View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by Research Papers in Economics

Choosing between Auctions and Negotiations in Online B2B Markets for IT Services: The Effect of Prior Relationships and Performance

Uladzimir Radkevitch, Eric van Heck and Otto Koppius

ERIM REPORT SERIES *RESEARCH IN MANAGEMENT*	
ERIM Report Series reference number	ERS-2008-004-LIS
Publication	February 2008
Number of pages	32
Persistent paper URL	http://hdl.handle.net/1765/11288
Email address corresponding author	uradkevitch@rsm.nl
Address	Erasmus Research Institute of Management (ERIM) RSM Erasmus University / Erasmus School of Economics Erasmus Universiteit Rotterdam P.O.Box 1738 3000 DR Rotterdam, The Netherlands Phone: + 31 10 408 1182 Fax: + 31 10 408 9640 Email: info@erim.eur.nl Internet: www.erim.eur.nl

Bibliographic data and classifications of all the ERIM reports are also available on the ERIM website: www.erim.eur.nl

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT

REPORT SERIES

RESEARCH IN MANAGEMENT

ABSTRACT AND KEYWORDS	
Abstract	The choice of contract allocation mechanism in procurement affects such aspects of transactions as information exchange between buyer and supplier, supplier competition, pricing and, eventually, performance. In this study we investigate the buyer's choice between reverse auctions and bilateral negotiations as an allocation mechanism for IT services contracts. Prior studies into allocation mechanism choice focused on factors pertaining to discrete exchange situation, such as con-tract complexity or availability of suppliers. We broaden the research by focusing on buyers' past exchange relationships with vendors. Based on the literature on the economics of contracting and agency theory, we hypothesize that prior re-peat interaction with vendors favors the use of negotiations over auctions in the next transaction, while the need to explore the marketplace due to buyer's inexperience or dissatisfaction with vendor's performance in the most recent project leads to the use of auctions instead of negotiations. We find support for these hypotheses in a longitudinal dataset of 2,081 IT projects realized by 91 repeat buyers at a leading online services marketplace over a period of eight years. Taken together, the results show that analyzing B2B auctions and negotiations should move beyond analyzing discrete instances and instead analyze them in the context of the individual firm's history and supplier strategy.
Free Keywords	reverse auctions, online marketplace, IT services, outsourcing
Availability	The ERIM Report Series is distributed through the following platforms: Academic Repository at Erasmus University (DEAR), DEAR ERIM Series Portal Social Science Research Network (SSRN), SSRN ERIM Series Webpage Research Papers in Economics (REPEC), REPEC ERIM Series Webpage
Classifications	The electronic versions of the papers in the ERIM report Series contain bibliographic metadata by the following classification systems: Library of Congress Classification, (LCC) LCC Webpage Journal of Economic Literature, (JEL), JEL Webpage ACM Computing Classification System CCS Webpage Inspec Classification scheme (ICS), ICS Webpage

Choosing between Auctions and Negotiations in Online B2B Markets for IT Services: The Effect of Prior Relationships and Performance

Uladzimir Radkevitch
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
uradkevitch@rsm.nl
Telephone: +31(0)10 408 2906
Fax: +31(0)10 408 9010

Eric van Heck
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
evanheck@rsm.nl
Telephone: +31(0)10 408 2029
Fax: +31(0)10 408 9010

Otto Koppius
Department of Decision and Information Sciences, RSM Erasmus University
P.O. Box 1738, 3000 DR Rotterdam, the Netherlands
okoppius@rsm.nl
Telephone: +31(0)10 408 2250
Fax: +31(0)10 408 9010

Choosing between Auctions and Negotiations in Online B2B Markets for IT Services: The Effect of Prior Relationships and Performance

Abstract

The choice of contract allocation mechanism in procurement affects such aspects of transactions as information exchange between buyer and supplier, supplier competition, pricing and, eventually, performance. In this study we investigate the buyer's choice between reverse auctions and bilateral negotiations as an allocation mechanism for IT services contracts. Prior studies into allocation mechanism choice focused on factors pertaining to discrete exchange situation, such as contract complexity or availability of suppliers. We broaden the research by focusing on buyers' past exchange relationships with vendors. Based on the literature on the economics of contracting and agency theory, we hypothesize that prior repeat interaction with vendors favors the use of negotiations over auctions in the next transaction, while the need to explore the marketplace due to buyer's inexperience or dissatisfaction with vendor's performance in the most recent project leads to the use of auctions instead of negotiations. We find support for these hypotheses in a longitudinal dataset of 2,081 IT projects realized by 91 repeat buyers at a leading online services marketplace over a period of eight years. Taken together, the results show that analyzing B2B auctions and negotiations should move beyond analyzing discrete instances and instead analyze them in the context of the individual firm's history and supplier strategy.

Keywords: reverse auctions, online marketplace, IT services, outsourcing.

1. Introduction

In recent years auctions received a boost from the rise of internet technologies and became a popular tool in corporate procurement, known as "online reverse auctions". However, the discussion on which transactions are appropriate for online reverse auctions to be used as allocation mechanism

has been intense both in the business press and academic literature. While some authors embraced online reverse auctions as a way to optimize procurement, reduce prices, and contribute to process improvement (Smart & Harrison, 2002), others warned about potential negative impact on buyer-supplier relationships and supplier performance (Emiliani & Stec, 2002; van Tulder & Mol, 2002).

Choosing the right allocation mechanism is particularly important for transactions involving customized products and services (Goldberg, 1977) such as unique manufacturing parts and equipment, building construction services or customized software. In such transactions buyers and suppliers can to a lesser extent rely on exhaustive specifications and ready to use industry standards (Snir & Hitt, 2003) and have to exchange more information regarding the product and transaction terms (Goldberg, 1977). Also, many projects such as the ones in the building construction industry are prone to ex-post adjustments that are better dealt with by "cost plus" contracts (rather than fixed-price contracts), commonly associated with negotiations rather than reverse auctions (Bajari, McMillan & Tadelis, 2006). Furthermore, negotiations are found to better facilitate information exchange when complex contracts are involved and the level of non-contractibility is high; they are also used when buyer has a high preference for quality (Bonaccorsi, Lyon, Pammolli & Turchetti, 2000; Mithas, Jones & Mitchell, 2005; Bajari et al., 2006), whereas auctions are favored when contracts are less complex, the pool of available suppliers is large and costs of conducting auctions are lower than those of negotiations (Leffler, Rucker & Munn, 2003; Bajari et al., 2006).

As useful as these results are, past studies were limited to studying choices for isolated transactions and there is a concern that such a "discrete" perspective does not allow to take in account other important contextual factors that affect actors behavior and transaction outcomes (Rothkopf & Harstad, 1994; Pinker, Seidmann & Vakrat, 2003; Elmaghraby, 2007). These factors include information exchange (Goldberg, 1977), past relationships between partners (Jap, 2002) and expectations of future business (Heide & Miner, 1992). The latter factors are particularly important in procurement as

buyers conduct transactions that tend to repeat over time between buyers and vendors (Pinker et al., 2003; Elmaghraby, 2007) and hence aspects of the buyer-vendor relationship can be expected to play a role. In this study we address this gap in the literature by studying how a buyer's prior repeat interaction with vendors affects the choice between reverse auctions and bilateral negotiations for the next transaction.

From the extant literature we identify several mechanisms (such as vendor learning in software projects (Whang, 1995), vendor's specific investments (Richmond, Seidmann & Whinston, 1992) and costly bid evaluation (Snir et al., 2003)) that provide a connection between the past buyer-supplier exchange interaction and the choice of allocation mechanism. Based on these insights we develop our argument and hypothesize that repeat interactions with vendors will favor the use of negotiations, while poor performance in the most recent project will lead to auctioning the subsequent project. Also, we hypothesize that, since new buyers need to explore the marketplace, they are also more likely to prefer reverse auctions as this is an appropriate tool for discovering the supply.

The testing of our hypotheses is conducted on a sample of 2,081 IT projects realized by 91 repeat buyers in the period of 1999-2006 at a leading online marketplace for IT services. In such marketplaces, buyers use both open reverse auctions and bilateral negotiations for project allocation, which makes this platform a suitable ground for our empirical investigation. The results of the analysis demonstrate that the more intensive prior repeat interaction is between buyer and vendors – the more likely she is to use negotiations rather than auction to allocate her next contract. By contrast, auctions are preferred by buyers who want to switch to a different vendor when performance of incumbents becomes unsatisfactory, or when buyers are new to the marketplace and need to explore the supply (although the latter effect is small).

The rest of the chapter is organized as follows. In Section 2 we start by reviewing literature on allocation mechanism choice and contract choice that is followed in Section 3 by hypotheses develop-

ment where we also draw on the literature on the economics of software development. In Section 4, we discuss the methodology of the empirical analysis and introduce the empirical setting in more detail. The results of the analysis are presented in Section 5. A discussion and conclusions follow in Sections 6 and 7.

2. Literature, Empirical Context and Hypotheses

Allocation mechanism choice

The choice of contract allocation mechanism in procurement affects such aspects of transactions as information exchange between buyer and supplier, supplier competition, pricing and, eventually, performance. Some of the most widely used allocation mechanisms in procurement are reverse auctions and negotiations. Negotiations better facilitate information exchange when complex contracts are involved and the level of non-contractibility is high; they are also used when buyer has a high preference for quality (Bonaccorsi et al., 2000; Mithas et al., 2005; Bajari et al., 2006). Auctions are favored when contracts are less complex the pool of available suppliers is large and costs of conducting auctions are lower than those of negotiations (Leffler et al., 2003; Bajari et al., 2006).

An early study by Goldberg (1977) viewed auctions, along with other allocation mechanisms, primarily as a means of transmitting information between organizations, where product complexity plays an important role: "The properties (and the relative efficacy) of competitive bidding mechanisms will depend crucially on the subject matter of the bidding competition" (Goldberg, 1977: 250-251). Goldberg proposes that competitive bidding may be not always appropriate for complex transactions, such as provisioning of public utility services, because the customization requires costly information provision at the pre-contract stage that can make this type of allocation mechanism too expensive (Goldberg, 1977).

This reasoning has been taken further in Bajari et al. (2006) who focused on the implications of project complexity for the allocation mechanism choice and identified two reasons why higher complexity is better served by negotiations rather than auctions. The first reason is auctions' poor ability to facilitate information exchange when the input from suppliers is needed. In complex projects such information exchange is important e.g. with regards to "how to deal with adaptation due to unforeseen events and problems" (Bajari et al., 2006: 9). Absence of information exchange can lead to adverse selection, where suppliers can submit low bids with an intention to extract profits from expected changes in the course of the project.

The second reason is that (in the context of building construction industry where their empirical research is conducted) negotiations have been traditionally associated with "cost-plus" contracts and auctions are associated with fixed price contracts. Cost-plus contract is a more viable option for complex projects, where ex-post adaptations regularly occur. An empirical test on the dataset of construction projects showed a positive association between project complexity and the use of negotiations (Bajari et al., 2006). Another finding of Bajari et al (2006) was a positive relationship between the number of available suppliers and the use of reverse auctions.

Similar results regarding the effect of project complexity and the number of available buyers have been produced in a study of sales of private timber tracts (Leffler et al., 2003). In addition, they found that auctions are more likely to be used when the dispersion of the valuation of the good among bidders is higher and when using auction is cheaper than using negotiations (Leffler et al., 2003).

Other studies theoretically contrast price and quality as the factors of allocation mechanism choice. Manelli and Vincent (1995) consider an environment where the quality of goods or services is unknown to the buyer ex-ante and cannot be verified by the courts ex-post. In their model, when the preference for quality is high the buyer is better off choosing sequential negotiations with potential

suppliers instead of auctions (Manelli & Vincent, 1995). Tunca and Zenios (2006) consider procurement of manufacturing parts, where high-quality parts can be procured from one supplier under a relational contract and low-quality parts are procured from the market via a second-price reverse auction. High preference for quality leads to procuring manufacturing parts from the relational contract, low preference for quality stimulates the use of reverse auctions, while there is also a situation of moderate preference for quality where the two mechanisms can co-exist and auction-driven competition can lead to the enhancement of self-enforceability of relational contracts (Tunca & Zenios, 2006). The link between the quality concerns and the choice for negotiations has been empirically validated in the context of medical devices procurement in Italian hospitals (Bonaccorsi et al., 2000).

Along similar lines, Mithas et al (2005) hypothesized that buyers are less likely to use reverse auctions for procuring goods that are high on non-contractibility (this includes dimensions such as quality, supplier innovativeness, information sharing, responsiveness, trust, and flexibility) and asset-specificity and confirmed the relationships though the analysis of survey data in the US automotive industry (Mithas et al., 2005).

Finally, an auction-theoretical analysis by Bulow and Klemperer (1996) in the context of selling a company showed that in case when at least one additional bidder is expected to bid in the auction, the buyer should choose for an auction instead of negotiating (Bulow & Klemperer, 1996). The result holds for a case where bidders' values are independent and, under certain restrictions, for affiliated values.

To our knowledge, no prior research into allocation mechanism choice explicitly addressed the role of repeat contracting, while in the closely related filed of contracting literature is has been recognized as a major determinant of contract choice. We review these studies in the next sub-section.

Effect of repeat interaction on contract choice

Contract choice literature investigates factors determining contract design using the logic of transaction cost economics and agency theory. Contract choice literature is concerned with identifying the effect of these and other factors on the preference for particular contract form or identifying a contract form that maximizes buyer's value in an exchange situation with a given set of characteristics. Factors that affect contract choice include contract (project) complexity (Bajari & Tadelis, 2001), uncertainty (Kalnins & Mayer, 2004) measurement costs (Allen & Lueck, 1993), moral hazard (Lafontaine, 1992) supervision costs (Alston, Datta & Nugent, 1984) and enforcement costs (Allen & Lueck, 1992). For instance, it has been found that project complexity is better dealt with by time and materials (in construction – cost-plus) contracts rather than fixed fee contracts (Bajari et al., 2001), same as ex-ante uncertainty regarding the costs and project specification (Kalnins et al., 2004). More often than not, the analysis of contract choice centers on characteristics of an exchange situation at hand, such as the ones listed above. It is only recently that the research attention started to encompass also the history of interaction between contracting parties. There are a number of ways prior interaction can affect contract choice for a present exchange situation. Kalnins and Mayer (2004) summarize factors identified by sociologists and institutional economists and identify four such mechanisms: 1) trust; 2) established pattern of collaboration and norms of interaction; 3) decrease of contracting costs due to accumulated contracting expertise; 4) expectation of future business (Kalnins et al., 2004).

Several recent empirical studies addressed the effect of repeat interaction on contract choice. Gulati (1995) found that repeated alliances between partners are more likely to be set up without the use of equity than first-time alliances. This is interpreted is an evidence of the positive impact of trust established between the parties in prior alliance on the reduction of the suspicion of opportunism in the new alliances (Gulati, 1995). By contrast, in a study of the Indian software industry Benerjee and

Duflo (2000) find no significant effect of prior contracts on the choice between fixed-cost, mixed and time-and-material contracts (Banerjee & Duflo, 2000). Despite these mixed earlier results, further evidence on the effect of repeat interaction on contract choice has been provided by two more recent studies. First, Corts and Singh (2004) argued that repeat interaction might alleviate the problems of contracting costs and incentive problems in fixed-price and cost-plus contracts. In their empirical study of offshore oil drilling industry they found a positive relationship between repeat interaction and the use of day-rate contracts (equivalent to time-and-materials in the software development contracting setting of Banerjee & Duflo (2000)). This allows them to argue that repeat interaction between contacting parties acts as a substitute for high-powered contracts (in offshore oil drilling these are turnkey contracts) (Corts & Singh, 2004). Second, in another study of software industry Kalnins and Mayer (2004) found a positive effect of repeat interaction measured on the site level on the choice for time-and material contracts, which is in line with the findings of Corts and Singh (2004).

In summary, most of the empirical studies find that the presence of relationships affects the costs of monitoring and enforcing contracts and partly alleviates agency problems, which in turn has implications for allocation mechanism choice. As prior empirical studies into mechanism choice and contract choice showed that empirical context plays an important role in the discussion of actors' behaviour and the implications of the contracts (Corts et al., 2004; Kalnins et al., 2004; Bajari et al., 2006), we first introduce the empirical context in which this study is conducted before proceeding to the development of hypotheses.

Context: online marketplace for IT services

Contracting for software development is a complex endeavor characterized by information asymmetry with regard to production costs (Whang, 1995), intensive information exchange and heterogeneity of vendor quality (Snir et al., 2003), high costs of preparing and evaluating vendors' proposals

(Carr, 2003; Snir et al., 2003), and the need for vendor's specific investments to create value (Richmond et al., 1992). Our empirical investigation is set at a leading online marketplace for IT services that also shares these characteristics. Examples of online marketplaces for IT service include eWork.com, Elance Online, RentACoder.com, and oDesk. These marketplaces provide a platform for value-added exchange processes beyond the contract allocation, such as payments, risk mitigation and service delivery (Kambil & van Heck, 2002; Snir et al., 2003). The volume of this market segment is projected to increase from around USD 250 million now to USD 2 billon by 2015 (Aggarwal, 2007).

We illustrate the workings of such marketplaces with the example of Elance Online – one of the largest online marketplaces for professional services. One of the authors had a professional experience in the IT outsourcing industry, as well as experience of selling and buying services at this type of marketplaces. Additional insights were obtained from communications with an owner of another major IT service marketplace as well as several regular buyers of IT services.

Established in 1998, Elance now hosts around two thousand projects that are simultaneously open for bidding across all service categories at any moment of time. Around 60 thousand companies regularly use the marketplace to buy services and about half or more of them buy IT services (McDougall, 2005). The online marketplace contains a searchable database of vendors and offers reverse auctions and negotiations as allocation mechanisms. Buyers are businesses and individuals coming predominantly from the US. Vendors are mostly small and medium IT companies and freelancers from India, Eastern Europe and Russia. Some vendors have a turnover of more than two million USD within Elance.

The exchange process at the marketplace is organized as follows. First, before buyers and vendors are able to enter the exchange, they are required to go through a registration process. Participation for buyers is free of charge while a periodic fee applies to vendors. Two allocation mechanisms la-

belled "open auction" and "invite-only auction" are available to the buyer. A key characteristic of an open auction is that any vendor registered at the marketplace can submit a bid in response to an RFP posted in an open auction. Submitted bids, including all bid attributes, are either visible to all participants or, in a modification labeled "sealed auction", vendors can only see other bidders' identities, without bid details. Buyer can send invitation to individual bidders to submit bids in auctions. In such case names of invited bidders are listed on the web page with RFP and bidding details. The second type of allocation mechanism used at the marketplace is "invite-only auction", a mechanism buyer normally utilizes when a project is intended for a particular bidder; no other bidders are allowed submit bids in invite-only auctions.

When posting her RFP as an open or invite-only auction, the buyer specifies procedure parameters, such as start and end time, auction type and the type of suppliers who can bid. After the auction starts, vendors can submit bids. Bids specify price and estimated delivery time, contain information on vendor rating and earnings and a text field where the bidder can provide other relevant information. Once a bid has been submitted, it becomes visible to the buyer and other vendors (unless it is a sealed auction). During the auction, the buyer can decline or shortlist bids and communicate with individual vendors via a private message board.

3. Hypotheses development

We start with a simple intuition that new buyers at the online marketplace are different from experienced buyers in that they need to familiarize themselves with the marketplace and, especially, with the supply side. A straightforward and inexpensive way to explore the marketplace is through comparing vendors' offers at a reverse auction. This kind of intuition is supported by the insights from an analytical model that shows that reverse auctions are an important market exploration tool to

identify new source of coffee beans supply (Donnet, Jeitschko & Weatherspoon, 2007). Therefore, our first hypothesis is as follows:

H 1: *New buyers are more likely to use reverse auction than experienced buyers.*

In an analytical investigation of the procurement of software development services, Whang (1995) developed a model of vendor's bidding in a sequence of reverse auctions for contracts, where vendor's cost function incorporates the effects of learning that occurs when a vendor works on buyer's previous projects. By learning about the specificity of buyer's request and being able to modify and re-use parts of the source code, the vendor is able to cut the development costs dramatically in subsequent projects. The vendor who wins the first auction can create a lock-in effect and enjoy a competitive advantage against other bidders in subsequent auctions (Whang, 1995), which in turn strengthens this lock-in effect.

Several studies have pinpointed the importance of vendor's idiosyncratic investments for creation of value. For instance, Bakos and Brynjolffson (1993) develop a model, according to which suppliers are required to invest in non-contractible characteristics such as innovation, quality, flexibility, trust, information exchange and responsiveness to create value (Bakos & Brynjolfsson, 1993). Richmond et al (1992) in their study of IS development outsourcing contracts suggest that the value in outsourcing contracts is generated through vendors' specific investments that can be stimulated though a profit-sharing rule (Richmond et al., 1992). But why would buyer's willingness to stay with such vendor prevent her from putting new projects to open bidding and selecting a previous vendor?

First, recent empirical studies into the use of online reverse auctions in industry suggest that when exposed to a strong competition in reverse auctions buyers respond with an increased suspicion of buyer's opportunism (Jap, 2003; Jap, 2007). One can suggest that being suspicious of the other parity' s opportunism does not promote trust, willingness to cooperate and idiosyncratic investments, all of which are important factors in the success of IT projects. In line with Bakos and Brynjolffson

(1993b), vendors' willingness to make non-contractible relationship-specific investments is subject to their expectation of being able to claim a part of resulting gains in ex-post negotiations. This depends on vendors' ex-post bargaining power, which becomes higher as the buyer commits to a small, rather than large, number of vendors (Bakos et al., 1993). Using negotiations to allocate the next project lets the vendor retain more bargaining power, which, although by itself negative for the buyer, also signals the willingness to give away some of the value created as a result of vendors' specific investments, thus encouraging further relation-specific investments that may ultimately benefit the buyer. Second, when considering allocating her next project via auctions or negotiations, the buyer might take into account costs associated with setting up an auction and evaluate vendors' bids. As was shown by studies of costly bidding and bid evaluation at online IT service marketplaces, in such a setting the buyer incurs costs when evaluating vendor bids; at some point, the expected costs of evaluation can even exceed expected gains from the transaction (Carr, 2003; Snir et al., 2003; Radkevitch, van Heck & Koppius, 2007). In other words, auctions might be a more costly procedure in the context of online marketplaces compared to bilateral negotiations, which is likely to make auctions a less attractive option compared to lower cost negotiation with a familiar vendor.

Combined, these arguments lead to the following hypothesis:

H 2: *More repeat interaction with vendors leads to buyer's lower preference for auctions and higher preference for negotiations.*

Our last hypothesis deals with the effect of vendor performance in buyer's previous project on the choice of allocation mechanism for the next transaction. Due to their complexity and involvement of parties that are often distributed across the globe, IT outsourcing projects are often prone to failures. According to PricewaterhouseCoopers as much as 50% of outsourcing deals fail. Vendor's failure to perform well can arise from a multitude of reasons, such as vendor's poor qualification, pro-

ject mis-estimation, resource constraints, problems in communication and cooperation between the parties during the project (Kern, Willcocks & van Heck, 2002).

Rather than continue with a vendor who failed, the buyer is more likely to switch the vendor. Reverse auctions are an ideal mechanism for performing such a switch, as they allow accessing many new vendors, using competition to receive a low price and comparing bidders against one another. Therefore, we hypothesize that in such situation the buyer will opt for using reverse auctions rather than bilateral negotiations.

H3: *When performance in the most recent project has been unsatisfactory the buyer has a higher preference for auctions.*

The next section describes the methodology employed to test the hypothesized relationships.

4. Methodology and Data

Data

In order to test the hypotheses we collected transaction data on accomplished projects at a leading online marketplace for IT services. One advantage of using datasets from online marketplaces is that it "captures unbiased objective data: what players actually did, rather than what they say they did. This is preferable to the kind of survey data commonly used in other outsourcing studies which tend to be dependent on inaccurate memory, *post hoc* rationalizations, and subjective attitudinal scales." (Gefen & Carmel, 2008: 13).

There were several stages in data collection and processing. First, we identified buyers who had at least 20 awarded projects awarded at the marketplace (this number included projects awarded in any category of the marketplace, not only IT-related). This resulted in a sample of 530 buyers who allocated 20 to 300 projects each, starting from the launch of the marketplace in 1999 until May 2006.

Second, we selected projects from the overall category *Web development*, focusing on the four main sub-categories: *Web Programming, Web Design and Development, Simple Website* and a category labeled *Other – Web design and development*. Other subcategories existed within *Web* Development, but were not numerous enough in our sample to warrant inclusion. We removed projects with incomplete data, e.g. where buyer feedback on supplier performance was absent (at this marketplace buyers have discretion whether or not to provide feedback to vendors on accomplished projects). To ensure a reasonable amount of feedback data for each buyer, we only included buyers where feedback on at least 70% of projects was available and at least 10 projects belonged to *Web development* category. This procedure resulted in a dataset containing transactions of 91 buyers with data on 2,081 projects worth a total of USD 1,074,315. See Table 1 in the Appendix for descriptive statistics and Table 2 in the Appendix for correlations between the variables.

Measures

Below we discuss the measures of the allocation mechanism choice, complexity, buyer experience, repeat interaction and satisfaction with vendor performance.

Allocation mechanism choice

As discussed above, at the online marketplace where our empirical investigation is set the buyer has a choice of two allocation mechanisms and we model the allocation mechanism choice as a binary variable where "1" is equivalent to the use of auction and "0" denotes the use of negotiations (or "invite-only auctions" in the parlance of our marketplace).

Previously awarded projects

We use the number of projects awarded by the buyer prior to the current transaction as a straight-forward measure of how "new" the buyer is to the marketplace. Therefore, a buyer with 0 previously awarded projects is accomplishing his first project at the marketplace.

Repeat interaction

We define the number of repeat interactions as the number of transactions the buyer previously had with vendors with whom she already transacted more than once. Although prior exchange interactions technically could stretch back many years and/or projects, we focus on the more recent prior interactions as these are more likely to influence buyer behavior than interactions many projects ago, thus providing a more focused test of the effects of the learning and specific investments that occur in early projects. We therefore counted repeat interactions with vendors within buyer's five most recent projects. Therefore, the maximum number of repeat interactions for the buyer is 5, the minimum is 0. However, as a robustness check, we tested our model with an alternative specification of prior exchange relationships where we counted vendor re-uses with buyer's ten most recent projects instead of five. The significance and sign of the regression coefficient were practically the same as in our main results, but the effect size was even stronger (results available from the authors).

Performance in the most recent project

After a project has been accomplished the buyer can assign a rating on 1 to 5 point scale assessing vendor's performance and leave a textual message in vendor's public profile. As 91% of projects have a rating of '5', this suggests that 5 is the implied standard for any satisfactory project. We therefore modelled dissatisfaction with past performance as a binary variable where "0" is equivalent to the highest possible performance rating (5) in the previous project and "1" accounts for any rating below 5. As a robustness check, we also developed and tested two alternative specifications with benchmarks for dissatisfaction and 4 and 3, respectively. Testing both alternative specifications produced results similar to that of the main specification although the effect of dissatisfaction was even higher. .

Control variables

Past research identified project complexity as an important factor that influences the choice between auctions and negotiations (Bajari et al., 2006). The data available at the online marketplace does not

allow to judge project complexity directly, but we include dummy variables for each of the four subcategories to account for any possible differences in complexity across these subcategories.

5. Analysis

In order to test the hypotheses we focused on individual transaction as a unit of analysis. The descriptive statistics and correlations among key variables are presented in Table 1and 2. Interesting insights emerge from both tables. As can be see in Table 1, buyers have allocated their projects via negotiations in 62% of cases. This is roughly similar to the split between auction/negotiation use in other studies of allocation mechanism choice (Bajari et al, 2006; Leffer et al, 2004), in both of which auctions and negotiations were utilized in approximately equal number of transactions. An average project is realized by an experienced buyer with an average of 14.1 previously awarded projects. Prior vendors succeed in winning almost 2/3 of projects (65%) The data indicates that negotiations serve primary as a means to allocate projects to vendors with whom buyers did business before – almost 90% of negotiations are done with such vendors, whereas auctions are won 75.1% by new suppliers. The mean of 4.88 of the vendor performance rating indicates that a bulk of vendors (91%) receive the highest possible evaluation for their project performance. A possible explanation here may be that awarding a vendor the highest rating serves more as a reputational reward for good performance, rather than an objective measure thereof. The correlation coefficients in Table 2 show that negotiations are associated with higher project prices as well as with higher winner's bids. A strong association (.66***) is between invite-only auctions and repeat vendors being selected as winners.

Analysis Strategy

Since our dependent variable is binary, we employ a logit formulation and develop a statistical model that relates the probability of auction choice Pr(*Auction=1*) to a set of independent variables (*ProjectCategoryDummy*, *PreviousProject*, *RepeatProjects* and *DisatisfactionDummy*).

The dataset has a panel structure and this has implications for the logit estimation procedures. The main issue with panel data is that the assumption of independent distribution of the error may not hold (Kennedy, 2003), which might result in biased estimated if a standard logit estimation procedure is used. In order to deal with this issue we use three different logistic specifications that together help test the robustness of our results. The first way of testing is by using pooled logistic regression with a robust procedure with clustering on buyers as the first way to test the hypothesis. This procedure allows to obtain conservative standard errors and to avoid their inflation in case they are not independent.

Two other specifications, fixed effects and random effects models, allow to better account for the structure of the data by capturing the effect produced by individual buyers on the allocation mechanism choice. The fixed effects model treats the effect of individual buyers as constant, in which case it becomes a part of the intercept. By contrast, in a random-effects model the buyer-specific effects are assumed to be independently and identically distributed coming from a common normal distribution. Although random effects model produces more efficient estimations than the fixed effects model, it relies on stricter assumptions about the nature of the data. We conduct a Hausman test to verify whether the estimates produced by the two models are statistically different. In our case the results of the Hausman test showed that the random effects model cannot be rejected.

Results

In Table 3 the results of testing logit models are presented. We start the discussion of the results with a concise form of the model that includes only the subcategory dummy variables and the vari-

able for buyer experience (column 1). The initial test provides support for Hypothesis 1. The number of *Previously awarded projects* (our proxy for buyer experience) is negatively, associated with the use of reverse auctions (-0.0380, $p<0.01$). Its effect is small however: the marginal effect of an increase in *Previously awarded projects* from 0 to 1 is just around 1% of auction probability decrease. Although small, it is in contrast to the results in Bajari et al. (2006). A possible explanation may be that in the online marketplace context investigated here, the positive effect of buyer experience on the use of negotiations is related to the fact that when buyers start their activities at the online marketplace, auctions serve as a tool to explore the marketplace, by getting to know vendors and learning about the bidding process. As buyers acquire experience, from exploration of the marketplace they switch to exploitation of their knowledge and relationships they built with vendors, where negotiations is a more appropriate instrument.

Next, we add the exploratory variable *Buyer dissatisfaction dummy* to the regression in order to test Hypothesis 3. The new model (column 2) marginally gains in explanatory power (Pseudo $R^2 = 0.0668$). The regression coefficient for *Buyer dissatisfaction dummy* reveals a large positive effect on the use of reverse auctions (1.1211, $p<0.01$). This result provides strong support for Hypotheses 3 that predicted that buyer's dissatisfaction with vendor's performance in the most recent project provokes buyer's desire to switch to a different vendor – an intention that is better served by an auction. It is quite telling that the marginal effect of *Buyer dissatisfaction dummy* changing from 0 (the rating assigned to vendors is 5) to 1 (the rating assigned to vendors is less than 5) is high – the predicted probability of buyer auctioning her next project increases by as much as 27%.

The third model presented in column 3 of Table 3 regresses the probability of auction choice on the full set of the independent variables. The number of observations in this model is 1,780, since a subsample of buyers with at least 5 awarded projects has been used for testing. In comparison to the previous model, this model demonstrates a sharp increase in the explained variance to the level of

25.99% of the variation. The regression coefficient for *Repeat projects* is significantly and negatively related to the choice for reverse auction (-0.8262, $p<0.01$), which means that Hypothesis 2 is supported. As the analysis of the marginal reflects reveals in the same column, the increase of the number of repeat projects (which the buyer conducts within five latest projects) by one leads to 12.8% decrease in the probability of choosing to auction her next project. By contrast, the coefficient for *Buyer dissatisfaction dummy* loses significance. This is related to that fact that projects done by relatively inexperienced buyers (with less than five awarded projects) are now excluded from the analysis, yet these are also the projects where dissatisfaction with vendor's performance is more likely due to the lack of experience and fit with the appropriate vendor. Also, the coefficient for *Previously awarded projects* loses its significance, most likely due to the effect of buyer's experience in the models (which was small to begin with) in columns 3-5 is now absorbed by the *Repeat projects* variable.

Columns (4) and (5) display the results of hypotheses testing using random effects and fixed effects logit models. There are 1,357 observations in the fixed effects model compare to 1,780 in the random effects model, as the former model excludes buyers that do not have variation in the dependent variable. Qualitatively, the results are very similar. The support for Hypothesis 2 has been provided once again. Both random effects and fixed effects models demonstrate support for Hypothesis 3 that links buyer's dissatisfaction with vendor performance in the most recent project with the choice for auction in the subsequent project. The coefficients for *Buyer dissatisfaction dummy* in both models are positive and significant (0.7391, $p<0.01$ and 0.7640, $p<0.01$). The analysis of marginal effects shows that when buyer's rating for supplier performance in the last project is less than 5, the buyer is 15.5% (random effects model) and 0.065% (fixed effects model) more likely to use auction the next transaction.

Overall, the conclusion of the analysis is that Hypothesis 1 (on the negative effect of buyer experience on the use of auctions) finds partial support. New buyers are more likely to use auctions than

experienced buyers but the effect of marginal increase in experience on the decrease of negotiation use is quite weak and seems to be overrun by repeat interaction, when the latter is included in the model. Hypothesis 2 (on the relationship between repeat interaction and preference for negotiations in the subsequent project) and Hypothesis 3 (on the relationship between dissatisfaction with vendor performance in the previous project and preference for auctions in the subsequent project) find broad support. In the next section we discuss the implication of the findings.

6. Discussion

The findings of this study have a number of implications for research and practice. First, from the research perspective, this study not only extends the body of knowledge on the use of different allocation mechanisms. It also provides further support of an emerging perspective in the research on auction that argues for focusing not only on a discrete transaction when trying to explain participants' behaviour in auction outcomes but also on the business context in which such transaction occurs (Rothkopf et al., 1994; Pinker et al., 2003; Elmaghraby, 2007). We showed that taking into account a historical perspective of actor's exchange interaction, more specifically – prior repeat exchange interactions, results in valuable insights into the motivation of the behavior of economic agents. Second, these results contribute to the debate on the use of online reverse auctions in industrial practice. A viewpoint shared by a number of researchers is that online reverse auctions, if implemented "with care", can be utilized with the incumbent supply base without necessarily damaging existing relationships (Jap, 2002). Indeed, previous studies found that incumbent suppliers are more likely to win auctions than new suppliers and enjoy higher prices (Zhong & Wu, 2006), and that incumbents might be still willing to make idiosyncratic investments after reverse auctions even though they might start to suspect the buyer in trying to opportunistically decrease prices (Jap, 2003). A study in the banking industry revealed that, although the effect of supplier marketing program has a

higher effect of buyer's switching decision, personal relationships still do play a role as counter-weight for switching (Wathne, Biong & Heide, 2001). Although these prior findings look very plausible, a broader perspective on the use of online reveres auctions taken in our study reveals that buyers do not think reverse auctions to be very appropriate in the context of longer buyer-supplier relationships. We found and quantified a clear pattern of decreasing use of reverse auctions as the exchange relationships between buyers and vendors become more extensive, at least in terms of the number of previous exchange interactions. The decrease of the probability of using reverse auction for the next project (although somewhat dependent on the model specification employed) could be almost 16% per additional past repeat project with a vendor. Apparently, this is a sign that buyers do not see reverse auctions commensurable with the trust, vendor's learning and idiosyncratic investments amassed during the prior interaction and rather rely on negotiations to reap these benefits. By contrast, buyers are turning to reverse auctions when they need to sever relationships with their incumbent vendor – being dissatisfied with vendor's performance can boost the probability of auctioning their next project by as much as 27%.

These results can be useful guidelines for procurement managers who have a full discretion to use different allocation mechanisms with their incumbent supply base, especially in contexts where the knowledge and investments of as well as the trust to incumbent vendors are important for creating business value.

At the same time, the results of the present study should be generalized with caution. Unlike previous studies on the choice of allocation mechanism and contract choice that explored the empirical context in industries such as offshore oil drilling, hospital procurement or contracting for large-scale IT services, this study explores small-scale IT service projects in an online environment. One implication for the generalizability of results here is that larger companies might have formalized rules for the choice of allocation mechanisms that might prevent them from easily changing from one

mechanism to another. For example, several studies described procurement auctions of electronic components or automotive parts, where buyers would use exclusively reverse auctions to choose suppliers (Jap, 2003; Zhong et al., 2006). This is also true for public procurement, e. g. of construction services, where buyers always have to use tenders when certain criteria (e.g. monetary volume of the project) are met (Bajari et al., 2006). Another implication is that the transaction costs can be lower in the online environment that can make switching vendors easier. For example, these are the costs of buyer's searching for new vendors, which are lower in online markets (Bakos, 1997).

In addition to the concerns about generalizability, this study has several other limitations. First, the Web Development section of online marketplace we studied is but one of the areas of the marketplace. It is not clear whether our findings would equally hold for other professional services such as tax consulting, legal advice or language transaction where the importance of buyer's learning, trust and idiosyncratic investments might be lower than in the case of IT service. Second, the size of the contracts we studied is much smaller than the size of typical B2B software development contracts. As Gefen and Carmel (2008) note in a study that uses data from a marketplace similar to ours: "Such contracts span from three to six order of magnitude larger than the typical Rent A Coder contract and thus different marketplace behavior is likely" (Gefen et al., 2008: 11). The third limitation comes from the fact that it is difficult to compare the effects of prior relationships on the allocation mechanism choice to factors identified by prior studies, such as contract complexity (Bajari et al., 2006). The measures for complexity available at our marketplace lack the refinement necessary for drawing such conclusions. Finally, our dataset has been limited exclusively to projects that have been awarded and executed, and as previous studies in a similar marketplace pointed out, as much as 60% of posted auctions never result in a contract between the buyer and vendor (Snir et al., 2003; Radkevitch et al., 2007). The explanations offered by those authors are mainly in terms of costly bidding and costly bid evaluation, but both papers also found that projects with higher dollar value are

slightly more likely to not be awarded. This implies that the auction part of our sample is likely to have somewhat smaller projects compared to the overall population of auctioned projects. However, this only provides a stricter test of our hypotheses as the risk associated with high-value projects would make them theoretically more likely to be allocated through a negotiation rather than an auction (although since data on the value of negotiated projects is not available at the marketplace, we cannot test this hypothesis). It does suggest that a misfit between project value and allocation mechnism employed might be an additional explanation for the high percentage of failed auctions, but this is beyond the scope of this paper,

7. Conclusions

Procurement transactions often require a decision on the choice of a mechanism to allocate contract to a vendor to be made at a very early stage. As prior literature has demonstrated, the choice of the allocation mechanism is of crucial importance since the allocation mechanism affects a number of critical aspects of transactions such as information exchange, price and buyer-supplier relationships (Jap, 2002; Jap, 2003; Bajari et al., 2006). All these factors affect performance in the exchange.

Previous theoretical and empirical studies on allocation mechanism choice focused on transaction attributes such as product complexity, buyer's preference for quality, availability of suppliers and cost of conducing auctions as factors determining the mechanism choice (Manelli et al., 1995; Bonaccorsi et al., 2000; Leffler et al., 2003; Bajari et al., 2006). This means that until now the literature considered only discrete exchange situations ignoring the historical context in which exchange occurs in the real world. This has been a considerable gap for both theory and practice, as repetition is typical for procurement transactions (Pinker et al., 2003; Elmaghraby, 2007). This study aimed to bridge this gap and to extend the literature on the choice of allocation mechanisms by studying the

effect of buyer's repeat interactions with vendors on the choice between reverse auctions and bilateral negotiations.

This study makes three key contributions. First, we found and quantified the effect of buyer's repeat exchange interaction with vendors on the choice of allocation mechanism in buyer's next transaction at an online marketplace for IT services. We also found that in cases when the buyer needs to explore the supply at the marketplace or when she is dissatisfied with the vendor performance in the most recent project, the use of auctions in the subsequent project becomes more likely. These findings extend the body of knowledge on allocation mechanism choice.

Our second contribution deals with the new insights on the use of online reverse auctions. Buyers who enjoyed prior repeat interaction with vendors and are satisfied with their performance, are very unlikely to start experimenting with reverse auctions. By contrast, reverse auctions seem to serve as a tool that new buyers use to explore the marketplace; or, alternatively, to compare and switch to new suppliers in case vendor performance has become not satisfactory. This finding seems to challenge the insights of some prior studies that suggested that reverse auctions are likely to be used as a "wake-up call for the extant supply base" (Jap, 2002). However, more research is needed to find out to what extent these findings hold in other empirical contexts.

The third contribution consists of exploring an empirical context different from that utilized by prior studies on allocation mechanism choice. This allowed us to extend the study of allocation mechanism choice into the online environment that hosts an increasing number of transactions in recent decades. In addition, the use of the real transaction data from an online marketplace helped overcome a limitation of previous research that studied the link between reverse auctions and buyer-supplier relationships using survey data. In our study, rather than relying on the information about actors' subjective intentions and perceptions we could operate with the objective facts of actual

transactions, showing that the increasing availability of large, real-world transaction data offers great opportunities for building empirically valid theories of B2B market behavior.

References

Aggarwal, A. 2007. Person-to-Person Offshoring. Offshoring of Services Reaches Small Businesses and Homes. Report of Evalueserve Inc.

Allen, D. W.,Lueck, D. 1992. The" Back Forty" on a Handshake: Specific Assets, Reputation, and the Structure of Farmland Contracts. Journal of Law, Economics, & Organization, 8 (2): 366-376.

Allen, D. W.,Lueck, D. 1993. Transaction Costs and the Design of Cropshare Contracts. The RAND Journal of Economics, 24 (1): 78-100.

Alston, L. J., Datta, S. K.,Nugent, J. B. 1984. Tenancy Choice in a Competitive Framework with Transactions Costs. The Journal of Political Economy, 92 (6): 1121-1133.

Bajari, P., McMillan, R.,Tadelis, S. 2006. Auctions versus Negotiations in Procurement: An Empirical Analysis. NBER Working Paper No. w9757: 1-30.

Bajari, P. L.,Tadelis, S. 2001. Incentives Versus Transaction Costs: A Theory of Procurement Contracts. Rand Journal of Economics, 32 (2): 287-307.

Bakos, J. Y.,Brynjolfsson, E. 1993. Information technology, incentives, and the optimal number of suppliers. Journal of Management Information Systems, 10 (2): 37-53.

Bakos, Y. 1997. Reducing Buyer Search Costs: Implications for Electronic Marketplaces. Management Science, 43 (12): 1676-1692.

Banerjee, A. V.,Duflo, E. 2000. Reputation Effects and the Limits of Contracting: A Study of the Indian Software Industry. Quarterly Journal of Economics, 115 (3): 989-1017.

Bonaccorsi, A., Lyon, T. P., Pammolli, F.,Turchetti, G. 2000. Auctions vs. Bargaining: An Empirical Analysis of Medical Device Procurement, Working paper, Department of Economics, University of Washington.

Bulow, J.,Klemperer, P. 1996. Auctions Versus Negotiations. The American Economic Review, 86 (1): 180-194.

Carr, S. M. 2003. Note on Online Auctions with Costly Bid Evaluation. Management Science, 49 (11): 1521-1528.

Corts, K. S.,Singh, J. 2004. The Effect of Repeated Interaction on Contract Choice: Evidence from Offshore Drilling. Journal of Law, Economics, and Organization, 20 (1): 230-260.

Donnet, M. L., Jeitschko, T. D.,Weatherspoon, D. D. 2007. The Impact of E-Auctions in Adjusting Procurement Strategies for Specialty Coffee, SSRN.

Elmaghraby, W. 2007. Auctions within e-Sourcing Events. Production and Operations Management, 16 (4): 409-422.

Emiliani, M. L.,Stec, D. J. 2002. Realizing savings from online reverse auctions. Supply Chain Management, 7 (1): 12.

Gefen, D.,Carmel, E. 2008. Is the World Really Flat? A Look at Offshoring at an Online Programming Marketplace. MIS Quarterly, 32 (8).

Goldberg, V. P. 1977. Competitive Bidding and the Production of Precontract Information. The Bell Journal of Economics, 8 (1): 250-261.

Gulati, R. 1995. Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances. The Academy of Management Journal, 38 (1): 85-112.

Heide, J. B.,Miner, A. S. 1992. The Shadow of the Future: Effects of Anticipated Interaction and Frequency of Contact on Buyer-Seller Cooperation. The Academy of Management Journal, 35 (2): 265-291.

Jap, S. 2007. The Impact of Online Reverse Auction Design on Buyer-Supplier Relationships. Journal of Marketing, 71: 146-159.

Jap, S. D. 2002. Online Reverse Auctions: Issues, Themes, and Prospects for the Future. Journal of the Academy of Marketing Science, 30 (4): 506.

Jap, S. D. 2003. An Exploratory Study of the Introduction of Online Reverse Auctions. Journal of Marketing, 67 (3): 96-107.

Kalnins, A.,Mayer, K. J. 2004. Relationships and Hybrid Contracts: An Analysis of Contract Choice in Information Technology. Journal of Law, Economics, and Organization, 20 (1): 207-229.

Kambil, A.,van Heck, E. 2002. Making Markets - How Firms Can Design and Profit from Online Auctions and Exchanges. Boston, Mass.: Harvard Business School Press.

Kennedy, P. 2003. A Guide to Econometrics: MIT Press.

Kern, T., Willcocks, L. P.,van Heck, E. 2002. The Winner's Curse in IT Outsourcing: Strategies for Avoiding Relational Trauma. California Management Review, 44 (2): 47-69.

Lafontaine, F. 1992. Agency Theory and Franchising: Some Empirical Results. The RAND Journal of Economics, 23 (2): 263-283.

Leffler, K. B., Rucker, R. R.,Munn, I. A. 2003. The Choice Among Sales Procedures: Auction V. Negotiated Sales Of Private Timber, Working paper, Department of Economics, University of Washington.

Manelli, A. M.,Vincent, D. R. 1995. Optimal Procurement Mechanisms. Econometrica, 63 (3): 591-620.

McDougall, P. 2005. Small-Scale Offshoring InformationWeek, Vol. July 25.

Mithas, S., Jones, J. L.,Mitchell, W. 2005. Determinants of Governance Choice in Business-to-Business Electronic Markets: An Empirical Analysis. Under first review at MIS Quarterly.

Pinker, E., Seidmann, A.,Vakrat, Y. 2003. Managing Online Auctions: Current Business and Research Issues. Management Science, 49 (11): 1457-1484.

Radkevitch, U., van Heck, E.,Koppius, O. R. 2007. Coping with Costly Bid Evaluation in Online Reverse Auctions for IT Services., ERIM Report Series Reference No.ERS-2006-046-LIS. RSM Erasmus University. Rotterdam.

Richmond, W. B., Seidmann, A.,Whinston, A. B. 1992. Incomplete contracting issues in information systems development outsourcing. Decision Support Systems, 8 (5): 459-477.

Rothkopf, M.,Harstad, R. 1994. Modeling Competitive Bidding: A Critical Essay. Management Science, 40 (3): 364-384.

Smart, A.,Harrison, A. 2002. Reverse Auctions as a Support Mechanism in Flexible Supply Chains. International Journal of Logistics: Research & Applications, 5 (3): pp. 275-285.

Snir, E. M.,Hitt, L. M. 2003. Costly Bidding in Online Markets for IT Services. Management Science, 49 (11): 1504.

Tunca, T. I.,Zenios, S. A. 2006. Supply Auctions and Relational Contracts for Procurement. Manufacturing & Service Operations Management, 8 (1): 43.

van Tulder, R.,Mol, M. 2002. Reversed Auctions or Auctions reversed: First experiments by Philips. European Management Journal, 20 (5): 447-456.

Wathne, K. H., Biong, H.,Heide, J. B. 2001. Choice of Supplier in Embedded Markets: Relationship and Marketing Program Effects. Journal of Marketing, 65 (2): 54-66.

Whang, S. 1995. Market Provision of Custom Software: Learning Effects and Low Balling. Management Science, 41 (8): 1343-1352.

Zhong, F.,Wu, D. 2006. E-sourcing: Impact of Bidding Behavior and Non-price Attributes. Paper presented at the 27th International Conference on Information Systems, Milwaukee, WI.

Appendix

Table 1. Descriptive statistics.

	N	Min	Max	Mean	Std. Dev.
Allocation mechanism (Neg. = 0; Auct. = 1)	2,081	0	1	.63844	.4967
Project Price	2,081	5	15,150	516.25	1008.91
Winner's bid	2,033	1	8,750	354.18	502.77
Number of previously awarded projects	2,081	0	65	14.10	13.07
Winner is recurrent vendor	2,081	0	1	.65	.48
Percentage of previous projects with repeat vendors	1,980	.00	1.00	.3893	.4144
USD in projects with repeat vendors	1,980	0	52,660	4,162.19	6,423.18
Satisfaction	2,066	1	5	4.88	.53
Satisfaction with last project < 5	2,081	0	1	.09	.29
Satisfaction with last project < 4	2,081	0	1	.04	.19
Satisfaction with last project < 3	2,081	0	1	.03	.16
Days since the start of the 1st auction	2,081	0	2,321	548.56	481.09
Repeat projects within 5 last projects	1,780	0	5	3.34	1.63
Category "Web design and development"	2,081	.00	1.00	.4493	.4975
Category "Simple website"	2,081	.00	1.00	.2220	.4157
Category "Web programming"	2,081	.00	1.00	.2960	.4566
Category "Other – web design"	2,081	.00	1.00	.0308	.1727

Table 2. Pearsons' Correlations

	Auction	Price (USD)	Satisfact.	Win bid	Winner is repeat vendor	Satisfaction most recent project < 5	Repeat projects within 5 last projects	Previously awarded projects	Cat SW	Cat WDD
Price (USD)	-.099(**)									
	.000									
Satisfaction	-.203(**)	.009								
	.000	.668								
Win bid	-.120(**)	.588(**)	-.011							
	.000	.000	.626							
Winner is repeat vendor	-.660(**)	.041	.215(**)	.069(**)						
	.000	.063	.000	.002						
Satisfaction most recent project < 5	.173(**)	-.017	-.161(**)	.002	-.208(**)					
	.000	.436	.000	.926	.000					
Repeat projects within 5 last projects	-.551(**)	.027	.206(**)	.043	.635(**)	-.258(**)				
	.000	.253	.000	.074	.000	.000				
Previously awarded projects	-.214(**)	.054(*)	.092(**)	.022	.236(**)	-.079(**)	.270(**)			
	.000	.014	.000	.326	.000	.000	.000			
Cat SW	-.085(**)	.010	.014	.076(**)	.099(**)	-.034	.151(**)	.105(**)		
	.000	.659	.522	.001	.000	.116	.000	.000		
Cat WDD	-.025	-.029	.030	-.057(*)	.001	-.010	.017	.024	-.483(**)	
	.260	.189	.178	.011	.975	.642	.476	.281	.000	
Cat Other	-.066(**)	-.027	.021	-.020	.038	-.007	.015	.030	-.095(**)	-.161(**)
	.002	.223	.338	.364	.082	.739	.530	.169	.000	.000

*p<0.1, ** p<0.05; *** p<0.01

Table 3. The effect of project complexity, experience and prior performance and prior exchange interaction on the probability of choosing auction as an allocation mechanism: logistic regressions.

Dependent variable: Auction	(1) Logit with robust standard errors and clustering on buyers	(2) Logit with robust standard errors and clustering on buyers	(3) Logit with robust standard errors and clustering on buyers	(4) Logit with random effects for buyers	(5) Logit with conditional fixed effects for buyers
Previously awarded projects	-0.0380*** (0.0114)	-0.0366*** (0.0110)	0.0042 (0.0094)	0.0034 (0.0077)	-0.0005 (0.0079)
Buyer dissatisfaction dummy		1.1211*** (0.2584)	0.3962 (0.2671)	0.7391*** (0.2683)	0.7640*** (0.2696)
Repeat projects			-0.8262*** (0.0835)	-0.8981*** (0.0646)	-0.7866*** (0.0660)
"Simple website" dummy	-0.6046** (0.3065)	-0.5870* (0.3095)	-0.4289 (0.3721)	-0.4853* (0.2788)	-0.4016 (0.3045)
"Web design and development" dummy	-0.3717 (0.2813)	-0.3578 (0.2781)	-0.2372 (0.2958)	-0.2833 (0.2343)	-0.1908 0.2602
"Other – Website dev." dummy	-1.2075** (0.5770)	-1.2142** (0.5854)	-1.4433*** (0.3908)	-1.4817** (0.5747)	-1.2287** (0.6030)
Const	0.3518 (0.2742)	0.2200 (0.2775)	2.0004*** (0.2976)	2.0061*** (0.3084)	
Number observations	2,081	2,081	1,780	1,780	1,357
Number of buyers	91	91	91	91	62
Wald Chi²	22.08	51.35	150.90	234.83	238.50 (LR chi2)
Pseudo R²	0.0493	0.0668	0.2599	0.3421	0.192
Log pseudolikelihood/ Log likelihood	Log pseudolikelihood -1317.986	Log pseudolikelihood -1293.672	Log pseudolikelihood -840.907	Log likelihood -713.622	Log likelihood -501.733

Notes: Dependent variable – probability of auction choice. Standard errors are in parentheses.
*p<0.1, ** p<0.05; *** p<0.01

Publications in the Report Series Research* in Management

ERIM Research Program: "Business Processes, Logistics and Information Systems"

2008

An Evolutionary Framework for Determining Heterogeneous Strategies in Multi-Agent Marketplaces
Alexander Babanov, Wolfgang Ketter and Maria Gini
ERS-2008-002-LIS
http://hdl.handle.net/1765/10972

Choosing between Auctions and Negotiations in Online B2B Markets for IT Services: The Effect of Prior Relationships and Performance
Uladzimir Radkevitch, Eric van Heck and Otto Koppius
ERS-2008-004-LIS
http://hdl.handle.net/1765/11288

---

* A complete overview of the ERIM Report Series Research in Management:
https://ep.eur.nl/handle/1765/1

ERIM Research Programs:
LIS Business Processes, Logistics and Information Systems
ORG Organizing for Performance
MKT Marketing
F&A Finance and Accounting
STR Strategy and Entrepreneurship