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Signaling Mechanisms and Survival of Service Providers in an Electronic Market

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ABSTRACT

This research studies the survival of software implementation service providers in an electronic market (or e-market), and the role that vendor characteristics such as reputation, education, experience, 'preferred provider' status, and references play in predicting which service providers will exit the e-market after it (the e-market) implements trust enhancing mechanisms. Using theories from asymmetric information, signaling, and trust literatures, we propose a model to examine the relation between firm characteristics and survival. Our empirical results support the key role played by these signals in inducing the separating equilibrium that leads to the shakeout among software service providers in an e-market.

Keywords

software services, electronic markets, signaling, asymmetric information, firm survival

INTRODUCTION

A growing trend in software outsourcing is the use of electronic markets (e-markets) for buying and selling software implementation services. Websites such as rentacoder.com and elance.com enable businesses to post their requirement for software implementation projects, and also enable service providers to bid on implementing the software as specified for these projects. Such e-markets bring together vendors and clients from all over the world for many different types and sizes of projects, and cover a broad range of expertise needed for the project. The projects listed include accounting software implementation services, web designing, ERP implementation, and database design. In such e-markets, buyers have limited information about the likelihood that a seller will provide the desired service satisfactorily. Due to this information asymmetry, the classical 'markets for lemons' problem will play out where information asymmetry will cause the markets to collapse and no trade will take place (Akerlof, 1970). To overcome this problem, e-marketplaces need to develop mechanisms which enable each party to provide signals to the other party about its ability and intention to uphold their end of the bargain. However implementation of such mechanisms is likely to induce a separating equilibrium where service providers unable to signal a high quality are likely to earn consistently lower returns compared to the other firms. In this study, we examine the impact of signaling mechanisms on providers in an e-market for software implementation services that lost more than 95% of its registered providers within a year of implementing various signaling mechanisms. The main research questions that we address are as follows: what is the impact of signaling mechanisms on survival of providers in a e-market for software services?

Software implementation projects as well as transacting in electronic markets involve substantial risks. Implementing software applications can be a complex task and involves significant risks of failure[1]. The common reasons for failure of software projects include unrealistic goals, poor reporting of systems' status, poor communication among customers, developers and users, and poor project management (Charette, 2005). Since the buyer and the software vendor are separate entities who have their own personal objectives, outsourcing poses additional risks apart from the risks of software implementation. Agency theory analyzes the consequences of the vendor (acting as an agent) not always acting in the best interests of the buyer (the principal). The nature of software implementation makes it difficult for the buyer to monitor all the

[1]For example, a study by the Standish Group finds that more than 80% of software projects are delivered late, and more than half do not include required features (http://www.ibm.com/developerworks/websphere/library/techarticles/0306_perks/perks2.html)

actions of the vendor. Furthermore, transactions in electronic markets are also associated with higher levels of risk than transactions in traditional markets since these are separated more in space and time (Dellarocas, 2001)[2] .

Signaling is perhaps the most commonly used mechanism to alleviate the information asymmetry problem. Many e-markets now employ a variety of measures such as feedback mechanisms (eBay), certifications (Truste), and credential verifications (Integral7), which enable sellers to communicate expectations of product and service quality to the buyers. Signaling is especially important in software implementation projects because of the need for customization and the difficulty in monitoring the work of the vendor (Gefen, 2004). Most signaling mechanisms in e-markets are designed keeping the buyers' interest in mind, and therefore, the cost of complying with these mechanisms falls mainly on the sellers. [3] For example, the vendor may pay a periodic fee to become a preferred provider or invest in process improvements to increase customer satisfaction. Feedback ratings of 99% and higher imply that a vendor keeps nearly all customers happy at all time, which may require generous return policies, settling disputes in favor of the consumer, or having an adequately staffed customer service department.[4]. This may lead to a shakeout if many vendors quit an e-market because profits generated through that market are less than the costs of compliance.[5]

The term "shake-out", according to Willard and Cooper (1985) is "used in the popular business press to describe a situation in which a disproportionately large percentage of the firms engaged in an industry are forced to withdraw from competition within a relatively short period of time." There has been considerable interest in the industrial organization, economics and strategy literatures to study shakeouts to identify what differentiates the successful players from the less successful players in a separating equilibrium (for example, Klepper and Graddy, 1990; Bruderl et al, 1992; and Klepper and Simons, 2005) In the context of e-markets for services, the separating equilibrium is based on signals on providers that engender trust in their ability and willingness to satisfy buyer requirements. Mechanisms such as feedback ratings or vendor credential verification raise the bar on seller participation in the marketplace because they impose greater costs on and provide less benefits to the lower quality providers than higher quality providers. Therefore, when an e-marketplace enforces signaling mechanisms among its providers, a shakeout may occur with the departure of many vendors, whose net profitability is adversely affected when the cost of signaling outweighs the benefits in generating new business.

We use survival as the dependent variable in our study because little prior research on e-markets examines the issue of firm survival or the impact of signaling mechanisms on survival. While firm survival is a widely researched topic, the characterization of survival as a firm exiting an industry does not always hold true for firms in e-markets. For example, if the cost of operating in an e-market increases due to signaling mechanisms, a firm may cease operations in that e-market and operate in another e-market with more relaxed signaling mechanisms, or the firm may cease online operations altogether and operate in the offline world. Therefore, in studying the impact of signaling on survival of a firm in an e-market, we are not considering its overall profitability, but the profitability of its operations in a particular e-market, which may be a subset of its overall profitability. Signaling mechanisms such as feedback ratings are associated with positive consequences for a firm (price premiums – Ba and Pavlou, 2002), but using survival as a dependent variable enables us to get a holistic perspective on the costs and benefits of signaling. The question of what types of sellers will quit an e-market after it implements enhanced signaling mechanisms is also important from the perspective of the firm (such as eBay) which operates the e-market. For example, many high quality sellers threatened to quit eBay after it made changes to its feedback policy[6].

THEORETICAL FRAMEWORK AND HYPOTHESES

Information asymmetry in services e-markets

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[2] For example, the total loss due to fraud on the internet grew more than 100% in 2005 to over $13 million (http://www.fraud.org/2005_Internet_Fraud_Report.pdf)

[3] For example, several marketplaces such as Amazon.com and epinions.com have implemented reputation systems where only buyers can rate their experiences with the seller. E-bay was one of the few marketplaces where sellers could rate buyers, but recently they disallowed this practice (http://www.guardian.co.uk/technology/2008/feb/21/ebay.consumeraffairs)

[4] Also, several e-bay sellers complain that trust building mechanisms are sometimes misused by buyers into manipulating the sellers to give more discounts or make unjustified demands after a sale, with the threat to leave a negative feedback if the seller does not comply (http://forums.ebay.com/db1/thread.jspa?threadID=1000597751&tstart=0&mod=1195165526189)

[5] . For example, several sellers were forced to shut down their eBay business after eBay implemented a policy of putting restrictions on sellers whose buyer dissatisfaction rating went over 5% and suspending seller accounts if this level of dissatisfaction continued for more than 4 months (http://blog.auctionbytes.com/cgi-bin/blog/blog.pl?/comments/2007/6/1182798373.html)

[6] http://www.pcworld.ca/news/column/964ac5f90a\\01040801135d340148cafd/pg0.htm

Many e-markets for a variety of services such as creative writing, tax services, and legal services have grown rapidly in the past decade. While e-markets have been widely studied in a variety of literatures such as MIS and marketing, most of this discussion has focused on marketplaces such as eBay where transactions involve products. However, considerable differences exist between products and services. For example, the attributes of services are less quantifiable than those of products, and hence less easily conveyed through a website. Also, since the delivery of services is virtually indistinguishable from consumption, both the quality of the service as well as interactions between the client and the provider play an important role in ensuring client satisfaction (Zeithaml, Parasuraman, and Berry, 1985). Thus there exists a problem of information asymmetry where, ex-ante, the seller knows more about the quality of the service than the buyer. The cost of information asymmetry lies not only in the amount by which the purchaser is cheated, but also in the loss incurred from driving legitimate business out of existence (Akerlof, 1970). Two types of problems arise due to information asymmetry between buyers and sellers - adverse selection and moral hazard. Adverse selection occurs when the seller attempts to win a contract by claiming to have skills and expertise which, in reality, he does not have. Moral hazard, in the context of software service providers, is the propensity of vendor to not work sufficiently hard to satisfy the customer. For example, a software vendor may not devote enough resources to the project once the contract is signed.

Information asymmetry and signaling

While experienced buyers may be sufficiently knowledgeable to seek to protect themselves from information asymmetry problems through the use of carefully vetted contracts, the truth is that contracts cannot completely capture all aspects of uncertainty associated with software projects in e-markets because of the complexity of such projects (Koh, Ang, and Straub, 2004). Therefore, buyers of software implementation services in e-markets cannot completely eliminate the information asymmetry problem. In a Nobel-prize winning article, Ackerloff (1970) demonstrated that markets collapse when the sellers offer goods (or services) of differing quality and the buyers do not have any information on the actual quality offered by each seller. Therefore, in order to be successful in the long run, e-markets need to do their part by instituting solutions to the problems of information asymmetry. Signaling is one such commonly used mechanism that enables higher quality sellers to present information differentiating themselves from the lower quality sellers. However, this is effective only if the lower quality sellers incur a substantially higher cost if they misrepresent information pretending to be of higher quality (Spence, 1973).

The service marketing research literature identifies two distinct dimensions of service quality (Gronroos, 1984; Parasuraman et al., 1985). The service provider's *technical competence* is the dimension of quality which can be measured objectively and connotes "what the customer gets" (Gronroos, 1984). In case of a market for professional service, signals on technical competence include educational and professional qualifications, professional certifications, work experience and verifiable licenses. The other dimension of service quality is the provider's *functional competence* which reflects the manner in which the service is delivered or "how the customer gets the service" (Gronroos, 1984). The functional competence dimension is perceived in a more subjective manner (Gronroos, 1984) and e-markets try to capture this through signals such as customer references and feedback ratings from customers.

We conclude from our review of these diverse but related streams of research literatures that to investigate the relation between the different signals on provider characteristics and the likelihood of a vendor's survival, we must examine two types of signals. The first are signals on the vendors' technical ability:

- Education: The human capital literature suggests that the relevant education of a seller engenders greater trust in the quality of the service provided and results in a significant competitive advantage (Becker, 1964).For example, the more intelligent people can signal their intrinsic worth to others through the educational degrees or qualifications that they obtain (Spence, 1973). The social learning theory suggests that education also imparts tacit skills such as leadership and relationship building (Bandura, 1986).
- Experience: Prior research suggests that lack of experience is associated with lower level of managerial competence, and causes new firms to fail (Mayer and Goldstein, 1961).
  Online services marketplaces such as oDesk.com, for instance, furnish portfolio pages for all service providers where they can self-advertise their work experience, qualifications or past accomplishments, in addition to professional certificates and licenses.[7]

The second type of signals are on the vendor's functional competence to understand the customer's business processes and provide an appropriate solution as software implementation often requires customization to match the customer's unique

[7] Since most of the vendors on the e-market are small and services are delivered by the entrepreneurs, we use the human capital variables of the entrepreneurs as a proxy for the technical competence of the vendor.

requirements. In a market with both high quality and low quality sellers, a separating equilibrium occurs where the high quality sellers choose to signal and the low quality do not (Kirmani and Rao, 2000). Accordingly, we consider:

- Feedback Ratings: Customers who have transacted with the vendor in the past may leave a feedback rating for the seller indicating whether they received the product described on the website, whether they received the product on time, how friendly the customer service was and so on. Most e-markets such as eBay, Amazon, and rentacoder.com use the feedback mechanism to signal seller quality to buyers.
- References: This type of signaling is common in services markets such as e-lance where the seller can list testimonials from prior customers on the service quality of the seller. References are different from feedback ratings in that sellers can control who writes a testimonial for them.
- Preferred Provider Status: Some e-markets have instituted certifications such as 'Preferred Provider' for providers who provide exceptional service to clients. Providers can choose to acquire these certifications by paying a periodic fee and agreeing to be audited by the marketplace or third party which issues the certification. Sellers can be removed of their 'Preferred Provider' status if they receive a certain number of violations in a given time period. For example, rentacoder.com allows members to bid on projects as an "Expert" in that domain by paying a non-refundable deposit. If the vendor does not manage to complete the project to the satisfaction of the client, she stands to lose this deposit.

Signaling and firm survival

Prior literature on survival mainly studies survival as a function of firm characteristics such as size, and industry characteristics such as technological conditions (Gort and Klepper, 1982). Very little research exists on how service quality (as conveyed through signaling) impacts firm survival. The ability of a provider to signal its technical and functional competence has positive consequences for the provider (McKnight et al, 2002; Ba and Pavlou 2002). Signaling mechanisms also build trust between the client and the provider and is associated with the following positive outcomes in software projects: working collaboratively with others, adapting to complexity and change, and mitigating perceptions of opportunistic behavior (Lander et al, 2004). Therefore, we hypothesize that signals on technical and functional competence of a vendor are associated with a higher probability of survival.

Hypothesis 1: *The probability of survival of a service provider in an e-market increases with*
(1) Education level of provider
(2) Experience of the provider
(3)Higher feedback ratings
(4) References from customers
(5) 'Preferred Provider' status

DATA

We conduct our study in the context of an online market for accounting software implementation services that is a part of a larger online marketplace for professional services. The U.S. Census Bureau estimates e-commerce in professional and technical services to be $8.2 billion in 2003, up 26% from $6.5 billion in 2002. This sector of economic activity has continued to exhibit rapid growth in recent years, and attracted much attention in management research (e.g., Snir and Hitt, 2003). The Bureau of Labor Statistics estimates that more than 25 million people now work as independent professionals in the U.S., and the number of such freelancers is growing rapidly. Web-based professional service markets that emerged in recent years are excellent sources of data, providing information on various characteristics of projects, bidders, buyers, and the e-market system itself. These web-based marketplaces have been established as the fast growing Internet technology has facilitated e-commerce platforms that enable buyers of services to connect with talented freelancers (Malone and Laubacher, 1998).

Our research site, began operating in the late 1990s, and has now evolved into a leading project-based marketplace on the Internet, helping thousands of businesses each year to connect with high-skilled service providers in a wide variety of categories, including accounting, finance, software development, and business strategy. We collect data on accounting software implementation vendors to study the impact of signaling on the survival of vendors who provide these services. We selected accounting software services because working with a single service type maintains homogeneity in the data and eliminates confounding effects associated with data from different service types. Also, accounting software providers can choose to attain professional certifications such as CPA which enables us to examine the role of technical competence in contrast to functional competence. We obtained data from the research site beginning just prior to its implementation of signaling mechanisms, which enables us to analyze the impact of the introduction of such mechanisms on firm survival.

A total of 364 accounting service providers were registered with the site and we track them for a one year period. The timing of our data collection enables us to witness the shakeout in the marketplace after the implementation of these systems, and analyze their impact on firm survival. At the end of one year, we recorded which of the initial 364 vendors continued to operate in the e-marketplace. We measure survival as a binary variable *SURVIVAL* where *SURVIVAL =1* if the firm is still registered with the marketplace at the end of our data collection period. We also have information on the following signals on provider competence:

Education: An important professional signal of technical competence for accounting services is a license to practice as a certified public accountant (CPA) granted by a State Board of Accountancy. We measure education by a dummy variable *EDUCATION* that has a value of 1 when the provider has obtained the CPA certificate from any state and 0 otherwise.

Experience: The variable *EXPERIENCE* which is the logarithm of the cumulative work experience of the vendor in an accounting related or executive management position.

Reputation: We measure a provider's reputation by the variable *REPUTATION* as calculated by the e-marketplace as the average feedback score of the vendor, weighted by the winning bid prices of the projects whose buyers have rated the vendor.

References: We also capture whether the vendor has attached references from business associates, verified by US Search, attesting to the provider's capability in providing accounting services. The variable *REFERENCE = 1* if the vendor has provided such references and 0 otherwise.

Preferred Provider: The variable *PREFERRED* is 1 if the vendor has received the e-market's preferred provider status.

The descriptive statistics of the data are shown in Table 1.

Variable	**Description**	**Survived Sub-sample**	**Not Survived Sub-sample**
		Mean (std. dev.)	**Mean (std. dev.)**
EDUCATION	1 if the service provider has obtained the CPA certificate from any state and 0 otherwise	27%	11 %
EXPERIENCE	Logarithm of the number of years the service provider has worked in an accounting related job or in an executive management position	1.26 (3.63)	0.09 (1.16)
REPUTATION	Average score, weighted by winning bid prices of the projects	2.53 (2.29)	0.13 (0.79)
REFERENCES	1 if the service provider has attached statements verified by US Search where customers attest to the provider's capability in providing accounting services and 0 otherwise	13%	0.3%
PREFERRED	1 if the service provider has obtained a high quality status by committing to abide by the e-market's professional standards and paying a premium subscription fee and 0 otherwise	60%	4 %

Table 1: Descriptive Statistics

ESTIMATION MODEL AND RESULTS

The dependent variable in our model is *SURVIVAL,* explained by independent variables that represent the signals on service providers' technical ability and functional competence. Mathematically, we can express this model as follows:

$$\log\left(\frac{\Pr(\text{Survival}_j = 1)}{\Pr(\text{Survival}_j = 0)}\right) = \gamma_0 + \gamma_1 \text{EDUCATION}_j + \gamma_2 \text{EXPERIENCE}_j + \gamma_3 \text{REPUTATION}_j + \gamma_4 \text{REFERENCES}_j + \gamma_5 \text{PREFERRED}_j + \varepsilon_j$$

… Equation (1)

where j denotes each service provider. j = 0,1,2, ..., 364.Since our dependent variable is binary, we use a logit model to estimate the parameters. To test our hypothesis, we check whether the coefficients of the logit model are significantly greater than zero. We first present the results of our logit estimation of equation (1) in Table 2. The numbers in bracket represent the p-values and the *** represent the significance based on p-values from a one sided test (*** denotes significance at the 0.01 level, ** at the 0.05 level, and * at the 0.1 level).

Variable	Predicted Sign	Coefficient (p value)
Intercept	+	-5.0498*** (<.0001)
EDUCATION	+	0.9448 (0.1456)
EXPERIENCE	+	0.3374*** (0.0034)
REPUTATION	+	0.8464*** (<.0001)
REFERENCES	+	2.5026** (0.0311)
PREFERRED	+	3.3042*** (<.0001)
-2 log L		60.073
Pseudo R^2		51.96%

Table 2: Results from Logit Model

The *Pseudo* R^2 is calculated as the difference between the log likelihood of a constant only model and the model estimated in equation (1). Mathematically, *Pseudo* $R^2 = \frac{(L_0 - L_M)}{L_0}$ (McFadden, 1974).

DISCUSSION AND CONCLUSIONS

The main contributions of this research are as follows. We build and test an empirical model on how the signals acquired by software service providers in e-markets impact their probability of survival. This is one of the first studies to study the impact of signaling mechanisms on firm survival since prior studies mainly look at positive outcomes such as price premium and sales associated with signaling. Survival of firms in competitive industries has been an important line of inquiry in the

strategy literature because it identifies determinants of long term profitability and success. Since signaling involves significant investments by service providers, studying the determinants of their survival enables us to infer the impact of signaling on long term profitability in an e-market.

We analyzed data from an e-market where buyers post their requirements for software services and providers bid on the same. We used various signals such as reputation, 'preferred provider' status, references, education, and experience of the service providers as independent variables in our study and measured their impact on firm survival which is the dependent variable. We show that these signals are positively associated with a firm's probability of survival in a software services e-market. Surprisingly, the impact of education on firm survival is not significant. This suggests that clients may not give as much importance to the educational qualifications of a software vendor. On the other hand, the length of prior experience of the vendor has a strong positive and significant impact on firm survival. This suggests that clients consider experience of a vendor to be a more reliable signal of technical competence than education. Signals of functional competence such as feedback, reference, and preferred provider status are also significant predictors of firm survival.

Apart from contributing to the academic literature on signaling and survival, our results also have managerial implications for e-markets and the software vendors who participate in e-markets. By documenting that vendors that could signal higher service quality are more likely to survive in an e-marketplace, we showed that signaling has a positive impact on the profitability of a firm. This is especially relevant because online marketplaces fear the loss of high quality sellers when they institute signaling mechanisms. For example, many Power Users who have high reputation scores had recently threatened to quit eBay after it made changes to its feedback policy[8]. Our results show that these fears are unfounded and only sellers who fail to signal high quality quit after the implementation of signaling mechanisms. In product auctions, eBay is the dominant player and has a near monopoly; therefore even though sellers threaten to quit when eBay introduces stricter measures, most eventually do not follow through on the threat. Threat by vendors to quit an e-marketplace is especially interesting to study in services e-market because the market is fragmented among several top players such as guru.com, elance.com, and rentacoder.com, and vendors have other options if they quit a services e-market.

We are extending this paper to measure the relative importance of technical versus functional competence measures. Prior literature on software implementation suggests that many IT projects fail not because of technical capabilities, but because of the inability of the technical people to match the technology with the business process. Therefore, we expect to find that clients attach more importance to signals on service delivery acquired by the vendor at a cost than to the ex-ante signals vested with the vendor. This result would also imply firms should strategically invest in signaling mechanisms.

Although we conduct our study using data from accounting software implementation services, we expect similar results if we replicate this study with other types of software implementation such as ERP because they share many common characteristics. Typical entry and exit models (Dixit, 1989) consider survival as a function of firm profitability. It can be argued that survival is not a good proxy for firm profitability in the case of e-markets because firms can drop out from one marketplace and operate in another or operate offline. However, the fact that a firm exits an e-market signals that the profitability from continued operations in that e-market is less than the opportunity costs of operating elsewhere. Hence, it is very likely that survival in an e-market is closely associated with the long term profitability of the vendor in that e-market, even though it may not be an indicator of overall profitability (profits from operating in all e-markets + profits of operating offline). Another interesting extension for future research would be to compare software versus non-software services on the relative importance of the various signals on the survival of vendors.

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