Determinants of Electronic Integration in the Insurance Industry: An Empirical Test

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Abstract

Electronic integration -- a form of vertical quasi-integration achieved through the deployment of dedicated computers and communication systems between relevant actors in the adjacent stages of the value-chain -- is an important concept to researchers in the information systems field since it focuses on the role of information technology in restructuring vertical relationships. Drawing on theoretical and empirical research on transaction costs, we develop and test a model of the determinants of the degree of electronic integration in the commercial segment of the property and casualty (P&C) industry. Based on a sample of 120 independent agencies operating under dedicated information technology-mediated conditions, we provide empirical support for a generally-accepted proposition regarding the role of IT in influencing vertical relationships. Implications and research extensions are identified to guide further research in this important area.

Key Words: Information technology; vertical integration; electronic integration; organizational economics; transaction cost model; insurance industry -- commercial lines of business.

Introduction

This paper is concerned with the role of information technology in influencing the pattern of interfirm arrangements in a marketplace. It builds from the extensive body of research on the design of interfirm relationships that lie along a continuum from *markets* to *hierarchies* (Williamson, 1985) to a specific context where such relationships are fundamentally impacted by information technology (IT) applications (see for instance, Cash and Konsynski, 1985; Keen, 1986; Johnston and Lawrence, 1988; Johnston and Vitale, 1988; McFarlan, 1984; Rockart and Scott Morton, 1984; Scott Morton, 1991). While there has been a growing interest in the role of IT to influence interfirm relationships, the research stream has been handicapped by lack of rigorous theoretical articulations of how and why IT influences these relationships (see Malone, Yates, and Benjamin, 1986 and Gurbaxani and Whang, 1991 for exceptions) as well as empirical tests. To address this deficiency, this paper adopts the *transaction cost perspective* (Williamson, 1975; 1985) to empirically examine the pattern of vertical relationships between insurance carriers and independent agents[1] that is mediated by dedicated IT applications.

More specifically, we (a) develop a model of *electronic integration* -- defined 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 -- and (b) derive a set of its determinants based on the transaction cost perspective that has been recently argued to be relevant for settings impacted by IT applications (Bakos and Treacy, 1986; Malone, Yates, and Benjamin, 1987; Clemons and Row, 1988; Gurbaxani and Whang, 1991). This model is tested using data from 120 property and casualty (P&C) agents interfaced with insurance carriers through *dedicated* interorganizational information systems (IOS)[2] in the *commercial* lines segment. Subsequently, we develop implications and directions for further research in this area.

Theoretical Considerations

We develop our theory as follows. First, we provide a brief overview of the research stream on the different mechanisms for organizational governance to argue for conceptualizing electronic integration as a specific form of quasi-integration that exploits IT capabilities. Subsequently, we discuss the role of transaction costs in vertical integration research and the specific influence of IT on transaction costs to develop a set of determinants of electronic integration.

Mechanisms for Organizational Governance

In simple terms, the two traditional mechanisms for organizational governance are the *firm* (or the hierarchy) and the *market* (Coase, 1937; Williamson, 1975) -- where a firm is defined in terms of those assets that it owns or over which it has control (Grossman and Hart, 1986; see also Pfeffer and Salancik, 1978) and is engaged in transactions with other firms in the market. The firm coordinates the flow of materials through adjacent stages of a business process by means of rules and procedures established within the hierarchy. The market, on the other hand, coordinates the flow of materials between independent economic entities through the use of the price mechanism reflecting the underlying forces of supply and demand. Taking the firm and the market as pure forms, several intermediate governance mechanisms have been identified: long-term relational contracts (MacNeil, 1980; Stinchcombe, 1990), joint ventures (Harrigan, 1988), quasi-firms (Eccles, 1981), and quasi-integration (Blois, 1972); more generally, such mechanisms exemplify non-classical and *hybrid* forms of contracting (Williamson, 1990). Collectively, these mechanisms are used by organizations to maintain control over the critical resources necessary for their success (Pfeffer and Salancik, 1978; Thompson, 1967). Vertical integration[3] or hierarchical governance, has been an area of considerable research along multiple theoretical perspectives (see Perry, 1989 for a

comprehensive review), where the transaction cost model (Williamson, 1975, 1985) has been the dominant perspective (Walker, 1988).

Transaction Costs and Vertical Integration

The transaction cost perspective contends that vertical integration is preferred over market exchange when the sum of transaction and production costs of market exchange exceed those of hierarchy. The critical determining condition for high transaction costs is the existence of transaction-specific assets (Williamson, 1975, 1985, 1989; Klein, Crawford, and Alchian, 1978) within a broader context of environmental uncertainty, information asymmetry due to bounded rationality, and opportunism in the presence of a limited number of potential players in the marketplace. The key notion underlying this proposition is that behavioral conditions (bounded rationality and opportunism) combine with environmental conditions (small numbers exchange and uncertainty) to create high market transaction costs. The genesis of these costs is the possibility of appropriation of quasi-rents by one or the other party from the opportunistic reinterpretation of unforeseen contingencies in an exchange relationship. In order to avoid being 'held up' in this way, this perspective suggests a classic safeguard of internalization of the transaction through vertical integration.

Williamson (1979; 1985) argues that asset specificity is a major determinant of transaction costs. He contends that "the normal presumption that recurring transactions...will be efficiently mediated by autonomous market contracting is progressively weakened by asset specificity" (1979: p. 1548). The basic proposition relating transaction costs to governance mechanisms has been progressively refined with greater distinctions among various forms of *asset specificity* and increasing array of empirical research. For instance, constructs derived from this model have been adopted as the determinants of: backward integration (Monteverde and Teece, 1982; Masten, 1984; Masten, Meehan, and Snyder, 1989), forward integration into

distribution (John and Weitz, 1988), preference for internal *versus* external suppliers (Walker and Poppo, 1991), sales force integration (Anderson, 1985; Anderson and Schmittlein, 1984), make *versus* buy in components (Walker and Weber, 1984), contract duration (Joskow, 1987) and joint ventures (Pisano, 1989). The empirical approach has generally been one of assessing whether the observed pattern of relationships conforms to predictions from the transaction cost reasoning; the results have largely been supportive.

Electronic Integration and Transaction Costs

Rationale. Within the spectrum of organizational governance mechanisms, we define electronic integration as 'a specific form of vertical quasi-integration achieved through the deployment of dedicated information systems between relevant actors in adjacent stages of the value-chain.' Further, we argue that the transaction cost perspective that has served as a dominant theoretical anchor in vertical integration research has a central role in our ability to understand the nature of this governance mode for the following reasons: costs are theorized to arise not only from activities related to searching for and gathering information in a market but also from writing, monitoring, and enforcing contracts in an exchange relationship. Since these costs are directly influenced by IT capabilities (Bakos and Treacy, 1986; Clemons and Row, 1989) there is a compelling logic to assess the impact of IT on modes of governance (Malone et al, 1987; Gurbaxani and Whang, 1991). Malone et al. (1987) classify the impact of IT into: *electronic communication effects* -- through reduced cost of communication while expanding reach (time and distance); *electronic brokerage effects* -- increasing the number and quality of considerations of alternatives, while decreasing the cost of transactions; and *electronic (process) integration effects* -- increasing the degree of interdependence between participants involved in sequential business processes. Additionally, transaction costs are directly proportional to the *uncertainty* of the transaction context due to the superior

capabilities of information processing, which can potentially mitigate the information asymmetry between the parties in the exchange relationships.

The particular role of firm-specific IOS. Any discussion on the influence of IT on the nature of business relationships should distinguish explicitly between those applications reflecting a common electronic infrastructure and those that are firm-specific and employed to extend the scope of hierarchical governance. More importantly, in theoretical terms, the impact of IT in a setting characterized by a *common infrastructure* (e.g., ANSI X.12 standards or industry-specific standards such as those of the Automotive Industry Action Group, AIAG) is significantly different from a setting characterized by one or more *unique, proprietary IOS* (e.g., the Baxter Healthcare *ASAP* network or the American Airlines *SABRE* network). In the former case, there are strong competitive pressures to move toward electronic market-like modes of governance given the potential reduction in transaction costs (Malone et al, 1987) and benefits cannot be differentially appropriated by a firm since its competitors have relatively straightforward access to the same technological capabilities. However, in the latter case, individual firms commit resources to create firm-specific IT-based capabilities for restructuring their relationships with relevant players and enlarging the scope of hierarchical governance.

Clemons and Kimbrough (1986) argue that competitive advantage could result when the transaction costs are reduced in an *asymmetric* manner. Thus, it is entirely possible for the deployment of a unique, dedicated IT application to reduce transaction costs for a dyad or a set of dyads relative to other modes of exchange available to competitors. Extending this logic, Clemons and Row (1989) enumerate a set of restructuring types that includes vertical integration and *IT-enabled virtual integration*. Indeed, their notion of virtual forward integration as "the strategic network of McKesson and its customers achieve many of the benefits of large chains without ownership" (page 345) is consistent with our conceptualization of *electronic*

integration. Similarly, Gurbaxani and Whang (1991) discuss the possibility of using firm-specific IT applications to illustrate how IT can contribute to increasing the *degree of vertical integration* by expanding the scope of a firm's activities.

Conceptualization. We conceptualize the degree of electronic integration as 'the level of an independent agent's dedication to a principal whose proprietary IOS serves as the primary infrastructure for the conduct of the business.' Thus, in our conceptualization, we distinguish between the *principal* -- who deploys a proprietary IOS to expand the scope of hierarchical control and the independent *agent* -- who exercises a choice between accepting or rejecting the IOS. We elaborate on our definition by applying it to some of the well-known business relationships impacted by proprietary IOS. For example, in the case of Baxter's ASAP, the principal refers to Baxter (previously, American Hospital Supply Corporation) who deployed the interfacing system; the agent refers to the hospitals; and degree of electronic integration refers to Baxter's share of a hospital's purchase (given this proprietary infrastructure). Similarly, in the case of the SABRE reservation system, American Airlines is the principal, the independent travel agent is the agent and the degree of electronic integration refers to the share of American's business within a pool of possible bookings of a travel agent.

Our Research Model: Determinants of Electronic Integration

Asset Specificity

Asset specificity refers to the degree to which an asset can be redeployed to alternative uses without sacrificing its productive value. This is an important determinant since it transforms the transaction context into a small numbers bargaining situation. Williamson (1985) draws on Polanyi's (1962) articulation of *embedded human assets* and Marschak's (1968) concept of *unique assets* to identify four forms of asset specificity: site, human, physical and dedicated assets. In the context of

IT-mediated business relationships, we focus on the *business process asset specificity*. This is important because the agent invests resources (time and money) to exploit the system functionalities to derive *specific* business competences from this IOS through lower cost of information-exchange, faster response to inquiries and improved service. More specifically, business process asset specificity incorporates notions of *human and procedural asset specificities* as discussed below.

Human asset specificity deals with the degree to which skills, knowledge and experience of the agent's personnel are specific to this IOS-mediated business process. This is consistent with Anderson's (1985) consideration of specialized human knowledge in sales operations given her focus on the salesperson's role as an agent (versus an employee); Masten, et al's (1990) conceptualization of specialized technical knowledge in ship building; and John and Weitz (1988) who conceptualized human asset specificity in terms of the level of training and experience specific to the product-line in distribution channels.

Procedural asset specificity refers to the degree of agent's workflows and processes that are customized to exploit IOS capabilities in accordance with the principal's requirements. This is consistent with the notion of organizational *routines* (Nelson and Winter, 1982) which are hard to alter once established; and is particularly relevant given the role of IOS in fundamentally impacting the business process. It has been argued, for instance, that proprietary IOS such as the *ASAP* system of Baxter embodies "features built into the...system to customize the system to a particular hospital's needs, in effect creating a *procedural asset specificity* in the relationships between the buyer and seller" (Malone et al., 1987; emphasis added).

We draw an analogy here with the franchising system -- where franchisees are sometimes required to commit investments in transaction-specific capital, such as renting land from the franchiser, making it harder for the franchisees to terminate the agreement (Klein, 1980). This is seen as a hostage situation

(Williamson, 1985) since the incentives for the franchisee have been so structured as to make the termination of the relationship more costly than its continuance (Telser, 1981; Klein and Leffler, 1981). In the electronic interfacing context, the principal offers the IOS bearing most of the initial costs to the agent. In return, the agent is compelled to invest in specific assets related to the customization of business processes, thereby imposing on the agent a certain exogenous level of transaction specificity. These investments in transaction-specific capital are the analog of the investments in land by the franchisees mentioned above, and *render it more costly for the agent to switch business from the interfaced principal.*

Thus, the implementation of a principal-specific IOS creates non-redeployable specific assets (customized business processes through human and procedural asset specificities) that are costly to switch to alternative principals; consequently, market-based exchange does not provide an adequate safeguard for the transaction-specific assets of the agent. Thus, we expect the agent to channel more business to the interfaced principal, *ceteris paribus.* We formally hypothesize that:

H1: *Asset specificity will be positively related to the degree of electronic integration.*

Trust

Trust is an important characteristic of interorganizational relationships. From a transaction cost perspective, the focus has been on opportunism -- defined as 'self-interest seeking with guile' (Williamson, 1975, 1985). Indeed, Williamson (1975) contrasts opportunism with "stewardship behavior", which "involves a trust relation" (p.26). Trust is defined as 'the extent to which negotiations are fair and commitments are upheld' between the parties in a relationship (Bromiley and Cummings, 1991; Anderson and Narus, 1990). We argue that trust can be viewed as the obverse of opportunism (Jarillo, 1988), since it reflects one party's belief that its requirements will be fulfilled through future actions undertaken by the other party

(Anderson and Weitz, 1989). Such a view is in line with the theoretical reasoning in the negotiations literature (Pruitt, 1981) as well as the transaction cost perspective in which trust is an important determinant of long-term hierarchy-like relationships (Williamson, 1985; Aoki, 1990; Bromiley and Cummings, 1991).

Beale and Dugdale provide a succinct summary of the essential elements of trust among contracting businessmen:

> [B]esides there being a common acceptance of certain norms within the trade, there was a considerable degree of trust among firms. This was particularly so among smaller firms who .... frequently placed great trust in the fairness of one or two very large firms.....[E]ven more important than the general reputation of the firm was the desire to do business again with the other party..." (1975; pp 47-48).

Indeed in this vein, from an empirical point of view, trust has been demonstrated to influence expectations of continuity (i.e. long-term relationships) as opposed to short-term transactions akin to market exchange (Anderson and Weitz, 1989; Dwyer, Schurr, and Oh, 1987). Extending such conventional arguments for relating trust and hierarchy-like behavior to the specific context of IT-mediated exchange, we contend that trust is enhanced through greater ease of communication between the principal and the agent under conditions of dedicated electronic interfacing. Thus, we propose the following hypothesis:

H2: *Trust will be positively related to the degree of electronic integration.*

Reciprocal Investment

Williamson (1981, 1985) suggests that *reciprocal* investments in the relationship by the transacting parties offer an *alternative* to vertical integration as a means of safeguarding specific assets from opportunism. Specifically, this protective safeguard takes the form of:

> "introduc(ing) regularities which support and signal continuity intentions. Expanding a trading relation from unilateral to bilateral exchange -- through the concerted use, for example, of *reciprocity* --

> thereby to effect an equilibration of trading hazards..." (1981, p.183, emphasis added).

One form of reciprocity is each party holding as 'hostage' a non-redeployable transaction-specific investment, signalling a commitment to the continuation of the relationship (Williamson, 1985). To the extent that the principals and the agents invest in specific resources to leverage IT capabilities and restructure the nature of the transaction, this is an important determinant of electronic integration. In empirical research, this key construct has usually been neglected, with the notable exception of Heide and John (1990).

More specifically, reciprocal investments are defined here as 'the extent to which the principal invests resources in the relationship with the agent.' In this type of electronically-interfaced relationships, these refer to investments in the underlying hardware, software and communication systems as well as in providing customized training and support to use the interfacing system. Since reciprocal investments moderate the need to safeguard assets, higher levels of reciprocal investments by the other party to the exchange imply lower extent of electronic integration or quasi-integration, *ceteris paribus*. Thus, the formal hypothesis is:

> **H3:** *Reciprocal investment will be negatively related to the degree of electronic integration.*

Agent Size

Size is an important variable in industrial organization economics (Scherer, 1980) although its role in the transaction cost framework is ambiguous (Osborn and Baughn, 1990). In our research, we expect that larger agents may be less dedicated to a single interfaced carrier than smaller agents. This is because such dedication would reduce their ability to serve a broader array of market segments and customer preferences (Stern and El-Ansary, 1977). Thus, we introduce size as a control variable and expect a negative relationship with electronic integration *ceteris paribus*.

Methods

Research Setting

The property and casualty (P&C) insurance industry in the USA served as the setting for testing the research model. This industry is comprised of two major markets: (a) life and health; and (b) property and casualty (P&C) -- each with its distinctive set of products and channels of distribution. The P&C market offers protection against such risks as fire, theft, accident and general liability. The P&C market further breaks out into personal and commercial segments, the former covers individuals (automobile and homeowner insurance for example) and the latter indemnifies commercial policy holders against general liability and workers' compensation[4].

The distribution of commercial lines occurs principally through independent agents, who typically represent multiple carriers and are compensated on commission terms. The upstream P&C insurance market consists of as many as 3600 insurance carriers. Conditions of high fragmentation and low-cost entry and exit result in intense price-based competition and accentuate the highly cyclical pattern of industry evolution. Approximately 300 carriers have multiple offices[5] but 20 to 30 major carriers account for about 50% of total industry revenues. Competition in the downstream insurance market (i.e., among insurance *agencies*) is also intense due to an increased tendency for bargain-hunting by the insureds as well as a growing trend towards self-insurance and heightened competition from direct-writers. Volatile industry conditions are contributing to an ongoing consolidation among the agency population which is accentuated by insurance carriers restructuring their operations and eliminating the poorer-performing agencies.

Patterns of Electronic Interfacing

Common electronic standards for policy information transfer between insurance carriers and the independent agents have been set by the agent-carrier

industry organization ACORD, and in 1983 the *Insurance Value Added Network Services (IVANS)* was established. However the multiplicity of agency automation and interfacing systems, as well as a lukewarm commitment to a common electronic infrastructure by the major carriers, have prevented IVANS from becoming a true electronic market. Had IVANS fulfilled its original role (of a common infrastructure electronic market), independent agents would have benefitted significantly by reducing their dependencies on a narrow set of carriers, while exploiting the full benefits of electronic brokerage effects.

Simultaneously, several leading P&C carriers have deployed proprietary interfacing systems to more tightly couple their business processes with those of the independent agents and expand their domain of hierarchical control. This is akin to what Konsynski and McFarlan (1990) label an 'information partnership' which can confer benefits of scale without ownership. More formally, the deployment of a proprietary IOS between a focal carrier and a set of independent agents is a form of 'vertical quasi-integration' (Blois, 1972) that is rooted in IT capabilities. This is specifically termed here as *electronic integration* that is more 'hierarchy-like' (example: increased vertical referrals by the agent to the interfaced carrier) than 'market-like' (example: spot-market exchange).

Data

Overview. We collected the required data during Spring 1991 by means of questionnaires mailed to a stratified random sample of 400 electronically-interfaced independent agencies who are members of the leading industry association, the National Association of Professional Insurance Agents (PIA). Responses were received from 120 agents who were electronically-interfaced for commercial lines, representing an effective response rate of 30 percent. Assessment of nonresponse bias indicated no serious concerns across the waves of responses (Armstrong and

Overton, 1977). Within this sample, the mean agency size in terms of the annual commercial premium was $4 million.

Informant. With the objective of minimizing key-informant bias (Bagozzi and Phillips, 1982), we sought to identify knowledgeable informant(s) as well as assess the feasibility and benefits of multiple informants during the initial round of interviews. As most agencies in our sample are owner-managed, we chose the owner as our only informant since no other person has the vantage point for providing the data relevant for this study. This approach is consistent with the general recommendation to use the most knowledgeable informant (Huber and Power, 1985; Venkatraman and Grant, 1986); as well as the research practice of relying on a single senior-level informant in studies involving small organizational units (see for instance, Daft and Bradshaw, 1980). In our dataset, the average number of employees handling commercial lines within an agency is about five, implying that it is appropriate to rely on a single, senior-level informant.

Measures

In the following paragraphs, we briefly describe our approach to operationalizing the constructs and in the Appendix, we provide summary results of the measurement properties of the multi-item scales as well as a matrix of zero-order correlations among the indicators.

Electronic Integration. Consistent with our conceptualization of electronic integration as the degree of the agent's dedication to the interfaced principal (insurance carrier), we operationalize it as the *percentage of business (commercial premiums) directed to the interfaced carrier through the proprietary electronic channel.* We develop a continuous measure consistent with prior research such as: (a) John and Weitz (1988), who view forward integration as "percentage of direct sales to end-users" (p 345); (b) Masten et al (1989), who conceptualize backward integration as "the percentage of company's component needs produced under the governance of

the firm" (p 269); and (c) Caves and Bradburd (1988) who developed a continuous measure for vertical integration based on the share of industry outputs. We assess the convergent validity of this single-item potentially fallible measure by examining its correlation with two other indicators -- the number of carriers that account for 80% of the agent's business as well as the number of carriers that each account for at least 2% of the agent's business. The values of the correlations were r=0.5847 and r=0.4788 both significant at $p<.01$[6].

Business Process Asset specificity. We measured business process asset specificity in terms of the extent to which the following facets of the business processes are customized relative to the interfaced insurance carrier: (a) the skill level of the employees working on the interfaced carrier's business; (b) the extent of training needed; and (c) the workflows and routines of the interfaced carrier. Each indicator was measured on a 7-point scale -- relatively similar to other carriers to significantly customized to the interfaced carrier.

Trust. Consistent with our definition, we operationalize trust using the following three indicators: (a) the interfaced carrier and our agency have a high level of mutual trust; (b) the interfaced carrier and our agency work together as partners; and (c) it is assumed that the agreements will be renewed. Each indicator was measured on a 7-point scale from strongly agree to strongly disagree.

Reciprocal investment. We measured reciprocal investment in terms of the agent's perception of the degree to which the interfaced carrier has invested resources in the following three areas: (a) initial training pertaining to the use of electronic interface; (b) providing customized support; and (c) technical support. Each indicator was measured using a 7-point scale -- invested hardly any resources to invested considerable resources.

Size. Size was operationalized in terms of the *log of the total commercial lines premium written* by the agency.

Model Specification

Overview. We specify the model using the notations of structural equations that follow the estimation procedures implemented in the LISREL7 program. This analytical scheme operationalizes the analytical methods proposed by Joreskog and Sorbom (for details, see Joreskog and Sorbom, 1984; Hayduk, 1987). This approach allows the specification of measurement errors within a broader context of simultaneously assessing measurement properties and structural relationships (Bagozzi, 1980). One of the main advantages of this approach lies in its ability to statistically compare the superiority of competing theoretical specifications (Bagozzi, 1980; Bagozzi and Phillips, 1982). Thus, while the use of the fit statistic alone as a measure of model acceptance has been criticized by several researchers, there is general acceptance that model estimations should be based on comparison of the theoretical specifications to alternative, plausible specifications within a nested sequence (Anderson and Gerbing, 1988). Specifically, the superiority of one specification over another competing specification is given by the difference in χ^2 statistic (χ^2d), which is asymptotically distributed as χ^2; these sequential chi-square difference tests are asymptotically independent (Joreskog & Sorbom, 1984; Steiger, Shapiro, & Browne, 1985).

Within this general scheme, Anderson and Gerbing (1988) suggest an approach based on a set of five nested models. A model, M_2 is considered nested within another model, M_1, when its set of freely estimated parameters is a subset of those estimated in M_1. In other words, one or more parameters that are freely estimated in M_1 are constrained in M_2. The five models are as follows: (a) *saturated model (M_s)* -- where all the parameters relating the constructs to one another are estimated; (b) *unconstrained model (M_u)* -- which specifies the 'next most likely' unconstrained alternative specification; (c) *theoretical model (M_t)* -- which represents the model specified based on the underlying theory; (d) *constrained model (M_c)* --

which specifies the 'next most likely' constrained alternative specification with one or more parameters in M_t are constrained; and finally, (e) *null model (M_n)* -- which represents the null model with all parameters relating the constructs to each other fixed at zero. Given these specifications, the five models can be nested in a sequence as follows:

$$M_n < M_c < M_t < M_u < M_s$$

In practice, it is adequate to compare among constrained, theoretical, and unconstrained models since comparisons with saturated and null models are usually satisfied along statistical criteria (Anderson and Gerbing, 1988).

Specification of Models. We specify three models as follows:

Theoretical Model (M_t). The theoretical model specifies four direct effects on EI -- three pertaining to the hypotheses and one for the control variable.

Unconstrained Model (M_u). The unconstrained model specifies two additional plausible paths -- reflecting the possible association between (a) trust and asset specificity and (b) trust and reciprocal investment. The theoretical model had constrained these paths to be zero, which are unconstrained in this specification.

Constrained Model (M_c). The constrained model specifies that the eight independent indicators capture one underlying construct of the agent's organizational characteristics (with the corresponding implication that the finer separation into the four constructs of asset specificity, trust, reciprocal investment and size is spurious and unwarranted) which has an effect on the degree of electronic integration.

Results

Overview

Estimation of M_t using LISREL7 yielded the following statistics: χ^2 (df: 43) = 38.72; p <.657, indicating acceptable fit to the data. All the parameters of the

measurement component of the model indicate values in the acceptable range and there are no offending estimates (such as: negative error variances). However, as noted earlier, finding an insignificant χ^2 does not imply that there are no better models given the same data. Indeed, following the logic of Anderson and Gerbing (1988), we estimate both M_c and M_u as alternative constrained and unconstrained specifications respectively. Estimation of M_c yielded the following statistics: χ^2 (df: 44) = 267.52, $p<.01$, indicating poor fit to the data, while estimations of M_u yielded the following statistics: χ^2 (df: 41) = 35.43, $p<.716$, indicating acceptable fit to the data.

Formal Model Comparisons

A comparison of M_t with Mc indicates that M_t is a better specification given that the difference in χ^2 for 1 degree of freedom is 228.80, $p<.01$. Similarly, a comparison of M_t with Mu indicates that M_t again provides a better fit to the data since the difference in χ^2 for 2 degrees of freedom is 3.29, ns -- implying that the theoretical model, M_t with more degrees of freedom is a better representation than the unconstrained model (see Anderson and Gerbing, 1988; Joreskog and Sorbom, 1984 for additional discussions on model comparisons). Table 1 summarizes the results of testing the three models, Figure 1 represents the theoretical model that received strongest empirical support in this study and Table 2 summarizes the parameter estimates corresponding to the theoretical model in Figure 1.

(Insert Tables 1 and 2 and Figure 1 Here)

Discussion

The transaction cost perspective has served as the dominant theoretical perspective in vertical integration research with particular emphasis on predicting the polar ends of markets and hierarchies (more commonly referred as make versus buy). In recent years, this perspective has been adopted to explain intermediate forms of governance but with limited success (Milgrom and Roberts, 1988; Klein,

Frazier, and Roth, 1990; Walker and Poppo, 1991). Within the research stream on intermediate forms of governance, this study sought to develop and test a research model of electronic integration -- a form of vertical integration that exploits superior information processing capabilities -- based on the transaction cost perspective. We derived our rationale from: (a) prior use of this theoretical perspective to test various forms of organizational governance (Williamson, 1989) including vertical integration (Perry, 1989); and (b) the compelling articulation of the impact of IT on transaction costs and the consequent implications for economic reorganization (Clemons and Row, 1989; Malone et al, 1986; Gurbaxani and Whang, 1991).

The role of information technology in influencing the nature of business relationships has gained a significant amount of acceptance in recent years, largely based on anecdotal evidence (see for instance, McFarlan, 1984; Cash and Konsynski, 1985; Konsynski and McFarlan, 1990). Interestingly, such descriptions invoke the logic of the transaction cost perspective using terms such as 'lock-in' and 'easy-to-do-business' but a systematic empirical assessment of such implied hypotheses has been absent. Thus, our empirical test is not only timely but also important.

Our theoretical model (Figure 1) received strong empirical support in the data obtained from the sample of 120 independent insurance agencies, each interfaced with a focal carrier through dedicated IOS. First, the overall model was found to fit the data very well -- both in terms of absolute criterion (χ^2 values and the associated p-values) as well as in terms of relative criterion (model comparisons with constrained and unconstrained models; see Table 1). Second, in terms of the specific hypotheses, H1 and H2 -- relating business process asset specificity and trust to the degree of electronic integration -- received strong empirical support. Both coefficients were significant ($\gamma_2 = 0.248$, t=2.52 supporting H1; and $\gamma_3 = 0.31$, t=3.267 supporting H2). The third hypothesis, in contrast, received only marginal support. While the coefficient ($\gamma_4 = -0.154$, t=1.67) was negative as predicted, it was only

weakly significant ($p<.10$; one-tailed; less that the critical-value of 1.96 for LISREL estimates to be significant). However, collectively, we conclude that the theoretical model received adequate empirical support indicating that we have a parsimonious set of determinants of electronic integration that can serve as the basis for future empirical assessments. Thus, the primary contribution of this paper lies in providing empirical support to a set of strong untested theoretical assertions relating to the role of information technology in influencing business relationships from a transaction cost perspective.

It is particularly important to note that business process asset specificity -- an important conceptualization of asset specificity in a service sector like insurance emerged as a significant predictor of this intermediate governance mode. This construct -- an important empirical determinant in traditional transaction cost research -- has not been a strong predictor in cases of intermediate forms of governance (Klein, et al, 1990; Walker and Poppo, 1991). Hence, the strong result observed here serves as a significant addition to the growing body of empirical findings in this area.

In contrast to the dominant role of asset specificity, the level of empirical research attention to the role of trust has been somewhat sporadic. Our empirical results demonstrate the importance of trust in explaining the degree of vertical, quasi-integration. We contend that the carrier's decision to offer electronic interfacing -- favorably considered by many independent agents due to its efficiency benefits -- may have an important role to play in generating trust, but a useful area of extension would be to assess whether the level of perceived trust is different across interfaced and non-interfaced samples of insurance agents. Nevertheless, we would urge that trust should be recognized as an important construct in future research efforts.

Reciprocal investment -- as a counterbalance to asset specificity -- has recently become an important theoretical construct in research on distribution channels and interorganizational strategies. For instance, Heide and John (1988) found this to be an important construct in safeguarding assets; and more recently, Anderson and Weitz (1991) have developed a more comprehensive model of building and sustaining commitment in the exchange relationships. Thus, it was somewhat disappointing that this construct did not have a strong significant effect, although the coefficient has the expected (negative) sign.

One possible explanation may be that the strong assumptions of efficiency of governance modes in the transaction cost framework. As Granovetter observed: "Before we can make this assumption [of efficiency], two further conditions must be satisfied: (i) well-defined and powerful selection pressures toward efficiency must be satisfied; and (ii) some actors must have the ability and resources to 'solve' the efficiency problem..." (1985; p.503). To the extent that selection pressures for eliminating inefficient modes of governance are weak, empirical results may not conform to the normative theory. The P&C industry has recently been undergoing a significant transformation characterized by widespread downsizing by the carriers and significant consolidations in the number of agents by as much as 25% during 1980-1986[7]. Thus, data collected against such a backdrop may not support a model based on a comparative statics efficiency perspective and further research using this construct is needed before we can accept or reject this possible explanation.

Research Extensions

1. Theory-constrained versus theory-informed models. Our approach to the specification of the research model of the determinants of electronic integration was primarily constrained by extant theory in this area as well as the empirical research within one dominant theoretical perspective: the transaction cost framework. This reflects a research strategy of employing the best available (relevant) theory to test a

set of hypotheses on a new phenomenon -- termed as a 'theory-constrained' approach to model specification. Consequently, factors outside the domain of the underlying theory are explicitly excluded. Although we supported such a parsimonious model, another alternative is to identify a broader set of factors that has the potential to explain and/or predict the phenomenon of interest from several complementary theoretical perspectives -- termed as a 'theory-informed' approach to the specification of research models. Given the relative recency of the phenomenon of IT-induced transformation in dyadic business relationships and lack of rigorous extant theories to guide research in this area, one attractive research extension would be to develop models that subscribe to theoretical pluralism. Promising set of theoretical concepts include: bargaining and influence costs (Milgrom and Roberts, 1990); agent-theoretic arguments (see for instance, Gurbaxani and Whang, 1991) as well as the resource dependency perspective (Pfeffer and Salancik, 1978). Such an approach would involve the specification of a larger set of constructs reflecting these theoretical perspectives in explaining and predicting the degree of electronic integration.

2. *Comparative static model versus per-post design.* An important extension incorporating both theoretical and methodological considerations is a study where it would be possible to test the same theoretical model across two time periods for the same sample: before- and after- electronic interfacing. By collecting data on the independent and dependent variables at two time-periods, we would be in a better position to recognize the temporal changes in the pattern and determinants of electronic integration and isolate the impact of the theoretically-specified determinants.

3. *Use of a control group of non-interfaced agents.* This study adopted a design, which falls within the category of posttest only design (Campbell and Stanley, 1963). A natural line of future inquiry would be to adopt a quasi-experimental design

incorporating a control group of agents without the particular IOS functionalities. It would be a logical extension to Venkatraman and Zaheer (1990) who adopted such a design to compare the *effects* of electronic interfacing but did not compare the coefficients of determinants of quasi-integration across two samples: an experimental group of agents operating under conditions of electronic interfacing and a matched sample of agents operating under traditional business conditions. By explicitly comparing the coefficients of determinants of quasi-integration across these two settings, we may be able to further advance the specific role of electronic interconnection in interorganizational relationships.

Conclusions

Research in the area of IT-induced interorganizational relationships is at critical crossroads today as it attempts to move beyond conceptual frameworks, isolated case studies and untested assertions. Within this general arena, this paper attempted to provide empirical support for a model of electronic integration based on a transaction cost perspective. We provide general support for the two traditional constructs -- namely: business process asset specificity and trust, while the third determinant, reciprocal investment, had the expected sign but was only weakly significant. We developed implications for further research in this important area at the intersection of information technology and organizational economics.

References

Alchian, A.A. and H. Demsetz. (1972) "Production, information costs, and economic organization". *American Economic Review*, 62(5):777-795.

Anderson, E. (1985). "The salesperson as outside agent or employee: a transaction cost analysis." *Marketing Science*, 4:234-253.

Anderson, E. and D.C. Schmitlein. (1984). "Integration of the sales force: An empirical examination". *Rand Journal of Economics*, 15:3-19.

Anderson, E., and B.Weitz. (1991), "The use of pledges to build and sustain commitment in distribution channels," Working Paper, Marketing Science Institute 91-114.

Anderson, J.C and D. W.Gerbing (1988), "Structural equation modeling in practice: A review and recommended two-step approach," *Psychological Bulletin*, 103 (May), 411-423.

Aoki, M. (1990). "The participatory generation of information rents and the theory of the firm," in M. Aoki, B. Gustafsson, and O.E. Williamson (eds.) *The Firm as a Nexus of Treaties*. London: Sage.

Anderson, E., L.M. Lodish, and B.A. Weitz. (1987)."Resource allocation behavior in conventional channels," *Journal of Marketing Research*, 24: 254-262.

Armstrong, J. S., and T.S. Overton (1977), "Estimating nonresponse bias in mail surveys," *Journal of Marketing Research*, 14, 396-402.

Bagozzi, R.P. *Causal Models in Marketing*, New York: Wiley, 1980.

Bagozzi, R.P. and L.W. Phillips (1982). "Representing and testing organizational theories: A holistic construal". *Administrative Science Quarterly*, 27:459-489.

Bakos, J.Y. and M.E. Treacy (1986). "Information technology and corporate strategy: A research perspective." *MIS Quarterly*, June pp 107-119.

Barrett, S., and B. Konsynski (1982). "Inter-organization information sharing systems". *MIS Quarterly, Special Issue*, 1982.

Beale, H., and T. Dugdale, (1975), "Contracts between businessmen: Planning and the use of contractual remedies," *British Journal of Law and Society*, 2, 45-60.

Blois, K.J. (1972) "Vertical quasi-integration" *Journal of Industrial Economics*, 20, 253-272.

Bromiley, P. and L.L. Cummings. (1991). "Transaction costs in organizations with trust," Working Paper, Department of Strategic Management, Curtis L. Carlson School of Management, University of Minnesota.

Campbell, D.T. and J.C. Stanley (1963). *Experimental and Quasi-experimental Designs for Research,* Boston: Houghton-Mifflin.

Cash, J.I. and B. Konsynski, (1985), "IS redraws competitive boundaries, " *Harvard Business Review*, 63 (2), 134-142.

Caves, R.E. and R.M. Bradburd (1988). "The Empirical Determinants of Vertical Integration", *Journal of Economic Behavior and Organization*, 9:265-279.

Clemons, E. K. and M. Row (1989), "Information Technology and Economic Reorganization." *Proceedings of the 10th International Conference on Information Systems*. Boston, Mass: December 1989.

Clemons, E. K. and S.O. Kimbrough (1986)."Information Systems, Telecommunications, and their Effects on Industrial Organization, " *Proceedings of the Seventh International Conference on Information Systems*, pp. 99-108.

Coase, R. (1937), "The Nature of the Firm, " *Economica*, 4:386-405.

Daft, R.L., and P.J. Bradshaw, (1980), "The process of horizontal differentiation: Two Models," *Administrative Science Quarterly*, 25: 441-484.

Dwyer, F.R., P.H. Schurr, and S. Oh. (1987)."Developing buyer-seller relationships," *Journal of Marketing*, 51: 11-27.

Eccles, R. G. (1981). "The Quasi-Firm in the Construction Industry'" *Journal of Economic Behavior and Organization*, 2:335-357.

Etgar, Michael. (1976). "Effects of administrative control on efficiency of vertical marketing systems". *Journal of Marketing Research*, 13:12-24.

Granovetter, M. (1985). "Economic action and social structure: A theory of embeddedness," *American Journal of Sociology*, 91(3): 481-510.

Grossman, S.J., and O.D. Hart, (1986) "The costs and benefits of ownership: A theory of vertical and lateral integration, " *Journal of Political Economy*, 94, 691-719.

Gurbaxani, V. and S. Whang. (1991). "The impact of information systems on organizations and markets," *Communications of the ACM*, January 1991.

Harrigan, K.R. (1988). "Joint Ventures and Competitive Strategy, " *Strategic Management Journal*, 9:141-158.

Hayduk, Leslie A. (1987), *Structural equation modeling with LISREL.* Baltimore: Johns Hopkins Press.

Heide, J.B. and G. John (1988)."The Role of Dependence-Balancing in Safeguarding Transaction-Specific Assets in Conventional Channels, " *Journal of Marketing*, 52:20-35.

Huber, G., and D. Power (1985). "Retrospective reports of strategic level managers" *Strategic Management Journal*, 6: 171-180.

Jarillo, J. C (1988). "On strategic networks". *Strategic Management Journal*, 9:31-41.

John, G., and B. Weitz (1988). "Forward integration into distribution: An empirical test of transaction cost analysis". *Journal of Law, Economics and Organization*. 4:337-355.

Johnston, H.R., and M.R. Vitale (1988) Creating competitive advantage with interorganizational information systems. *MIS Quarterly*, June, 153-165.

Johnston H.R. and P.R. Lawrence (1988)."Beyond Vertical Integration -- the Rise of the Value-Adding Partnership, " *Harvard Business Review*, July August, pp. 94-101.

Joreskog, K. G. 1971. Statistical analysis of congeneric tests.*Psychometrika*, 36:109-133.

Joreskog, K. G., and Sorbom, D. Eds. 1979. *Advances in factor analysis and structural equation models*. Mass: Abt Books.

Joreskog, K.G. and D. Sorbom (1984). *Analysis of Linear Structural Relationships by Method of Maximum Likelihood*. Chicago: National Education Resources.

Joskow, P. (1987). "Contract duration and relationship-specific investments: empirical evidence from coal markets." *American Economic Review* 77:168-185.

Keen, Peter G.W. (1986). *Competing in Time*. Cambridge, MA: Ballinger Publishing Company.

Klein, B. (1980), "Transaction costs determinants of 'unfair' contractual arrangements, " *American Economic Review*, 70, 356-362.

Klein, B., R.G. Crawford and A.A. Alchian (1978)."Vertical Integration, Appropriable Rents, and the Competitive Contracting Process, " *Journal of Law and Economics*, 21(2):297-326.

Klein, B., and K.B. Leffler.(1981). "The role of market forces in assuring contractual performance," *Journal of Political Economy*, 89: 615-641.

Klein, S., G.L. Frazier, and V.J. Roth (1990), "A transaction cost analysis model of channel integration in international markets, " *Journal of Marketing Research*, 27, 196-208.

Konsynski, B.R., and F.W MacFarlan. (1990). "Information Partnership: Scale without Ownership. *Harvard Business Review*, September-October.

Konsynski, B.R., and A. Warbelow. (1989) "Cooperating to Compete: Modeling Interorganizational Interchange." Mimeo. Harvard Business School.

Lawley, D. N. and Maxwell, A. E. 1971. *Factor analysis as a statistical method*. London: Butterworth.

Levy, D.T. (1985). The transactions cost approach to vertical integration: An empirical investigation". *Review of Economics and Statistics.* 67:438-445.

MacNeil, I.R. (1980). *The New Social Contract.* New Haven, CT: Yale University Press.

Mahoney, J.T. (1989). "The choice of organizational form: Vertical integration versus other methods of vertical control". Working Paper No. 89-1622, College of Commerce and Business Administration, University of Illinois at Urbana-Champaign.

Malone, T. J., J. Yates and R. Benjamin. (1987). "Electronic markets and electronic hierarchies". *Communications of the ACM.* 30(6):484-497.

Marschak, J. (1968). "Economics of inquiring, communicating, deciding," *American Economic Review,* 58: 1-18.

Masten, S. (1984). "The organization of production: Evidence from the aerospace industry". *Journal of Law and Economics.* 27:403-418.

Masten, S.E., J.W. Meehan and E.A. Snyder (1989), "Vertical integration in the US Auto industry" *Journal of Economic Behavior and Organization,* 12, 265-273.

Masten, S.E., J.W. Meehan and E.A. Snyder (1991), "The Costs of Organization" *Journal of Law Economics and Organization,*

Milgrom, P and J. Roberts, (1990)."Bargaining Costs, Influence Costs and the Organization of Economic Activity, " In J.E Alt and K.H Shepsle. *Perspectives on Positive Political Economy.* Cambridge, England: Cambridge University Press.

Monteverde, K. and D. J. Teece. (1982). "Supplier switching costs and vertical integration in the automobile industry". *Bell Journal of Economics,* 13:206-213.

Nelson, R.R. and S.G. Winter, (1982). *An Evolutionary Theory of Economic Change,* Cambridge, Mass: Harvard

Osborn, R.N., and C.C. Baughn. (1990). "Forms of Interorganizational Governance for Multinational Alliances, " *Academy of Management Journal,* 33(3), 503-519.

Perry, M.K. (1989). Vertical Integration: Determinants and Effects" In R. Schmalansee and RD Willig (Eds.) *Handbook of Industrial Organization* Vol. 1, Amsterdam: Elsevier Holland. Chapter 4.

Pfeffer, J. and G.R. Salancik. (1978). *The External Control of Organizations.* New York: Harper and Row.

Pisano, G. P. (1989). "Using equity participation to support exchange: evidence from the biotechnology industry". *Journal of Law, Economics and Organization.* 5(1):109-126.

Polanyi, M. (1962). *Personal Knowledge: Towards a Post-Critical, Philosophy*, New York: Harper & Row.

Powell, W.W. (1990)."Neither Market Nor Hierarchy, " in L.L. Cummings and B.M. Staw (eds.) *Research in Organization Behavior*. Greenwich, CT: JAI Press.

Pruitt, D. G. (1981). *Negotiation Behavior*, New York, NY: Academic Press.

Robins, J.A. (1987)."Organization Economics - Note on the Use of Transaction Cost Theory in the Study of Organizations, " *Administrative Science Quarterly*, 32:68-86.

Rockart, J.J. and M.S. Scott Morton (1984)."Implications of Changes in Information Technology for Corporate Strategy, " *Interfaces*, 14(1):84-95.

Scherer, F.M. (1980). *Industrial Market Structure and Economic Performance*. Boston: Houghton Mifflin.

Scott Morton, M.S. (1991). *The corporation of the 1990s*. New York and Oxford: Oxford University Press.

Stern, L. W. and A. I. El-Ansary.(1977). *Marketing Channels*. Englewood Cliffs, NJ: Prentice Hall.

Steiger, J.H., Shapiro, A., and Browne, W.M. (1985) On the multivariate asymptotic distribution of sequential chi-squared statistics. *Psychometrika*, 43, 225-243.

Stinchcombe, A.L. (1990). *Organizations and Information*. San Francisco: California.

Telser, L.G. (1980)." A theory of self-enforcing agreements," *Journal of Business*, 53: 27-44

Thompson, J.D. (1967). *Organizations in Action*. New York: McGraw Hill.

Venkatraman, N. (1989), "Strategic orientation of business enterprises: The construct, dimensionality and measurement," *Management Science*, 35 (8), 942-962.

Venkatraman, N., and J.H. Grant (1986) "Construct Measurement in Organizational Strategy Research: A Critique and Proposal, " *Academy of Management Review*, 11, 71-87.

Venkatraman, N., and A. Zaheer (1990), "Electronic Integration and Strategic Advantage: A Quasi-experimental study in the insurance industry," *Information Systems Research*, 1: 377-393.

Walker, G (1988), "Strategic Sourcing, Vertical Integration, and Transaction Costs" *Interfaces*, 18: 62-73.

Walker, G and L. Poppo. (1991). "Transaction costs in organizations and markets, " *Administrative Science Quarterly*,

Walker, G., and D. Weber, (1984), "A Transaction Cost Approach to Make versus

Buy Decision" *Administrative Science Quarterly*, 29:373-391.

Williamson, O. E. (1975). *Markets and Hierarchies*. New York: The Free Press.

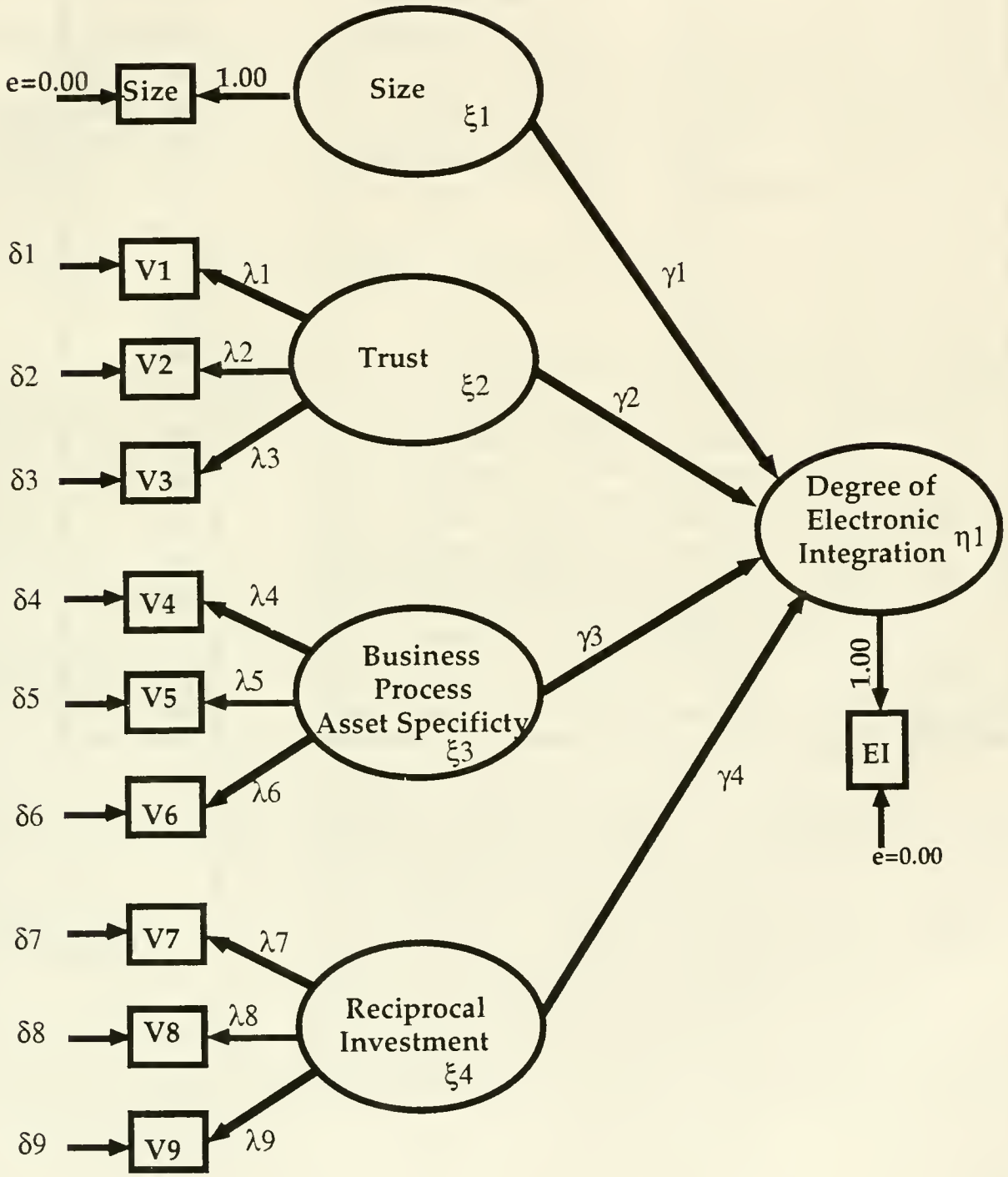
Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. New York: The Free Press.

Williamson, O. E. (1989). "Transaction Cost Economics, " in R. Schmalansee and R.D. Willig (eds.) *Handbook of Industrial Organization* Volume I. Amsterdam: Elsevier.

Table 1: A Summary of Model Comparisons

Model	Description	Model Fit	Model Comparisons	Results
M_t	Specification of four direct effects (3 hypotheses and 1 control variable) on EI	χ^2 (df: 43) = 38.72; p<.657	NA	NA
M_u	Specification of two additional plausible paths -- reflecting the possible association between (a) trust and asset specificity and (b) trust and reciprocal investment. .	χ^2 (df: 44) = 267.52; p<.001	Comparison of M_u with M_t yields a χ^2d (df: 1) = 228.80; p<.001	M_t is acceptable over M_u
M_c	Specification that all ten indicators capture on one construct of organizational characteristics	χ^2 (df: 41) = 35.43; p<.071	Comparison of M_c with M_t yields a χ^2d (df: 2) = 3.29; p>.05	M_t is acceptable over M_c

Figure 1: The Theoretical Model



Note: Details of the indicators corresponding to V1 through V9 are available in Table A2

Table 2: Parameter Estimates for the Theoretical Model (Figure 1)

Parameter	ML Estimate	t-value	Standardized Solution
λ_1	1.00	(fixed parameter)	1.00
λ_2	1.00	(fixed parameter)	0.822
λ_3	0.985	8.548*	0.810
λ_4	0.963	8.437*	0.792
λ_5	1.00	(fixed parameter)	0.587
λ_6	1.043	5.128*	0.612
λ_7	1.546	4.755*	0.907
λ_8	1.00	(fixed parameter)	0.869
λ_9	0.975	8.952*	0.847
λ_{10}	0.812	7.852*	0.706
γ_1	-0.167	-1.55	-0.165
γ_2	0.382	3.267*	0.310
γ_3	0.428	2.520*	0.248
γ_4	-0.179	-1.675t	-0.154
ϕ_{11}	1.00	(fixed parameter)	1.00
ϕ_{22}	0.676	4.918*	1.00
ϕ_{33}	0.344	2.959*	1.00
ϕ_{44}	0.755	5.254*	1.00
ψ_{11}	0.810	7.117*	0.791

* -- p<.01; t-- p<.10;

Appendix: Measurement Details

Table A1 summarizes the descriptive statistics and the matrix of zero-order correlations among the indicators used in this study.

Measurement Properties of Multi-item Scales

Internal Consistency of Measurements. Within a confirmatory factor analytic approach (Bagozzi, 1980) operationalized using the LISREL framework (Joreskog and Sorbom, 1979; 1984), the internal consistency of measures is given by ρ_c which reflects the proportion of trait variance accounted for by the measures.

$$\rho_c = \left(\sum_{i=1}\lambda_1\right)^2 \text{Variance (A)} \Big/ \left(\left(\sum_{i=1}\lambda_1\right)^2 \text{Variance (A)} + \sum\theta_\delta\right) \qquad \text{(A1)}$$

Table A2: Measurement Properties of Multi-Item Scales

Construct	# of Items	Description of the Measures	ρ_c
Trust	3	(a) the interfaced carrier and our agency have a high level of mutual trust; (b) the interfaced carrier and our agency work together as partners; and (c) it is assumed that the agreements will be renewed. Each indicator was measured on a 7-point scale from strongly agree to strongly disagree.	0.84
Business Process Asset Specificity	3	The extent to which the following facets of the business processes are customized relative to the interfaced insurance carrier: (a) the skill level of the employees working on the interfaced carrier's business; (b) the extent of training needed; and (c) the workflows and routines of the interfaced carrier. Each indicator was measured on a 7-point scale -- relatively similar to other carriers to significantly customized to the interfaced carrier.	0.75
Reciprocal Investments	3	We measured reciprocal investment in terms of the agent's perception of the degree to which the interfaced carrier has invested resources in the following three areas: (a) initial training pertaining to the use of electronic interface; (b) providing customized support; and (c) technical support. Each indicator was measured using a 7-point scale -- invested hardly any resources to invested considerable resources.	0.83

Convergent and Discriminant Validity of Measurements. Convergent validity of the three multi-item constructs is assessed through a confirmatory factor analytic approach (see Venkatraman, 1989 for an application in a related context). The basic model of convergent validity is written as:

$$X = \Lambda\xi + \delta \qquad \text{(A2)}$$

where X is a vector of p measurements, ξ is a $k < p$ sector of traits, δ is a vector of unique scores (random errors), and Λ is a p x k matrix of factor loadings relating the observations to the underlying dimension. With the assumptions of $E(\xi) = E(\delta) = 0$; $E(\xi\xi') = \phi$ and $E(\delta\delta') = \psi$, the variance-covariance matrix of X can be written as

$$\Sigma = \Lambda\Phi\Lambda' + \psi \qquad \text{(A3)}$$

where Σ is the variance-covariance matrix of observations, Φ is the matrix of intercorrelations among the traits, and ψ is a diagonal matrix of error variance (θ_δ) for the measures.

Maximum likelihood (ML) parameter estimates for Λ, Φ, ψ, and χ^2 goodness of fit index for the null model implied by equations (A2) and (A3) are obtained from the LISREL7 Program. The probability level associated with a given χ^2 statistic indicates the probability (p) of attaining a large χ^2 value given that the hypothesized model is supported. The higher the value of p, the better is the fit, and as a rule of thumb, value of $p > 0.10$ are considered as an indication of satisfactory fit (Lawley and Maxwell, 1971). The results of testing the basic convergent validity model was: χ^2 (df:24) 14.42, $p<.937$ -- indicating acceptable fit to the model with strong t-values.

Discriminant validity refers to the degree to which measures of the three different constructs are unique. This is achieved when measures of each construct converge on their corresponding true scores and can be tested that the correlations between the pairs of dimensions are significantly different from unity. This requires a comparison of a model with this correlation constrained to equal one with the unconstrained model. A significantly lower χ^2 value for the model with the unconstrained correlation, when compared with the constrained model, provides support for discriminant validity. A χ^2 difference value with an associated p-value less than .05 (Joreskog, 1971) supports discriminant validity. Tests of a constrained model yielded the following statistics: χ^2 (df:27) 81.77, $p<.001$ -- indicating poor fir to the data. Further, the difference in χ^2 (df:3) was 67.35, $p<.001$, providing strong support for the discriminant validity of measurements.

Table A1: Descriptive Statistics and The Matrix of Zero-Order Correlations (n=120)

Variable	Mean	Sd	EI	Size	V1	V2	V3	V4	V5	V6	V7	V8	V9
EI	34.06	25.42	1.00										
Size	4.0 Mill	3.2 Mil	-0.044	1.00									
V1	5.139	1.468	0.244	0.022	1.00								
V2	4.565	1.528	0.270	0.064	0.668	1.00							
V3	4.887	1.549	0.261	0.085	0.655	0.635	1.00						
V4	4.400	1.900	0.057	0.116	0.024	-0.036	0.069	1.00					
V5	3.188	1.998	0.182	0.111	0.096	0.006	0.146	0.369	1.00				
V6	3.957	1.894	0.244	0.117	0.173	0.090	0.109	0.534	0.552	1.00			
V7	4.922	1.585	-0.059	-0.294	0.095	0.044	0.111	0.121	0.082	0.104	1.00		
V8	4.617	1.750	-0.023	-0.215	0.076	0.118	0.178	0.120	0.068	0.106	0.736	1.00	
V9	4.209	1.755	-0.019	-0.230	0.077	0.077	0.148	0.083	0.049	0.045	0.612	0.600	1.00

Correlations greater than 0.14 are significant at $p<.01$.

Note: V1 to V3 correspond to the three measures of trust; V4 to V6 to the three measures of business process asset specificity; and V7 to V9 to the three measures of reciprocal investment as summarizes in Table A2

Notes

[1]The *agent (or agency)* refers to the independent organization that forms the downstream link between insurance *carrier*, and the insured in the marketplace for insurance services.

[2] We attribute this term to Barrett and Konsynski (1982).; for detailed discussion on the role of IOS in different markets, see also Cash and Konsynski (1985); Konsynski and Warbelow (1990),

[3]Following (Perry, 1989), vertical integration is defined as a condition in which a firm "encompasses two single output production processes in which either (1) the *entire* output of the 'upstream' process is employed as *part or all* of the quantity of one intermediate input into the 'downstream' process, or (2) the *entire* quantity of one intermediate input into the 'downstream' process is obtained from *part or all* of the output of the 'upstream' process. "(p.185, italics in the original).

[4]For background details, see *Standard & Poor's Industry Surveys*: Insurance and Investment Banking.

[5]Frost and Sullivan, 1984.

[6] The actual correlation coefficient was computed as follows: The *ln* (EI) with *ln* (1/n1) and *ln* (1/n2), where n1 = number of carriers that account for 80% of the agent's business; and n2= the number of carriers that each account for at least 2% of the agent's business. Given such transformations, we expect positive and significant correlations with the EI measure.

[7]d'Adolf, *Independent Agent*, August 1987.