

# Importance of Measures of Past Performance: Empirical Evidence on Quality of e-Service Providers\*

RAJIV D. BANKER, *Temple University*

INY HWANG, *Drexel University*

## 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 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. Measures of past performance we consider in this study are observable by both the principal and the agent, and differ from the predecision precontract information in Baiman and Evans 1983 that is available only to the agent. Past performance in our study 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 (Darrough and Melumad 1995). The compensation paid for the service, therefore, is likely to depend on the past performance and other signals on the provider's ability to deliver valuable service. Murphy and Zbojnik (2003), for example, find that as large corporations now tend to hire chief executive officers (CEOs) externally rather than through internal promotions, transferable skills are more important than firm-specific skills. As a

\* Accepted by Jeffrey Callen. An earlier version of this paper was presented at the 2006 *Contemporary Accounting Research* Conference, generously supported by the **Canadian Institute of Chartered Accountants**, the **Certified General Accountants of Ontario**, the **Certified Management Accountants of Ontario**, and the **Institute of Chartered Accountants of Ontario**. We acknowledge helpful comments and suggestions from seminar participants at 2006 *Contemporary Accounting Research* Conference, 2005 American Accounting Association (AAA) Annual Conference, 2006 AAA Management Accounting Section Conference, 2005 AAA Information Systems Section Conference, and 2005 Swiss Accounting Research Conference.

result, signals such as an MBA on a CEO's ability are associated with the CEO's salary. To the extent that multiple measures of past performance are available, we need to consider the underlying ability dimension for which each measure serves as a signal. The relative importance of a performance measure is likely to increase with the importance of its associated ability dimension in creating value for the purchaser of the service.

We evaluate these hypotheses about the role of measures of past 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 \$8.2 billion in 2003, up 26 percent from \$6.5 billion in 2002. This sector of economic activity has continued to exhibit rapid growth in recent years (Guzzo 2003), and attracted much attention in management research (e.g., Autor 2001; Snir and Hitt 2003). The Bureau of Labor Statistics estimates that more than 25 million people now work as independent professionals in the United States, and the number of such freelancers is growing rapidly.<sup>1</sup>

Specifically, we obtained a sample of data on service provider quality signals, projects they bid on, and bid prices by subscribing (but not actually bidding or participating) as a provider of accounting and bookkeeping services with a large e-marketplace for professional and technical services. We selected the accounting service e-market to collect our sample data because of our own professional experience with those services and because of the potential differences in tax and bookkeeping services that make different dimensions of provider quality relatively more important. This provides a natural test bed with data on real economic transactions to formulate and evaluate hypotheses about the relative importance of different signals. While the value of each transaction in these markets is small (on average, \$225), this setting arguably provides greater external validity to understanding various economic forces than what could be replicated in a laboratory setting.

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 (Malone and Laubacher 1998; Bernstein and Klein 2004). In contrast to the auditing service business of public accounting firms, which is anchored by substantial audit fees paid by large public corporations, the emergence of web-based accounting service markets has been supported by many small businesses now finding individual 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 (U.S. Bureau of Labor Statistics 2003). 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 small businesses and 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 e-marketplaces.

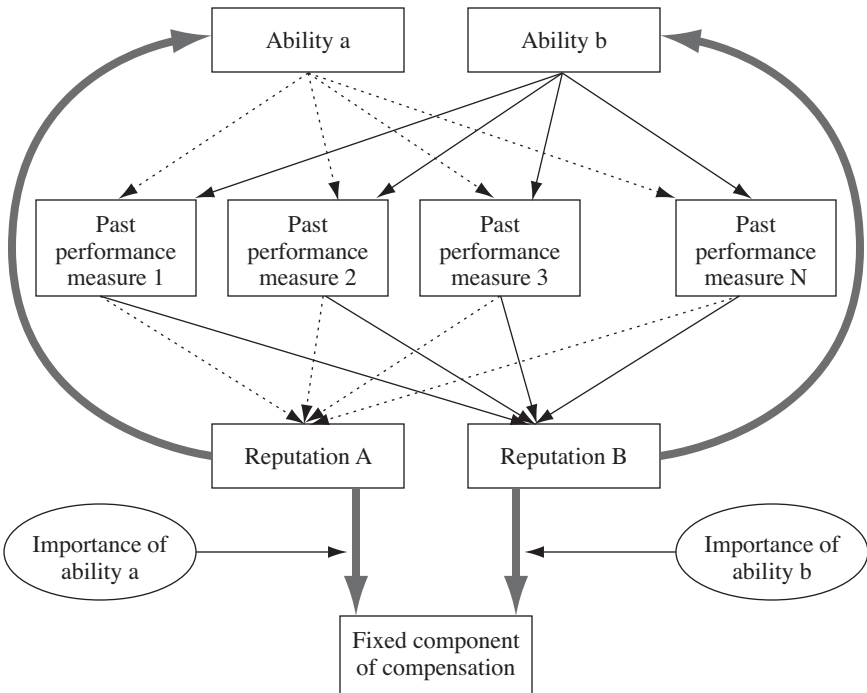
A significant caveat in online outsourcing is the potential variability in the capability of service providers, some of whom could be less skilled or even dishonest. Buyers in online marketplaces such as eBay and Amazon rely on the sellers' reputation for their purchasing decision to assess the unobservable 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 (Klein and Leffler 1981; Shapiro 1983; Allen 1984), and empirical studies have documented the impact of reputation on sellers' bidding (Resnick and Zeckhauser 2001; Melnik and Alm 2002; Houser and Wooders 2006; Dewally and Ederington 2006) and buyers' willingness to pay (McDonald and Slawson 2002; Melnik and Alm 2003; Dewan and Hsu 2004; Jin and Kato 2006).<sup>2</sup> There may be several dimensions of ability and quality intrinsic to, or developed by, the provider. Past performance measures and other signals enable potential buyers to draw inferences about the provider's ability and quality, and that inference constitutes the provider's reputation, as shown in Figure 1. What measures of past performance and accomplishments and other related signals on providers' quality should be collected by the accounting system and emphasized in the reports, however, is a question that has not been addressed.

The service delivery process involving the customer is important because services are intangible and, therefore, multiple dimensions of sellers' quality are relevant. The marketing research literature identifies at least two distinct dimensions of service quality (Gronroos 1984; Parasuraman, Zeithaml, and Berry 1985; Brady and Cronin 2001; Escalas and Luce 2004). From an outcome perspective, the provider's technical competence, as evidenced, for example, 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. 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 that provide information on multiple dimensions of provider quality.

Signals on technical competence include education, professional certification, and verifiable licenses. Signals on functional ability include work experience and business references 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, therefore, are likely to be more important predictors of providers' bookkeeping service performance.

Nonfinancial performance measures are being increasingly used in compensation contracts at all levels of an organization (Ittner et al. 1997; Banker et al. 2000). Here, we explore the role of measures of functional ability and technical competence in determining the compensation for accounting services contracted for on the Internet. The principal question we address in this paper is the relative importance of signals on technical competence and functional ability in affecting the likelihood of a bidder winning a contract. Our results indicate that functional ability signals play a significant role in 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.

**Figure 1** Agent's ability, past performance, and reputation



A broad implication of our study is that accounting systems designed to inform the determination of compensation need to gather and aggregate information on measures of past performance and accomplishments. Prior research has focused primarily on the measurement of prospective performance and how contracts may be contingent on those measures. As a result, the noncontingent component of compensation has been treated as “fixed”. We present evidence in this paper to argue that the “fixed” component, in fact, may vary systematically with past performance and accomplishments. Consequently, accounting systems designed for employee and supplier compensation must consider what tasks require what abilities, and which of multiple performance measures provide the best signals on those abilities.

The remainder of this paper is organized as follows. In section 2, we discuss features of web-based outsourcing markets that affect 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 theory 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 example, 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 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, Lambert, and Larcker (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 a positive relation between the noise in accounting measures and the relative importance of market and individual performance measures in bonus contracts.

While these studies examine the relation between incentive compensation and performance metrics specified in the contract (Healy 1985), the moral hazard models do not explain 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, equilibrium 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 the agent's ability that affect 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. Prior theoretical research indicates that 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 companies now outsource manufacturing and service activities (Deutsch 2004). Essential to successful outsourcing is the hiring of suppliers, including identifying whom to hire and deciding on payment terms (Plambaeck and Taylor 2005; Iyer, Schwarz, and Zenios 2005). In procurement management, auction mechanisms have become a powerful tool since competition between bidders facilitates identification of high-quality, low-cost suppliers. An important benefit of outsourcing is communication of information between suppliers and buyers (Baiman and Rajan 2002) as competing suppliers bidding for projects have a strong incentive to reveal their good-quality signals to improve their prospects of being awarded the contract by the buyer.

Consider an auction where multiple service providers make bids on a project posted by a buyer (e.g., McAfee and McMillan 1987). The buyer's utility  $U$  is the value,  $V_j$ , of the project performed by a service provider,  $j$ , net of the procurement price,  $p_j$ , so that  $U(V_j, p_j) = V_j - p_j$ . Service providers are endowed with two dimensions of ability,  $a_1$  and  $a_2$ . The value  $V_j$  created by a service provider  $j$  increases in each dimension of his ability so that  $V(a_j) = v_0 + v_1 a_{1j} + v_2 a_{2j} + \epsilon_{Vj}$ . There is a signal  $x_{ij} = a_{ij} + \epsilon_{ij}$  on each ability dimension  $a_i$ ,  $i = 1, 2$ , for each provider  $j$ , where each  $\epsilon_{ij}$  is drawn from a standard normal distribution. The expected value created by the provider, given the observed signals  $x_j$ , is  $\bar{V}(x_j) = E(V|x_j) = v_0 + v_1 E(a_{1j}|x_j) + v_2 E(a_{2j}|x_j)$ . The buyer selects the service provider that maximizes her expected utility. Each service provider incurs a private cost  $c_j$  if hired by the principal to provide the service. The ability levels  $a_{ij}$ , the signals  $x_{ij}$ ,  $i = 1, 2$ , and the private cost  $c_j$  for the provider  $j$  are all random variables.<sup>3</sup> All parameters and model structure are common knowledge except that cost information is asymmetric (only the individual provider  $j$  knows the actual realization of  $c_j$ ) and  $\epsilon_{Vj}$  are unobservable.

The most advantaged provider is the one who can create the greatest expected net value  $\bar{V}(x_j) - c_j$ . In a descending English auction, for example, all of the service providers, except the most advantaged provider, drop out when the individual rationality constraint  $p_j \geq c_j$  is binding and prevents them from making a competing bid that is superior to the best current bid. As a result, the winning bidder's (denoted by  $w$ ) price is  $p_w^* = \bar{V}(x_w) - [\bar{V}(x_j) - c_j]$ , where  $\bar{V}(x_j)$  and  $c_j$  are the expected value created and the personal costs incurred by the second most advantaged

bidder (McAfee and McMillan 1987). Since  $\bar{V}(x_w)$  is a linear function of the signals  $\{x_{1w}, x_{2w}\}$ , so is the equilibrium winning price  $p_w^*$ . Also, the probability of winning for a service provider  $w$  increases with the expected value creation  $\bar{V}(x_w)$  given the signals on his ability, and the impact of each signal  $x_i$  on value creation is directly related to the valence  $v_i$  of the underlying ability dimension  $a_i$ . In our context, measures of past performance serve as signals on the agent's ability and are expected to be positively related to the probability of winning.

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 result in higher-quality service providers, offer greater protection to buyers, and improve dispute resolution. For example, Elance.com and Guru.com have furnished service providers with space for self-advertisement and created third-party verification processes to prescreen service providers.<sup>4</sup> These mechanisms are believed to separate high-quality professionals committed to customer satisfaction from low-quality and less capable providers (Spence 1973; Rosenman and Wilson 1991).

The marketing research literature recognizes that service quality is multi-dimensional (Czepiel, Solomon, and Surprenant 1985; Carman 1990; Dabholkar, Thorpe, and Rentz 1996). Service is basically intangible, and comprises 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 (Gronroos 1984). The 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 the interaction she experiences with the provider during the service process. The provider's functional ability in communicating and coordinating with the customers, understanding their needs and requirements, and providing customers with 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 (Surprenant and Solomon 1987; Czepiel 1990; Bitner, Booms, and Mohr 1994; Hartline and Ferrell 1996). An effective customer relationship in providing services is most critical when (a) the service is complex, customized, and delivered over a continuous stream of transactions (Berry 1983; Levitt 1983; Lovelock 1983) and (b) 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, Evans, and Cowles 1990), and motivates our first hypothesis:

*HYPOTHESIS 1. 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 subcategories of accounting services contracted in the online market we study are bookkeeping services and tax compliance services, as described

in Table 1, panel A. Each has its own unique features with different implications for the role of quality signals. Consider the following excerpts from some customers' specifications for their bookkeeping projects:

We need a "template" spreadsheet producing for our financial modeling. It must incorporate P&L, Cashflow, Balance Sheet, etc., together with easy-to-manipulate "rules"/formulae.

I am looking for a new accountant since the current one cannot handle the job recently. Please bid on the project for a monthly or quarterly review of accounts in Quickbook format and give me advice for finance as needed. ... The bidder must be familiar with Quick Book Pro 2002.

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 based 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 or help change existing processes to fit the software. 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 as signalled by educational qualification and certification.

We expect providers' 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 (Dhaliwal, Gleason, and Mills 2004; O'Donnell, Koch, and Boone 2005) and how they may relate to the client's tax situation. Consider the following excerpts from some 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.

TABLE 1  
Basic description of Elance.com

| <b>Panel A:</b> Categories of accounting service projects |   |
|---|---|
| Categories  | Examples of service requirements  |
| Tax reporting   | Preparing taxes and returns or filing tax forms<br>Occasional advising on tax shelters, federal and state taxes, appeals to IRS   |
| Bookkeeping   | Bookkeeping software:<br>Setup or change (Quickbooks Pro, Netledger, Quicken, Peachtree)<br>Ongoing bookkeeping services (e.g., data entry)<br>Accounts management (e.g., A/R, A/P, Inventory, Payroll)<br>Preparing financial statements or bank statements<br>Advice on bookkeeping matters |
| Other projects  | Financial analysis: revenue projection, pro forma budgeting<br>Project evaluation<br>Recommendations for startups<br>Mortgage consulting, SBA loan, rolling over retirement plan  |

**Panel B:** Typical transaction on Elance

A client posts a description of her project on an online marketplace and solicits competitive bids from service providers, explaining the services she desires. Service providers search the site for posted projects that match their areas of expertise and submit a bid. These bids usually include a price and details of their qualifications and experience. The buyer then chooses one of the service providers and awards the project to that provider. The e-marketplace generates revenue by charging monthly subscription fees for the providers who are enrolled at the marketplace and through transaction-based fees.

**Panel C:** Change in the numbers of projects awarded and service providers registered

| Projects awarded | Early period<br>(09/2001–06/2002) | Late period<br>(07/2002–06/2003) |
|------------------|-----------------------------------|----------------------------------|
| Bookkeeping      | 65                                | 59                               |
| Tax              | 37                                | 36                               |
| Other            | <u>35</u>                         | <u>48</u>                        |
| Total            | 137                               | 143                              |

| Service providers registered | Middle of<br>early period | Middle of<br>late period |
|------------------------------|---------------------------|--------------------------|
| Bookkeeping                  | 201                       | 187                      |
| Tax                          | <u>138</u>                | <u>128</u>               |
| Total                        | 339                       | 315                      |

I have many questions about S corporations, tax shelters, possible losses and how to claim these losses on my individual tax return. I will also need help in filing taxes at the end of the year. I would like to know what the cost would be for a consultation regarding S corporations. I would also need some one that can direct me to the necessary paperwork needed to claim deductions such as cafeteria plan, self-insured medical.

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 (Spence 1973; Kirmani and Rao 2000). Economic theory thus suggests the next hypothesis:

*HYPOTHESIS 2. Signals on service providers' technical competence are positively associated with buyers' decisions to select a provider for tax service projects but such association is less likely to exist for bookkeeping service projects than for tax projects.*

### 3. Data and estimation models

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

#### *Research site and sample selection*

Web-based professional service markets that have 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 2002, about 300 accounting service providers were using the marketplace, with more than 10 new projects posted on average each week. The typical transaction at Elance.com is described in Table 1, panel B. We selected accounting services on the Elance website for the collection of our sample data because our own professional background enabled us to subscribe as a service provider. Also, the distinction between the nature of the service and the extent of interaction with the customer required for the tax and bookkeeping projects listed under the accounting service category created a natural test bed to evaluate our hypotheses about the relative importance of different quality signals.

Until the second half of 2001, the quality monitoring system was not fully developed at Elance. For example, provider verification features, such as the Square-Trade 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.<sup>5</sup> We exclude 45 of these projects that have only a single bidder because the objective of our estimation model is to explain the customer's choice among multiple bidders. We also delete 6 projects that have more than 20 bidders because the relation between the winning decision and bidders' characteristics is likely to be different when there are many bidders on a project.<sup>6</sup> 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 six and seven bidders on the projects.

### *Data description*

Many different signals on service providers' quality are available to buyers at the Elance marketplace. For each project, we collect data on characteristics of service providers. The averages for the 15 variables pertaining to either technical competence or functional ability are presented in Table 3.

We collect data on six signals on providers' technical competence: education in accounting or business, CPA license, other accounting-related certificates, and each of these three measures with "credentials" mark.<sup>7</sup> We also collect data on nine signals on functional ability, such as Select seal, SquareTrade seal, standardized services, customer feedback rating, and providers' cumulative earnings. Signals on functional ability also include work experience and references, and each of these two measures with the credentials mark.

TABLE 2  
Sample selection criteria

|  | Number of<br>awarded projects | Number of bidders<br>on the projects |
|--|-------------------------------|--------------------------------------|
| From September 1, 2001 to June 30, 2003  | 278 projects                  | 1,666 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                  | 1,444 bidders                        |
| Includes: Tax reporting projects         | 72 projects                   | 446 bidders                          |
| Bookkeeping projects                     | 108 projects                  | 825 bidders                          |
| Other projects                           | 41 projects                   | 173 bidders                          |

*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 a 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 example, furnishes portfolio pages for all service providers where they can self-advertise their qualifications or past accomplishments, such as education, certificates, and licenses.<sup>8</sup>

TABLE 3

Descriptive statistics on bidders' quality signals (number of bidders = 1,444): means with standard deviations in parentheses

| Variable                               | Definition  | Mean<br>(s.d.) |
|--|---|----------------|
| <i>Signals on technical competence</i> |   |                |
| <i>Education</i>                       | 1 if the service provider has degrees in accounting or business administration from a college- or higher-level institution, and 0 otherwise   | 54%            |
| <i>Verified education</i>              | 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%            |
| <i>CPA</i>                             | 1 if the service provider has obtained the CPA certificate from any state, and 0 otherwise  | 29%            |
| <i>Verified CPA</i>                    | 1 if the service provider has obtained from any state the CPA certificate and has it verified by US Search, and 0 otherwise   | 9%             |
| <i>Certification</i>                   | 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%            |
| <i>Verified certification</i>          | 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%             |

(The table is continued on the next page.)

TABLE 3 (Continued)

| Variable                             | Definition   | Mean<br>(s.d.) |
|--------------------------------------|--|----------------|
| <i>Signals on functional ability</i> |  |                |
| <i>Select mark</i>                   | 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%            |
| <i>SquareTrade seal</i>              | 1 if the service provider has a membership in the online dispute resolution program SquareTrade, and 0 otherwise   | 32%            |
| <i>Feedback rating</i>               | Weighted average score on a scale from 0 to 5, weighted by winning bid prices of the projects whose buyers have rated the service provider, and 0 if there is no feedback rate                     | 2.28<br>(2.44) |
| <i>Cumulative earnings</i>           | Logarithm of the service provider's total revenues earned from accounting services   | 3.40<br>(3.52) |
| <i>Standardization</i>               | 1 if the service provider offers standardized services in its content, price per hour, delivery time, etc., and 0 otherwise  | 23%            |
| <i>Work experience</i>               | Logarithm of the number of years the service provider has worked in an accounting-related job or in an executive management position   | 0.83<br>(1.12) |
| <i>Verified work experience</i>      | Logarithm of the 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<br>(0.70) |
| <i>References</i>                    | 1 if the service provider has attached statements where his or her business associates attest to the provider's capability in providing accounting services, and 0 otherwise                       | 36%            |
| <i>Verified references</i>           | 1 if the service provider has attached statements verified by US Search where his or her business associates attest to the provider's capability in providing accounting services, and 0 otherwise | 11%            |
| <i>Control variables</i>             |  |                |
| $\ln(\text{Bid})$                    | Logarithm of the bid price   | 5.15<br>(0.88) |
| <i>Invitation</i>                    | 1 if the bidder is invited by the buyer and 0 otherwise  | 7%             |
| $\ln(\text{Time needed})$            | Logarithm of the number of days required to complete the project   | 1.32<br>(1.01) |

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

Service providers enrolled in an e-marketplace can present other qualifications on their profile space. Commonly found in e-marketplaces for accounting services are higher education degrees 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 percent of the providers assert that they have this qualification, only 22 percent 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. Many e-markets 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.<sup>9</sup> 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 example, 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 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 are reviewed by the Select program and possibly 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 partnerships with online dispute resolution programs, 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 (Gronroos 1988; Chernev 2004). When the service provider fails to complete the project or the outcome is not what is expected by the buyer, well-executed service recovery is important for mitigating customer dissatisfaction, maintaining customer relationships, and preventing impairment in reputation (Fornell and Wernerfelt 1987). With substantial failure risk in the e-marketplace for professional and technical services, buyers are likely to prefer service providers with a 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 its recovery quality.<sup>10</sup> SquareTrade works with a number of leading businesses by providing online dispute resolution services. 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 SquareTrade 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 percent of bidders were Select providers, 32 percent were SquareTrade members, and 28 percent were neither.

Our research site, Elance, is equipped with a customer feedback rating system that reports the history of a service provider's evaluation by the buyers and his or her earnings since enrolment. Feedback on Elance is scored on a scale from 0 to 5. The *Feedback rating* variable is measured as an average score weighted by contract price of awarded projects.<sup>11</sup> 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 many buyers. The *Cumulative earnings* variable for our study is measured as total revenues earned from Elance accounting projects. Direct signals on the providers' past performance at the marketplace (feedback), as well as "Select" and "SquareTrade" seals that guarantee honest trade practices, are likely to be reassuring for buyers in the e-market and influence their decisions to award the contract (Spence 1973).

Elance also allows service providers to offer standardized services in its content, price per hour, and delivery time at his or her personal web page furnished by the e-market. Experienced service providers in the e-marketplace who have obtained a good sense of how to satisfy customers may appeal to buyers as high-

quality providers by offering standardized services. We measure *Standardization* as a dummy variable that takes the value 1 if the service provider offers 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, Neumark, and Troske (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 references are likely to be related to service providers' interpersonal skills in interacting with customers when delivering professional services. 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 the 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 20 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.<sup>12</sup> The remaining variable, *Reference*, is a 0/1 dummy variable that takes the value of 1 if the provider has attached statements from his or her business associates attesting to the provider's capability in providing accounting services.

### *Control variables*

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.<sup>13</sup> Table 4 presents the range of project costs for the 211 sample projects. The bid price variable ( $\ln(\text{Bid})$ ) is measured by taking the logarithm of the raw value. We also include two other control variables. Invitation is a unique practice of our e-marketplace. If a buyer is familiar with some service providers, 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.<sup>14</sup> Therefore, we include *Invitation*, a dummy variable with the value 1 if a bidder is invited, and 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 *Time needed* ( $\ln(\text{Time needed})$ ) variable mitigates the effect of the right-skewed distribution of the raw variable.<sup>15</sup>

### *Estimation model*

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. Consider a buyer who posts a

project  $i$  on the online auction market for accounting services. Her utility from choosing a bidder  $j$  is

$$U_{ij}^* = X_j\beta + u_{ij} \quad j = 1, 2, \dots, N_i \tag{1}$$

where  $u_{ij}, j = 1, 2, \dots, N_i$ , are unobservable attributes affecting preferences.<sup>16</sup> In other words, the buyers' utility is a linear function of the bidders' characteristics,  $X_j$ , including their bid prices, with a common parameter vector  $\beta$ . 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 selection of the winning bidder. If buyer  $i$  awards the project to bidder  $w_i$  in particular, then we assume that  $U_{iw_i}$  is the maximum among the  $N_i$  utilities  $U_{ij}^*$ . Hence, the statistical model is estimated by choosing parameter values to maximize the probability  $p_i(W_i = w_i) \equiv \text{Prob}(U_{iw_i} \geq U_{ij})$  for all  $j \neq w_i$  that the actual choice is  $w_i$ . It can be shown that if the  $N_i$  disturbances,  $u_{ij}$ , are independently distributed with the Type I extreme value distribution (McFadden 1974), then the probability that the winning bidder for project  $i$  is  $w_i$  (and not any of the other  $N_i - 1$  bidders) is as follows:

$$p_i(W_i = w_i) = \exp(X_{w_i}\beta) / \sum_{j=1}^{N_i} \exp(X_j\beta), w_i \in \{1, 2, \dots, N_i\} \tag{2}$$

We estimate the coefficient vector  $\beta$  using the maximum likelihood criterion. For this purpose, we derive the log-likelihood function by first defining, for each project  $i$ ,  $\delta_{ik} = 1$  if the bidder  $k$  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  $\delta_{ik}$ 's is 1. Next, we estimate  $\beta$  by maximizing the log-likelihood function

$$\ln L = \ln \prod_{i=1}^{221} p_i(W_i = w_i) = \sum_{i=1}^{221} \sum_{k=1}^{N_i} \delta_{ik} \ln \text{Prob}(W_i = w_k)$$

TABLE 4  
Project cost range (based on 211 winning bids in the sample)

|                    |            |
|--------------------|------------|
| Mean               | \$224.77   |
| Standard deviation | \$378.02   |
| Minimum            | \$35.00    |
| 10th percentile    | \$60.00    |
| 1st quartile       | \$75.00    |
| Median             | \$180.00   |
| 2nd quartile       | \$250.00   |
| 90th percentile    | \$400.00   |
| Maximum            | \$4,000.00 |

where  $w_i$  indicates the winner of each project  $i$ ,  $i = 1, 2, \dots, 221$ , and  $\text{Prob}(W_i = w_k)$  is given by (2) for each bidder.

Since our 15 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 5 reports the rotated factor pattern. In the previous subsection, 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 comprise exclusively 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. We label this factor *Feedback*. There is a high correlation (0.6719 Pearson, 0.6627 Spearman) between the two variables. *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 understanding of customers are willing to limit their action choices and offer standardized 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. The greater the work experience, the greater is the likelihood that the provider understands how to interact with e-market customers and manage the online service delivery process to satisfy them. Business references may further reinforce inferences about service providers' functional ability.

The fourth factor, *CPA*, measures the acquisition of essential accounting and business knowledge as indicated by educational or professional qualifications. This factor comprises a CPA license and a bachelor's or higher degree in accounting or a related field. In contrast, the fifth factor, *Certification*, includes narrowly specified and more technical certificates that do not require as much conceptual knowledge as a CPA must have.<sup>17</sup>

On the basis of the factor analysis results, we include, as explanatory variables, five factors representing different quality signals and three control variables:

$$\begin{aligned}
 U_{ij}^* = & \beta_1 * \text{Feedback}_j + \beta_2 * \text{Self-selection} + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j \\
 & + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invitation}_j \\
 & + \beta_8 * \ln(\text{Time needed}_j) + u_{ij}
 \end{aligned} \tag{3}$$

*Self-selection*, *Feedback*, and *Experience* comprise signals on providers' functional ability, whereas *CPA* and *Certification* consist of signals on providers' technical competence. We expect that the three functional ability factors have a significantly positive impact on the buyer's choice of provider for all accounting

TABLE 5  
Factor analysis for the 15 quality signals\*

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

**Notes:**

\* Variables measuring quality signals are as defined in Table 3.

services, but the two technical competence factors have a significantly positive impact only for the tax service projects.

#### 4. Results

In this section, we present the results of empirical evaluation of our two hypotheses regarding the relative importance of multiple signals on providers' past performance and accomplishments for our sample drawn from an online accounting service market. To evaluate our 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, we first estimate the effects of quality signals on buyers' award decision in (3) for our full sample. As we have proposed in Hypothesis 1, the results in Table 6 reveal that the signals on service providers' functional ability (*Feedback*, *Self-selection*, and *Experience*) have a significant impact on the buyer's winning bid choice decision. The fourth column, reporting marginal effects, indicates that a one-unit increase in the *Feedback*, *Self-selection*, and *Experience* factor scores increases the probability of a bidder's winning the project, on average, by 4.47 percent, 3.36 percent, and 0.66 percent, respectively.<sup>18</sup> None of the factors representing the signals on providers' technical competence, however, 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 subcategories of tax and bookkeeping projects, and in Table 7 we present the separate results of the impact of quality signals on the 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 buyer's decision. Also, on the basis of the estimated marginal effects of *CPA* and  $\ln(\text{Bid})$  variables, we infer that CPAs can bid on average 19.7 percent 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 *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 are relevant in the case of tax services, whereas other signals based on transaction history and commitment of service providers in e-marketplaces 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

TABLE 6

Service providers' quality signals and buyers' award decisions for the full sample (1,444 bidders on 221 projects)

$$U_{ij}^* = \beta_1 * \text{Feedback}_j + \beta_2 * \text{Self-selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invitation}_j + \beta_8 * \ln(\text{Time needed}_j) + u_{ij}$$

| Variables             | Predicted sign | Estimated coefficient | Significance level | Marginal effect | Odds ratio  |
|-----------------------|----------------|-----------------------|--------------------|-----------------|-------------|
| <b>Feedback</b>       | +              | <b>0.5205*</b>        | <b>&lt;0.0001</b>  | <b>0.0447</b>   | <b>1.68</b> |
| <b>Self-selection</b> | +              | <b>0.3910*</b>        | <b>&lt;0.0001</b>  | <b>0.0336</b>   | <b>1.48</b> |
| <i>Experience</i>     | +              | 0.0773                | 0.1113             | 0.0066          | 1.08        |
| <i>CPA</i>            | +              | 0.0009                | 0.4933             | 0.0001          | 1.00        |
| <i>Certification</i>  | +              | -0.0627               | 0.8239             | -0.0054         | 0.94        |
| <b>ln(Bid)</b>        | -              | <b>-0.4551*</b>       | <b>0.0002</b>      | <b>-0.0391</b>  | <b>0.63</b> |
| <b>Invitation</b>     | +              | <b>0.4294‡</b>        | <b>0.0787</b>      | <b>0.0369</b>   | <b>1.54</b> |
| ln(Time needed)       | -              | -0.0774               | 0.2273             | -0.0067         | 0.93        |

Value of objective function =  $-338.7190$ ,  $\chi^2 [= -2\ln(L_0/L)] = 77.46^*$ ,  
Pseudo  $R^2 [= 1 - \ln L / \ln L_0] = 10.26\%$

#### Notes:

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

*Feedback* = 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: *certification* and *verified certification*.

The three control variables are as defined in Table 3.

\* Significant at the 1 percent level (one-sided where sign is predicted).

† Significant at the 5 percent level (one-sided where sign is predicted).

‡ Significant at the 10 percent level (one-sided where sign is predicted).

premiums in bidding for customer jobs in an e-market setting.<sup>19</sup> Further, since e-marketplaces are motivated to screen out low-quality service providers (Akerlof 1970), the significant coefficients on both *Feedback* 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.

TABLE 7  
Service providers' quality signals and buyers' award decisions

$$U_{ij}^* = \beta_1 * Feedback_j + \beta_2 * Self-selection_j + \beta_3 * Experience_j + \beta_4 * CPA_j + \beta_5 * Certification_j + \beta_6 * \ln(Bid_j) + \beta_7 * Invitation_j + \beta_8 * \ln(Time\ needed_j) + u_{ij}$$

| Variables   | Predicted sign | Estimated coefficient | Significance level | Marginal effect | Odds ratio  |
|---|----------------|-----------------------|--------------------|-----------------|-------------|
| <b>Panel A: Tax projects (446 bidders on 72 projects)</b> |                |                       |                    |                 |             |
| <i>Feedback</i>   | +              | <b>0.3838*</b>        | <b>0.0022</b>      | <b>0.0027</b>   | <b>1.47</b> |
| <i>Self-selection</i>                                     | +              | <b>0.3244†</b>        | <b>0.0123</b>      | <b>0.0023</b>   | <b>1.38</b> |
| <i>Experience</i>   | +              | -0.0768               | 0.7268             | -0.0005         | 0.93        |
| <i>CPA</i>  | +              | <b>0.1709‡</b>        | <b>0.0703</b>      | <b>0.0012</b>   | <b>1.19</b> |
| <i>Certification</i>                                      | +              | <b>0.1670†</b>        | <b>0.0453</b>      | <b>0.0012</b>   | <b>1.18</b> |
| <i>ln(Bid)</i>  | -              | <b>-0.9489*</b>       | <b>0.0003</b>      | <b>-0.0067</b>  | <b>0.39</b> |
| <i>Invitation</i>   | +              | -0.4615               | 0.7731             | -0.0033         | 0.63        |
| <i>ln(Time needed)</i>                                    | -              | -0.2049               | 0.1025             | -0.0014         | 0.81        |

Value of objective function = -107.7435,  $\chi^2 [ = -2\ln(L_0/L) ] = 26.08^*$ ,  
Pseudo  $R^2 [ = 1 - \ln L / \ln L_0 ] = 10.80\%$

|  |   |                |                   |               |             |
|--|---|----------------|-------------------|---------------|-------------|
| <b>Panel B: Bookkeeping projects (825 bidders on 108 projects)</b> |   |                |                   |               |             |
| <i>Feedback</i>  | + | <b>0.6837*</b> | <b>&lt;0.0001</b> | <b>0.1029</b> | <b>1.98</b> |
| <i>Self-selection</i>  | + | <b>0.5034*</b> | <b>&lt;0.0001</b> | <b>0.0758</b> | <b>1.65</b> |
| <i>Experience</i>  | + | <b>0.1979†</b> | <b>0.0125</b>     | <b>0.0298</b> | <b>1.22</b> |
| <i>CPA</i>   | + | -0.1022        | 0.8670            | -0.0154       | 0.90        |
| <i>Certification</i>   | + | -0.1788        | 0.9787            | -0.0269       | 0.84        |
| <i>ln(Bid)</i>   | - | -0.2861‡       | 0.0685            | -0.0431       | 0.75        |
| <i>Invitation</i>  | + | <b>0.9290†</b> | <b>0.0229</b>     | <b>0.1399</b> | <b>2.53</b> |
| <i>ln(Time needed)</i>   | - | -0.0407        | 0.3990            | -0.0061       | 0.96        |

Value of objective function = -167.9124,  $\chi^2 [ = -2\ln(L_0/L) ] = 70.70^*$ ,  
Pseudo  $R^2 [ = 1 - \ln L / \ln L_0 ] = 17.39\%$

**Notes:**

Variables are as defined in Table 6.

\* Significant at the 1 percent level (one-sided where sign is predicted).

† Significant at the 5 percent level (one-sided where sign is predicted).

‡ Significant at the 10 percent level (one-sided where sign is predicted).

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 non-nested models. The results of the Vuong test reported in Table 8 indicate that the three factors that signal functional ability have a more significant impact on the probability of being accepted by the buyer than the two factors that signal technical competence. In the analysis of the subsamples, the finding that functional ability signals are more important than technical competence signals holds for bookkeeping projects but disappears for tax projects, as expected from Hypotheses 1 and 2.<sup>20</sup> Pairwise comparisons of individual factors provide very similar insights (not reported here).

Table 9 displays the impact of quality signals on prices bid by service providers. A one-unit increase in the *Feedback*, *Self-selection*, and *Experience* factor scores allows a bidder for bookkeeping services to increase the bid price 239 percent, 176 percent, and 69 percent, respectively, holding the probability of winning constant. 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. A one-unit increase in *CPA* and *Certification* factor scores enables an 18 percent increase in price, keeping the winning probability constant. These results in Tables 7, 8, and 9 indicate that the buyer’s decision depends as much on technical competence as on functional ability when a service project requires complex technical knowledge, as in the case of tax projects, but clients who hire bookkeeping service providers tend to put negligible weight on technical competence measures.

TABLE 8  
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 non-nested model selection; a significant positive Z-statistic indicates that model B is rejected in favor of model A.

$$\text{Model A: } U_{ij}^* = \beta_1 * \text{Feedback}_j + \beta_2 * \text{Self-selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \ln(\text{Bid}_j) + \beta_5 * \text{Invitation}_j + \beta_6 * \ln(\text{Time needed}_j) + u_{ij}$$

$$\text{Model B: } U_{ij}^* = \gamma_1 * \text{CPA}_j + \gamma_2 * \text{Certification}_j + \gamma_3 * \ln(\text{Bid}_j) + \gamma_4 * \text{Invitation}_j + \gamma_5 * \ln(\text{Time needed}_j) + u_{ij}$$

|                                | Vuong’s Z-statistics | Probability |
|--------------------------------|----------------------|-------------|
| Model A versus Model B:        |                      |             |
| Full sample (n = 221)          | 4.004                | < 0.001     |
| Bookkeeping projects (n = 108) | 3.877                | < 0.001     |
| Tax projects (n = 72)          | 1.147                | 0.251       |

## 5. Conclusion

This research examines the relative importance of alternative measures of service providers' past performance and accomplishments in influencing their compensation level. Imperfect information about service providers' ability and quality motivates the reliance on past performance. While the management accounting literature has mainly focused on measures of future performance contingent on an agent's effort in managerial compensation contracts, in this study we investigate the role of measures of past performance and accomplishments in enabling a more efficient contractual relationship between outsourcers and their selected suppliers. The development of e-markets where professional and technical service providers have different quality levels unobservable to the buyers presents a valuable source of real data to test hypotheses about the importance of alternative performance measures. We analyzed sample data collected by subscribing to an online outsourcing auction market for accounting services to evaluate hypotheses about different measures of past performance that signal different dimensions of service providers' quality.

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' choices 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.

TABLE 9  
Impact of quality signals on price\*

| Quality signals       | Full sample     | Tax projects    | Bookkeeping projects |
|-----------------------|-----------------|-----------------|----------------------|
| <i>Feedback</i>       | 1.144           | 0.404           | 2.390                |
| <i>Self-selection</i> | 0.859           | 0.342           | 1.760                |
| <i>Experience</i>     | 0.170           | NS <sup>†</sup> | 0.692                |
| <i>CPA</i>            | 0.002           | 0.180           | NS <sup>†</sup>      |
| <i>Certification</i>  | NS <sup>†</sup> | 0.176           | NS <sup>†</sup>      |

### Notes:

\* Impact of unit increase in quality signals on percentage change in price, given by  $-\beta_6/\beta_s$ ,  $s = 1, 2, \dots, 5$ , where  $\beta_s$  and  $\beta_6$  are estimated from the relationship

$$U_{ij} = \beta_1 * \text{Feedback}_j + \beta_2 * \text{Self-selection}_j + \beta_3 * \text{Experience}_j + \beta_4 * \text{CPA}_j + \beta_5 * \text{Certification}_j + \beta_6 * \ln(\text{Bid}_j) + \beta_7 * \text{Invitation}_j + \beta_8 * \ln(\text{Time needed}_j) + u_{ij}$$

† Not significant.

While we analyzed the e-market for accounting services only as a representative sample to evaluate hypotheses about the importance of measures of past performance in compensation contracts, our results provide useful substantive insights about an emerging market for accounting services in the small business sector. Although a 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 the professional service provided to small businesses requires intensive interpersonal interactions. That is, buyers of small accounting service projects do not seem to believe that the accounting education that these qualifications represent signals a greater likelihood of higher-quality interpersonal interactions in the delivery of some 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 those of 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 and accomplishments in facilitating contracting between buyers and providers of professional and technical services in heretofore unexamined segments of the industry.

## Endnotes

1. Freelancers are consultants and other knowledge workers and independent professionals in technology, creative design, management consulting, and other fields of expertise. There are many web-based marketplaces, such as Opus360 ([www.freeagent.com](http://www.freeagent.com)), Emoonlighter ([www.guru.com](http://www.guru.com)), and Elance ([www.elance.com](http://www.elance.com)), where transactions are conducted as "reverse auctions". A client in need of tax compliance, for example, posts her request as a project in an online marketplace and solicits competitive bids from 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 of the service providers who bid on her project. After a winning bid is accepted, the buyer and the 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.

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 — for example, 500 Mhz processors (Resnick and Zeckhauser 2001), U.S. \$5 coins (Melnik and Alm 2002), stamps (Dewan and Hsu 2004), Pentium III chips (Houser and Wooders 2006), and comic books (Dewally and Ederington 2006).
3. The case when the agent's private cost is a function of his ability is complex because the relationship could be either positive or negative. If signals on his ability are public, it is possible that the reservation wage of the more competent providers is higher because they will have better opportunities. However, if signals on his ability are not public, all agents have the same reservation wage, and the less capable agents have a higher private cost because they have to spend more time and effort to perform the job at the same quality level as the more competent agents. Thus, this analysis requires an advanced auction model incorporating price and ability variables simultaneously. Such a model is beyond the scope of our present study and we defer it to future research.
4. 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 on 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.
5. The number of registered accounting and tax service providers decreased steeply during the early months of Elance's operation. Many registered providers exited by the end of 2001 after the quality monitoring system was installed. The number of providers for the remainder of our sample period remained relatively stable. The average number of accounting and tax projects awarded also remained relatively stable throughout our sample period. These statistics are summarized in panel C of Table 1, where the early and late periods of roughly equal length are determined on the basis of three specific dates when we recorded data on the registered service providers.
6. The results reported here are robust to the inclusion of these 51 observations.
7. Signals with credentials are verified by US Search, one of Elance's partners to enhance trust in its marketplace. While signals with the credentials may be more reliable than self-reported signals, only 41.3 percent of the service providers have one or more of their signals verified by US Search.
8. While service providers are able to verify their offline qualifications using US Search verification system, it is possible that they self-advertise bogus qualifications as well. These signals, therefore, may be noisy unless verified independently.
9. The quality standards include, for example, providing detailed and customized proposals that are relevant to the project, working with the buyer before the project begins, and detailed specification of requirements, milestones, and payment terms.
10. Recent studies on e-commerce show that web assurance seals, such as TRUSTe, BBB Online, Verisign®, and CPA WebTrust, influence consumers' online purchasing behavior (Jamal, Maier, and Sunder 2003; Odom, Kumar, and Saunders 2002; Kovar, Burke, and Kovar 2000).
11. Our results are robust when we make an additional distinction between providers that have no rating due to their newness in the marketplace and those with a very bad

history. For this purpose, we score a new provider at the average rating for all providers instead of a zero reported by Elance.

12. Winsorizing at the 90th percentile leaves the results unchanged.
13. The bidder's decision cannot be modeled separately in the absence of any additional data. Without additional data, the reduced form of the buyer's decision in a system of equations would be exactly the same as what we have estimated as a single equation.
14. Since new business may generate future recurring projects, service providers may have the incentive to make a low-ball bid. After the initial project is completed to the satisfaction of both parties via Elance, the buyer may find it easy to contract directly with the same service provider on future projects. However, buyers may not have the same incentive to contract offline because they may want to explore lower prices through competition among bidders on Elance. To the extent that all providers face the same incentives, such behavior will not change their likelihood of winning.
15. Additional robustness checks include the consideration of the number of bidders as a control variable. Since we model the buyer's utility, and not the provider's bid price, the number of bidders should have no impact on utility and hence we exclude it from our analysis. The results are similar if this variable is included.
16. The number of bidders  $N_i$  may vary across different projects, bounded above by the total number of enrolled service providers.
17. The *Self-selection* and *Certification* factors have a 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.
18. The parameter estimates of the logit model are not necessarily marginal effects. The marginal effect in the conditional logit model is  $\partial E(w|x)/\partial x = p(x'\beta)[1 - p(x'\beta)]\beta$  and will vary with the values of  $x$ . For computing marginal effects presented in the fourth column, we first evaluate the marginal effects at every observation point and then average them.
19. The ratio of mean bid for CPAs to mean bid for non-CPAs is significantly different from 1 at the 5 percent level ( $t = 2.33$ ). Significantly higher bids are also found for better-quality providers, as indicated by the three factors that signal functional ability (*Feedback*, *Self-selection*, and *Experience*).
20. Since it may be argued that *Experience* helps a provider improve technical competence as much as functional ability, we repeat the tests after excluding *Experience* from both groups of signals, or even including it together with the technical competence signals. The results remain robust to these alternative test formulations.

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