nature of the information. The best economic incentives can be achieved either through the centralization of information and asset ownership in one party when the information is alienable without any potential holdup problems, or through decentralization of information and economic assets when the information can be made contractible. In principle, access to the information asset can be allocated to each contractual party based on the appropriate contingencies that will maximize their economic incentives. As with alienability as a necessary condition for an alternative governance mode, we can expect additional economic value creation when the information becomes contractible from the use of a relation-specific IT system, which is superior to a general purpose IT system in its information capability. As with improved contractibility based on this relation-specific IT system, a firm can achieve vertical coordination efficiently without acquiring full control over the whole operation through vertical integration. This economic outcome is possible because firms can access crucial information through information sharing based on a relation-specific IT system, such as a Vendor Managed Inventory (VMI) system. *Without resorting to vertical*

*integration, electronic integration through information sharing based on a relation-specific IT system provides an **alternative governance mode** as a distinctive hybrid organizational form.*

Proposition 3: *(Controlling for the initial governance mode being the market) The use of a specific IT system between firms is positively related to the specificity of information in transactions, and negatively related to the degree of vertical integration.*

As far as the number of contractual relationships is concerned, the coordination cost approach suggests that the optimal number of suppliers is determined by trading off the economic costs of further searching against the expected economic benefits from identifying a better supplier, and that the “make versus buy” decision can be seen as an economic tradeoff between production and coordination costs (Bakos and Brynjolfsson, 1993). Controlling for the specificity of the IT systems to be low universally, Malone et al. (1987) argue that IT will facilitate a move from a single-supplier arrangement to multiple supplier arrangements, because it reduces the economic costs of coordination with suppliers, especially by lowering the economic costs of acquiring information. However, there has been evidence that firms tend to rely on fewer suppliers (Johnston and Lawrence, 1988). In addition, one empirical study found that the average number of suppliers in the automobile industry decreased by 25 percent between 1983 and 1988 (Helper, 1991).

Transaction costs theory suggests that a potential contractual danger of working with few suppliers with highly specific assets is the higher contractual risk that these suppliers will behave opportunistically and hold up the buyer. If the IT investment is not likely to be relationship-specific, the risk of opportunistic behavior inherent in this interdependency situation can be alleviated, and this difference enables firms to work with fewer suppliers since IT reduces the information costs but does not increase the incentive costs. In other words, if the IT investment is *ex post* transferable to other equally

valuable uses or can be contractually specified *ex ante*, the appropriate number of suppliers is determined by production costs. On the other hand, if the IT investment is *ex post* specific and non-contractible, the firm will need to limit the number of suppliers employed in order to convince these suppliers that the economic return on their investments will not be expropriated in *ex post* bargaining. When the investment is *ex post* specific, reciprocal efforts of remedies to build effective deterrence to holdup can enhance mutual economic benefits for both contracting parties. Telser (1980) describes this situation as a self-enforcing agreement while Williamson (1983) emphasizes the dyadic structure of the investment as mutual hostages to support economic exchange.

The key to effective bilateral deterrence is to give each contractual party sufficient means to retaliate economically toward any opportunistic behavior of the other contractual party, such as incurring very high switching costs. When the asset is highly relation-specific, each contractual party will be able to penalize the other contractual party simply by withholding its cooperation when it suspects the other contractual party of opportunism. Likewise, mitigating contractual hazards can be achieved if each contractual party invests in a relation-specific IT system jointly, thereby constituting a bilateral self-enforcing contract, whereby mutual sunk-cost commitment to a small number of core suppliers will be a superior governance choice. In sum, a specific IT system substitutes for the managerial hierarchy in the sense that it makes vertical integration less attractive. In addition, if the IT system is highly relation-specific and requires high switching costs, the superior governance choice will be mutual commitment to sunk-cost investments in order to achieve a long-term cooperative relationship with a small number of core suppliers.

Proposition 4: *(Controlling for the initial governance mode as the market) The use of a specific IT system between firms is positively related to the specificity of information in transactions, and negatively related to the number of suppliers of the firm.*

Table 2 summarizes the propositions developed in the current paper with respect to the relationships of IT systems and resulting governance structure decisions.

Table 2. Summary of the Propositions

| | Firm t_2 | Market t_2 |
|--------------|--|--|
| Firm t_0 | <p>Number of Employees \uparrow</p> <p>Proposition 2 (Co-specialization with firm-specific resources)</p> <p>Second-order effect (Change within a governance)</p> | <p>Outsourcing \downarrow</p> <p>Proposition 1 (Converging expectation and Controlled information)</p> <p>First-order effect (Change of governance)</p> |
| Market t_0 | <p>Integration \downarrow</p> <p>Proposition 3 (Electronic integration through IT)</p> <p>First-order effect (Change of governance)</p> | <p>Number of Suppliers \downarrow</p> <p>Proposition 4 (Mutual sunk-cost commitment)</p> <p>Second-order effect (Change within a governance)</p> |

- t_1 : the time of IT investment.
- Proposition 1 and 3 indicate first-order effects.
- Proposition 2 and 4 indicate second-order effects.

DISCUSSION AND CONCLUSIONS

The development of effective cooperative relationships is becoming increasingly important for economic value creation, and the importance of this business phenomenon is reflected in the growing academic research interest concerning cooperative relationships between vertically-related firms. Previous studies of vertical relationships have demonstrated that close supplier-buyer relationships can become valuable resources, and a central theme of this research concerns the interdependence of exchange partners seeking competitive advantage (e.g, Blackenburg Holm, Eriksson, and Johanson, 1999). The current paper emphasizes that to achieve effective cooperative relationships, both suppliers and buyers must make substantial mutual sunk-cost commitments that require a long-term perspective for developing mutual business relationships. Furthermore, strategic sunk-cost investments for the development of long-term vertical relationships with exchange partners have organizational impacts concerning the resulting governance modes.

In the current paper, we examine the phenomenon of inter-firm cooperation that leverages IT capability – that has been previously described as electronic integration (Zaheer and Venkatraman, 1994) within a broader continuum of electronic markets and electronic hierarchies (Malone et al., 1987). The current paper is believed to be timely and useful especially when we survey recent empirical findings directly related to this business phenomena. For example, Bensaou (1997) tests the influence of the use of an IT system on buyer-supplier relationships in the context of the United States and Japanese automobile industries. According to Bensaou (1997), United States' automakers are believed to become the electronic coordinator of an IT-mediated production network, typically purchasing more core components from outside, thus reducing its level of vertical integration and at the same time reducing its

total number of suppliers. The emerging strategic relationships involve higher levels of cooperation via electronic JIT (just-in-time), with a strategic intent to replicate the Japanese JIT system. As this new inter-firm relationship corresponds to more cooperative governance, Bensaou (1997) predicts that the use of an IT system supports greater inter-firm coordination by increasing information-processing capabilities and by reducing task uncertainty.

The empirical results, however, show that the use of a general IT system does not play the key role in cooperation across firm boundaries in the automobile industry. The association is not significant especially in the United States sample, even though, in absolute terms, United States' firms rely more heavily on an IT system that is measured by the scope of general EDI use in six business functions. Bensaou concludes that: "the findings of this study clearly indicate that this ambitious use of information technology has not yet translated into IT playing a major role in explaining cooperation between the two firms" (1997: 119). This empirical result is, however, not the case for Japan, where the use of IT is significantly associated with cooperation. This empirical difference indicates that in contrast to United States' policy to develop an electronic platform to support an "electronic marketplace" for car components based on the use of a standardized IT platform, Japanese manufacturers are engaged in an "electronic partnership" where a relation-specific IT system, co-specialized with other relation-specific practices, supports exchange with the close partners as a mutual (sunk-cost) commitment that supports economic exchange.

Dyer and Singh (1998: 662) define a relational rent as "a supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation and can only be created through the joint idiosyncratic contributions of the specific alliance partners," and argue that alliances generate relational rents only as they move the relationship away from the attributes of market

relationships. More specifically, Dyer and Singh (1998) provide four conditions for the competitive advantages of partnerships:

- Investments in relation-specific assets;
- Substantial knowledge exchange;
- The combining of complementary, but scarce, resources and/or capabilities; and
- Lower transaction costs than competitor alliances, owing to more effective governance mechanisms.

The four propositions developed in the current paper meet Dyer and Singh's (1998) four conditions since relational rents are possible when vertical partners invest in a relation-specific IT system and share strategic information. A long-term vertical partnership is achieved by employing a superior governance mode of electronic integration that lowers transaction costs and gains relational rents through mutual sunk-cost commitments.

From the perspective of strategic management, the current paper provides various research agendas, both for the existence and boundary of the firm (Casson, 1997) and for sustainable competitive advantage (Mahoney, 1998). Regarding the existence and boundary of the firm, information should be traded within the firm when it is less costly than other forms of market transactions. Information attributes and specificity of an IT system determine the efficiency of the coordination mechanisms for the given transaction and correspondingly the efficient boundary choice of the firm. With respect to sustainable competitive advantage, not all information is equally costly to trade, nor are all coordination mechanisms equally efficient for processing the information for the transaction. Sustainable competitive advantage rests on the comparative assessment of (imperfect) alternative governance modes in acquiring and handling information of uncertain quality at lower costs, while simultaneously managing economic

incentive problems. The strategic intent of searching for improved governance in acquiring and processing information effectively continues to provide challenges for both strategic management theory and strategic management practice.

A specific IT system, that entails substantial mutual sunk-cost commitments on the part of both buyer(s) and supplier(s), acts as a “mutual strategic hostage to support economic exchange.” Such mutual sunk-cost commitments play the role of economic collateral that protects the contractual parties against possibilities of opportunistic contractual holdup problems. Therefore, a specific IT system *substitutes* for a managerial hierarchy in serving the joint functions of “economizing on bounded rationality” (via better information processing between the buyer and seller) and of “attenuating opportunism” (since mutual sunk-cost investments better align mutual economic incentives and thereby reduce the likelihood of distributional conflicts whereby one or both contracting parties attempt to renegotiate contractual agreements *ex post*).

APPENDIX: Cooperative Game and Mutual (Sunk-cost) Commitment

Game theory is the analysis of rational behaviors in situations involving interdependent outcomes when the firm's payoff depends on what it does and what the other firm does. Since many strategic decisions involve interdependent outcomes, game-theoretic analysis can be applied to the study of vertical supplier-buyer relationships. In game-theoretic models each firm's optimal action depends on what it believes its counterpart will do. In other words, the game-theoretic analysis requires assumptions about the counterpart's rationality and the counterpart's belief about the firm's own rationality.

The prisoners' dilemma game provides a powerful metaphor for a fundamental conflict that arises in business situations involving vertical interdependence (Saloner, 1991; Scherer and Ross, 1990). In the prisoners' dilemma what is best for the individual firm is to maximize its own profit and this "individual rationality" is detrimental to group performance. The "collective rationality" is for both firms to cooperate and obtain a higher group payoff, but the "individual rationality" is for each firm to play their dominant strategy, given the current payoff matrix. No matter how much they preach the importance of the group (common) good, there is always the possibility that the poor group outcome will be the dominant strategy equilibrium as predicted in the prisoners' dilemma game.

One way out of the prisoners' dilemma occurs when the players take steps that change the payoff matrix. Paradoxically, worsening some of one's own payoff possibilities may improve the likely outcome of the game (Schelling, 1960). Consider the case of an IT investment between Wal-mart and P&G. The best strategies for the collective good are that both firms cooperate. While this is collectively rational, it is unfortunately not individually rational in terms of individual firm profitability. Thus, in Payoff Matrix 1 we have an example of the Prisoners' dilemma situation where the Nash equilibrium point **(91, 91)** is predicted when each firm plays their dominant strategy of behaving opportunistically.

| Payoff Matrix 1 | | Wal-mart | |
|-----------------|-------------|-------------|-----------------|
| | | Cooperation | Opportunism |
| P&G | Cooperation | (112, 112) | (58, 123) |
| | Opportunism | (123, 58) | (91, 91) |

Let's suppose P&G posts an economic bond (e.g., investing in a relation-specific IT system) that P&G would lose if P&G defects from the joint collaboration. In effect, this action unilaterally lowers the payoff associated with an opportunistic behavior by P&G (i.e., from 123 to -28, and from 91 to -51, respectively below). Thus, P&G eliminates the attractiveness of defecting from the cooperative solution. Such voluntary agreement is considered self-enforcing because third-party enforcement is not relied upon (Klein, 1985; Telser, 1980). As a result, Cooperation is now P&G's dominant strategy.

| Payoff Matrix 2 | | Wal-mart | |
|-----------------|-------------|-------------|------------------|
| | | Cooperation | Opportunism |
| P&G | Cooperation | (112, 112) | (58, 123) |
| | Opportunism | (-28, 58) | (-51, 91) |

If Wal-mart emulates P&G's action (i.e., mutually commits to a relation-specific IT with P&G) then this action further transforms the situation to Payoff Matrix 3 (as we see below) to encourage mutual commitments to cooperation that increases both firms' payoffs to **(112, 112)**. This example illustrates that firms involved in interdependent outcomes should seek both to give and receive mutual (sunk-cost) commitments that facilitate ongoing relationships and adaptation (Williamson, 1985).

| Payoff Matrix 3 | | Wal-mart | |
|-----------------|-------------|-------------------|-------------|
| | | Cooperation | Opportunism |
| P&G | Cooperation | (112, 112) | (58, -28) |
| | Opportunism | (-28, 58) | (-51, -51) |

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