

Relative Importance of Measures of Past Performance: Empirical Evidence on Quality of E-Service Providers

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Last Revised: April 20, 2005

Preliminary and incomplete draft

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ABSTRACT: We investigate the relative importance of alternative measures of past performance that signal the quality of service providers. Web-based markets for professional services, including accounting services, have been growing rapidly. Motivated by hypotheses derived from an adverse selection model, we evaluate the relative weights on different quality signals in online auction markets for accounting services in the buyer's assessment of service provider quality. We identify various alternative quality signals about accounting service providers who bid on bookkeeping and tax service projects posted at an e-marketplace. We find that signals based on the service providers' past performance have a significant impact on the buyers' award decisions and the service providers' subsequent success in a competitive market place. Our results also indicate differences in the relative importance of different types of signals depending on whether the projects are for tax or bookkeeping services. The results support theoretical predictions that signals pertaining to service providers' technical competence, such as professional certification, are more important for tax services than for bookkeeping services, whereas signals pertaining to service providers' quality in interacting with clients are relatively more important for bookkeeping services than for tax services.

Keywords: Relative weights; compensation; measures of past performance; professional and technical services; accounting service providers; quality signals; online auction market; small businesses

Data Availability: Data were obtained from membership in a web-based market for accounting services and are not disseminated publicly. Membership is generally open at web-based markets and available for a small fee.

1. INTRODUCTION

There has been considerable interest in the management accounting research literature in studying how managerial and worker compensation depends on measures of their performance. Stemming from the theoretical analysis of Holmstrom (1982), Banker and Datar (1989) and others, several empirical studies have sought to examine the implicit role and impact of different performance measures (e.g., Antle and Smith, 1986; Lambert and Larcker, 1987; Bushman, Indjejikian and Smith 1996; Ittner, Larcker and Rajan, 1997; Banker, Potter and Srinivasan, 2000). Since the economic theory motivating this research stems from a model of moral hazard with unobservable effort from the agent, the only performance measures that appear relevant are those whose distributions are shifted by the agent's choice of effort level. As a result, the focus of the past research has been on measures of *future* performance that are contingent on agent's effort.

In this paper, we focus on the role of measures of *past* performance and accomplishments in determining compensation for services provided. Past performance provides a signal on the intrinsic ability or quality of a service provider. In an adverse selection setting where the service provider's intrinsic ability is not observed directly by the purchaser of the service, measures of past performance and accomplishments are likely to be informative. The compensation paid for the service, therefore, is likely to depend on the past performance. To the extent multiple measures of past performance are available, the relative importance of those measures is likely to increase with their informativeness (Banker and Datar, 1989).

We evaluate these hypotheses about the role of past measures of performance and accomplishments empirically in the context of an e-market for professional and technical services. The U.S. Census Bureau estimates e-commerce in professional and technical services to be \$6.5 billion in 2002, up 25% from \$5.2 billion in 2001. This sector of economic activity has continued

to exhibit rapid growth in recent years (Pittsburgh Business Journal, 2003), 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.¹

Specifically, we obtained a sample of data on service provider quality signals, projects they bid on and bid prices by subscribing as a provider of accounting and bookkeeping services with a large e-marketplace for professional and technical services. Internet-based markets for accounting and bookkeeping services include preparation of financial statements and tax returns and operation of accounting software. Unlike auditing services examined in the prior accounting research literature, data on contracts for these accounting services have not been readily available in the public domain. Recently, however, many web-based accounting service 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 in accounting as well as other professional services such as legal, engineering, and web design services (Snir and Hitt, 2003). In contrast to the auditing service business of public accounting firms that is anchored by substantial audit fees paid by large public corporations, the emergence of web-based accounting service

¹ Freelancers are consultants and other knowledge workers and independent professionals in technology, creative design, management consulting and other field of expertise. There are many web-based platforms, such as Opus360 (www.freeagent.com), Emoonlighter (www.guru.com) and Elance (www.elance.com) are marketplaces where transactions are conducted as 'reverse auction'. A client in need of tax compliance, for instance, posts her request as a project in an online marketplace and solicits competitive bids to service providers – accounting professionals enrolled at the online market. The posting explains the detailed services she desires. Registered service providers around the world search the online market for the posted projects that match their areas of expertise, and submit bids on selected projects. The buyer then awards the project to one among the service providers who have bid on her project. After a winning bid is accepted, the buyer and the selected service provider schedule deadlines, exchange files, and deliver the final service. Once a project is complete, the service provider invoices the buyer through the market system and the buyer sends payment to the service provider. Both the buyer and the service provider then enter feedback ratings, shown on their respective profile pages.

markets has been supported by many small businesses now finding accounting professionals on the Internet when they need accounting services.

While each service transaction is small in amount, the small business sector and consequently their demand for accounting services have been growing rapidly in the aggregate (US Census Bureau, 2002). The Internet channel for acquiring accounting services is particularly suitable for small businesses. Most small businesses do not have in-house accounting software expertise and the Internet enables them to connect with accounting professionals. Most accounting services required by small firms are for preparing financial statements, reporting for tax compliance, and implementing accounting systems such as bookkeeping, billing, and payroll processing. Because these services can be provided online by transmitting electronic files, physical distance between them and the accounting professionals is not important and hence there is a larger pool of service providers available in online markets. With greater supply of accounting professionals, small businesses have a relatively greater bargaining power on the Internet. Also, they may pay less for acquiring services relying on the reverse auction bidding mechanisms of the e-market places.

A significant caveat in online outsourcing is the potential variability in the capability of service providers, some of whom could be less skilled or even dishonest. Buyers in online marketplaces such as eBay and Amazon rely on the sellers' reputation for their purchasing decision to assess the unobservable quality of the sellers. Several theoretical studies analyzing economic models of imperfect signals on sellers' unobservable quality suggest a positive relationship between price and seller reputation (Allen, 1984; Shapiro, 1983; Klein and Leffler, 1981), and empirical studies have documented the impact of reputation on sellers' bidding (Resnick and Zeckhauser, 2001; Melnik and Alm, 2002; Houser and Wooders, 2005) and buyers'

willingness to pay (McDonald and Slawson, 2002; Melnik and Alm, 2003).² How multiple measures of past performance and accomplishments that signal providers' quality can be aggregated, however, is a question that has remained unaddressed.

Because the intangible nature of services emphasizes the importance of the service delivery process involving the customer, multiple dimensions of sellers' quality are important. The marketing research literature identifies at least two distinct dimensions of service quality (Gronroos, 1984; Parasuraman et al., 1985; Brady and Cronin, 2001; Escalas and Luce, 2004). From an outcome perspective, the provider's *technical competence*, as evidenced for instance by educational and professional qualifications and certification, increases the likelihood of a high quality service outcome. Since the customer is an integral part of the service production process, the provider's *functional ability* in interacting and communicating with the customer and in understanding and being responsive to customer needs is also likely to enhance the overall service experience. This makes an e-market service provider's quality more difficult to determine and, hence, information on their past performance and accomplishments and the aggregation of those quality signals are important to infer the provider's quality. Most e-marketplaces have developed quality disclosure and monitoring systems to filter out low-quality professionals. These include market-specific qualification-check systems, service providers' self-advertisement (including disclosures of their education, experience, and certification), and summary reports on feedback on past engagements at the marketplace.

Signals on technical competence include education, professional certification and verifiable licenses. Signals on functional ability include work experience and business references

² Previous research on the role of information in auction markets has focused on the quality of sellers of goods rather than that of service providers (e.g., 500 Mhz processor (Resnick and Zeckhauser, 2001), U.S. \$5 coin (Melnik and Alm, 2002), and Pentium III (Houser and Wooders, 2005)).

and e-market generated signals such as feedback ratings and accumulated earnings. Tax services require considerable professional expertise and knowledge of complex tax rules and regulations to perform the service satisfactorily. For bookkeeping and accounting software services, on the other hand, buyers' satisfaction depends much more on close interaction and communication between buyers and service providers to ascertain business requirements than on technical knowledge. Signals on functional ability based on service providers' work experience and transaction history in the online auction markets, indicating credibility and reliability, therefore, are likely to be more important predictors of providers' bookkeeping service performance. The question we address in this paper is the relative importance of those quality signals in affecting the likelihood of a bidder winning a contract and the likelihood of a service provider surviving in the e-marketplace. Our results indicate that functional ability signals play a significant role in the buyers' award decisions for all projects, whereas CPA and other accounting certificates play a relatively more important role for tax compliance projects than for bookkeeping projects.

The remainder of this paper is organized as follows. In Section 2, we discuss features of web-based outsourcing markets that impact the relative weights on accounting service providers' quality signals. In Section 3, we describe data sources, variable measurement, and empirical models to test our hypotheses. We present the empirical results in Section 4, and conclude in Section 5 with a discussion of opportunities for future research.

2. THEORY and HYPOTHESES

The agency theoretic literature in accounting research has focused mainly on models of moral hazard to address the important question of relative weights placed on different performance measures in a compensation contract (an exception is Darrough and Melumad, 1995). Banker and

Datar (1989), for instance, show that the relative weight on each signal in the optimal performance evaluation measure for incentive purposes is directly proportional to its informational intensity (sensitivity times precision). Kim and Suh (1991) show that the value of an information signal is also based on the informational intensity of the signal. With the emphasis on providing incentives in a moral hazard setting, these models find only future performance to be relevant, past performance or accomplishments have little direct role in determining compensation.

A number of empirical studies have supported the theory. Lambert and Larcker (1987) and Sloan (1993) provide limited evidence that the weights placed on different performance signals, such as stock returns and accounting returns, are proportional to the sensitivity and precision of the signals. Janakiraman et al. (1992) investigate relative performance evaluation using a related model, and Lambert and Larcker (1995) explore bonus contracts for hospital administrators. Natarajan (1996) derives measures of the stewardship value of earnings and components of earnings from their joint distribution, while Bushman et al. (1996) and Ittner et al. (1997) find positive relation between the noise in accounting measures and the relative importance of market and individual performance measures in bonus contract.

While these studies examine the relation between incentive compensation and performance metrics specified in the contract (Healy, 1985), the moral hazard models do not motivate an empirical relationship between the compensation level and the agent's past performance and accomplishments. In models of adverse selection where the principal cannot directly observe the agent's ability, measures of the agent's past performance are informative signals on his ability and hence are related to the expected value of the outcome of the service provided by the agent to the principal. In a labor market setting, the market-clearing wages for the agents will therefore be increasing in measures of the agent's past performance that signal his ability or quality. If there

are multiple dimensions of agent's ability that impact the value created by the service provided by the agent, then the relative weights placed on different signals reflect the relative importance of the underlying quality dimensions in creating value. Similar results obtain in an auction market setting as well, and the likelihood of a bidder being awarded a service assignment is increasing in measures of his past performance that signal his ability and quality.

Many online auction houses have created seller rating systems that record providers' past performance and accomplishments, and help buyers choose service providers. These systems are believed to have resulted in higher quality service providers, offered greater protection to buyers, and improved dispute resolution. For instance, Elance.com and Guru.com have furnished service providers with space for self-advertisement and created third-party verification processes to prescreen service providers.³ These mechanisms are believed to separate high quality professionals committed to customer satisfaction from low quality and less capable providers (Rosenman and Wilson, 1991; Spence, 1973).

The marketing research literature recognizes that service quality is multidimensional (Czepiel et al., 1985; Carman, 1990; Dabholkar et al., 1996). Service is basically intangible, and comprises of nearly simultaneous production and consumption processes involving the provider and the customer. Consequently, there are at least two dimensions that are important in characterizing service quality. *Technical competence* of the provider is essential to ensure that the outcome of the service process is satisfactory to the customer. In addition, the customer's perceptions about the service depend on his experience with the interactions with the provider

³ The principal revenue source for e-marketplaces is transaction fees and membership subscription fees charged to service providers. The challenge for online markets is to establish themselves as self-sustaining marketplaces by attracting more buyers to post projects and more high quality freelancers to bid for those posted projects (Akerlof, 1970). Therefore, there exists a significant demand for quality monitoring systems to mitigate the information asymmetry and benefit the e-marketplace and its participants.

during the service process. The provider's *functional ability* in communicating and coordinating with the customers, understanding their needs and requirements, and providing customers a pleasant experience, is critical in determining the perceived value of the service. The provider's ability in handling interpersonal interactions is identified as the key element in a service setting, and as having the greatest impact on service quality perceptions (Bitner, Booms and Mohr, 1994; Hartline and Ferrell, 1996; Czepiel, 1990; Surprenant and Solomon, 1987). Effective customer relationship in providing services is most critical when (i) the service is complex, customized, and delivered over a continuous stream of transactions (Berry, 1983; Levitt, 1983; Lovelock, 1983) and (ii) the environment is dynamic and uncertain in ways that affect future needs and offerings (Zeithaml, 1981). This applies to professional services such as accounting, financial, and business services (Crosby et al., 1990). This motivates our first hypothesis:

H1: Signals on service providers' functional ability are positively associated with the likelihood of a service provider's selection by a buyer in the online outsourcing market for all types of accounting services

The two major sub-categories of accounting services contracted in the online market we study are bookkeeping services and tax compliance services as described in Table 1.⁴ Each has its

⁴ Accountants perform two fundamental tasks: the preparation of financial and tax reports and the attestation of those reports. While only certified public accountants (CPAs) can provide audit services to attest financial statements of public companies listed on a stock exchange, non-CPA providers can provide businesses with accounting services related to maintenance of financial records and preparation of financial statements. Prior research in accounting has focused almost exclusively on large public accounting firms and their audit services to attest the financial statements of listed companies where competition exists between only CPA firms. Studies have documented that audit fee premiums of the CPA firms are associated with quality signals such as brand name (e.g., Big 4) (Craswell et al., 1995; Francis and Wilson, 1988; Francis and Stokes 1986; Francis 1984; Simunic 1980), service differentiation (Davis et al. 1993; Simunic and Stein 1987) or industry specialization of the CPA firms (Ferguson et al., 2003; Craswell et al., 1995). However, the question of what signals are associated with perceptions of premium quality in providing other accounting services such as preparation of financial and tax reports has remained largely unaddressed until now due to difficulty in obtaining data at the level of non-auditing services.

own unique features with different implications for the role of quality signals. Consider the following excerpts from customer's specifications for their bookkeeping projects:

We are looking for someone with insight and vision to do what is best for the Company. Initially it will be setting up systems, basic bookkeeping but as we start to get busy there will be a lot to do. This is a unique and exciting venture for the right person and for the rest of our ever-expanding team. Experience in the international accounting systems/customs/taxes will be essential.

I need someone who can help me transfer my technical abilities into a successful business. I need some help to get my accounting aspects in line and someone who can answer questions and help manage the inflow of information.

Review existing chart of accounts and suggest changes based on company background and relevant information. I am looking for someone with experience in working with small, technology professional services firms.

Many of the bookkeeping service projects are ongoing relationships, often on a monthly basis, and the accountant's functional ability, especially responsiveness, accessibility and timeliness, is very important in satisfying the customer. Many of the bookkeeping projects involve the deployment of bookkeeping and related software packages. This requires the provider to acquire specific knowledge of the customer's business and implement the software in order to support the business processes. Therefore, the ability of the service provider to interact closely with the buyer and be responsive to business requirements is more important than the provider's technical competence signalled by educational qualification and certification.

We expect provider's functional ability to be important for buyers' decisions for tax service projects as well. Such projects, however, require considerable technical knowledge of

complex statutory tax rules and regulations, and how they may relate to the client's tax situation.

Consider the following excerpts from customers' specifications for their tax projects:

We are a small web programming and hosting company that needs to bring its tax filings up-to-date. We need to file Federal 1120 C-Corp and State (CBT-100 NJ) Tax returns for the years 1999, 2000 and 2001. All the detailed reconciled bank transaction information is available in Quick Books Pro 2000 format and can be used directly in the tax returns with little or no adjustments needed.

What we need now is to file the appropriate tax forms for the years 2000 and 2001 to the IRS. The forms must be completed in a way that will allow us to realize the maximum tax advantages from our development losses against any future earnings we may have. If you are a qualified tax accountant who can prepare these late IRS filings for us, please bid on this project.

We are looking for subcontractors who are knowledgeable in the area of incorporations, 501(c)(3) matters, other federal tax issues, litigators and web site design.

Therefore, buyers of tax services are likely to find signals on service providers' knowledge more important for the successful execution of their projects, and prefer providers who have CPA and tax-related certifications that signal comprehensive command of taxation rules (Kirmani and Rao, 2000; Spence, 1973). Economic theory thus suggests the next hypothesis:

H2: Signals on service providers' technical competence are positively associated with buyers' decisions to select a provider for tax service projects but such association is not as strong for bookkeeping service projects.

Next we turn to the service providers' success competing at the e-marketplace. Service providers in online outsourcing markets compete to win awards of projects from buyers. Providers can signal a higher quality by incurring the cost of acquiring qualifications such as CPA or the additional costs of building a favorable reputation within the e-market. With costly signals

that are associated with attributes that buyers prefer, we expect a separating equilibrium in this signaling game (Spence, 1973). More talented service providers will acquire signals of technical competence and functional ability to emphasize their high quality, enhance their appeal to the buyers and increase their chance of winning projects they bid on. In a competitive online auction marketplace, we expect that providers with higher quality signals are likely to have a higher probability of survival in that marketplace. Therefore, we hypothesize:

H3: High quality service providers are more likely to survive in the competitive e-marketplace.

3. DATA and ESTIMATION MODELS

In this section, we describe our research site, sample selection, data description, and estimation models.

3.1. Research Site and Sample Selection

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. We collected transactions data over a 21-month period from one of the e-marketplaces for accounting services. Our research site, Elance, began operating in 1999, 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. There has been considerable demand for accounting services at the Elance marketplace since the inception of its auction platform. In 2003, more than two hundred accounting service providers were using the marketplace with over ten new projects posted each week.

Until the second half of 2001, the quality monitoring system was not fully developed at Elance. For instance, provider verification features, such as the SquareTrade Seal program and certification credentials, were implemented in the third quarter of 2001. Therefore, we begin our sample data collection period on September 1, 2001, and track a total of 278 projects and 1,666 bidders for those projects until June 30, 2003. We exclude 45 of these projects that have only a single bidder because there was no competition in those instances, 6 projects that have more than 20 bidders because the relation between winning decision and bidders' characteristics is likely to be different when there are many bidders on a project.⁵ There were 6 unusual projects where the buyers awarded more than two bidders who offered different bids. We discard these because the data do not reveal how the project was split between the winning bidders. As a result, the final sample consists of 221 projects with 1,444 bidders. The selection procedure leading to our sample projects is summarized in Table 2. On average, there were between 6 and 7 bidders on the projects.

3.2. Data Description

Many different signals on service providers' quality are available to buyers at the e-marketplace. For each project, we collect data on characteristics of service providers. The averages for the fifteen variables pertaining to either technical competence or functional ability are presented in Table 3. We first measure six quality signals on technical competence: education in accounting or business, CPA license, other accounting-related certificates, and each of three

⁵ The results reported here are robust to the inclusion of these 51 observations.

measures with “credentials” mark.⁶ Then, we measure nine quality signals on functional ability: work experience, references, and each of two measures with the credentials mark, Select seal, SquareTrade seal, standardization, feedback rating and cumulative earnings.

Signals on Technical Competence: A primary concern of buyers in an e-market setting is the reliability of service providers they have never met. 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). To filter out low quality professionals, many online outsourcing platforms have created quality monitoring mechanisms that signal service providers’ technical competence. Elance.com, for instance, furnishes portfolio pages for all service providers where they can self-advertise their qualifications or past accomplishments, such as education, certificates and licenses.⁷

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. The vast majority of States require CPA candidates to be college graduates. Preparation for the CPA examination and formal college education in accounting or related business degree programs are likely to enable a service provider to perform accounting service tasks in a competent and professional manner. *Ceteris paribus*, we expect CPAs and accounting graduates to be perceived as better qualified than those providing accounting services without such education. We measure ‘CPA’ as a dummy variable that has a value of 1 when the provider has

⁶ Signals with credentials are verified by US Search, one of Elance’s partners to enhance trust in its marketplace. While signals with the credentials are more reliable than self-reported signals, only 41.3% of the service providers have one or more of their signals verified by US Search.

⁷ While service providers are able to verify their offline qualifications using US Search verification system, it is possible that they self-advertise bogus qualification as well. These signals, therefore, may be noisy unless verified independently.

obtained that certificate from any state and 0 otherwise. About 30% of the service providers report they are CPAs, but only 9% have it verified.

Service providers enrolled in an e-marketplace can present other qualifications on their profile spaces. Commonly found in e-marketplaces for accounting services are degree of higher education or accounting-related certificates obtained from public institutions such as the National Association of Tax Professionals and the American Institute of Professional Bookkeepers. 'Education' is coded as 1 if the enrolled service provider has degrees in accounting or business administration from a college- or higher-level institution. While 54% of the providers assert that they have this qualification, only 22% have it verified. 'Certification' is scored 1 if the service provider has accounting-related certificates from the National Association of Tax Professionals or the American Institute of Professional Bookkeepers.

Signals on Functional Ability: As discussed earlier, the provider's functional ability in interacting and communicating with the customer and in understanding and being responsive to customer needs is critical in determining the perceived value of the service. Some online professional service markets, therefore, have launched several quality signal generating systems. First of all, they have their own standard criteria for quality and offer a special subscription to the service providers if they agree to abide by the e-market's professional standards.⁸ If a service provider commits to upholding those high professional standards, maintaining exceptional customer satisfaction, and adhering to fair business practices, then a special mark is given to the service provider as an acknowledgement of a high quality status. For instance, Elance offers the symbol 'Select', and Emoonlighter the symbol 'Choice', to help competent professionals differentiate themselves and secure more projects. These premium providers pay a periodic

⁸ The quality standards include, for example, providing detailed and customized proposals that are relevant to the project and working with buyer before project begins to outline requirements, milestones and payment terms.

subscription fee. The providers who do not qualify for this status have various restrictions in the bidding process, such as a narrower range of projects to bid on, limited bidding time, and limited access to information on buyers. However, if premium providers repeatedly dissatisfy clients as evidenced by poor feedback or buyer complaints, cancel accepted projects, or fail to complete projects, they will be reviewed by the Select program and can be suspended from Select. Thus, only the high quality service providers who are confident of obtaining more contracts from the less restricted access in the bidding process will choose to incur the cost of commitment to high quality service and pay a higher subscription fee to get the premium status (Spence, 1973).

Some e-marketplaces including Elance.com have also established a partnership with an online dispute resolution program, such as SquareTrade. SquareTrade is a leading developer of online trust services and provides online dispute resolution services in order to promote reliable and safe e-commerce. One of the important facets of service quality is service recovery which refers to the actions an organization takes in response to a service failure (Gronross, 1988; Chernev, 2004). When the appointed service provider fails to complete the project or the outcome is not what is expected by the buyer, well-executed service recoveries are important for mitigating customer dissatisfaction, maintaining customer relationships, and preventing impairment in reputation (Fornell and Wernerfelt, 1987). With substantial failure risks in the e-marketplaces for professional and technical services, buyers are likely to prefer service providers with strong commitment to service recovery. By obtaining SquareTrade, a digitally watermarked seal, a service provider pledges to resolve any issues that might arise over the online transactions and, as insurance, assures buyers of their recovery quality.⁹ SquareTrade works with a number of leading businesses by providing the SquareTrade Seal and online dispute resolution services.

⁹ Recent studies on e-commerce show that web assurance seals, such as TRUSTe, BBB Online, Verisign[®] and CPA WebTrust, influence consumer's online purchasing behavior (Jamal et al, 2003; Odom et al, 2002; Kovar et al, 2000).

SquareTrade's clients include Elance, Ebay, Yahoo, VeriSign, PayPal, NCPA (The National Community Pharmacists Association), Overture Service Inc., California Association of Realtors, and Econsumer.gov. Its experience in resolving disputes has made the SquareTrade Seal an instantly recognized mark of an online seller's trust and reliability and membership in it represents the service provider's commitment to satisfying customers, maintaining professional standards, and using a mediator to resolve any disputes. We measure each of 'Select' and 'SquareTrade' as a dummy variable that has a value of 1 when the provider has obtained that seal mark through the e-marketplace and 0 otherwise. During the sample period, 70% of bidders were Select providers, 32% were SquareTrade members, and 28% were neither.

Our research site, Elance, is equipped with a feedback rating system that reports the history of how a service provider has been evaluated by the buyers and his/her earnings since enrollment. The Elance website reports a feedback rating score on a scale from zero to five. The 'Feedback Rating' variable is measured as an average score weighted by contract price of awarded projects. The providers' cumulative earnings are also usually public information along with their feedback rating in many online auction markets, as is the case at Elance. This provides an alternative measure for reputation. An established provider that reports large cumulative earnings is likely to be deemed to be a good quality service provider by some buyers. The 'Cumulative Earnings' variable for our study is measured as total revenues earned from accounting services. Direct signals on the providers' past performance at the marketplace (reputation) as well as 'Select' and 'SquareTrade' seals that guarantee honest trade practices are likely to be reassuring for the buyers in the e-market and influence their decisions to award the contract (Spence, 1973).

In addition to those three market-generated quality signals, Elance provides a few more past performance measures pertaining to functional ability. The e-marketplace allows service

providers to offer standardized services in its content, price per hour, and delivery time at his/her personal web-page furnished by the e-market. The standardization is likely to be adopted by veterans rather than newcomers because it is vital that the service providers have obtained good senses of how to provide customer satisfaction. Thus, the service providers may appeal to buyers as self-selected high-quality providers by offering standardized services. We measure 'Standardization' as a dummy variable that takes the value 1 if the service provider offers the standardized services and 0 otherwise.

Service providers in the e-marketplace can also advertise their qualifications pertaining to their functional ability. Research in labor economics documents characteristics of labor suppliers that are related to their market value. Altug and Miller (1998), Hellerstein et al. (1999), and Light (2001) show that productivity improves with experience. Holzer and Neumark (1999) find that job qualifications such as previous experience, vocational training, and references are correlated with performance. Work experience and business associates' references are likely to be related to service providers' interpersonal skills in delivering professional and technical services as customer-involving process, and therefore, those signals are likely to represent the functional ability. We measure 'Work Experience' with or without credentials by the number of years the service provider has worked in an accounting related job or in an executive management position. While 1,444 accounting service providers registered with Elance report, on average, over three years of work experience, the average for the verified experience level is one year. Some providers report more than twenty years of work experience, but buyers are not likely to give proportionately additional credit for extremely high levels of experience. Hence, we logarithmically transform work experience years to reflect the diminishing marginal benefit of

increased experience.¹⁰ The remaining variable, ‘Reference,’ is a 0-1 dummy variable that is set equal to 1 if the provider has attached statements from his/her business associates attesting to the provider’s capability in providing accounting services.

Control variables: We include the logarithm of bid price and number of days to delivery (Agility) to control for other factors that may affect the buyers’ choice.¹¹ Agility is measured as the time lapse between the last date of the project posting and the service completion date proposed by a bidder.¹² In addition, we control for the buyer’s favorable opinion about particular service providers. The e-marketplace we examine has developed provider invitation system where buyers can invite specific service providers to their project. If a buyer is aware of certain service providers whose work she is familiar with or whose profile she likes, the buyer may invite them while streamlining bidding to reduce efforts of comparing many unknown bidders’ proposals. Since the buyer has a favorable opinion of the invited bidders and is more likely to award the project to them than uninvited providers, we include a dummy variable ‘Invitation’ that takes the value 1 if a bidder is invited and the value 0 otherwise.

Estimation models: Our first model relates buyers’ choice of provider to observed quality signals and control variables to evaluate which signals play a more important role in the buyers’ decision. We employ the conditional logit model (Wooldridge, 2001; Greene, 2002) commonly employed in consumer choice research. Suppose for a buyer i who posts a project on the online auction market for accounting services, the utility from choosing a bidder j is

¹⁰ Winsorizing at the 90th percentile leaves the results unchanged.

¹¹ We follow the common practice of logarithmically transforming the size variable. We use $\ln(\text{Bid})$ also because it allows us to interpret the coefficient as the impact of a percentage change in bid price (i.e., $\beta_x = \frac{\partial Y}{\partial \ln X} = \frac{\partial Y}{\partial X} X$).

¹² Sometimes bidders express their willingness to provide the required services immediately, even before the auction closing date. In this case, Agility is set equal to the minimum value of one.

$$U_{ij}^* = X_j \beta + a_{ij}, \quad j = 1, 2, \dots, N_i \quad \text{Equation (1)}$$

where $a_{ij}, j = 1, 2, \dots, N_i$, are unobservable attributes affecting tastes.¹³ In other words, buyers' utility is a linear function in choice attributes (bidders' characteristics), X_j , with a common parameter vector β , where X_j is a $1 \times K$ vector. However, the buyer's utility function, $U_{ij}(X_j)$, is not observed by the researchers. The only observable information regarding the buyer's utility is her winner selection decision. If buyer i awards bidder w_i in particular, then we assume that U_{iw_i} is the maximum among the N_i utilities. Hence, the statistical model is driven by the probability that choice w_i is made, which is:

$$p_i(W_i = w_i) = \text{Prob}(U_{iw_i} > U_{ij}) \quad \text{for all other } j \neq w_i.$$

McFadden (1973) shows that if the N_i disturbances, a_{ij} , are independently distributed with the type I extreme value distribution, then the winning probabilities of bidder w_i for buyer i 's project is as follows:

$$p_i(W_i = w_i) = \exp(X_{w_i} \beta) / \sum_{j=1}^{n_i} \exp(X_j \beta), \quad w_i = 1, 2, \dots, N_i \quad \text{Equation (2)}$$

We estimate the coefficient vector β using the maximum likelihood criterion. For this purpose, we derive the log-likelihood function by first defining, for each project i , $\delta_{ij} = 1$ if alternative bidder j is chosen by the buyer, and 0 otherwise for the $N_i - 1$ losing bidders. Thus, for each i , one and only one of the δ_{ij} 's is 1. Next, we estimate β by maximizing the log-likelihood

function $\ln L = \ln \prod_{i=1}^{221} p_i(W_i = w_i) = \sum_{i=1}^{221} \sum_{j=1}^{N_i} \delta_{ij} \ln \text{Prob}(W_i = j)$ where w_i indicates the winner of

¹³ The number of bidders N_i may vary across different projects, while its maximum value is the total number of enrolled service providers.

each project i , $i = 1, 2, \dots, 221$, and $\text{Prob}(W_i = j)$ is given by the expression in Equation (2) for each bidder $j = 1, 2, \dots, N_i$.

Since our fifteen quality signals are highly correlated, we first run an exploratory factor analysis. Analysis of the scree plot and the Akaike Information Criterion indicate five underlying factors. Table 4 reports the rotated factor pattern. In the previous sub-section, we described nine signals on functional ability and six signals on technical competence. The first three factors consist of signals on functional ability whereas the other two are comprised exclusively of signals on technical competence.

The two components of the first factor are service providers' feedback rating from the e-market's seller rating system and their cumulative earnings. Both these variables are proxies for the providers' 'Reputation.' There is a high correlation (0.6719 Pearson, 0.6627 Spearman) between the two variables because large number of transactions in the marketplace facilitate stronger reputation formation. 'Self Selection' is the second factor comprising three signals on functional ability: Standardization, Select mark and SquareTrade seal. All three variables are associated with service providers that have revealed choices that are more likely to be made by high quality providers. Service providers with superior capability based on their cumulative work experience in the e-marketplace are more likely to offer standardization services. The premium (Select) providers pay an extra periodic subscription fee. Only the high quality service providers who are confident of obtaining more contracts from less restricted access in the bidding process are likely to bear this additional cost for the Select mark. To earn the SquareTrade Seal, service providers need to commit to a dispute-resolution mechanism. The third factor 'Experience' is formed by four variables, work experience and business references with or without credentials. Work experience is likely to be critical for buyers to infer service providers' functional ability.

References from business associates may reinforce that quality dimension. The fourth factor ‘CPA’ measures the acquisition of essential accounting and business knowledge as indicated by educational or professional qualifications. This factor comprises of a CPA license and a bachelor’s or higher degree in accounting or a related field. In contrast, the fifth factor ‘Certification’ comprises of narrowly specified and more technical certificates that do not require as much conceptual knowledge as a CPA must have.¹⁴

Based on the factor analysis results, we include, as explanatory variables, 5 factors representing different quality signals and 3 control variables:

$$U_{ij}^* = \beta_1 * \text{Reputation}_j + \beta_2 * \text{Self Selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invitation}_j + \beta_8 * \ln(\text{Agility}_j) + \epsilon_{ij}$$

... Equation (3)

Self Selection, Reputation and Experience are comprised of signals on providers’ functional ability, whereas CPA and Certification consist of signals on providers’ technical competence. We anticipate that the three functional ability factors have significantly positive impact on the buyer’s choice of provider for all accounting services, but the two technical competence factors have a significantly positive impact only for the tax service projects.

A meaningful comparison between bidders’ quality signals is achievable only after we control for their bid prices, and we include it as a control variable.¹⁵ The bid price variable is measured by taking the logarithm of the raw value. We also include two other control variables.

¹⁴ The ‘Self Select’ and ‘Certification’ factors have lower Cronbach alpha than the other three factors. Results of hypothesis tests reported in the paper are robust to including each variable in these two factors separately, instead of as a component of a factor, in the estimation of the logit models.

¹⁵ One caveat with respect to the bid variable is that it could be determined endogenously based on a provider’s knowledge of his/her own characteristics. However, without detailed information on the project content, we cannot develop a model of the bid price choice using information beyond that already included in the provider characteristics variables. Therefore, due to these data limitations, we treat bid price as an exogenously determined variable.

Invitation is a unique practice of our e-marketplace. If a buyer is familiar with some service providers and wants to limit her project's bids to those providers, then she can invite those providers to bid on her project. Although uninvited providers can still bid on that project, it is likely that the invited providers have a better chance of being selected by the buyer. Therefore, we include Invite, a dummy variable with the value 1 if a bidder is invited and the value 0 otherwise. The third variable we control for is bidders' pledge of a delivery date as a part of their bids. Buyers are likely to favorably review the bidders who are able to deliver the services more quickly than other bidders (Taylor, 1994). Logarithmic transformation of the Agility variable mitigates the effect of the right-skewed distribution of the raw variable.

4. RESULTS

In this section, we present the results of empirical evaluation of our three hypotheses regarding the relative importance of multiple signals on providers' past performance and accomplishments for our sample drawn from an online accounting service market. Section 4.1 addresses the first two hypotheses on whether signals on the service providers' functional ability and technical competence impact the buyers' choice of the winning bidder to whom the project is awarded. Section 4.2 is devoted to Hypothesis 3 regarding the impact of the providers' quality signals on their survival in the marketplace.

4.1. Implication of Providers' Past Performance on Buyers' Choice of Winning Bidder

We estimate the effects of quality signals on buyers' award decision in Equation (3) for our full sample. As we have proposed in Hypothesis 1, the results in Table 5 reveal that the signals on

service providers' functional ability, Reputation, Self Selection and Experience, have a significant impact on the buyer's winning bid choice decision. The last column reporting marginal effects indicates that one unit increase in the Reputation, Self Selection and Experience factor scores increase the probability of a bidder's winning the project, on average, by 4.47%, 3.36% and 0.66%, respectively.¹⁶ Among the signals on providers' technical competence, however, none of the factors is significant. The three control variables have the expected signs and two of them are significant.

It may appear surprising at first glance that professional qualifications for accounting services, especially CPA and other accounting-related certificates and licenses, have little impact on the buyer's evaluation of service providers. We have hypothesized that buyers are likely to be more attentive to whether the bidders have CPA or other accounting-related certificates only when they need services such as reporting for tax compliance and filing tax returns. We consider the two sub-categories of tax and bookkeeping projects, and in Table 6 we present the separate results of the impact of quality signals on buyer's award decision for these two types of projects. For the 72 tax projects (see Panel A), CPA and Certification factors have a significant impact on the buyers' decision. Also, based on the estimated marginal effects of CPA and $\ln(\text{Bid})$ variables, we infer that CPAs can bid on average 19.7% higher than non-CPA accounting service providers and maintain the same probability of winning as non-CPAs. On the other hand, Panel B shows that all three factors that signal providers' functional ability are significant in explaining buyers' choice of bookkeeping service providers. For bookkeeping projects, buyers seem to consider CPA and

¹⁶ The parameter estimates of the logit model are not necessarily marginal effects. The marginal effect in the conditional logit model is $\frac{\partial E[w|x]}{\partial x} = p(x'\beta)[1-p(x'\beta)]\beta$ and will vary with the values of x . For computing marginal effects presented in the last column, we first evaluate the marginal effects at every observation points and then average them.

Certification as less important information, and instead choose to depend more on signals that assure the service provider's interpersonal ability and excellence in service delivery. These results confirm the theoretical prediction that education signals on service providers' technical competence is relevant in case of tax services, whereas other signals based on transaction history and commitment of service providers in e-market places are relatively more important for bookkeeping projects. Thus, while all signals may indicate service providers' better quality in performing accounting services, it is the superior signals depending on the nature of the service that yield providers premiums in bidding for customer jobs in an e-market setting.¹⁷ Further, since e-marketplaces are motivated to screen out low quality service providers (Akerlof, 1970), the significant coefficients on both Reputation and Self Selection factors in the results reported in both Tables 5 and 6 provide an explanation for why most e-marketplaces now provide quality verification systems.

We compare the five factors that signal functional ability and technical competence in terms of their impact on the buyer's award decision using Vuong's (1989) test for competing nonnested models. The results of the Vuong Test reported in Table 7 indicate that the three factors that signal functional ability have a more significant impact on the probability of being accepted by the buyer than two factors that signal technical competence. In the analysis of the sub-samples, the functional ability signals over technical competence signals holds for bookkeeping projects but disappears for tax projects, as expected from hypotheses 1 and 2. Pairwise comparisons of individual factors provide very similar insights (not reported here).

¹⁷ The ratio of mean bid for CPAs to mean bid for non-CPAs is significantly different from 1 at 5% level ($t=2.33$). Significantly higher bids are also found for better quality providers indicated by three factors that signal functional ability, Reputation, Self Selection and Experience.

Table 8 displays the impact of quality signals on service providers' bid pricing decision. One unit increase in each of Reputation, Self Selection and Experience factor scores allows a bidder for bookkeeping services to increase bid price 239%, 176% and 69%, respectively, holding the same probability of winning. For a service provider bidding on tax service projects, on the other hand, the impact of functional ability signals on bid price is relatively small, whereas one unit increase in CPA and Certification factor scores offsets the adverse impact of 18% increase in price on the winning probability. These results in Tables 7 and 8 indicate that the buyer's utility or winner decision depends as much on technical competence as on functional ability when a service project requires little interaction between clients and service providers, but clients hiring bookkeeping service providers tend to put negligible weight on past performance measures representing technical competence compared to those representing functional ability.

4.2. Implication of Signals of Past Performance on Service Providers' Subsequent Success

We have so far investigated the buyers' award decision and found evidence indicating the impact of signals on functional ability and technical competence on buyers' choice for different categories of accounting service projects. Next, we explore the implications of those signals of past performance on service providers' subsequent success in surviving in the competitive marketplace.

We observe that the number of service providers registered in the accounting category at our research site had declined substantially as advanced quality-verification mechanisms were introduced by the e-marketplace. There were 217 providers in the accounting service category at the beginning of our sample period, but only 97 (44.7%) of those providers remained enrolled at

the end of our sample period. We collected the same type of information from those 217 service providers at the beginning of our sample period as in the earlier analysis of individual projects. Retrieving factor scores using the weights and pattern obtained earlier in our exploratory factor analysis in Table 4, we estimate a log-probability survivorship model to assess the impact of past performance on subsequent survival over our sample period. We estimate the logit model as Equation (4) below¹⁸:

$$\log\left(\frac{\Pr(\text{Survival}_j = 1 \mid \text{signals})}{\Pr(\text{Survival}_j = 0 \mid \text{signals})}\right) = \gamma_0 + \gamma_1 \text{Reputation}_j + \gamma_2 \text{Self Selection}_j + \gamma_3 \text{Experience}_j + \gamma_4 \text{CPA}_j + \gamma_5 \text{Certification}_j + \varepsilon_j \quad \dots \quad \text{Equation (4)}$$

where Survival_j is scored as zero if provider j existed at the beginning of our sample period but withdrew from the market before the end of the sample period, and as one if he/she survived in the marketplace throughout our sample period. This approach can be used whenever the survival process can be adequately conceptualized as an irreversible single decrement process such as mortality or the transition to the first marriage among a cohort of never-married individuals (Hill, 2005). The results in Table 9 indicate that all quality signals except Experience and Certification have a significant impact on the likelihood of survival.

5. CONCLUSION

This research examines the relative importance of alternative measures of service providers' past performance in influencing their compensation level. Information asymmetry

¹⁸ We conduct survival analysis using a logit model with a dichotomous dependent variable (e.g., 'continue' or 'quit' in our model). A shortcoming of the logit model when there are time-dependent covariates is that it cannot incorporate information on the timing of the event (e.g., when a service provider quits). One solution to this problem is to make the dependent variable the length of time between entry and exit. Estimation of this type of survival model requires data on the exact times at which the changes occurred. However, because our sample dataset does not provide that information, we are limited to using the relatively simple logit model.

between buyers and service providers about their ability motivates the reliance on past performance as imperfect signals on ability and quality. While the prior management accounting literature has mainly focused on measures of future performance contingent on agent's effort in managerial compensation contracts, this study investigate the role of measures of past performance and accomplishments in e-markets where professional and technical service providers have different quality levels unobservable to the buyers. Specifically, sample data collected by subscribing to an online outsourcing auction market for accounting services are analyzed to evaluate hypotheses about the relative importance of different past performance measures.

We find that signals based on service providers' past performance have a significant impact on the buyers' award decisions and are associated with the service providers' subsequent success. Our results also indicate differences in the relative importance of different types of signals depending on whether the projects are for tax or bookkeeping services. While signals pertaining to service providers' functional ability are important in influencing the buyers' choice in the e-market for all accounting service projects, signals pertaining to service providers' technical competence play a significant role only for tax service projects. Consequently, providers whose past performance and accomplishments signal higher ability on quality dimensions that are important for the service project enjoy a premium in the price they command.

While we analyzed the e-market for accounting services only as a representative sample to evaluate hypotheses about relative weights on past performance in compensation contracts, our results provide useful substantive insights about an emerging market for accounting services. Although the CPA certificate and higher-level accounting education generally indicate higher proficiency, superior knowledge and better skills in performing accounting services, results

indicate that these qualifications seem to have little value when service requires intensive interpersonal interactions. That is, the buyers of accounting services do not seem to believe that the accounting education that these qualifications represent, does not ensure that the provider has acquired the functional ability necessary to ensure satisfactory interpersonal delivery of service in e-market places for professional and technical services.

There are some questions that must remain unanswered in this research because of limitations on data availability. We do not model the potential endogeneity of a bidder's bid decision. If service providers know that buyers rely on service quality signals as well as bid price, then their optimal bid on a certain project will depend on their own quality attributes as well as their potential competitors'. The service providers can also decide how much they are going to invest in quality signals, such as getting another license related to accounting services or paying additional fees to the e-marketplace in order to get certified credentials. Limits on data availability also preclude us from incorporating individual heterogeneity into our conditional logit model, and we leave it to future research to explore buyer side characteristics. Nonetheless, with increasing availability of data from e-markets, we believe that a fruitful direction for future research, of importance to both accounting academics and practitioners, will be the further exploration of the role of measures of past performance in facilitating contracting between buyers and providers of professional and technical services in heretofore unexamined segments of the industry.

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Table 1. Categories of Accounting Service Projects

Categories	Examples of Service Requirements
Tax reporting	Preparing taxes and returns or filing tax forms
	Occasional advising on tax shelters, federal and state taxes, appeals to IRS

Bookkeeping software:	
Bookkeeping	Setup or change (Quickbooks Pro, Netledger, Quicken, Peachtree)
	Ongoing bookkeeping services (e.g., data entry)
	Accounts management (e.g., A/R, A/P, Inventory, Payroll)
	Preparing financial statements or bank statements
	Advice on bookkeeping matters

Financial analysis: revenue projection, pro forma budgeting	
Other projects	Project evaluation
	Recommendations for startups
	Mortgage consulting, SBA loan, Rolling over retirement plan

Table 2. Sample Selection Criteria

	Number of Awarded Projects	Number of Bidders on the Projects
From September 1, 2001 to June 30, 2003	278 projects	1666 bidders
Less: Projects with a single bidder	(45 projects)	(45 bidders)
Less: Projects with more than 20 bidders	(6 projects)	(146 bidders)
Less: Projects with multiple winners	(6 projects)	(31 bidders)
Final sample	221 projects	1444 bidders
Includes: Tax reporting projects	72 projects	446 bidders
Bookkeeping projects	108 projects	825 bidders
Other projects	41 projects	173 bidders

Table 3. Descriptive Statistics on Bidders' Quality Signals
(Number of bidders = 1,444)
(Means with standard deviations in parentheses)

Variable	Definition	Mean (Std Dev)
Signals on Technical Competence:		
Education	1 if the service provider has degrees in accounting or business administration from a college- or higher-level institution and 0 otherwise	54%
Verified education	1 if the service provider has degrees in accounting or business administration from a college- or higher-level institution and has it verified by US Search and 0 otherwise	22 %
CPA	1 if the service provider has obtained the CPA certificate from any state and 0 otherwise	29 %
Verified CPA	1 if the service provider has obtained from any state the CPA certificate and has it verified by US Search and 0 otherwise	9 %
Other certificates	1 if the service provider has accounting-related certificates, such as those from the National Association of Tax Professionals or the American Institute of Professional Bookkeepers and 0 otherwise	14 %
Verified other certificates	1 if the service provider has accounting-related certificates, such as those from the National Association of Tax Professionals or the American Institute of Professional Bookkeepers and has them verified by US Search and 0 otherwise	3 %
Signals on Functional Ability:		
Select mark	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	70 %
SquareTrade Seal	1 if the service provider has a membership of an online dispute resolution program, SquareTrade and 0 otherwise	32 %
Feedback rating	Weighted average score on a scale from zero to five, weighted by winning bid prices of the projects whose buyers has rated the service provider and 0 if there is no feedback rate	2.28 (2.44)
Cumulative earnings	Logarithm of the service provider's total revenues earned from accounting services	3.40 (3.51)

Standardization	1 if the service provider offers standardized services in its content, price per hour, delivery time, etc and 0 otherwise	23 %
Work experience	Logarithm of the number of years the service provider has worked in an accounting related job or in an executive management position	0.83 (1.12)
Verified work experience	Number of years the service provider has worked in an accounting related job or in an executive management position verified by US Search	0.31 (0.69)
References	1 if the service provider has attached statements where his/her business associates attest to the provider's capability in providing accounting services and 0 otherwise	36 %
Verified references	1 if the service provider has attached statements verified by US Search where his/her business associates attest to the provider's capability in providing accounting services and 0 otherwise	10 %
Control variables:		
ln (Bid)	Logarithm of the bid price	5.15 (0.88)
Invitation	1 if the bidder is invited by the buyer and 0 otherwise	7.3%
ln (Agility)	Logarithm of the number of days required to complete the project	1.32 (1.01)

Table 4. Factor Analysis for the Fifteen Quality Signals*

Quality signals	Factor 1 (Reputation)	Factor 2 (Self Selection)	Factor 3 (Experience)	Factor 4 (CPA)	Factor 5 (Certification)
Feedback rating	0.9154	0.1275	-0.0032	-0.0908	0.0463
Cumulative earnings	0.8002	0.3269	0.1921	0.1091	0.0184
SquareTrade Seal	0.2276	0.8045	0.0586	0.0993	0.0565
Select mark	0.1226	0.6493	0.2697	0.0218	0.0298
Standardization	0.3180	0.4171	0.0996	0.3902	0.4142
Work experience	0.1913	-0.0607	0.8355	0.1858	0.0330
References	0.0270	0.1826	0.7349	-0.0018	0.3773
Verified work experience	0.0425	0.3101	0.6865	0.2104	0.0408
Verified references	-0.0217	0.1928	0.6205	-0.2349	-0.2586
CPA	-0.0061	0.2642	-0.0353	0.7950	0.0137
Education	0.0116	-0.0595	0.3367	0.7169	-0.0458
Verified CPA	-0.1634	0.0857	-0.2900	0.6912	-0.0608
Verified education	0.3064	-0.1099	0.3595	0.6757	-0.0488
Other certificates	0.0136	-0.0970	0.1269	-0.0117	0.8448
Verified other certificates	0.0216	0.1773	-0.0685	-0.1096	0.7710
<i>Cronbach alpha</i>	<i>0.8038</i>	<i>0.6159</i>	<i>0.7516</i>	<i>0.7314</i>	<i>0.6144</i>

* Variables measuring quality signals are defined in Table 3.

**Table 5. Service Providers' Quality Signals and Buyers' Award Decisions
for the Full Sample
(1,444 bidders on 221 projects)**

$$U_{ij}^* = \beta_1 * \text{Reputation}_j + \beta_2 * \text{Self Selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invite}_j + \beta_8 * \ln(\text{Agility}_j) + \varepsilon_{ij}$$

Variables @	Predicted sign	Estimated Coefficient	Significance Level	Marginal Effect	Odds Ratio
Reputation	+	0.5205***	<0.0001	0.0447	1.68
Self Selection	+	0.3910***	<0.0001	0.0336	1.48
Experience	+	0.0773	0.1113	0.0066	1.08
CPA	+	0.0009	0.4933	0.0001	1.00
Certification	+	- 0.0627	0.8239	- 0.0054	0.94
ln (Bid)	-	- 0.4551***	0.0002	- 0.0391	0.63
Invitation	+	0.4294*	0.0787	0.0369	1.54
ln (Agility)	-	- 0.0774	0.2273	- 0.0067	0.93

Value of objective function = -338.7190, χ^2 [= -2ln(L₀/L)] = 77.46***, Pseudo R² [= 1 - lnL/lnL₀] = 10.26%

*** significant at 1% level, **significant at 5% level, *significant at 10% level, one-sided where sign is predicted

@ Variable definitions

The first five hypothesized variables are factor scores obtained from an exploratory factor analysis based on 15 quality signals:

- Reputation = Factor that has high loadings of two signals on functional ability: service providers' feedback rating from the e-market's seller rating system and cumulative earnings
- Self Selection = Factor that has high loadings of three signals on functional ability: standardization, Select mark and SquareTrade Seal
- Experience = Factor that has high loadings of four signals on functional ability: work experience, references, verified work experience and verified references
- CPA = Factor that has high loadings of four signals on technical competence: CPA, education, verified CPA and verified education
- Certification = Factor that has high loadings of two signals on technical competence: other certificates and verified other certificates

The three control variables are defined in Table 3.

Table 6. Service Providers' Quality Signals and Buyers' Award Decisions

$$U_{ij}^* = \beta_1 * \text{Reputation}_j + \beta_2 * \text{Self Selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invite}_j + \beta_8 * \ln(\text{Agility}_j) + \varepsilon_{ij}$$

Variables*	Predicted sign	Estimated Coefficient	Significance Level	Marginal Effect	Odds Ratio
Panel A: Tax projects (446 bidders on 72 projects)					
Reputation	+	0.3838***	0.0022	0.0027	1.47
Self Selection	+	0.3244**	0.0123	0.0023	1.38
Experience	+	-0.0768	0.7268	-0.0005	0.93
CPA	+	0.1709*	0.0703	0.0012	1.19
Certification	+	0.1670**	0.0453	0.0012	1.18
ln (Bid)	-	-0.9489***	0.0003	-0.0067	0.39
Invitation	+	-0.4615	0.7731	-0.0033	0.63
ln (Agility)	-	-0.2049	0.1025	-0.0014	0.81
Value of objective function = -107.7435, χ^2 [= -2ln(L ₀ /L)] = 26.08***, Pseudo R ² [= 1 - lnL/lnL ₀] = 10.80%					
Panel B: Bookkeeping projects (825 bidders on 108 projects)					
Reputation	+	0.6837***	<0.0001	0.1029	1.98
Self Selection	+	0.5034***	<0.0001	0.0758	1.65
Experience	+	0.1979**	0.0125	0.0298	1.22
CPA	+	-0.1022	0.8670	-0.0154	0.90
Certification	+	-0.1788	0.9787	-0.0269	0.84
ln (Bid)	-	-0.2861*	0.0685	-0.0431	0.75
Invitation	+	0.9290**	0.0229	0.1399	2.53
ln (Agility)	-	-0.0407	0.3990	-0.0061	0.96
Value of objective function = -167.9124, χ^2 [= -2ln(L ₀ /L)] = 70.70***, Pseudo R ² [= 1 - lnL/lnL ₀] = 17.39%					

*** significant at 1% level, **significant at 5% level, *significant at 10% level, one-sided where sign is predicted

* Variables are defined in Table 5.

Table 7. Comparison of Impact of Signals on Functional Ability Versus Signals on Technical Competence on Buyers' Award Decisions

Results of the likelihood ratio test developed by Vuong (1989) for nonnested model selection; a significant positive Z-statistic indicates that model 2 is rejected in favor of model 1.

Model 1: $U_{ij}^* = \beta_1 * Reputation_j + \beta_2 * Self\ Selection_j + \beta_3 * Experience_j + \beta_6 * \ln(Bid)_j + \beta_7 * Invitation_j + \beta_8 * \ln(Agility_j) + \varepsilon_{ij}$

Model 2: $U_{ij}^* = \beta_4 * CPA_j + \beta_5 * Certification_j + \beta_6 * \ln(Bid)_j + \beta_7 * Invitation_j + \beta_8 * \ln(Agility_j) + \varepsilon_{ij}$

Model 1 vs. Model 2		Vuong's Z-statistics	Probability
Full sample	(n = 221)	4.004	<0.001
Tax projects	(n = 72)	1.147	0.251
Bookkeeping projects	(n = 108)	3.877	<0.001

Table 8. Impact of Quality Signals on Price

Quality Signals	Full Sample	Tax Projects	Bookkeeping Projects
Reputation	1.144	0.404	2.390
Self Selection	0.859	0.342	1.760
Experience	0.170	NS	0.692
CPA	0.002	0.180	NS
Certification	NS	0.176	NS

Impact of unit increase in quality signal on percentage change in price

Table 9. Service Providers' Quality Signals and the Likelihood of Their Survival in the e-Marketplace

$$\log\left(\frac{\Pr(\text{Survival}_j = 1 \mid \text{signals})}{\Pr(\text{Survival}_j = 0 \mid \text{signals})}\right) = \gamma_0 + \gamma_1 \text{Reputation}_j + \gamma_2 \text{Self Selection}_j + \gamma_3 \text{Expertise}_j + \gamma_4 \text{CPA}_j + \gamma_5 \text{Certification}_j + \varepsilon_j$$

Logistic Regression					
Variables	Predicted sign	Estimated Coefficient	Significance Level	Standardized Estimates	Odds Ratio
Intercept		-0.9538	<0.0001	.	
Reputation	+	0.7594***	<0.0001	0.8138	2.14
Self Selection	+	1.7643***	0.0011	0.3969	5.84
Experience	+	0.4457	0.2480	0.1500	1.56
CPA	+	1.5893**	0.0108	0.3293	4.90
Certification	+	1.0452	0.2373	0.1349	2.84

$\chi^2 = 39.51^{***}$, Pseudo $R^2 = 13.19\%$

*** significant at 1% level, **significant at 5% level, *significant at 10% level, one-sided where sign is predicted

The dependent variable, Survival, is defined to be zero if a provider existed at the beginning of the sample period but withdrew from the market before the end of the sample period, and to be one if they continue bidding on the market through the sample period. Independent variables are defined in Table 5.