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RESEARCH NOTE

BUYER INTENTION TO USE INTERNET-ENABLED REVERSE AUCTIONS: THE ROLE OF ASSET SPECIFICITY, PRODUCT SPECIALIZATION, AND NON-CONTRACTIBILITY[1]

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Abstract

Information technology enabled exchanges in electronic markets have significant implications for buyer–supplier relationships. Building on studies that emphasize the role of intangible assets in interorganizational relationships, this study argues that buyers are less likely to use reverse auctions for supplier relationships involving a high degree of non-contractibility. The argument complements traditional transaction cost economics arguments that focus on the impact of asset specificity and product specialization. We identify six dimensions of non-contractibility—quality, supplier technological investments, information exchange, responsiveness, trust, and flexibility—which encompass task-based and interaction-based non-contractibility. The study finds that, together with product specialization, these non-contractible elements of interorganizational relationships have greater explanatory power for reverse auction use than asset specificity. This result highlights the importance of supplier investments in non-contractible elements of exchange relationships in an increasingly dynamic service- and knowledge-based economy.

Keywords: Reverse auctions, procurement auctions, electronic markets, transaction cost economics, interorganizational relationships, buyer–supplier relationships, incomplete contracts approach, non-contractibility, business-to-business auctions, asset specificity, uncertainty, customer satisfaction

Introduction

The Internet has facilitated many new information technology enabled procurement options that raise questions for business practice and academic research. On-line reverse auctions, in which industrial buyers announce purchasing requirements

[1]Vivek Choudhury was the accepting senior editor for this paper.

and select suppliers from among the lowest bidders (Anderson and Frohlich 2001; Mithas and Jones 2007), are a particularly intriguing practice.[2] On one hand, Internet-enabled reverse auctions may help buyers gain efficiencies by providing access to a larger pool of suppliers. On the other hand, reverse auctions may imperil long-term supplier relationships and appear inconsistent with the trend of firms developing deep relationships with a few suppliers in response to the growing importance of knowledge-based exchanges in the highly dynamic service economy (Bensaou 1997; Steinfield et al. 1995).

Despite the growing importance of reverse auctions in procurement, few studies have examined the determinants of reverse auction use. Research on IT-mediated interorganizational systems and buyer–supplier relationships focuses largely on transaction cost economics (TCE) arguments concerning asset specificity as the primary explanation for organizational boundaries (Malone et al. 1987; Williamson 1975). More recently, scholars have argued for the need to expand traditional TCE reasoning (Choudhury et al. 1998; David and Han 2003; Geyskens et al. 2006; Hess and Kemerer 1994; Monczka et al. 1998) and to extend research beyond the boundaries of TCE theory by drawing on perspectives such as relational theory (Bensaou 1997; Grover et al. 2002; Nidumolu 1995) and incomplete contracts theory (Bakos and Brynjolfsson 1993a, 1993b) (Table 1 lists selected studies from this literature). Bakos and Brynjolfsson (1993a, 1993b) argued that non-contractible elements arising in incomplete contract theory—such as commitment to quality, technological investments, sharing information, responsiveness, trustworthiness, and flexibility—may influence procurement choices such as use of reverse auctions. However, researchers have yet to assess the relative importance of non-contractibility and asset specificity as explanations of firms' sourcing choices.

This paper assesses how non-contractibility influences firms' use of reverse auctions, comparing and contrasting the effect of non-contractibility with traditional TCE determinants of sourcing choices. Our goal is to understand when firms will select reverse auctions rather than more traditional sourcing relationships, with reverse auction usage implying arm's-length market transactions rather than hierarchical or hybrid relationships.[3] Our guiding logic is that a firm's choice among different IT-enabled procurement mechanisms stems from the firm's underlying choice of sourcing relationship. In identifying the literature that we use to frame the study, we note inadequate consideration of non-contractibility and conceptual limits within traditional views of sourcing determinants. We studied the likelihood of reverse auction use by U.S. automotive assemblers and component manufacturers. The study finds that non-contractibility has greater explanatory power for reverse auction use than traditional asset specificity.

Background and Theory

Prior Literature

Drawing on TCE theory, Malone et al. (1987) made two predictions: First, that IT-enabled exchange would reduce coordination costs and, second, in what has become known as the "electronic market hypothesis" (EMH), that firms would move toward greater use of markets compared to hierarchies because of IT-enabled reduction in coordination costs and ease of describing complex products. Research has found significant support for the prediction of reduced coordination costs (Bardhan et al. 2007; Brynjolfsson et al. 1994; Dewan et al. 1998; Hitt 1999) but less support for the EMH (Choudhury et al. 1998; Hess and Kemerer 1994; Monczka et al. 1998). Hess and Kemerer (1994, p. 251) observe that "the underlying hypothesis [i.e., the electronic market hypothesis] will require augmentation in order to fully explain the results," while Choudhury et al. (1998, p. 471) note the need for considering "additional variables…in understanding the uses and impacts of electronic markets." Thus, although TCE helps explain aspects of IT-enabled exchange, it does not provide a full explanation for observed patterns.

Scholars have taken several approaches to generate a more complete explanation. One approach seeks to augment TCE by considering intangible aspects of specificity, in addition to traditional investments in tangible specialized assets. For example, Christiaanse and Venkatraman (2002, p. 16) emphasize the "need to go beyond a traditional transaction cost economics perspective…that focuses on deployment of tangible assets…to a perspective that recognizes the role of intangible assets." In this vein, Bensaou and Anderson (1999), Choudhury and Sampler (1997), Subramani (2004), and Subramani and Venkatraman (2003) helped extend TCE by identifying additional dimensions of specificity, including buyer side asset specificity, business process specificity, domain knowledge specificity, and information specificity. A second path, drawing from sociological arguments, emphasizes the importance of relational influences (i.e., coordination

[2]Reverse auctions have descending bids, such that the bids decline as an auction continues.

[3]Reverse auctions fall toward the contractual governance end of Bakos and Brynjolfsson (1993a, 1993b) contractual–institutional distinction, owing to the emphasis on documenting specifications and terms before conducting the auctions (Anderson and Frohlich 2001; Mithas and Jones 2007).

Table 1. Selected Studies in Interorganizational Systems and Interorganizational Relationships

Study	Conceptual/ Analytical	Case Studies	Empirical
Transaction Cost (Coase-Williamson) Theory			
1. Malone et al. 1987	X		
2. Hess and Kemerer 1994		X	
3. Choudhury et al. 1998		X	
4. Monczka et al. 1998			X
5. Subramani 2004			X
Relational Theory			
6. Nidumolu 1995			X
7. Bensaou 1997			X
8. Grover et al. 2002			X
Incentives-Based Theory (property rights, incomplete contracts)			
9. Bakos and Brynjolfsson 1993a, 1993b	X		

Note: Table 1 lists some representative studies and does not exhaustively review the literature. Although other perspectives such as institutional theory (Teo et al. 2003) are also relevant to study interorganizational systems and buyer–supplier relationships, we focus on TCE and incomplete contracts theory in this paper.

and closeness) in interorganizational relationships (Grover et al. 2002), which also function as intangible investments that will shape governance choices.

While useful, these approaches need to be complemented to expand our understanding of governance choices for IT-enabled exchanges. Simply expanding the definition of asset specificity to include intangible assets still assumes uncertainty as a given (outside the control of a buyer) and, therefore, an exogenous element of a buyer–supplier relationship, without recognizing its endogenous nature (i.e., buyers can influence uncertainty through their governance and sourcing choices, as we discuss below). Current discussions of relational influences, meanwhile, typically do not discuss particular aspects of intangible investments that will arise during a relationship. What is needed, therefore, is a theory and framework to address these limitations of conventional TCE and relational approaches by identifying and measuring these intangible investments and recognizing their endogenous nature.

Incomplete contracts theory, which is sometimes referred to as property rights theory (Bakos and Nault 1997; Grossman and Hart 1986; Hart 1988; Hart and Moore 1990), expands our understanding of electronic market usage, particularly by highlighting the notion of non-contractibility (Bakos and Brynjolfsson 1993a, 1993b). Incomplete contracts theory complements asset specificity and relational arguments by describing the nature of intangible investments more precisely. It also explains why and for what types of exchanges buyers will choose to limit their sourcing options and thereby forego any short-term benefits that might arise from using reverse auctions.

Before discussing particular elements of non-contractibility and developing arguments for how non-contractibility will affect boundary choices, it is useful to understand how non-contractibility differs from asset specificity. Asset specificity refers to the degree to which investment in a particular asset has lower value in its next-best use. TCE theory argues that firms will seek to bring highly specific investments within their boundaries in order to limit the ability of others to act opportunistically in market transactions involving such assets (Williamson 1975). By contrast, non-contractibility involves difficult-to-specify investments that a firm may need to make in the future in order to sustain a set of existing transactions or to initiate a new set of exchanges with the same partner (Bakos and Brynjolfsson 1993b). Non-contractible elements of exchange such as trust, responsiveness, flexibility, commitment to quality, technological investments, and information sharing often have major impacts on a firm's ability to develop and market new goods and services. Thus, perhaps most strikingly, the notion of non-contractibility in a buyer–supplier relationship departs from the traditional TCE argument that focuses on discrete transactions and "normally examines each trading nexus separately," helping address the fact that "interdependencies among a series of related contracts may be missed or undervalued" (Williamson 1985, p. 393) in TCE.

To some degree, TCE attempts to encompass non-contractibility by incorporating the role of uncertainty in boundary choices and arguing that firms will prefer vertical integration when uncertainty is high. Non-contractibility arises because environmental or performance uncertainties make it impossible to write contracts that cover all future contingencies. TCE assumes that if it was not for uncertainty, one could write a complete contract with independent actors and thereby externalize transactions that a firm would otherwise undertake internally. TCE focuses on uncertainty about states of the world, however, where it is difficult to predetermine contractual contingencies. By contrast, non-contractible elements of an activity are attributes that are simply difficult or impossible to specify in contracts no matter how much foresight one had about the future and, instead, depend on the goodwill and willingness of actors to work together effectively. Indeed, non-contractible elements of an evolving set of activities typically arise over time, based on actors' commitments to work with each other. The theory of incomplete contracts views non-contractible activities as investment options that agents will exercise when they make economic sense in the face of other actors' actions, without committing to them *ex ante* because these investments are costly and non-verifiable. Thus, TCE views uncertainty and any resulting difficulties in creating contracts as exogenous issues that determine a firm's boundaries, whereas non-contractible factors often arise endogenously because of the boundaries that firms have created and the degree to which they commit to undertaking a series of transactions within and across those boundaries.

In turn, one might argue that non-contractibility, rather than offering a new perspective on governance or sourcing arrangements, is simply another form of asset specificity. We sympathize with this point of view, because many of the elements of non-contractibility involve activities whose greatest values arise in the context of particular relationships. Indeed, Malone et al. (1987) point to the fact that asset specificity can arise over time as the result of interaction between parties. Nonetheless, a critical difference between non-contractibility and traditional views of asset specificity is that specificity is a characteristic of investment in an asset that supports a particular transaction or series of *stable* transactions, while non-contractibility is a characteristic of investment in activities that involve a series of *changing* transactions between organizations over time. The major distinction is that asset specificity involves particular physical or human capital investments that a firm expects to undertake in order to support a given stream of transactions, whereas non-contractibility involves unknown investments that a firm may need to be willing to make in the future in order to sustain the transactions or to initiate a new set of exchanges with the partner (Bakos and Brynjolfsson 1993b). Therefore, although asset specificity and non-contractibility are related concepts, they warrant separate attention.

Clearly, whether one views non-contractibility as an alternative to or an extension of transaction cost theory depends on how encompassing a view of TCE theory one wishes to take. We do not take a strong stand on just where the dividing line lies in demarking TCE explanations from "alternative" theories. Instead, our primary purposes are, first, to highlight the importance of non-contractibility in interorganizational relationships, which has not been fully reflected in prior studies of electronic markets or, more generally, of firm boundaries, and then to identify key dimensions of non-contractibility and assess how non-contractibility affects firms' sourcing decisions.

Multidimensional Attributes of Non-Contractibility

Prior research helps identify non-contractible characteristics of relationships that are common in many settings. We focus on six characteristics: quality, technological investments by a supplier, information exchange, responsiveness, trust, and flexibility (Bakos and Brynjolfsson 1993b). Table 2 shows the definitions of the six dimensions of non-contractibility, with references to previous research.

For conceptual clarity and parsimony of the research model, we posit non-contractibility as a second order construct that contains two subdimensions, *task-based* and *interaction-based non-contractibility*. The task and interaction subdimensions appear implicitly in previous research as "task" and "process" factors. For example, Kayworth et al. (2001, p. 9) note that "given the complex nature of today's organizations, the ability to take action may be extremely difficult and require high levels of integration of *tasks* and *processes* across a potentially wide range of organizational stakeholders" (emphasis added).

The *task* dimension of non-contractibility helps ensure high product performance standards, while the *interaction* dimension supports relationship longevity. We view quality, technology investments, and information exchange as task elements of the exchange relationship. In parallel, we view responsiveness, trust, and flexibility as interaction elements of non-contractibility. We outline the conceptual background of the six first-order elements of non-contractibility here and validate their measurement in the empirical section.

Table 2. Dimensions of Non-Contractibility

Dimension	Definition	References
Task-Based Non-Contractibility		
Quality	Manufacturing capability, warranty implications, and criticality in terms of interaction with other components in an assembly.	Cusumano and Takeishi 1991; Takeishi 2001
Technological Investments	Supplier's track record of continuous improvement in existing products, development of new products, and investment in keeping abreast with technological developments.	Helper 1991; Takeishi 2001
Information Exchange	Exchange of proprietary information between buyer and supplier for cost reduction and involvement in planning and goal setting activities.	Cusumano and Takeishi 1991; Dyer 1997; Helper 1991; Monczka et al. 1998; Takeishi 2001
Interaction-Based Non-Contractibility		
Responsiveness	Supplier's sensitivity and ability to respond quickly to buyer's needs and to keep buyer updated on the requests.	Goodhue and Thompson 1995; Johnston and Lawrence 1998
Trust	Buyer's perception about supplier's trustworthiness, confidence in supplier, and belief that supplier will honor its promises.	Dyer 1997; Johnston and Lawrence 1988; Zaheer and Venkatraman 1994
Flexibility	Willingness of supplier to modify a contract, make necessary adjustments, and react to buyer's requests that may be beyond the terms of a contract. Flexibility relates more to the strategic aspects of a relationship while responsiveness (see above) relates more to operational issues.	Goodhue and Thompson 1995; Monczka et al. 1998; Young-Ybarra and Wiersema 1999

Quality. While contracts can easily specify some quality attributes, such as tolerances and defect rates, many other attributes, particularly those relating to fit or relative customization for a specific buyer, typically remain unstated because of difficulty in specifying them *ex ante*. Subjective assessments of how performance of a part affects other parts and risks due to failure to meet quality requirements are much more difficult to specify than standard, or tolerance-based, definitions of quality. A quote from Mayer et al. (2004, p. 1065) highlights the connection between high quality and non-contractibility:

> The buyer may have a valuable reputation for a high quality product and its reputation with consumers or regulators (if the product or production is regulated) could be devalued should an undetected low-quality input enter the manufacturing process and lead to the selling of low quality output. Such spillover costs are referred to in the quality literature as external costs…spillover costs are vexing to a buyer because they are nonverifiable and thus noncontractible.

Technological Investments. Buyers competing on innovation need to develop partnerships with selected suppliers that support adoption of newer technologies. Helper (1991, p. 17) argues that "higher levels of information sharing and commitment…encourage suppliers to make investments that…enable them to improve performance in…product and process innovation." These investments need not be made specifically for a particular buyer, but instead reflect a supplier's orientation toward use of new technology. Since use of newer technologies and willingness to support innovation are discretionary investments by suppliers, technological investments are non-contractible to the extent that contracts cannot specify these nonspecific and discretionary investments *ex ante*.

Information Exchange. The ability to adapt products and sourcing arrangements depends upon the ability of buyers and suppliers to share tacit knowledge in production tasks (Grant 1996); in turn, hierarchy or long-term supplier relationships facilitate knowledge sharing. Kogut and Zander (1992) note that long-term relationships facilitate transactions within a supplier network via a learned and shared code. Helper (1991), Rai et al. (2006), and Takeishi (2001) have argued that increased communication and integrated problem solving are important for improving design quality and overall performance. It is difficult to specify the exchange of specific contextual knowledge and to mandate and enforce all the

desirable information exchanges in a contract, making such information exchanges a non-contractible parameter of a buyer–supplier relationship.

Responsiveness. Johnston and Lawrence (1988) define value-adding partnerships as a set of independent companies that work closely together to manage the flow of goods and services along the entire value-added chain. Each company in a value-adding partnership has an incentive to stay in touch with environmental changes and be ready to react quickly; otherwise it could lose business to other producers. Responsiveness influences governance mechanisms because each player in the value-added chain has a stake in the others' success. This success in turn requires the ability of a unit to tailor aspects of its organization, such as personnel, plant, compensation schemes, career tracks, accounting systems, and management styles, to the task at hand. Milgrom and Roberts (1990) note that advances in manufacturing and distribution now allow suppliers to undertake some degree of customization without having to invest in assets specific to a particular buyer. Because responsiveness has a dynamic and contextual meaning, it is costly to specify the level of responsiveness for each contingency in a contract, thereby giving it a non-contractible character.

Trust. Bakos and Brynjolfsson (1993a) suggest that trust is an important non-contractible attribute of a relationship. Moorman et al. (1992) define trust as "the willingness to rely on an exchange partner in whom one has confidence." Trust facilitates coordination, particularly as products and processes change over time (Barzel 1982; Dyer 1997; Gulati et al. 2000). Researchers often distinguish between deterrence and knowledge-based trust (Gulati 1995; Kale et al. 2000), where knowledge-based trust is non-contractible. Several studies confirm the role of trust and coordination in cooperative relationships (Monczka et al. 1998; Smith et al. 1995). Barney and Hansen (1994) have argued that trust can be a source of competitive advantage for firms. Because building trust occurs over a period of time and involves substantial costs, buyers may be reluctant to replace trusted suppliers as may occur with the use of reverse auctions.

Flexibility. Flexibility is the ability of an actor to adjust its behavior or the terms of an agreement to respond to changes in the environment or to the needs of its partners (Heide and John 1992). Although the concept of flexibility has some overlap with the notion of responsiveness, previous research suggests that responsiveness arises as an operational issue, while flexibility relates more to the strategic aspects of a relationship (Goodhue and Thompson 1995; Monczka et al. 1998). Flexibility is a non-contractible parameter because it is a reaction to unexpected situations that are not enumerated in a contract. Given the bounded rationality of partners, the viability of a relationship may depend on the flexibility with which partners can modify and go beyond the terms of the contract for continued value creation. Conner and Prahalad (1996) suggest that the flexibility with which one can change responsibilities on an ongoing basis, in order to respond to new learning or other unexpected situations, may determine the choice of organizational mode. The cost of implementing flexibility under a market contract is higher than under internal organization, hence, "firm organization is more likely to be preferred on knowledge-based flexibility grounds, the more dynamic and uncertain is the competitive environment" (p. 488). We extend this reasoning to the governance structure of outsourcing relationships and argue that buyers valuing flexible suppliers are less likely to risk arm's-length contracts through processes such as reverse auctions.

Hypotheses

The principal prediction of the EMH is that information technology will cause increased use of market outsourcing. Malone et al. (1987, p. 495) suggest that "electronic hierarchies frequently develop into biased, then unbiased markets when the products themselves are not asset specific and are easily described in standardized terms." They also note that "in the long run, the significant additional benefits to buyers possible from the electronic brokerage effect will drive almost all electronic markets toward being unbiased channels for products from many suppliers" (p. 492). An implication of the EMH, therefore, is that buyer–supplier relationships that require general investments (involving little asset specificity) will suit reverse auctions, while relationships that require substantial asset specificity will not. Based on this logic, we posit a baseline prediction that buyers will be less likely to use reverse auctions for exchange relationships involving a higher degree of asset specificity.

> **Hypothesis 1**. The greater the asset specificity in an exchange relationship, the less likely that buyers will use reverse auctions in electronic markets.

Complementing their discussion of traditional asset specificity, Malone et al. also identified product specialization as an important explanatory variable determining governance choice. Product specialization refers to the amount of information needed to fully specify attributes, which is sometimes referred to as description complexity. As Malone et al. note, "commodities…have simple, standardized descriptions, while those of business insurance policies or large and complicated computer systems are much more complex" (p. 486). The EMH posits that buyers will tend to procure components with

lower description complexity through market-like arrangements. Clemons et al. (1993) reinforce this argument and argue that search benefits decline as products become more complex and service-intensive. Choudhury et al. (1998) further suggest that sellers can compare commodities based on price information, while specialized products require comparison along additional dimensions. Specialized products with greater description complexity require joint action and tighter coordination mechanisms, while commodity components with relatively less description complexity are more amenable to simpler coordination mechanisms (Bensaou and Anderson 1999). We posit that buyers are less likely to use reverse auctions in exchange relationships involving greater product specialization.

> **Hypothesis 2**. The greater the product specialization in an exchange relationship, the less likely that buyers will use reverse auctions in electronic markets.

Asset specificity and product specialization are important, but they are neither necessary nor sufficient to explain use of market mechanisms such as reverse auctions. Clemons et al. agree with the prediction of EMH that information technology will lead to a contraction in a firm's boundaries, but they also expect a move toward long-term relationships with a select group of suppliers. They referred to such a combination of greater outsourcing with a reduced supplier base as the "move to the middle hypothesis" (MMH). The incomplete contract theory reinforces the MMH in that this approach posits that if a buyer and a supplier cannot specify all the contingencies in a contract, then their *ex ante* investments in the exchange relationship will be influenced by their expected *ex post* bargaining power (Grossman and Hart 1986; Hart 1988; Hart and Moore 1990). Under such a situation, if supplier investments in non-contractible parameters of a relationship are critical for the success of the exchange relationship, then the buyer is better off limiting its options to close relationships with a few specific suppliers, so that those suppliers will have incentives to undertake needed investments.

As Bakos and Brynjolfsson (1993b, p 48) note,

> suppliers' continuing effort to improve these characteristics [quality, innovation, and information sharing] go hand-in-hand with employing fewer suppliers. This allows the buyer to increase the supplier's incentives to go above and beyond the "letter of contract."

Thus, given the increased importance of non-contractible elements of relationships and their further accentuation due to IT, it will often be cost-effective for parties to rely on trust, *ex post* bargaining, and institutional incentives such as long-term relationships to deal with incomplete contracts rather than to depend on contractual governance (Bakos and Brynjolfsson 1993a). This logic suggests that buyers will avoid reverse auctions in exchange relationships with high degrees of non-contractibility.

> **Hypothesis 3**. The greater the non-contractibility in an exchange relationship, the less likely that buyers will use reverse auctions in electronic markets.

Method

The U.S. automotive industry, with an annual market size of about $600 billion in 2002, offers substantial variation in component types, buyer–supplier relationships, and firm characteristics that make it an appropriate setting to study the use of reverse auctions (Mudambi and Helper 1998). The unit of analysis in this research is the buyer–supplier relationship for production goods (items that buyers use directly in manufacturing their end products). Following initial interviews, we collected data through a survey of U.S.-based automotive assemblers and component manufacturers that make independent procurement decisions. Each respondent firm rated the likelihood of using reverse auctions for two categories of production goods (commodity and specialized types of production goods) with varying degrees of asset specificity and non-contractibility (see Appendix A for details). Examples of commodity production goods are forgings, castings, steel, copper, and plastic resin; examples of specialized production goods are engineering applied polymers, engineered mold plastics, injection molded parts, and specialty chemicals.

Survey development proceeded in four phases. First, several faculty members, doctoral students, industry executives, and survey methods consultants reviewed the questionnaire for content, wording, and comprehensibility. Early in the conceptual development of the study, the first author worked with a tier-one automotive component manufacturer to assess the firm's reverse auctions strategy. Interactions with purchasing executives and reverse auction vendors during the engagement helped ensure the face validity of the items. Second, we refined the questionnaire based on feedback received from our interactions with industry executives and automotive industry researchers during a major industry conference in August 2001. Third, we pretested the refined version of the instrument from phase two with a random sample of 30 suppliers selected from an automobile industry database. Fourth, after incorporating changes based on the responses in the pretest,

Table 3. Profile of the Firms in the Sample (n = 152)

Firm Type	Percent[†]
OEMS	20
Tier 1 component manufacturer	84
Tier 2 component manufacturer	66
Tier 3 component manufacturer	30
Tier 4 component manufacturer	8
Firm Size – Revenues in Million $	
Less than $100 million	58
More than $100 million but less than $1 billion	30
More than $1 billion	12
Firm Size – Number of Employees	
Less than 500	60
More than 500 but less than 5,000	28
More than 5,000 but less than 10,000	3
More than 10,000 but less than 50,000	6
More than 50,000	3

[†]Figures do not total up to 100% because of multiple responses for firm type.

we administered our instrument to firms in the automotive sector during the winter of 2002. Appendix A provides more details on construct operationalization, variables, and actual items used in the survey questionnaire.

We used a list of automotive industry firms operating in the United States from the ELM database (2001), which includes more than 1,400 automotive assemblers and component manufacturers. We mailed the surveys in two waves during the winter of 2002. To minimize key informant bias, we administered the surveys to the key executive responsible for the purchasing function for the firms in our sample. In all 706 firms (including assemblers and tier-one through tier-four component manufacturers) met our sampling criterion of more than $10 million sales annually; these are the firms with sufficient critical mass that are more likely to use reverse auctions than other smaller firms in the ELM database. We received 152 responses from senior executives (typical designations were President, Senior Vice President, Vice President, Director, and Manager) responsible for purchasing, materials, or procurement. The response rate of 22 percent is similar to or exceeds that of previous empirical studies using survey questionnaires (e.g., Bardhan et al. 2007; Bardhan et al. 2006; Grover et al. 2002). Table 3 shows the characteristics of the respondent firms in terms of firm type (OEM versus component manufacturer), annual sales, and number of employees.

We examined the data to assess potential issues related to nonresponse bias, common method bias, and merging of samples from two waves of survey administration. To check for the nonresponse bias, we compared number of employees and annual sales for the respondents and nonrespondents. We did not find statistically significant differences, suggesting that respondent firms form a representative sample of automotive firms in the United States. We checked for the common method bias by using Harman's one-factor test (Podsakoff and Organ 1986). No single factor emerged as a dominant factor accounting for most of the variance (the factor with the greatest eigen value accounted for 27 percent of the variance), indicating that common method variance is unlikely to be a serious problem in the data. We merged the data obtained from the two waves of the survey because we found no evidence of any systematic difference between the two samples.

Results

We used structural equation modeling (Lisrel version 8.52) to test our hypotheses. To assess the reliability of the scale, we calculated composite reliability for each multiple-item construct (Appendix A shows the constructs and related items; Table 4 provides composite reliability estimates) and found these to be equal to or greater than the generally recommended value of 0.70 and well above the 0.60 threshold appropriate for newly developed scales (Nunnally 1988; Nunnally and Bernstein 1994). Given the large number of

Table 4. Measurement Model: Parameter Estimates and Reliability

Construct and Indicators	Standardized Loading‡	Composite Reliability
Non-contractibility (NC): Second order construct consisting of two first-order subconstructs		
First-order subconstruct: Task-based non-contractibility (NCA)		0.78
• Quality (NC1)	0.59*	
• Technological Investments (NC2)	0.80	
• Information Exchanges (NC3)	0.77	
First-order subconstruct: Interaction-based non-contractibility (NCB)		0.77
• Responsiveness (NC4)	0.81*	
• Trust (NC5)	0.75	
• Flexibility (NC6)	0.64	
Asset Specificity (AS): First-order construct		0.74
• Product Customization (AS1)	0.42*†	
• Equipment Specificity (AS2)	0.70	
• Labor Specificity (AS3)	0.71	
• Business Process Specificity (AS4)	0.74	
• JIT Needs (AS5)	0.42†	
Reverse Auction Use (RAU): Second order construct consisting of three first-order subconstructs.		
First-order subconstruct: Reverse auction use corresponding to "task" based non-contractibility (RAU_TaskNC)		0.98
• LNC1	0.96*	
• LNC2	0.98	
• LNC3	0.96	
First-order subconstruct: Reverse auction use corresponding to "interaction" based non-contractibility (RAU_IntNC)		0.92
• LNC4	0.76*	
• LNC5	0.96	
• LNC6	0.95	
First-order subconstruct with single composite indicator: Reverse auction use corresponding to asset specificity (RAU_AS)	0.97†	0.95

*Constrained parameter for identifying the measurement model.

†Items AS1 and AS5 have relatively small standardized factor loadings, but measurement and structural models that omitted the items reported similar results (Appendix A provides item descriptions).

‡All factor loadings are significant at $p < 0.01$.

manifest variables and complexity of our research model, we adopted a partial aggregation approach for consolidating the manifest items of a latent variable into a smaller number of composite indicators (Bagozzi and Heatherton 1994; Williams and Hazer 1986). To construct a composite indicator for each subconstruct, we used the average score of the constituent manifest items corresponding to that subconstruct. This approach reduced the number of indicator variables for non-contractibility and reverse auction use to 6 and 7 from, respectively, the 19 and 24 original manifest items. We used single composite indicators for IT capability, competitive strategy, and supply chain strategy.

Table 4 reports the measurement model for non-contractibility, asset specificity, and reverse auction use. As Figure 1 shows, we combined the first-order subdimensions of non-contractibility and reverse auction use to form second-order constructs for the two concepts. This aggregation made the research model more parsimonious and also provided better fit properties. We conducted the confirmatory factor analysis

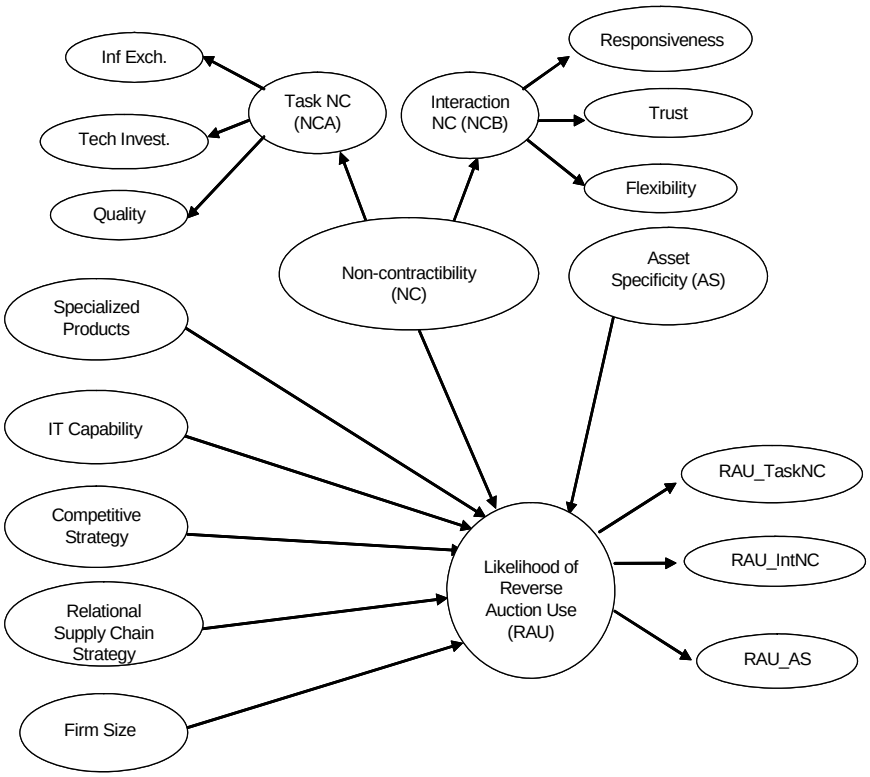

Figure 1. Conceptual Model

by pooling the items for all of the constructs within one measurement model. The measurement model suggests that the measures satisfied the requirements of reliability and validity. The overall measurement model provided an acceptable fit (Chi-square/df = 2.82, RMSEA = 0.077, GFI = 0.87, NFI = 0.92, NNFI = 0.93, CFI = 0.95). The significance of factor loadings for the effect indicators provides support for convergent validity of the respective scales.

As Table 5 shows, the correlations between all pairs of constructs are less than the threshold of 0.80, providing evidence of discriminant validity (Bagozzi et al. 1991; Teo et al. 2003). We also found evidence for discriminant validity among latent constructs when we compared an unconstrained model to models that constrained the pair-wise correlation among constructs to one. In particular, the discriminant analysis reveals distinct latent constructs for asset specificity and non-contractibility; the chi-squared value increases by 216.02 ($p < 0.01$) when we constrain correlation between asset specificity and non-contractibility to one. In addition, multi-collinearity diagnostics produced values of reasonable magnitude (maximum VIF value is 2.34; highest condition number is 2.73 after centering variables).

Table 6 presents the structural model. The values for both the GFI and NFI indicate that the model has adequate overall fit, as do the NNFI, CFI, RMSEA, and AIC measures in the table (Bollen 1989; Devaraj et al. 2001; Kline 1998; Teo et al. 2003).

The results in Table 6 (also depicted in Figure 2) provide the strongest support for influences of specialization and non-contractibility on reverse auction use. We do not find support for H1, concerning asset specificity ($\beta_{11} = -0.20$, n.s.). The results strongly support H2, concerning the negative impact of product specialization ($\beta_{12} = -0.63$, $p < 0.01$). The results also strongly support H3, concerning the negative influence of non-contractibility ($\beta_{13} = -0.44$, $p < 0.01$).

The control variables in Table 6 provide useful insights. First, consistent with relational governance arguments, buyers with a relationship orientation to supply chain strategy are less likely to use reverse auctions than buyers that take a transaction orientation toward their suppliers. Second, larger firms are more likely to use reverse auctions, possibly because greater scale justifies undertaking a new form of procurement (including paying the auctioneer fees for setting up the auc-

Table 5. Correlations and Descriptive Statistics

Variable	Mean	SD	Min	Max	1	2	3	4	5	6	7
1. Reverse Auction Use (RAU)	3.2	0.9	2	6	1						
2. Non-contractibility (NC)	5.6	0.7	2	7	-0.16	1					
3. Asset Specificity (AS)	5.3	1.0	1	7	-0.10	0.74	1				
4. Product Specialization	0.5	0.5	0	1	-0.11	0.01	0.13	1			
5. IT Capability	4.4	1.0	2	7	0.14	0.11	0.14	0.00	1		
6. Competitive Strategy (Differentiation)	3.9	0.3	1	7	0.01	-0.05	-0.04	0.00	0.04	1	
7. Supply Chain Strategy (Relationship Orientation)	5.9	1.0	3	7	-0.18	0.08	0.13	0.00	-0.03	-0.04	1
8. Firm Size (Revenues)	3.5	0.8	2	5	0.25	0.00	0.08	0.00	0.33	-0.09	-0.08

Table 6. Estimates of the Structural Equation Models Explaining Reverse Auction Use (*positive coefficient = more likely to use reverse auctions; n = 304*)

		Reverse Auction Use[†]
Asset Specificity (H1)	β_{11}	0.20
Product Specialization (H2)	β_{12}	-0.63***
Non-contractibility (H3)	β_{13}	-0.44***
Supply Chain Strategy (Relationship Orientation)	β_{14}	-0.23***
Firm Size (Revenues)	β_{15}	0.77***
IT Capability	β_{16}	0.04
Competitive Strategy (Differentiation)	β_{17}	0.08

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

[†]Chi-square / df = 3.47, GFI = 0.84, NFI = 0.90, NNFI = 0.91, CFI = 0.93, RMSEA = 0.077, AIC = 857.87

Note: The value of RMSEA global fit measure in this study is less than 0.1, suggesting acceptable fit consistent with guidelines and similar values in previous research (Browne and Cudek 1993; Devaraj et al. 2002).

tion) or, alternatively, because they possess expertise needed to use a licensed copy of reverse auction software. Third, the insignificant IT capability coefficient implies that other product- and supplier-related considerations influence reverse auction use more than a buyer's IT capability.

We conducted several robustness checks. First, Table 7 reports a regression approach that assessed the independent effects of asset specificity and non-contractibility by controlling for the order of entry. Column 1 of Table 7 shows a model using asset specificity, product specialization, and control variables (without including non-contractibility), while column 2 shows a model with non-contractibility, product specialization, and control variables (without including asset specificity). We find that the model with non-contractibility has higher explanatory power than the model with asset specificity. Column 3 shows a model with both asset specificity and non-contractibility, along with product specialization and control variables, which provides similar results as the SEM model in Table 6.

Second, we conducted exploratory analyses to study whether non-contractibility might affect reverse auction use through its effect on asset specificity or whether asset specificity affects reverse auction use through its effect on non-contractibility. Figure 3 shows results using structural equation models. Based on the AIC values, we find greater support for the asset specificity mediated effect of non-contractibility on reverse

Table 7. Sensitivity Analysis: OLS Regression Estimates of Effects of Asset Specificity and Non-contractibility†

	(1)	(2)	(3)
	Reverse Auction Use	**Reverse Auction Use**	**Reverse Auction Use**
Asset Specificity	-0.086*		0.049
Product Specialization	-0.172*	-0.191**	-0.203**
Non-contractibility		-0.210***	-0.262**
Supply Chain Strategy (Relationship Orientation)	-0.139***	-0.139***	-0.144***
Firm Size (Revenues)	0.244***	0.233***	0.229***
IT Compatibility	0.063	0.070	0.068
Competitive Strategy (Differentiation)	0.028	0.021	0.021
R-squared	0.113	0.129	0.131

*significant at 10%; **significant at 5%; ***significant at 1% (n = 304)

†These models include an intercept term. Ordered probit models that relax the assumption of interval nature of the dependent variable also yield similar results.

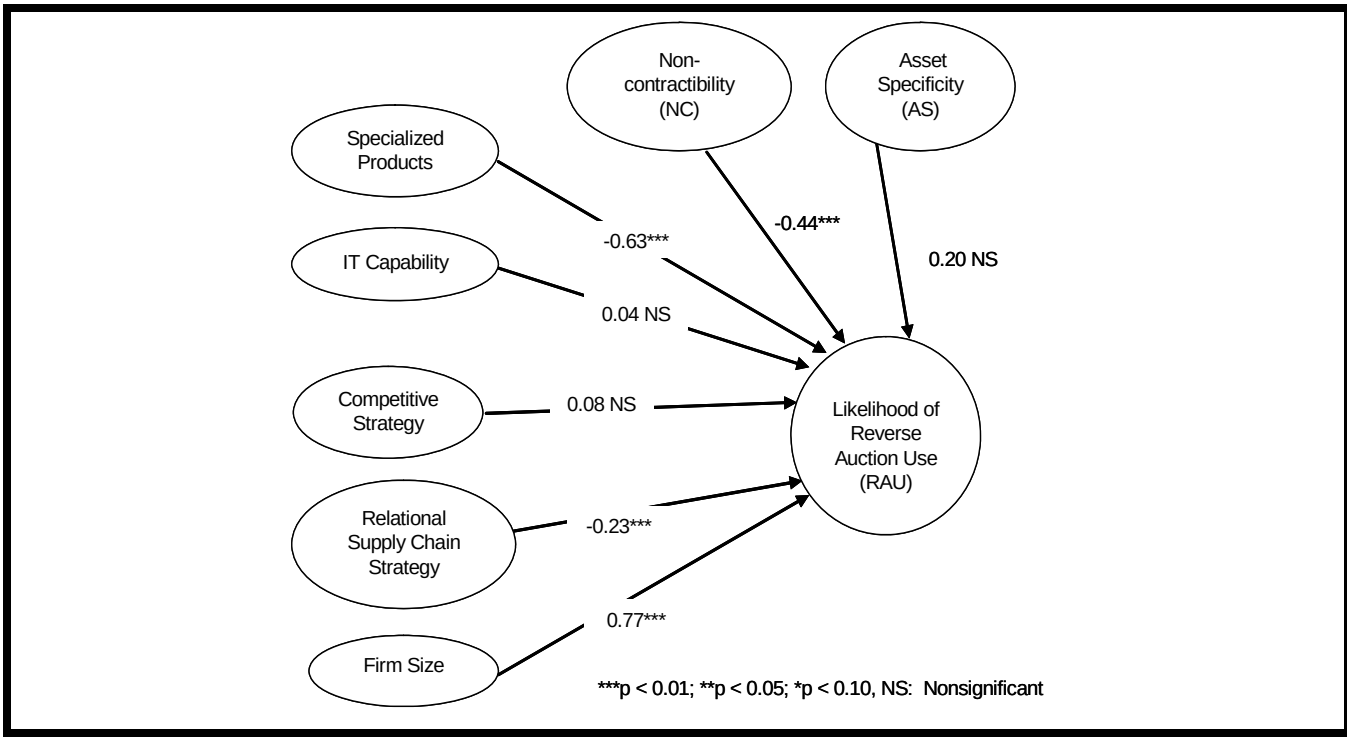

Figure 2. The Estimated Structural Equation Model

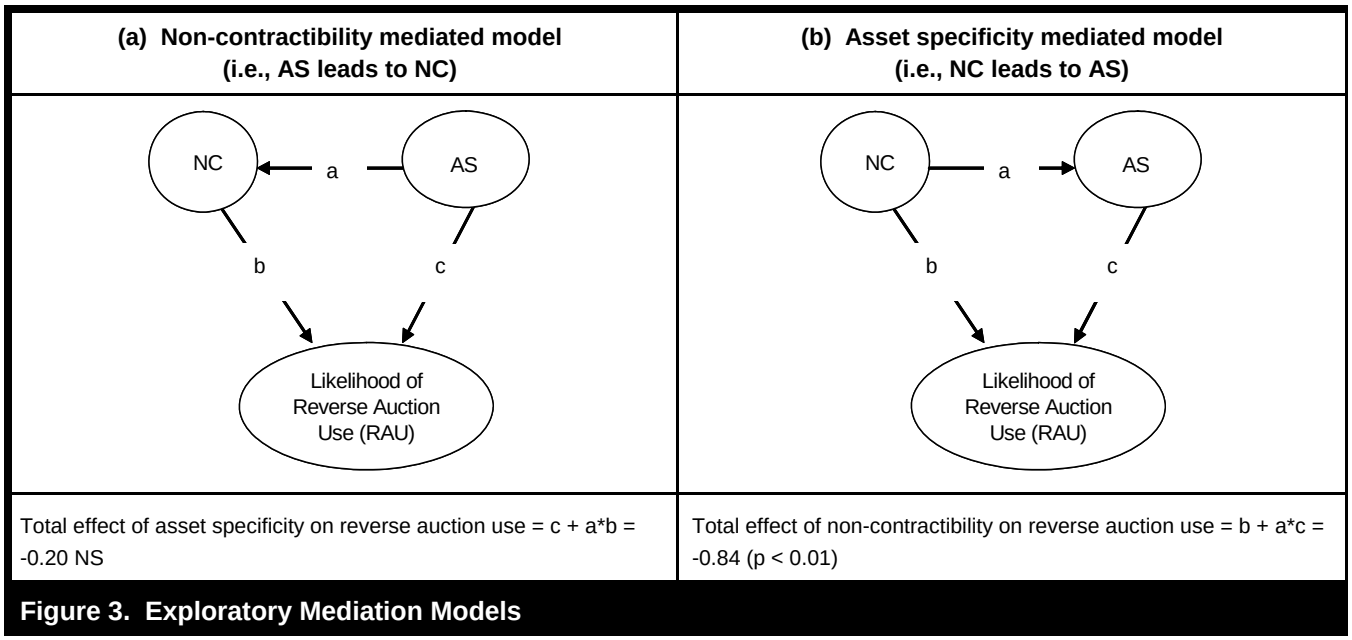

Figure 3. Exploratory Mediation Models

auction use in Figure 3 (i.e., greater support for the idea that non-contractibility leads to asset specificity, rather than the reverse). Baron and Kenny's (1986) approach for analyzing the mediation models yielded similar results. We suggest caution in interpreting the results of mediation models; further research needs to use a counterfactual or potential outcomes approach to establish causality (see Holland 1986; Mithas et al. 2006; Mithas and Krishnan 2009).

Discussion

Our goal in this research was to study the determinants of reverse auction use. We proposed and tested a theoretical model that builds on transaction cost and incomplete contracts reasoning. We developed a validated instrument for the non-contractibility concept and found that non-contractibility, together with product specialization, strongly influences reverse auction use. Although asset specificity also reduces reverse auction use when we do not control for non-contractibility, it loses its explanatory power in the fully specified analysis.

The core results provide three insights. First, buyers prefer to avoid reverse auctions for specialized goods. This result extends previous research. For example, Bensaou (1999), in his study of 447 managers across U.S. and Japanese automakers, found that components in market-exchange have much lower average product complexity compared to components in captive buyer, captive supplier, and strategic partnership exchange. Although Choudhury and his colleagues (Choudhury 1997; Choudhury et al. 1998) did not find support for the effect of product complexity on the use of electronic markets in the aircraft parts industry, they cautioned against extending their findings to other electronic markets because their study considered an electronic market that had only supplier identification functionality. By contrast, the scope of reverse auctions in our study includes supplier selection as well.

Second, our study offers the first empirical test of the incomplete contracts arguments concerning IT-enabled relationships, suggesting that buyers avoid reverse auctions when relationships with suppliers will involve substantial non-contractible commitments. We find that non-contractibility arising from needs for quality, technology investments, information exchange, responsiveness, trust, and flexibility leads buyers to avoid electronic markets that emphasize arm's-length relationships. These results support the argument that non-contractible aspects of buyer–supplier relationships remain important even as IT innovations allow firms significant flexibility in managing these relationships.

Third, once non-contractibility is assessed directly and is incorporated in the model, traditional asset specificity does not have a significant influence on reverse auction use, although product specialization does retain a significant influence. Because asset specificity and non-contractibility are likely to covary, as we discussed earlier, our empirical models

allow for correlations between asset specificity and non-contractibility—that is, the results partial out the common sources of variation between asset specificity and non-contractibility. Thus, both theoretically and empirically, this study teases out independent effects of asset specificity and non-contractibility, while addressing the covariance between the two constructs. Because most previous empirical research did not consider non-contractibility directly, effects of non-contractibility that covary with asset specificity will have been attributed to asset specificity alone. Indeed, the results are consistent with a study of 154 buyer–supplier strategic alliances by Monczka et al. (1998), in which asset specificity did not determine partnership success, while information sharing, joint problem solving, trust and coordination, and information quality and participation significantly did affect partnership success.

Implications for Research

The study suggests three implications for research. First, the fact that asset specificity becomes less relevant once we account for non-contractibility may imply that it is not so much asset specificity that buyers care most about but, instead, the degree to which supplier investments are non-contractible. The importance of non-contractibility in relation to asset specificity becomes critical when buyers need unspecifiable exchange support from suppliers that will evolve over time. Typically, non-contractibility becomes salient when the degree of uncertainty concerning the nature of the support that the firms will need to provide each other rises to the extent that parameters such as performance guarantees and non-compliance penalties become vague and impossible to enforce. Such issues are common in many modern supply relationships, particularly those involving products that face ongoing changes in underlying technology or in the nature of market demand. Growth of the service sector further underscores the importance of non-contractibility, because information technology and flexible manufacturing technologies are progressively causing a decline in asset specificity (Milgrom and Roberts 1990). Thus, there is a need to assess the effects of the intangible and largely non-contractible aspects of underlying relationships that may not covary with transaction specific investments.

Second, an alternative interpretation of the lack of significance of the asset specificity measure in Table 6 may be that the most important aspects of asset specificity are reflected in the non-contractible elements of a relationship. This interpretation would be consistent with thoughtful discussions in prior transaction cost analyses, which point out that specialized investments do not arise simply from physical investment or from investment around a single stream of transactions, but commonly arise from relational interactions that involve two or more parties (e.g., Malone et al. 1987). Non-contractibility will be particularly prevalent when such interactions involve a complex and changing set of activities over time. From a historical perspective, the notion of asset specificity, with its theoretical origin in the 1930s, was influenced by a manufacturing-based economy due to Ronald Coase's visits to U.S. automotive plants. Subsequent developments in the 1970s and onwards defined asset specificity-related instruments and tested their implications in physical manufacturing contexts. Therefore, it is not surprising that the traditional notion of asset specificity underemphasizes the additional dimensions of modern service-based exchanges that are increasingly based on intangibles.

Third, our results are informative regarding assessment of the electronic markets hypothesis if we view Internet-enabled reverse auctions as an arm's-length governance mechanism that allows firms to locate efficient suppliers and award contracts primarily based on price. The EMH suggested that information technology would lead to greater use of arm's-length relationships. While this prediction was based on the role of asset specificity in exchange relationships, our results suggest the importance of recognizing non-contractible factors and lend support to Hess and Kemerer's (1994) and Choudhury et al.'s (1998) observations that argue for complementing TCE logic. Arm's-length agreements such as reverse auctions would be uncommon when the issues associated with non-contractibility are more salient in the exchange relationship. Traditional asset specificity may be a less important issue in such cases. Indeed, asset specificity is not a problem if firms can write complete contracts to govern the exchange processes, even if the relationships involve dedicated assets. If the parties cannot write a fully contingent contract for even a general asset, however, then one or both parties will be exposed to the requirements of non-contractible performance parameters.

As we noted earlier, we sympathize with the argument that non-contractibility reflects an extension of the transaction cost argument. However, even if one takes an expansive view of transaction cost theory, the non-contractible aspect is frequently under-emphasized despite the fact that it may often have the biggest impact on sourcing choices in cases such as our reverse auctions context. We note that our measure of asset specificity includes investments in human assets and business processes, in addition to investments in physical assets. The key distinction remains, however, that the concept of asset specificity speaks most directly to particular investments that a firm expects to undertake in order to support a specified stream of transactions, while non-contractibility

speaks more directly to unknown investments that a firm and its partners may need to make in the future in order to sustain the transactions or to initiate a new set of exchanges. Moreover, initial boundary choices influence the willingness of the actors to undertake those non-contractible investments.

The distinction we made between task-based non-contractibility (the need for quality, technological investments, and information exchanges) and interaction-based non-contractibility (the need for flexibility, trustworthiness, and responsiveness) helps explore this issue further. One might expect task-based non-contractibility to overlap more directly with asset specificity because it most directly addresses performance of given products, while interaction-based non-contractibility may arise more independently of asset specificity because it most directly speaks to uncertain future transactions. The correlation between the two subdimensions of non-contractibility and asset specificity supports this reasoning: asset specificity correlates more highly with task-based non-contractibility ($r = 0.69$) than with interaction-based non-contractibility ($r = 0.49$).

Additional studies need to delineate and further verify these distinctions between asset specificity and non-contractibility. An opportunity for future research to measure non-contractibility will be to explore additional components of task-based (e.g., development speed, relative strength of the knowledge bases of the buyer and supplier) and interaction-based (e.g., number of personnel involved, scope of component systems) non-contractibility. In parallel, it also would be useful to enrich the notion of non-contractibility by elaborating upon the relationship between contractibility and the notion of modularization that arises in the supply chain and global service disaggregation literature (Apte and Mason 1995; Hoetker et al. 2007; Mithas and Whitaker 2007). Such linkages will both enrich the sourcing literature and help provide a conceptual foundation for the emerging discipline of service science (Chesbrough and Spohrer 2006; Rai and Sambamurthy 2006).

Managerial Implications

The results have three managerial implications. First, our study provides insights that help in deciding which products and services are most suitable for procurement through reverse auctions. Second, our field interviews and related work suggest that satisfied buyers are likely to continue business with their suppliers even if they are not the lowest bidders in the auction process (Mithas and Jones 2007). These findings suggest that suppliers benefit from investment in non-contractible aspects of relationships, echoing the recent findings related to the importance of customer satisfaction for firm performance (Mithas et al. 2005; Fornell et al. 2006). Finally, our findings suggest that electronic market makers should be careful in positioning their reverse auction offerings for selected items, in order to reduce negative perceptions that may arise when reverse auctions fail to meet buyer expectations and objectives.

Limitations and Suggestions for Further Research

The study has three limitations that can be overcome in future research. First, given the difficulty of collecting proprietary data about actual reverse auction use from multiple firms, this research used data on self-reported likelihood of reverse auction use and the factors influencing such decisions for different categories of products. Although our approach is consistent with previous research (e.g., Teo et al. 2003), there is a need to extend our findings by collecting more objective archival data on actual use of reverse auctions for specific product categories. Such a research design will also allow collection of data on detailed product and supplier characteristics for richer insights. Second, we cover a large cross-section of firms in the automotive industry to make our results as generalizable as possible. Future research could fruitfully use similar analysis in service, retail, and other sectors to examine the generalizability of our findings in different time frames. Finally, it is likely that firms may use reverse auctions as a price or supplier discovery mechanism and then move on to establish deeper collaborative relationships with suppliers they choose to transact with. There is a need to study this aspect of reverse auction use through longitudinal studies to assess how reverse auctions shape and reconfigure firm boundaries by changing the composition of the supplier pool and the nature of supplier relationships over time.

To conclude, this paper studies the importance of product and relationship characteristics that influence buyers' choice of governance mechanisms. We found that greater non-contractibility in an exchange relationship led to less expected use of reverse auctions. The study has implications for research in firm boundaries because the notion of non-contractibility complements the traditional concept of asset specificity. Non-contractibility becomes even more descriptive of the underlying relationships between buyers and suppliers as the importance of intangibles and services grows in the economy.

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Appendix A

Constructs and Questionnaire Items

Likelihood of reverse auction use: Each respondent evaluated the likelihood of using reverse auctions on a seven-point scale (1 = low likelihood, 7 = high likelihood).

Asset specificity: We measured asset specificity with a five-item scale: equipment (Dyer 1997; Mudambi and Helper 1998), labor skills (Walker and Poppo 1991), business processes (Zaheer and Venkatraman 1994), product customization (Bensaou and Anderson 1999), and just-in-time requirements.

Non-contractibility: We developed a new scale to assess the non-contractibility items because the concept has received little empirical attention. In developing our scale, we relied on prior conceptual descriptions and empirical measures of elements of non-contractibility (see Table 2). We verified the content validity of the items through expert appraisals and discussions with key informants from buyers, suppliers, and electronic marketplace organizations.

The non-contractibility scale included six multi-item constructs. *Quality* contains three items: manufacturing quality of the product, the extent to which a product affects performance of other parts, and the risk a product poses in terms of warranty liabilities. *Technological investment* contains three items: The need for a supplier to stay abreast of technological developments, the need for continuous production innovation, and the degree to which a supplier develops new technology products critical to buyer success (this operationalization allows us to consider both product- and supplier-specific issues related to technological investments; the need for a *product* to have continuous innovation is distinct from the degree and pace with which a *supplier* develops new technology. *Information exchange* contains four items: the need for exchange of buyer's proprietary information related to products, the need for supplier's proprietary information, the need for detailed information on cost structure, and the need for buyer participation in supplier's planning and goal setting activities. *Responsiveness* contains three items: supplier's proactive anticipation of buyer needs, supplier's responsiveness to buyer requests, and the need for a supplier to keep the buyer updated on its requests. *Trust* contains three items: trustworthiness, honoring past promises, and mutual confidence (previous research has operationalized trust in multiple ways; we focused on three common items in order to keep the questionnaire to a reasonable length). *Flexibility* contains three items: the willingness of the supplier to modify the contract, to make necessary adjustments on a continuous basis, and to go beyond the terms of a contract in fulfilling buyer needs.

Product specialization: We assessed product specialization by asking our respondents to assess one commodity and one specialty production good when they responded to our survey. As noted before, each respondent firm rated the likelihood of using reverse auctions for two categories of production goods (commodity and specialized types of production goods).

Control variables: Four control variables addressed other influences on reverse auction use. Two items assess the impact of relational governance (Bensaou 1997) by measuring a firm's supply chain strategy in terms of a buyer's relational or transactional orientation to its suppliers. A relational orientation emphasizes developing long-term supplier relationships (Grover 1993), while a transactional approach emphasizes changing suppliers to gain better prices. Eight items measured *IT capability* by examining investments in legacy EDI technologies and current web technologies (Grover 1993; Mishra et al. 2001). We controlled for IT capability because firms with greater information system sophistication are more likely to use newer technologies such as reverse auctions (Grover 1993). We assessed the *competitive strategy* of a firm by measuring the extent to which the firm emphasizes competing on cost or differentiation (Porter and Millar 1985); differentiators may be less likely to use reverse auctions. Finally, we measured *firm size* based on annual sales revenues, because larger firms are more likely to have a critical mass of procurement business. Large firms are also likely to have the expertise necessary for using a licensed copy of reverse auction software or for affording the auctioneer fees for setting up the auction. Firm size becomes an important variable because our field interviews suggest that for most firms, use of reverse auction is not a one time event.

Questionnaire Items

We are interested in knowing how important the following product and supplier characteristics are to the purchase of production inputs. Please indicate the importance (1 = Low, 7 = High) of each product or supplier characteristic. Then, indicate the likelihood (1 = Low, 7 = High) of your adopting reverse auctions for sourcing from a supplier with such characteristics.
Non-Contractibility (NC): This scale included subconstructs for Quality, Innovativeness, Information Exchanges, Responsiveness, Trust, and Flexibility. The subconstructs used several items (1 = strongly disagree, 7 = strongly agree)

Quality (NC1)
a. Product has a high manufacturing quality requirement.
b. Product performance critically affects performance of other parts or components.
c. Product has a significant risk of warranty liabilities.
Technological Investments (NC2)
a. Product requires continuous technological innovation.
b. Supplier that keeps abreast with latest technological developments.
c. Supplier that develops new technology products critical to your success.
Information Exchanges (NC3)
a. Product requires significant sharing of your proprietary information with the supplier.
b. Supplier that shares their proprietary information with you.
c. Supplier that allows your participation in their planning and goal-setting activities.
d. Supplier that shares detailed information on their cost structure.
Responsiveness (NC4)
a. Supplier that proactively anticipates your emerging needs.
b. Supplier that is responsive to your requests.
c. Supplier that keeps you updated on your requests.
Trust (NC5)
a. Supplier that is absolutely trustworthy.
b. Supplier that honors their promises.
c. Supplier that establishes a very high level of mutual confidence with your firm.
Flexibility (NC6)
a. Supplier that will be flexible in response to requests that may be beyond the terms of your contract.
b. Supplier will modify the agreement rather than stick to original terms if an unexpected situation arises.
c. Supplier will make continuous adjustments to cope with changing circumstances.
Asset Specificity (AS)
a. Product needs significant customization to meet your requirements. (AS1)
b. Supplier will invest in manufacturing equipment specifically for your requirements. (AS2)
c. Supplier has technical labor skills that are unique to your requirement. (AS3)
d. Supplier understands your business processes in order to satisfy all your needs. (AS4)
e. Supplier will be able to satisfy your JIT (Just in time) inventory requirements. (AS5)
Likelihood of Reverse Auction Use (RAU): Respondents rated the likelihood of reverse auction use (1 = low, 7 = high) for production goods with varying asset specificity and non-contractibility. For structural equation modeling, we used second order constructs with partially aggregated subconstructs as shown in Table 4.
Please indicate the extent to which you agree or disagree with each following statement. (1 = Strongly disagree, 7 = Strongly agree)
IT Capability
a. We are comfortable with web-based information technologies.
b. We have invested a substantial amount of time and money in EDI (Electronic Data Interchange) technologies.
c. We already use the Internet for procurement purposes.
d. We share procurement related information electronically between units within our firm.
e. Our firm has automated the ordering process for production goods (raw materials).
f. We can easily exchange and integrate data electronically from our major suppliers.
g. Our major suppliers have computer systems in place to quickly respond to our product enquiries.
h. Our major suppliers can electronically process business documents (e.g., invoices, designs, POs).
Differentiation Competitive Strategy
a. We continuous attempt to distinguish our products and services from those of our competitors on features other than price.
b. We aggressively attempt to reduce our costs of providing products and services to our customers (reverse scored)
Relationship-Oriented Supply Chain Strategy
We strive to develop long-term relations with our major suppliers.
We change our suppliers frequently to get the best prices. (reverse scored)
Sales Revenue last year: Scale of 1 to 5 (< $1 million, $1-$10 million, $10-$100 million, $100 million-$1 billion, > $1 billion).