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The Online Shadow of Offline Signals: Which Sellers Get Contacted in Online B2B Marketplaces?*

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THE ONLINE SHADOW OF OFFLINE SIGNALS:

WHICH SELLERS GET CONTACTED IN ONLINE B2B MARKETPLACES?

Abstract

This article extends the understanding of what impels buyers to contact particular sellers in online business-to-business (B2B) marketplaces, which are typically characterized by sparse social structures and concomitant limitations in observing social cues. Integrating an institutional perspective with signaling theory, our core argument is that offline seller characteristics that are visible online—in particular, geographic location and legal status—convey credible signals of seller behavior because they provide buyers with information on sellers' local institutional quality and the institutionally-induced obligations and controls acting on sellers. Using unique data from a large Italian online B2B marketplace between the fourth quarter of 1999 and July 2001, we find that both sellers' local institutional quality and their legal statuses affect a buyer's likelihood of contacting a seller. Moreover, consistent with the idea that a buyer's own local institutional quality generates a relevant reference point against which sellers are evaluated, we find that a buyer is progressively more likely to contact sellers the higher their local institutional quality relative to the buyer. Jointly, our findings imply that in online B2B marketplaces, signals conveyed by sellers' geographic locations and legal statuses may constitute substantive sources of competitive heterogeneity and market segmentation.

Online B2B marketplaces that are dedicated to spot sourcing considerably widen the market reach of both buyers and sellers but they also create specific challenges (Mahadevan 2003). For example, in such markets pre-existing social structures are typically sparse and so social cues are particularly difficult to observe (e.g., Pavlou & Gefen 2004). Therefore, the assessment of relevant exchange risks represents an intricate task for buyers looking to initiate contact with sellers. Prior studies offer several possible approaches to address this fundamental challenge. Some research suggests that buyers can reduce online exchange risks by focusing on sellers that are well known (e.g., Lee, Kang, & McKnight 2007; Smith & Brynjolfsson 2001). Buyers may also rely on mechanisms that are 'native' to an online marketplace, such as online reputation systems that collect and disseminate information on sellers' behaviors (e.g., Dellarocas 2003) or certification systems that should give buyers greater confidence in the reliability of certified compared to uncertified sellers (e.g., Pavlou & Gefen 2004). Finally, a broader literature would suggest that spatial and social proximity may reduce the costs of screening exchange partners (e.g., Hegde & Tumlinson 2014; Sorenson & Stuart 2001).

Despite the potential of these approaches to alleviate online exchange risks, each also faces limitations. For example, many or even most sellers in online B2B marketplaces tend to be unfamiliar to the average buyer. Moreover, the availability and effectiveness of online reputation and certification systems can vary greatly and such native mechanisms are less useful in situations where buyers face cohorts of sellers that have similar online reputations or certifications. Finally, there is considerable ambiguity about the role of proximity in breeding connections in an online context (e.g., Gefen & Carmel 2008; Steinfield 2004). Therefore, these potential approaches to reducing online exchange risks appear limited in their ability to fully account for buyer-seller contact dynamics in online B2B marketplaces. Such limitations in turn underscore the need for studies of online seller selection to move beyond risk-reduction

mechanisms rooted in sellers' brands, reputation or certification systems, or proximity. In this article, we offer a theory and empirical analysis that begins to address this need.

We integrate an institutional perspective (e.g., Shapiro 1987; Zucker 1986) with signaling theory (Spence 1974) to propose that offline seller characteristics that are visible online—in particular, geographic location and legal status—convey credible signals of seller behavior to buyers. Though information on sellers tends to be limited by the standard profiles through which they appear in online B2B marketplaces, geographic location and legal status are among the few widely available pieces of information that buyers can gauge from sellers' online profiles. Geographic locations can differ, for example, in their informal institutions, defined as the behavioral norms that constrain the way in which the formal rules and regulations related to market transactions are enforced (North 1984, 1990). Thus, geographic locations may convey information on sellers' local 'institutional quality'—i.e., the extent to which informal institutions support the efficiency of market transactions. Moreover, legal statuses embody the collection of rules imposed on sellers by a legislature and so they may convey additional information on the institutionally-induced obligations and controls acting on sellers (Hannigan 2012). Overall, both sellers' geographic locations as well as their legal statuses can constitute a credible basis upon which online buyers establish their inference about the exchange risks that sellers represent.

Building on these core arguments, we develop two sets of predictions connecting the offline institution-based signals conveyed online by sellers' geographic locations and legal statuses to a buyer's likelihood of contacting a particular seller in an online B2B marketplace. First, we predict that the higher a seller's local institutional quality and the stronger the obligations and controls associated with the seller's legal status, the more likely a buyer is to contact that seller. Second, following research suggesting that more complete accounts of buyer decision making must also consider buyer characteristics (e.g., Qualls & Puto 1989), we propose

that the effectiveness of individual signals differs across buyers as well. In particular, because a buyer's own local institutional quality and legal status can generate relevant reference points against which sellers are evaluated (e.g., Helson 1948; Thibaut & Kelley 2009; Tversky & Kahneman 1981), we predict that a buyer is more likely to contact a seller the higher the seller's local institutional quality and legal status relative to the buyer.

We test these predictions by examining the initiation of contacts between buyers and sellers in a large Italian online B2B marketplace during a 21-month period, from the fourth quarter of 1999 to July 2001. This marketplace was populated by thousands of Italian companies covering a multitude of industries and was designed to facilitate spot sourcing for buyers and to extend the market reach of both buyers and sellers. It provides a setting particularly well suited to examining our theory for two reasons. First, a focus on the specific case of Italy around the turn of the century effectively rules out variance in formal, legislative institutions by design and so we are able to isolate the implications of Italy's deeply-ingrained internal heterogeneity in informal institutions. Indeed, the online sellers in our sample are located across all of Italy's regions, providing us with considerable variance in institutional quality (e.g., Dunford & Greco 2006; Peri 2004; Putnam 1993). Second, various features of this marketplace allow us to control for the potential confounding effects of reputation and certification systems, unobserved differences across companies, and heterogeneity in sellers' online profiles.

As our dependent variable, we focus on whether or not a buyer submits a request for quotation to a seller. Requests for quotation are important contacts between industrial buyers and sellers because final orders generally occur only after a request for quotation has been submitted. Moreover, unlike final orders, requests for quotation are not confounded by additional information conveyed by the pricing of products and services. Consequently, by examining whether and when sellers receive requests for quotation in an online B2B marketplace, we can

begin to understand how online market segmentation may arise for sellers even before pricing information is disclosed. Econometric analysis of 438 requests for quotation occurring in a sample of 116,417 potential contacts, and submitted by 34 unique buyers to 301 unique sellers, largely supports our theoretical framework.

THEORY AND HYPOTHESES

In online B2B marketplaces dedicated to spot sourcing, many or even most sellers tend to be unknown to the average buyer and so such marketplaces can be viewed as largely anonymous markets characterized by considerable information asymmetries. Here, 'anonymous' does not mean that seller identities are concealed, but rather that observable identities are mostly unfamiliar to buyers given the sheer number of available sellers. In this sense, online B2B marketplaces facilitating spot sourcing are akin to what Marshall (2006 [1919]: 182) referred to as 'general markets' largely devoid of prior mutual knowledge, in which the enabling role of pre-existing social structures (e.g., Rangan 2000) is necessarily restricted. Consequently, online buyers are confronted with substantial uncertainty about the exchange risks associated with different sellers. Specifically, buyers confront both trading risks as well as value appropriation risk. Trading risks involve the risk of receiving unreliable information prior to placing an order and the related risk that contacted sellers do not deliver products or services to specification once an order is placed. Instead, value appropriation risk involves the risk of potential losses if sellers fail to deliver to the agreed-upon specifications. Theories of signaling and screening would imply that buyers can alleviate the uncertainty associated with asymmetric information and improve their assessment of the exchange risks associated with different sellers by relying on observable and credible signals of seller behavior (Spence 1974; Stiglitz 2000).

Because online B2B marketplaces mostly aim to coordinate the supply and demand of buyers and sellers, and because companies are generally required to complete standard profiles

for display in such markets, the number of characteristics visible in a seller's online profile tend to be inherently limited. Indeed, geographic location and legal status represent two among few available offline seller characteristics that buyers can gauge from sellers' online profiles. For example, a seller's geographic location—e.g., London, New York City, Rome—can be easily observed, while its legal status—e.g., whether it is a sole proprietorship, a limited liability company, or a corporation—is generally disclosed in its name (e.g., 'ABC CORP'). Geographic locations and legal statuses provide information to online buyers about the offline institutional forces acting on sellers and, in the below, we develop the argument that both can convey credible signals of seller behavior to online buyers. By providing information on the quality of local informal institutions, sellers' geographic locations help buyers form general impressions about the offline 'playing field' of online sellers (North 1990).[1] Legal statuses instead provide buyers with more direct information on online sellers, by conveying the institutionally-induced obligations and controls acting on individual sellers (Hannigan 2012).

Several studies have focused on the facilitating role of institution-based signals in offline settings. For example, Oxley (1999) studied the governance of international strategic alliances formed by U.S. companies, showing that alliance governance tended to be less focused on monitoring and control when intellectual property protection in a partner's home country was strong. This result suggests that stronger intellectual property protection serves as a credible signal because it generates disproportionate costs for less compared to more reliable companies. Also, Sanders and Boivie (2004) showed that institutional ownership was positively associated with a company's market valuation at IPO because institutional investors monitor company

[1] Our theoretical framework can be extended to incorporate the quality of formal institutions (i.e., prevailing rules and regulations) that sellers' geographic locations may convey and we return to this possibility in the discussion section. However, in the context of this study, we focus exclusively on variance in the quality of informal institutions across different geographic locations. Throughout this article, therefore, 'institutional quality' refers solely to the quality of *informal* institutions.

conduct and so institutional ownership conveys a credible signal to the market. Finally, Balboa and Martí (2007) showed that private equity managers were able to raise more funds if they were a member of the national private equity association because such membership governed managerial behavior, thus sending a credible signal to investors.

As these examples suggest, in cases where observable institution-based signals are more costly for less reliable companies, such signals convey credible information on the exchange risks associated with different online sellers (e.g., Negro, Hannan, & Fassiotto 2014; Spence 1974). Nevertheless, prevailing research has tended to underemphasize the idea that offline institution-based signals—specifically, those conveyed by the geographic location and legal status of online sellers—may affect online buyer-seller contact dynamics. Indeed, prior studies have focused mostly on the role of seller brand (e.g., Lee et al. 2007; Smith & Brynjolfsson 2001) and that of online reputation or certification systems (e.g., Dellarocas 2003; Pavlou & Gefen 2004). In what follows, we develop hypotheses on how the signaling role of offline institutions can systematically affect the initiation of contacts between buyers and sellers in online B2B marketplaces. Specifically, we begin by focusing on the independent effects of the signals conveyed by sellers' geographic locations and legal statuses. We subsequently propose that buyers also interpret the information conveyed by these seller characteristics relative to their own geographic location and legal status when deciding which seller to contact.

Sellers' Geographic Locations, Local Institutional Quality, and Contact Initiation

To the extent that the sellers within a buyer's choice set differ in their geographic locations, such differences can convey useful information to online buyers on variation in institutional quality across sellers' home locations. By affecting trading and value appropriation risks, two interconnected dimensions of institutional quality are particularly relevant to buyers looking to reduce exchange risks in online B2B marketplaces. First, institutional environments

differ in their judicial efficiency—i.e., the extent to which efficient law enforcement is the norm (Laeven & Woodruff 2007; North 1990). In higher-quality institutional environments, enforcement costs are lower (Djankov, La Porta, Lopez-de-Silanes, & Shleifer 2003; Johnson, McMillan, & Woodruff 2002) and so buyers are better able and more likely to enforce their rights through the court system (Doornik 2010). This way, judicial efficiency reduces trading risks because it decreases the discounted value of deception and non-compliance (Chemin 2012). Moreover, even when failing to deliver to specification, sellers should be more motivated to repay potential creditors in an environment with a more efficient legal system (Jappelli, Pagano, & Bianco 2005), which in turn reduces value appropriation risk.

Second, closely related to the efficiency of the legal system, institutional environments also differ in the prevalence of corruption and organized crime (Hay & Shleifer 1998; Mauro 1995; Shleifer & Vishny 1993).[2] In lower-quality institutional environments, corruption and organized crime are more prevalent and so buyers run a greater risk of dealing with an illicit seller—i.e., a counterparty involved in or supportive of illegal conduct. The nature of the activities of illicit sellers might render court involvement less useful or desirable (Frye 2002; Hay & Shleifer 1998) and such sellers may therefore be more likely to avoid resort to legal institutions altogether, instead relying on often illegal private protection (Gambetta 1993; Milhaupt & West 2000). Moreover, even if they do resort to courts in case of disputes, illicit sellers may nevertheless be able to violate the law with impunity to the extent they manage to get favors in the justice system (Tanzi 1995).[3] Through either mechanism, buyers will face a lower value

[2] Judicial efficiency and the prevalence of corruption and organized crime are often reciprocally and inversely associated, both because judicial inefficiency creates opportunities for private ordering through corruption and organized crime (Black 1983; Varese 2001) and because corruption may reduce the efficiency of the legal system (Tanzi 1995).

[3] This argument underscores the deep interrelations that tend to exist between judicial systems and corruption and organized crime (see Footnote 2). In locations where corrupt and otherwise criminal activities are prevalent, such activities tend to affect both private and public sectors (Briquet & Favarel-Garrigues 2010). Consequently, illicit companies may manage to violate the law without appropriate consequences aided by ties to illicit public officials.

appropriation risk when engaging with sellers in an institutional environment characterized by low levels of corruption and organized crime, while trading risks should also be lower, as a reduced access to illicit channels of protection should discourage deception and non-compliance.

These arguments suggest that institutional quality expresses the extent to which market transactions are governed broadly by norms of compliance with prevailing rules and regulations and so locating in a higher-quality institutional environment should be less costly for more compared to less reliable sellers. Therefore, to the extent geographic locations differ in their institutional quality, they can form the basis upon which online buyers establish their inference about the exchange risks associated with different sellers. Specifically, when engaging online with sellers in higher-quality institutional environments, buyers face a reduced risk of receiving unreliable information, products or services are more likely to be delivered to specification, and buyers should also be better able to recover potential losses.

Consequently, we propose that institutional quality conveys credible information on seller behavior and so it constitutes an offline signal that buyers in online B2B marketplaces can rely on as a screening device to assess the exchange risks associated with a given seller (Spence 1974), without the requirement that the buyer and seller have interacted before (McKnight, Cummings, & Chervany 1998; Shapiro 1987; Zucker 1986). An online buyer can use their geographic locations to differentiate among the sellers within its choice set and should be more likely to contact a seller located in a higher-quality institutional environment.[4]

Hypothesis 1. The higher a seller's local institutional quality, the greater the likelihood that a buyer contacts that seller in an online B2B marketplace.

[4] Spence (1974: 1; italics added) defined signals as "activities or attributes of individuals [sellers] in a market which, *by design or accident*, alter the beliefs of, or convey information to, other individuals [buyers] in the market." Consistent with Spence's original definition, our theory on the role of geographic location is agnostic regarding whether sellers intentionally (i.e., "by design") or unintentionally (i.e., "by accident") sort into a particular geographic location for signaling purposes. Therefore, intentional sorting is not a necessary condition for the association predicted in H1.

Sellers' Legal Statuses and Contact Initiation

While geographic locations create general impressions about the offline 'playing field' of online sellers, buyers may also be looking for more specific information on individual sellers. Despite the relative scarcity of such information in online B2B marketplaces, buyers can usually gauge sellers' legal statuses from their online profiles. We propose that an online seller's legal status may act as a second offline signal of seller behavior because it conveys additional, credible information on the strength of the offline institutional forces that the seller is subject to.

Sole proprietorships, limited liability companies, and corporations are among the most prevalent forms of legal status that companies employ (Hannigan 2012). Sole proprietorships are owned by a single individual and can be registered relatively straightforwardly and without the involvement of a notary. They are not legally required to make upfront investments and can file their income statement through the owner's personal tax return. Moreover, sole proprietorships are not required to draft documents such as Articles of Organization, Operating Agreements, or Articles of Incorporation. Therefore, compared to limited liability companies and corporations, few obligations and controls govern the sole proprietorship.

Limited liability companies must typically be registered with the Chamber of Commerce by a notary and are required to draft Articles of Organization and an Operating Agreement that details members' managerial and financial rights and obligations, which often involves attorneys or consultants. Limited liability companies may also require significant starting capital and must typically hold and document regular meetings of the Board of Directors and quotaholders. Moreover, in some cases limited liability companies must appoint a board of statutory auditors to supervise and control the management of the company, and to assess the accuracy of the company's accounting procedures and systems, and the company's compliance with tax regulation, among other things. Consequently, compared to sole proprietorships, limited liability

companies are subject to stronger obligations and controls.

Sellers that operate as a corporation face additional obligations and controls over and above those faced by limited liability companies. Corporations require Articles of Incorporation and a higher starting capital than limited liability companies. Moreover, corporations always have a board of statutory auditors and an external audit is required in case the company is listed on a stock exchange, which will in itself expose the company to the scrutiny of capital markets and to more elaborate reporting and transparency requirements (Roëll 1996). Therefore, compared to sole proprietorships and limited liability companies, corporations are subject to the strongest obligations and controls.

Based on the strength of the obligations and controls associated with each, different forms of legal status can be positioned on an ordinal scale that ranges from low to high levels of obligations and controls.[5] Companies with a higher legal status are subject to stronger obligations and controls, which will tend to be less costly for more compared to less reliable sellers (e.g., Barney & Hansen 1994). Therefore, their legal statuses convey credible information on the exchange risks sellers represent, regardless whether or not sellers intentionally sort into a particular legal status to signal their reliability (Spence 1974). Reinforcing these arguments, some evidence suggests that companies with a higher legal status may find it easier to attract external financing (e.g., Storey 1994), while they may also be more likely to survive (e.g., Brüderl, Preisendörfer, & Ziegler 1992; Mata & Portugal 2002) and less likely to liquidate due to financial distress (e.g., Wennberg, Wiklund, DeTienne, & Cardon 2010).

Consequently, we propose that seller legal status serves as a second offline signal that online buyers can rely on to infer the trading and value appropriation risks associated with a

[5] The specific obligations and controls associated with different forms of legal status vary across legislatures, though they tend to increase in strength consistently from sole proprietorships to limited liability companies and corporations.

given seller. Seller legal status can serve as a screening device that helps online buyers distinguish among otherwise indistinguishable sellers within their choice sets, again without the requirement that the buyer and seller have interacted before (McKnight et al. 1998; Shapiro 1987; Zucker 1986). The implication is that in online B2B marketplaces, buyers should be more likely to contact sellers that have a higher legal status.[6]

Hypothesis 2. The stronger the obligations and controls associated with the legal status of a seller, the greater the likelihood that a buyer contacts that seller in an online B2B marketplace.

Heterogeneity across Buyers: Sellers' Relative Institutional Quality, Relative Legal Status, and Contact Initiation

Consistent with the signaler-centric perspective in much signaling research to date, the above two hypotheses propose that certain seller characteristics may constitute important factors shaping a buyer's decision regarding which seller to contact in an online B2B marketplace. However, research in behavioral decision theory (e.g., Kahneman & Tversky 1984; Tversky & Kahneman 1981) and related literatures on social comparison (e.g., Alexander 1972; Lindenberg 1977) and social exchange (e.g., Thibaut & Kelley 2009) would suggest that a more complete model of buyer decision making must move beyond a sole focus on seller characteristics by simultaneously considering relevant buyer characteristics. In particular, because they differ in their past and present context of experience, buyers are likely to have different reference points (Puto 1987; Qualls & Puto 1989; Thaler 1985), where a reference point is defined in our context

[6] We view legal status as distinct from certification. The obligations and controls associated with a company's legal status convey a credible signal because they act both as *ex ante* selection mechanisms that help filter companies based on differences in reliability and as *ex post* monitoring mechanisms that differentially reinforce such reliability. In contrast, the credibility of a certification signal can vary widely with such factors as the interests of the certifying agent, the extent of screening and monitoring, and the concomitant capital and effort required by certification candidates to obtain and maintain certification. For example, on Alibaba.com, the world's largest e-commerce platform, though certified 'Gold Suppliers' are authenticated by a third-party verification company, such "verification does not verify the integrity of the business, so it is still important for [a buyer] to use [their] best judgment regarding…the supplier" (Alibaba 2014).

as the standard of reliability to which a buyer has adapted and against which the buyer compares the reliabilities, and evaluates the attractiveness, of the sellers within its choice set.

Sellers that fall below a buyer's reference point are likely to be categorized as less attractive, while those above the reference point are likely to be categorized as more attractive instead. Moreover, prior research would suggest that evaluations of attractiveness vary in their magnitude depending on how high or low a seller's signaled reliability is relative to the buyer's reference point (e.g., Alexander 1972; Wegener 1992). Reference points thus reflect the threshold level of reliability below which buyers are progressively less likely to interact with a seller and above which they are instead progressively more likely to interact with a seller. Consequently, even if multiple buyers are faced with an identical set of sellers, they may nevertheless differ in their assessments of a given seller, and so in their likelihood of contacting that seller, because of differences in their individual reference points.

These arguments suggest that the offline institution-based signals that sellers convey in online B2B marketplaces may differ in their consequences depending on the reference points of individual buyers. To the extent that online buyers attend to sellers' local institutional quality and legal statuses as signals of reliability, their reference points are likely to be shaped by their own local institutional quality and legal status, respectively. Indeed, reference points are influenced by an actor's exposure to relevant social norms and experiences (Helson 1948; Puto 1987; Thibaut & Kelley 2009; Tversky & Kahneman 1981) and in our context, buyers' local institutional environment and legal status likely supply such relevant exposure. A buyer's local institutional quality determines the extent to which the buyer is held to comply with prevailing rules and regulations, while the buyer's legal status determines the extent to which the buyer is subjected to a variety of institutionally-induced obligations and controls. Thus, by shaping the level of reliability to which a buyer has adapted, local institutional quality and legal status will set the

minimum standard of reliability that the buyer deems desirable and so both buyer characteristics should determine the reference points used in evaluating the attractiveness of different sellers.

These arguments suggest that the likelihood that an online buyer contacts a seller should not just depend on absolute levels of a seller's local institutional quality (i.e., H1) and legal status (i.e., H2), but also on the seller's local institutional quality and legal status relative to the buyer. Specifically, a buyer will be progressively more likely to contact a seller the further the seller's local institutional quality is above that of the buyer, while the buyer will be progressively less likely to contact a seller the further the seller's local institutional quality is below that of the buyer. By this logic, a seller located in a geographic location with average institutional quality, for example, would be more likely to be contacted if the local institutional quality of the buyer is low rather than high. Similarly, a buyer will be progressively more likely to contact a seller the further the seller's legal status is above that of the buyer, while the buyer will be progressively less likely to contact a seller the further the seller's legal status is below that of the buyer. This logic implies that an incorporated seller, for example, will be more likely to be contacted if the buyer is a sole proprietorship rather than a limited liability company. Consequently, the institutional quality and legal status signals conveyed by an online seller may lead to different outcomes depending on buyers' reference points, which are in turn shaped by their own local institutional quality and legal status.

Hypothesis 3. The higher a seller's local institutional quality relative to a buyer, the greater the likelihood that the buyer contacts that seller in an online B2B marketplace.

Hypothesis 4. The stronger the obligations and controls associated with a seller's legal status relative to a buyer, the greater the likelihood that the buyer contacts that seller in an online B2B marketplace.

DATA AND METHODS

Our empirical setting was an Italian online B2B marketplace around the turn of the century, owned by an Italian e-procurement provider and dedicated to facilitating spot sourcing by registered companies and covering a multitude of industries. Specifically, we analyzed the marketplace activities of a sample of Italian companies registered in this online marketplace during a 21-month period, from the fourth quarter of 1999 to July 2001, drawn from a proprietary dataset made available to us by the e-procurement provider. To understand the nature of the online B2B marketplace, we conducted some interviews with the e-procurement provider and some marketplace participants. In addition, to operationalize several of the study variables, we collected data from the Italian National Institute of Statistics (ISTAT) and used results reported by Calderoni (2011) and Golden and Picci (2005).

This setting was particularly suitable to test our theory for two reasons. First, a focus on the particular case of Italy during 1999-2001 effectively ruled out variance in formal, legislative institutions by design and so it allowed us to isolate the impact of Italy's longstanding internal heterogeneity (e.g., Jappelli et al. 2005).[7] Indeed, such heterogeneity was reflected not only in the divide between the North, Center, and South of Italy (Dunford & Greco 2006; Leonardi 1995), but also in substantial and persistent socio-economic differences across Italy's 20 regions and the 103 provinces embedded within them (de Blasio & Nuzzo 2009; Peri 2004; Putnam 1993). Perhaps not surprisingly, therefore, some suggest that differences in local institutional quality are deeply ingrained in the beliefs of Italian citizens (e.g., Capozza, Bonaldo, & Di Maggio 1982).

Second, the platform owner did not offer buyers the possibility to leave online feedback about their interactions with sellers, nor did the platform operate a certification procedure. Moreover, companies were initially charged a fee by the e-procurement provider only after they

[7] Through a constitutional reform (Article 117 of the Italian Constitution), Italian regions were granted general legislative powers only after the end of our sampling window, in October 2001.

bought or sold products or services in the marketplace. Therefore, companies faced no unequal incentives to join the marketplace and request quotations from sellers. Finally, all companies provided information according to identical criteria, which minimized heterogeneity across sellers in the amount and nature of available information. By design, these three features reduced the concern that associations between our proposed offline institution-based signals and the likelihood of buyer-seller contact were confounded by a reputation or certification system, by unobserved differences across companies, or by heterogeneity in sellers' online profiles.

We began with a sample of 475 requests for quotation that buyers submitted to sellers but due to incomplete information, the final analysis examined 438 requests for quotation submitted by 34 unique buyers to 301 unique sellers, which constituted the basis for our dependent variable. Buyers requesting quotations were located across nine of Italy's 20 regions, while contacted sellers were located across 18 of Italy's regions.

Empirical Approach and Estimation

Our empirical approach was at the dyad level of analysis and assessed the likelihood that a specific buyer requested a quotation from a specific seller in the online B2B marketplace. Thus, we compared the sample of 438 realized contacts to a comparison group of buyer-seller contacts that could have occurred. Given the large number of companies, it appeared unlikely that a buyer always considered all sellers in this marketplace. Indeed, interviews with the e-procurement provider and some marketplace participants revealed that buyers began their search for sellers by first selecting a broad industry category. For each of the 438 realized requests for quotation, we thus used the industry affiliation of the contacted seller as an a priori criterion for creating a more restricted comparison group. Specifically, the comparison group for each observed request for quotation consisted of other companies with the same major, two-digit industry sector affiliation as the contacted seller at the point in time the contact occurred. Consequently, our approach led

to risk sets varying in size depending on the industry affiliations of contacted sellers and the timing of contacts.

Insert Tables 1 and 2 about here

On aggregate, our estimation sample consisted of 4,557 Italian sellers and 116,417 individual buyer-seller dyads at risk of generating a request for quotation. Tables 1 and 2 show information on the affiliations of sampled sellers and quotation requests by industry division and Italian region. Table 1 shows that sampled sellers represented nine major industry divisions and Manufacturing accounted for a large share of all quotation requests. Table 2 shows that sampled sellers were located across all of Italy—i.e., its North, Center, and South. It also shows that numbers of sellers and quotation requests were closely associated across regions, which is what one would expect by random chance alone. This underscored the need to account for such purely stochastic effects, which we achieved through a control variable (as defined below) capturing the percentage of all sellers in the online marketplace representing a seller's home region.

We estimated the likelihood that a buyer requested a quotation from a seller using rare events logistic regression models (Tomz, King, & Zeng 2003). This way, we obtained coefficients and standard errors corrected for a possible rare events bias due to the low contact rate in our estimation sample, which might introduce bias and imprecision within a standard logistic regression framework (King & Zeng 2001).

Dependent and Independent Variables

Dependent variable. The dependent variable, *Request for quotation*, was a dichotomous variable taking the value of '1' if a buyer requested a quotation from a seller and '0' otherwise.

Independent variables: institutional quality (Hs 1 and 3). We constructed a summary measure of regional institutional quality based on the two interconnected dimensions of the

quality of informal institutions as introduced in our theory: 1) regional judicial efficiency and the concomitant ease of contractual enforcement (e.g., Djankov et al. 2003; Laeven & Woodruff 2007; Moretti 2014) and 2) the regional lack of corruption and organized crime (e.g., Daniele & Marani 2011; Mauro 1995; Peri 2004). Our summary measure was composed of five different indicators drawn from three distinct data sources and we based our selection of indicators on prevailing large-scale empirical research and the availability of reliable Italian data.

First, to proxy for judicial efficiency, we collected provincial data on the average length (in days) of bankruptcy proceedings, and regional data on the average length (in days) of judicial examination proceedings for civil trials, both in first instance and in instance of appeal (e.g., Moretti 2014). We drew these indicators from ISTAT's *Territorial Information System on Justice* (ISTAT 2014a), which summarizes the indicators for the year 2000. We standardized and then inverted the indicators, by subtracting the standardized values from '1', to obtain indicators of judicial efficiency rather than inefficiency (Moretti 2014). Finally, while we obtained data on judicial examination proceedings directly at the regional level of analysis, we aggregated the provincial data on bankruptcy proceedings to the regional level by averaging standardized scores across the provinces within each of Italy's 20 regions.

Second, to proxy for the intensity of corruption and organized crime, we used measures rigorously validated in methodological studies by Calderoni (2011) and Golden and Picci (2005). As our corruption proxy, we standardized Golden and Picci's (2005: 46) corruption measure, capturing the lack of corruption (i.e., higher scores suggest lower levels of corruption) in each of Italy's 20 regions using data from the late 1990s. The intuition behind this measure is that physical quantities of public infrastructure relative to the cumulative price paid for such infrastructure can proxy for regional corruption, by quantifying the extent to which money is "siphoned off to mismanagement, fraud, bribes, kickbacks, and embezzlement" (Golden & Picci

2005: 37). As the basis for our organized crime proxy, we instead used Calderoni's (2011: 61-62) 'MIen' rank indicator, ranking Italian provinces according to a comprehensive collection of eleven measures of organized crime across 1983-2009.[8] We standardized and then inverted this indicator, by subtracting the standardized values from '1', to obtain an indicator of the lack of organized crime. Finally, we aggregated the standardized provincial indicator to the regional level by averaging scores across the provinces within each of Italy's 20 regions.

Next, we performed a factor analysis at the regional level (n = 20) to assess whether the above five indicators could be viewed as representing one underlying institutional quality construct. The Kaiser-Meyer-Olkin measure of sampling adequacy generated a value of 0.736, suggesting that factor analysis on these indicators was appropriate. The eigenvalue of the first factor was 2.560 while that of the second factor was only 0.430, well below the Kaiser criterion of 1, and so the first factor explained almost six times as much variance in the five indicators as the second. Moreover, all five indicators had their highest factor loading on the first factor. Together, these results strongly suggested that one common factor underlay the five indicators. Accordingly, in the spirit of prior studies of institutional quality (e.g., Bürker & Minerva 2014; Laeven & Woodruff 2007; Moretti 2014; Tabellini 2010), we measured institutional quality as the first principal factor of the five institutional quality indicators (Cronbach's α = 0.822), shifted such that the value for the Italian region with the lowest institutional quality equaled zero.

Insert Table 3 about here

Table 3 shows values for institutional quality by region. Convergent with received wisdom, institutional quality varied considerably across Italy, with values being highest on

[8] Though our sampling window covered 1999-2001, we were interested in persistent cross-regional variance in organized crime as ingrained in the beliefs of Italian citizens, which an aggregated indicator spanning 1983-2009 was able to capture.

average in Northern Italy, followed by Central and Southern Italy. Institutional quality also varied greatly within these three sets of regions, especially in Southern Italy (see also Gerrieri & Iammarino 2006). We attributed the institutional quality scores in Table 3 to sellers based on their home regions to obtain *Seller institutional quality*, which we used to test H1.

To test H3, we first attributed institutional quality scores to buyers based on their home regions to obtain *Buyer institutional quality*. Next, we calculated *Relative institutional quality seller* as the ratio of *Seller institutional quality* to *Buyer institutional quality*. A value of unity on this variable indicates that institutional quality in the home regions of the seller and buyer in a dyad are identical, while higher (lower) values indicate progressively higher (lower) institutional quality in a seller's home region relative to that of the buyer. Our results were robust to using the signed difference rather than ratio of sellers' and buyers' local institutional quality.

Our choice to measure institutional quality at the aggregated regional level rather than the more granular provincial level was motivated by two considerations. First, theory and evidence suggest that decision makers will at least initially strive to reduce cognitive strain and economize on search costs by relying on a relatively coarse categorization of companies within their choice sets (e.g., Gensch 1987; Jensen & Roy 2008). Second, due to Italy's longstanding internal heterogeneity in informal institutions (e.g., Dunford & Greco 2006), indigenous buyers should have a sufficiently ingrained understanding of differences in institutional quality across Italy's 20 regions (e.g., Capozza et al. 1982), which is perhaps less so across Italy's 103 provinces. Nevertheless, in a supplementary analysis we used an institutional quality measure specified at the provincial level and our results for Hs 1 and 3 were fully replicated.

Independent variables: legal status (Hs 2 and 4). Sellers in our sample reported their company names in standard marketplace profiles and under the Italian Civil Code, company names must contain an indication of the company's legal status. Therefore, legal statuses were

visible to all buyers and sellers in the marketplace. The three broad legal status categories represented in our setting were sole proprietorships, limited liability companies, and corporations. Table 4 shows the main obligations and controls governing these three types of entities, based on the Italian Civil Code and other relevant legislation applicable during 1999-2001.

Insert Table 4 about here

Consistent with our arguments, the institutionally-induced obligations and controls are clearly stronger for limited liability companies compared to sole proprietorships as well as for corporations compared to limited liability companies. However, because the three types of legal status represent qualitative categories, we cannot assume *a priori* that the differences in the strength of obligations and controls are identical between different sets of adjacent categories. Therefore, rather than measure the legal status categories on one linear scale, we measured them with two dummies, while using sellers that were sole proprietorships as the omitted category: *Seller is limited liability company*, taking the value of '1' if the seller was a limited liability company and '0' otherwise, and *Seller is corporation*, taking the value of '1' if the seller was a corporation and '0' otherwise. Full support for H2 requires both a positive coefficient on *Seller is limited liability company* and a larger coefficient on *Seller is corporation* compared to *Seller is limited liability company*.

To test H4, and keeping in mind the categorical nature of different types of legal status, we specified four dummies, while using *Same legal status* as the omitted category: *Relative legal status seller lowest*, taking the value of '1' if the seller was a sole proprietorship and the buyer a corporation and '0' otherwise; *Relative legal status seller low*, taking the value of '1' if either the seller was a sole proprietorship and the buyer a limited liability company, or the seller was a limited liability company and the buyer a corporation, and '0' otherwise; *Relative legal status*

seller high, taking the value of '1' if either the seller was a limited liability company and the buyer a sole proprietorship, or the seller was a corporation and the buyer a limited liability company, and '0' otherwise; and *Relative legal status seller highest*, taking the value of '1' if the seller was a corporation and the buyer a sole proprietorship and '0' otherwise. Support for H4 required both progressively negative coefficients on *Relative legal status seller low* and *Relative legal status seller lowest*, and progressively positive coefficients on *Relative legal status seller high* and *Relative legal status seller highest*.

Control Variables

We controlled for a number of other factors that might be associated with a buyer's propensity to request a quotation from a seller. Consistent with the measurement of sellers' legal status, we measured buyers' legal status with two dummies, while using buyers that were sole proprietorships as the omitted category: *Buyer is limited liability company*, taking the value of '1' if the buyer was a limited liability company and '0' otherwise, and *Buyer is corporation*, taking the value of '1' if the buyer was a corporation and '0' otherwise.

We controlled for value added per capita in buyer and seller home regions to proxy for the potential confounding effects of companies' regional competitiveness. For example, buyers in more competitive regions may be better informed about potential sellers, while the offerings of sellers in more affluent regions may be perceived as more attractive by buyers. Using data from ISTAT's *Territorial Indicators* database (ISTAT 2014b), *Buyer region value added per capita* captured the value added per capita (as a proportion of the Italian average) in a buyer's home region in the year 2000, while *Seller region value added per capita* captured the value added per capita (as a proportion of the Italian average) in a seller's home region in the year 2000.

Sellers in the online marketplace were distributed unevenly across Italian regions and so purely by chance, regions differed in their baseline probability to be targeted with a quotation

request (see Table 2). Specifically, regions with a greater number of sellers in the online marketplace should on aggregate be more likely to attract new business. To control for such purely stochastic effects, *Seller region marketplace representation* captured the proportion of all sellers in the marketplace located in the focal seller's home region.

Buyers may be more likely to contact sellers with whom they share common characteristics, for example, because they are more familiar with local compared to nonlocal sellers; they are more familiar with the norms governing the operations of sellers with similar social status; or because their operations have greater relatedness to sellers within their own broad industry category. We included three variables to capture any such effects. *Same region* took the value of '1' if a buyer and a seller were located in the same region and '0' otherwise. *Same legal status* took the value of '1' if a buyer and a seller had the same legal status and '0' otherwise. *Same industry* took the value of '1' if a buyer and a seller had the same industry affiliation and '0' otherwise.

To control for the broader role of geographic proximity in fostering buyer-seller contact, *Geographic distance* captured the great circle distance (i.e., 'as the crow flies') between the home locations of buyer and seller. Specifically, we first assigned the radian latitude (lat) and longitude (long) at the center of the capital of the Italian province in which they resided to both buyers and sellers. Next, we used spherical geometry to calculate the geographic distance (in km) between buyer i and seller j as follows:

$$Geographic\ distance_{ij} = r * arccos[sin(lat_i)*sin(lat_j) + cos(lat_i)*cos(lat_j)*cos(long_j - long_i)], \quad (1)$$

where r is the radius of the earth ($\approx$ 6,378 km). In an unreported supplementary analysis, we established that this great circle distance measure was largely proportionate to driving distances and driving times between pairs of Italian cities, unless one of two companies was located in Sardinia. With a control for sellers in Sardinia (as defined below), it was reasonable to assume

that the great circle distance measure accurately captured buyers' perceptions of travel distance from and to sellers. Consistent with prior tie formation studies (e.g., Hegde & Tumlinson 2014; Rider 2012; Sorenson & Stuart 2001), we logged the distance measure (+ 1) in all our models.

Prior quotation requests in focal marketplace captured the number of times a buyer had contacted a seller with a quotation request prior to that buyer and seller appearing in the risk set for the focal request for quotation. Econometrically, this endogenous occurrence dependence variable controlled for unobserved relational heterogeneity at the buyer-seller level (Heckman & Borjas 1980). *Mean value of $Y_{i,j}$ for all prior dyads with i or j* captured the mean of the dependent variable for all dyads in which buyer *i* and seller *j* appeared prior to appearing in the focal risk set (Lincoln 1984: 56-61). This autoregression variable addressed the concern that, because buyers and sellers entered the sample multiple times, the standard errors for company attributes that were constant across multiple dyads (e.g., institutional quality and legal status, our main variables) could be systematically underestimated (Kenny, Kashy, & Cook 2006). In unreported robustness checks, we instead clustered observations simultaneously by buyer and seller companies (Cameron, Gelbach, & Miller 2011; Kleinbaum, Stuart, & Tushman 2013) and found similar results. Both the autoregression variable and clustering of the standard errors would assuage the concern that unobserved company characteristics shared across multiple dyads materially affected the estimation results (Cameron & Miller 2010; Lincoln 1984).

We incorporated three variables to account more directly for stable company effects. *Buyer active* took the value of '1' if a company submitted 5% or more of all requests for quotation and '0' otherwise. This variable captured stable differences in screening behavior between more and less active buyers. Similarly, *Seller attractive* took the value of '1' if a company received 5% or more of all requests for quotation and '0' otherwise. Finally, *Seller # other buyers* captured the number of buyers, other than the buyer in the focal dyad, that contacted

the focal seller during the sampling window. Stable but otherwise uncontrolled factors, such as seller reputation or brand, would be manifest in the numbers of quotation requests and buyers a seller attracted. Therefore, with these control variables, we further reduced the concern that any such factors would systematically confound our empirical results.

All models included time, industry, and geographic location fixed effects. First, we accounted for temporal fixed effects through quarter dummies for January-March (*First quarter*), April-June (*Second quarter*), and July-September (*Third quarter*), while using October-December as the omitted category. Because our sampling window spanned the period between the fourth quarter of 1999 and July 2001, we also included *Year 2000*, a dummy capturing whether an observation occurred in the year 2000. This way, the year 1999 was accounted for through the linear combination of *Year 2000* = '0', *First quarter* = '0', *Second quarter* = '0', and *Third quarter* = '0', while the year 2001 was accounted for through the linear combination of *Year 2000* = '0' and one of *First quarter*, *Second quarter*, or *Third quarter* equal to '1'. Second, we controlled for prevalent industry affiliations through dummies for buyers and sellers in Manufacturing subdivisions SIC 20 and SIC 30 and sellers in SIC 50, SIC 51, and SIC 73, while *No buyer SIC* captured all buyers that did not record their industry affiliation in the online B2B marketplace. The two omitted categories captured all the remaining industry affiliations of buyers and sellers. Third, we included dummies for buyers in Central and Southern Italy and sellers in Central and Southern Italy. The two omitted categories captured buyers and sellers in Northern Italy. Finally, we included a dummy for sellers in Sardinia to account for the potential influence of sellers' remote island location on their attractiveness to buyers.

Descriptive Statistics

Table 5 shows summary statistics for all study variables. The average for *Prior quotation requests in focal marketplace* is 0.021. Suggesting the sparseness of the pre-existing social

structure in our setting, this average is about 5.7 times less than the 0.12 average on *Repeated ties* reported by Gulati and Gargiulo (1999: 1468) and about 2.6 times less than the 0.055 average on *Previous dyadic alliances* reported by Rosenkopf, Metiu, and George (2001: 764), both in studies of the formation of alliances between companies. It is also about 3.3 times less than the 0.07 average on *Number of prior co-investments* reported by Rider (2012: 469) in a study of the formation of co-investment relationships between companies.

Insert Tables 5 and 6 about here

Table 6 shows correlations among the key variables. Collinearity appears limited among most variables, even though variance inflation factors on *Buyer region value added per capita*, *Seller region value added per capita*, *Buyer institutional quality*, *Buyer is limited liability company*, and *Buyer is corporation* were above the rule-of-thumb threshold of ten (Kennedy 2003: 213). While a supplementary analysis excluding these five variables still fully supported all our main conclusions, to ensure that an omitted variable bias would not affect our estimates, we decided to include the full set of control variables in the reported models (Greene 2003: 58).

RESULTS

Hypothesis Tests

Table 7 shows rare events logistic regression models of the likelihood that a buyer requests a quotation from a seller. Each model in Table 7 includes a range of fixed effects for time, industries, and geographic locations; estimates for these are given in Appendix Table A1.

Insert Table 7 about here

Model 1 includes the control variables only, while Models 2-4 introduce the variables testing Hs 1 and 2, both separately and simultaneously. Models 2 and 4 support H1: the higher a

seller's local institutional quality, the more likely a buyer is to contact that seller with a request for quotation, all else equal. By Model 4, the odds of contact increase by almost 150% for each one-standard deviation increase in *Seller institutional quality* (i.e., a multiplicative factor of *exp*[1.366*0.670] = 2.497), which represents a substantial effect in real terms.

Models 3 and 4 show that a buyer is progressively more likely to contact a limited liability company or a corporation compared to a sole proprietorship, all else equal. However, a comparison of the coefficients on *Seller is limited liability company* and *Seller is corporation* shows that the difference between the two coefficients is not statistically significant (Model 3: χ^2 [1df] = 0.34, $p = 0.56$; Model 4: χ^2 [1df] = 0.33, $p = 0.56$). Therefore, buyers appear to distinguish sole proprietorships most clearly from other types of sellers, while there is less evidence to suggest that they distinguish systematically between sellers that are limited liability companies and those that are corporations. These results provide partial statistical support for H2, though the fact that the coefficients on *Seller is corporation* are consistently higher than those on *Seller is limited liability company* is generally consistent with H2. In real terms, the estimated legal status effects are substantive, as the odds of contact are about 73% higher if the seller is a limited liability company rather than a sole proprietorship (i.e., a multiplicative factor of *exp*[0.549*1] = 1.732), while they are about 98% higher if the seller is a corporation rather than a sole proprietorship (i.e., a multiplicative factor of *exp*[0.684*1] = 1.982).

Model 5 tests and supports H3: the higher a seller's institutional quality relative to a buyer, the more likely the seller is to be contacted by that buyer, all else equal. The estimate suggests that the odds of contact increase by over 190% for each one-standard deviation increase in *Relative institutional quality seller* (i.e., a multiplicative factor of *exp*[3.691*0.289] = 2.906). It is useful to illustrate this finding with a hypothetical example situated in our empirical setting. Consider a seller located in Veneto. By the result for H1, the likelihood that this seller is

contacted is independent of the buyer's own institutional quality—i.e., the buyer's reference point. However, consideration of heterogeneity in buyers' reference points (i.e., H3) adds nuance to this result. For example, if the buyer is located in Umbria, then *Relative institutional quality seller* is equal to 1.088 (i.e., 2.637/2.423; see Table 3), indicating that the seller in Veneto is above the buyer's reference point. Instead, if the buyer is located in Lombardy, then *Relative institutional quality seller* is equal to 0.966 (i.e., 2.637/2.731; see Table 3) and so the seller in Veneto is now below the buyer's reference point. It follows that the odds that the buyer in Umbria contacts the seller in Veneto are about 57% greater compared to the buyer in Lombardy (i.e., a multiplicative factor of exp[3.691*(1.088-0.966)] = 1.569). Therefore, though the likelihood of contact on average depends on the absolute level of a seller's local institutional quality (i.e., H1; Models 2 and 4), it also varies systematically and substantially with a seller's local institutional quality relative to a buyer (i.e., H3; Model 5).

Finally, Model 6 tests H4, predicting that the higher a seller's legal status relative to a buyer, the more likely the seller is to be contacted by that buyer. The coefficients on the four dummy variables capturing a seller's legal status relative to a buyer are mostly insignificant, with the exception of *Relative legal status seller lowest*, which has a negative and significant coefficient. The estimate indicates that the odds of contact between an incorporated buyer and a sole proprietorship are close to 49% lower compared to a buyer and seller with identical legal status (i.e., a multiplicative factor of exp[-0.670*1] = 0.512).[9] Moreover, though the coefficient on *Relative legal status low* is not significant versus the omitted category, it is significantly less negative than that on *Relative legal status seller lowest* (χ^2 [1df] = 10.22, p = 0.001). The two remaining dummies, capturing cases in which sellers' legal status is higher than that of buyers, are both insignificant. Therefore, except in the extreme case where an incorporated buyer faces a

[9] Note that *Same legal status* constitutes the omitted category in Model 6.

seller that is a sole proprietorship, relative legal status does not systematically condition a buyer's likelihood of contacting a seller and so the results do not support H4.

Overall, after controlling for a wide range of other factors, the likelihood that an online buyer requested a quotation from a seller in this online B2B marketplace varies systematically with sellers' local institutional quality and legal statuses. Moreover, consistent with our theory of the role of buyers' reference points in shaping signal effectiveness, the effect of sellers' local institutional quality also varies depending on the local institutional quality of buyers.

Robustness to Alternative Explanations

Industry clustering. Industry clustering has long been a prevalent feature of Italy's industrial landscape (Sforzi 2009) and prior studies would suggest that locating in an industry cluster may enhance a company's visibility, legitimacy, and survival chances (e.g., Delgado, Porter, & Stern 2010; Pouder & St. John 1996). If the presence of industry clusters in Italy was systematically associated with local institutional quality, then one might worry that industry clustering confounded the association between institutional quality in a seller's home region and the likelihood that the seller is contacted with a request for quotation online. To assess the potential confounding effect of industry clustering, we used data documenting Italian clusters drawn from ISTAT's *2001 Census of Industry and Services* (ISTAT 2001) to specify a dummy variable taking the value of '1' if a seller was located in a region with a major industry cluster in its core industry and '0' otherwise. In our sample, there was some evidence suggesting that industry clusters tended to be located in regions with higher institutional quality: sellers with a local industry cluster had an average local institutional quality of 2.249 ($\sigma = 0.759$), while that average was 2.552 ($\sigma = 0.471$) for sellers without a local industry cluster. Nevertheless, though the industry cluster dummy generated a positive and significant coefficient when included in the regression models shown in Table 7, all our main results were fully replicated.

Sellers in Lombardy. The region of Lombardy accounted for 35.97% of all sampled sellers and 39.95% of all requests for quotation (see Table 2), while at the same time scoring high on the institutional quality scale (see Table 3). Thus, one might worry that Lombardy alone drove the institutional quality effects in Table 7. However, models estimated on a restricted sample excluding all 41,105 dyads in which the seller was located in Lombardy generated results that were very similar to those shown in Table 7.

Seller size. Compared to smaller companies, larger companies may have a better-known brand, a different product offering, or they may generally be viewed as more reliable (e.g., Rider 2009: 579-580). Though seller identities were visible in the focal marketplace, company size was not directly observable to buyers. Nevertheless, to the extent larger sellers tended to be better known or if buyers made inferences about company size and perhaps product offerings based on sellers' legal statuses, such alternative mechanisms might confound our legal status results. Unfortunately, we had no access to systematic data on company size for all 4,557 sellers in the estimation sample. However, the e-procurement provider was able to provide us with annual turnover data for 2,119 sellers (i.e., 46.5%). Descriptively, among sellers for which such data were available, turnover correlated only marginally with legal status: the partial correlation between turnover and *Seller is limited liability company* was 0.005, while that between turnover and *Seller is corporation* was 0.073. Moreover, when included in the regression models shown in Table 7, seller turnover consistently failed to reach significance.[10] Importantly, all our main results were fully replicated, consistent with the argument that buyers' inference about the institutionally-induced obligations and controls acting on sellers supplies the theoretical mechanism generating the legal status association with a buyer's likelihood of requesting a quotation from a seller.

[10] All models included a dummy variable for observations with missing data (i.e., '1' if seller turnover was missing and '0' otherwise) so that the coefficient on seller turnover would not be biased.

Prior contacts. We controlled for *Prior quotation requests in focal marketplace*—i.e., the number of times a buyer had previously contacted a seller with a quotation request in the focal marketplace. To the extent buyers and sellers previously interacted *offline*, this measure underestimates the total number of prior contacts between buyers and sellers. Unfortunately, we had no data to measure prior offline interactions directly. However, empirical evidence suggests that offline intra-national trade drops steeply across regional boundaries, and across geographic distance more generally (e.g., Helliwell & Verdier 2001; Wolf 2000), and so we believe that our *Same region* and *Geographic distance* controls sufficiently absorbed meaningful variance in the presence of prior offline contacts between buyers and sellers.

Prior quotation requests in focal marketplace also underestimates the total number of prior contacts between buyers and sellers if buyers contacted sellers *online* in ways other than through a quotation request. Indeed, in our marketplace buyers were not only able to submit quotation requests; they could also submit (more informal) generic information requests to sellers. Responses to the latter might themselves provide buyers with information on the exchange risks a seller represented. Moreover, variance in the occurrence of generic information requests across pairs of companies might reflect additional unobserved relational heterogeneity not otherwise captured in our models (Heckman & Borjas 1980). To assess the potential confounding effects of such alternative explanations, we specified a variable capturing the number of times a buyer had contacted a seller with a generic information request prior to the two companies appearing in the risk set for the focal request for quotation. In our sample, the frequency of generic information requests was low, though including this variable in the models shown in Table 7 generated a positive and significant coefficient, consistent with an information acquisition mechanism as well as the presence of otherwise unobserved heterogeneity at the buyer-seller level. However, all our main results were again fully replicated.

Additional Analysis: Unbundling Institutional Quality

Our factor analysis showed that indicators of judicial efficiency and the lack of corruption and organized crime loaded onto one institutional quality factor. To provide further insights into the institutional quality results in Table 7, we also unbundled both *Buyer institutional quality* and *Seller institutional quality* to assess whether buyers focused on specific dimensions of institutional quality. In these additional analyses, *Judicial efficiency* captured the first principal factor of our inverted regional indicators of the length of bankruptcy proceedings, the length of judicial examination proceedings in first instance, and the length of judicial examination proceedings in instance of appeal, shifted such that the value for the Italian region with the lowest judicial efficiency equaled zero. *Lack of corruption and organized crime* captured the first principal factor of our regional indicators of the lack of corruption and organized crime, again shifted such that the value for the Italian region with the highest level of corruption and organized crime equaled zero. Consistent with argument and evidence suggesting that greater judicial efficiency is associated with lower levels of corruption and organized crime (Black 1983; Milhaupt & West 2000; Tanzi 1995; Varese 2001), *Judicial efficiency* and *Lack of corruption and organized crime* correlated positively in our estimation sample (i.e., $r = 0.563$).

In support of H1, we found that the higher a seller's local judicial efficiency, the more likely that seller was to be contacted with a request for quotation, all else equal. Moreover, the higher a seller's local judicial efficiency compared to a buyer, the more likely the buyer was to contact that seller with a request for quotation, which is consistent with H3. Instead, the lack of corruption and organized crime in a seller's home location, either by itself or relative to a buyer, showed no significant effects and so the institutional quality effects in Table 7 appear to be driven mostly by variance in local judicial efficiency. Across all these models, the results on a seller's legal status were largely identical to those shown in Table 7, consistent with H2.

DISCUSSION

The increasing prevalence and importance of online commerce has directed scholarly attention to understanding the mechanisms through which buyers select sellers in online markets. We contribute to this line of inquiry by presenting one among relatively few studies focusing specifically on contact initiation in online B2B marketplaces. Theoretically, we integrated an institutional perspective with signaling theory to begin to incorporate the signaling role of offline institutions into the analysis of buyer-seller contact dynamics in online B2B marketplaces. Empirically, we examined a large Italian online B2B marketplace during 1999-2001 and found that over and above various other sources of seller differentiation, the offline institution-based signals conveyed online by sellers' geographic locations and legal statuses systematically conditioned a buyer's likelihood of contacting a seller.

We theorized and found that buyers are more likely to contact a seller in an online B2B marketplace when the quality of a seller's informal institutional environment is higher and when the obligations and controls associated with the seller's legal status are stronger. To achieve a more complete account of buyer decision making, we also examined how the effects of these offline institution-based signals might vary across buyers. Specifically, we found that a buyer is more likely to contact a seller online the higher the seller's local institutional quality relative to the buyer. Buyers thus appear to interpret a seller's institutional quality signal relative to a buyer-specific reference point, and not only in terms of the absolute strength of the signal, and so the consequences of one and the same signal may vary across different buyer-seller pairs. This finding expands signaling research, whose predominantly signaler-centric focus has tended to remain agnostic on relevant heterogeneity across signal recipients and, by implication, on differences in signal effectiveness across pairs of companies (e.g., Connelly, Certo, Ireland, & Reutzel 2011: 62; Kim & Jensen 2014). Our theory and evidence on buyers' reference points also

complement research on the role of reference points in the purchasing process (e.g., Puto 1987, Qualls & Puto 1989; Thaler 1985), by suggesting a buyer's local institutional quality as a relevant but previously unexamined reference point.

Prior studies of seller selection in online markets have mostly examined the risk-reduction potential associated with seller brand (e.g., Lee et al. 2007; Smith & Brynjolfsson 2001) and online reputation or certification systems (e.g., Dellarocas 2003; Pavlou & Gefen 2004), while generally taking for granted that sellers are aware that such mechanisms convey meaningful signals to online buyers. In contrast, our account suggests that sellers in online markets may send consequential signals even without being aware of it (e.g., Connelly et al. 2011), as they become differentiated online as a perhaps unintended by-product of their offline geographic locations and legal statuses. Therefore, even though online environments cannot be fully equated to more traditional contexts (e.g., Porter 2001), offline company characteristics like geographic location and legal status can have previously unexplored implications for understanding which sellers are ultimately more likely to attract business online. Our study thus implies that these offline seller characteristics may be important for understanding competitive heterogeneity even in online B2B marketplaces. Moreover, because we examined online buyers submitting quotation requests rather than actual orders, a related implication is that offline institution-based signals help explain how segmentation in online B2B marketplaces may arise for sellers even before pricing information is disclosed. In particular, based on their geographic location and legal status, some sellers may be intrinsically more likely than others *even to be considered* for an order.

Though we examined buyers' selection of sellers in the specific setting of an Italian online B2B marketplace during 1999-2001, several considerations foreshadow that the implications of our study hold relevance for online B2B marketplaces more generally. For example, the majority of online markets transcend heterogeneous geographical areas and so local

institutional quality is likely to be a prevalent consideration. Moreover, in a supplementary analysis, we found that the vast majority of 38 other marketplaces (1999-2014) consisted of at least hundreds of registered sellers. Therefore, the information asymmetries faced by the buyers in our study are not atypical when compared to a large number of other marketplaces. Finally, we also found that several key marketplace indicators for 16 other marketplaces (2000-2014), such as shares of active buyers in all registered buyers, marketplace activity per active buyer, and percentages of quotation requests eventually converted to purchasing orders, were generally in line with those for the marketplace we studied. Overall, based on this supplementary evidence, the conclusions drawn within our empirical setting appear generalizable to a greater variety of online B2B marketplaces.

Beyond contributing to signaling research and the understanding of competitive heterogeneity and market segmentation in online B2B marketplaces, our study also contributes to a broader literature on exchange risks in interorganizational tie formation. In this literature, studies have tended to focus on how companies originate their relationships endogenously, by embedding them in pre-existing social structures that shape expectations about the future behaviors of potential exchange partners (e.g., Chung, Sing, & Lee 2000; Gulati & Gargiulo 1999; Podolny 1994; Rider 2012). However, pre-existing social structures in markets like ours tend to be sparse, and in many cases absent, and so the endogenous approach to tie formation faces limitations in fully accounting for the reduction of exchange risks and, eventually, the formation of relationships in such markets. Complementing a focus on the endogenous consequences of exchange relationships for future tie formation, we offer a novel theory and empirical analysis of some exogenous, institution-based antecedents of exchange relationships that do not require companies to be connected through a pre-existing social structure (e.g., Ahuja, Soda, & Zaheer 2012; Hallen 2008). Our study thus illuminates how institution-based signals can

exogenously promote and constrain the formation of exchange relationships and, by implication, any potential endogenous dynamics that such relationships may subsequently induce.

Opportunities exist to extend our research as well as address some of its limitations. First, some limitations stem from our data, which despite important strengths do not (completely) cover company sizes and order types. In a supplementary analysis we found no evidence to suggest that seller size directly confounded our empirical results (see the 'Robustness to Alternative Explanations' subsection). Nevertheless, with appropriate data, future studies could more integrally examine the importance of mechanisms related to company size relative to the institution-based signals we examined. Moreover, though we focused on the average effects of offline institution-based signals across quotation requests for perhaps heterogeneous orders, it is conceivable that buyers' attention to exchange risks may differ across order types. Thus, it appears valuable to investigate how transaction-specific characteristics (e.g., order quantity) may moderate the institution-based signaling effects we examined in this study.

Moreover, data limitations precluded specification of finer-grained measures for relative legal status, which might have limited the potential explanatory power of our empirical test of H4.[11] We did find that compared to buyer-seller pairs of equal legal status, high-legal status buyers were significantly less likely to contact low-legal status sellers, while low-legal status buyers were no more of less likely to contact high-legal status sellers. This asymmetric effect is consistent with the idea that legal status differences may be perceived much more clearly by buyers that have a high rather than low legal status (e.g., Alexander 1972; De Soto & Bosley 1962; Wegener 1992). Nevertheless, the specific mechanisms driving such potentially asymmetric reference point effects merit further consideration in future research, while more granular measurement of relative legal status differentials also appears valuable.

[11] We thank an anonymous reviewer for highlighting this issue as one possible interpretation for our results on H4.

Second, we studied institutional quality and legal status signals conveyed to online buyers by two offline seller characteristics, i.e., geographic location and legal status. We chose to focus on these characteristics because they are among the very few salient offline seller characteristics that are widely observable in online B2B marketplaces. At the same time, geographic locations may convey signals other than the quality of informal institutions. For example, consistent with findings in offline settings (e.g., Yu, Beugelsdijk, & de Haan 2015), it is conceivable that formal institutions (i.e., prevailing rules and regulations) also have signaling value online, both in countries where formal institutions vary by region or state and in markets that transcend national borders. Though the specific case of Italy around the turn of the century effectively allowed us to rule out variance in formal institutions, future research is needed to examine the transaction-level implications of formal institutions in online B2B marketplaces. More broadly, offline seller characteristics other than geographic location and legal status do exist and may be relevant as well. For example, in their marketplace profiles sellers could signal memberships of prominent industry associations (e.g., Laband 1986) or affiliations to prominent partners (e.g., Stuart, Hoang, & Hybels 1999), both which may convey credible signals to buyers, especially if such characteristics are hard to imitate for less reliable companies (e.g., Negro et al. 2014; Spence 1974). Future studies of online markets could examine the potential signaling effectiveness of these and other alternative offline seller characteristics.

Finally, though our theory and empirical analysis have remained agnostic regarding whether or not buyers systematically combine individual signals in deciding which sellers to contact, interesting questions arise as to whether and how different signals are meaningfully combined by a receiver of multiple signals (Connelly et al. 2011: 60-61). In a supplementary analysis, which we do not report in full to conserve space, we found that a seller's local institutional quality and the obligations and controls associated with the seller's legal status were

strong substitutes in their impact on a buyer's likelihood of contacting a particular seller. This finding foreshadows that the study of individual signals can be usefully complemented with a focus on possible interactions among them. For example, future research on online B2B marketplaces could ask how buyers combine information conveyed by factors such as a seller's brand, online reputation and certification systems, the pricing of products and services, and the offline institution-based signals as examined in this article. We hasten to emphasize that given potential differences in the nature of alternative signals and settings, signals might in some cases operate as substitutes (e.g., Ozmel, Reuer, & Gulati 2013), like the two signals in our specific setting, while acting as complements in others (e.g., Plummer, Allison, & Connelly 2015). We encourage future signaling research that carefully develops and tests the potentially divergent mechanisms through which signal recipients may combine multiple signals.

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TABLE 1
Affiliations of Sampled Sellers and Quotation Requests by Industry Division

Industry division	SIC	Affiliated sellers	% of all sellers	Quotation requests	% of all quotation requests
Agriculture, forestry, and fishing	01-09	27	0.59	1	0.23
Mining	10-14	12	0.26	12	2.74
Construction	15-17	93	2.04	1	0.23
Manufacturing	20-39	2,250	49.37	263	60.05
Transportation, communications, electric, gas, and sanitary services	40-49	75	1.65	22	5.02
Wholesale trade	50-51	676	14.83	64	14.61
Retail trade	52-59	124	2.72	14	3.20
Services	70-89	1,275	27.98	59	13.47
Public Administration	91-99	25	0.55	2	0.46
Total across industry divisions:		4,557	100.00	438	100.00

TABLE 2
Affiliations of Sampled Sellers and Quotation Requests by Italian Region[a]

Region	Affiliated sellers	% of all sellers	Quotation requests	% of all quotation requests
Northern Italy:	*3,022*	*66.33*	*277*	*63.23*
Aosta Valley	3	0.07	0	0.00
Emilia-Romagna	347	7.61	25	5.71
Friuli-Venezia Giulia	105	2.30	10	2.28
Liguria	50	1.10	3	0.68
Lombardy	1,639	35.97	175	39.95
Piedmont	281	6.17	20	4.57
Trentino-Alto Adige/Südtirol	44	0.97	3	0.68
Veneto	553	12.14	41	9.36
Central Italy:	*757*	*16.61*	*90*	*20.54*
Lazio	390	8.56	46	10.50
Marche	91	2.00	5	1.14
Tuscany	243	5.33	35	7.99
Umbria	33	0.72	4	0.91
Southern Italy:	*778*	*17.08*	*71*	*16.21*
Abruzzo	60	1.32	4	0.91
Apulia	170	3.73	4	0.91
Basilicata	11	0.24	0	0.00
Calabria	34	0.75	1	0.23
Campania	322	7.07	53	12.10
Molise	4	0.09	1	0.23
Sardinia	28	0.61	1	0.23
Sicily	149	3.27	7	1.60
Total across regions:	4,557	100.00	438	100.00

a. Regions are listed alphabetically within Northern, Central, and Southern Italy.

TABLE 3
Values for Institutional Quality by Italian Region[a]

	Institutional quality
Northern Italy:	$\mu = 2.718$ $\sigma = 0.353$
Piedmont	3.145
Trentino-Alto Adige/Südtirol	3.102
Friuli-Venezia Giulia	2.948
Lombardy	2.731
Emilia-Romagna	2.727
Veneto	2.637
Aosta Valley	2.252
Liguria	2.204
Central Italy:	$\mu = 2.250$ $\sigma = 0.221$
Umbria	2.423
Tuscany	2.389
Marche	2.251
Lazio	1.938
Southern Italy:	$\mu = 0.912$ $\sigma = 0.540$
Sardinia	1.486
Abruzzo	1.460
Molise	1.252
Campania	1.209
Apulia	0.925
Sicily	0.540
Basilicata	0.423
Calabria	0.000

a. Regions are listed in descending order of institutional quality within Northern, Central, and Southern Italy.

TABLE 4
Obligations and Controls by Legal Status in Italy[a]

Sole proprietorship	Limited liability company	Corporation
Must register with the local Chamber of Commerce obtaining VAT number if exercising commercial activities [2195]	Must draft Articles of Association [2475] and register them in the Italian Company Register with the local Chamber of Commerce [2475, par. 2]. The process usually involves attorneys and consultants.	Must draft Articles of Association [2328] and register them, including by-laws, in the Italian Company Register with the local Chamber of Commerce [2330]. The process usually involves attorneys and consultants.
Must file income statement directly through personal tax return	Must draft the annual financial statement, an official document that must be registered and published at the Italian Company Register [2493]	Must draft the annual financial statement, an official document that must be registered and published at the Italian Company Register [2435]
	Notary public required: the incorporation of the company must be by means of public deed [2475]	Notary public required: the incorporation of the company must be by means of public deed [2328]
	Must in some cases appoint a Board of Statutory Auditors (e.g., if the Articles of Association so require it or if the company's capital exceeds 200 million Italian lire) [2488]	Must appoint a Board of Statutory Auditors [2397]
	Must hold and document meetings of the Board of Directors, the Board of Statutory Auditors (if appointed), and Quotaholders [2490]	Must hold and document meetings of the Board of Directors, the Board of Statutory Auditors, and Shareholders [2421]
	Requires starting capital of no less than 20 million Italian lire (i.e., just over €10,000) [2474]	Requires starting capital of no less than 200 million Italian lire (i.e., just over €100,000) [2327]
		Listed corporations are subject to the *Testo Unico della Finanza*, a detailed and strict set of rules, especially concerning financial operations, which must be communicated to the public
		Listed corporations are subject to the control of the *Commissione Nazionale per le Società e la Borsa*, the Italian Financial Market Authority, which verifies and controls their activities
		Listed corporations must be audited by an external auditor

a. The table is based on the Italian Civil Code and other relevant legislation as effective during 1999-2001. Numbers shown in square brackets refer to Articles in Book V of the version of the Italian Civil Code applicable during that period.

TABLE 5
Descriptive Statistics for Estimation Sample (n = 116,417)

Variable	Mean	S.D.	Min.	Max.
Request for quotation	0.0038	0.061	0	1
Buyer institutional quality	2.676	0.203	1.209	3.144
Buyer is limited liability company	0.119	0.324	0	1
Buyer is corporation	0.856	0.351	0	1
Buyer active	0.603	0.489	0	1
Buyer region value added per capita	1.274	0.100	0.622	1.330
Seller institutional quality	2.377	0.670	0	3.144
Seller is limited liability company	0.509	0.500	0	1
Seller is corporation	0.310	0.462	0	1
Seller attractive	0.001	0.033	0	1
Seller # other buyers	0.008	0.136	0	4
Seller region value added per capita	1.150	0.233	0.616	1.330
Seller region marketplace representation	0.172	0.142	0.001	0.360
Relative institutional quality seller	0.898	0.289	0	2.602
Relative legal status seller lowest	0.154	0.361	0	1
Relative legal status seller low	0.458	0.498	0	1
Relative legal status seller high	0.047	0.211	0	1
Relative legal status seller highest	0.008	0.087	0	1
Same region	0.221	0.415	0	1
Same legal status	0.334	0.472	0	1
Same industry	0.168	0.374	0	1
Geographic distance	4.969	1.420	0	7.003
Prior quotation requests in focal marketplace	0.021	0.555	0	29
Mean value of $Y_{i,j}$ for all prior dyads with i or j	0.002	0.013	0	0.501
First quarter	0.323	0.468	0	1
Second quarter	0.140	0.347	0	1
Third quarter	0.036	0.187	0	1
Year 2000	0.941	0.235	0	1
Buyer in SIC20	0.161	0.367	0	1
Buyer in SIC30	0.563	0.496	0	1
No buyer SIC	0.149	0.356	0	1
Seller in SIC20	0.367	0.482	0	1
Seller in SIC30	0.295	0.456	0	1
Seller in SIC50	0.074	0.262	0	1
Seller in SIC51	0.039	0.195	0	1
Seller in SIC73	0.210	0.407	0	1
Buyer in Central Italy	0.026	0.160	0	1
Buyer in Southern Italy	0.016	0.126	0	1
Seller in Central Italy	0.168	0.374	0	1
Seller in Southern Italy	0.158	0.365	0	1
Seller in Sardinia	0.004	0.060	0	1

TABLE 6
Pairwise Correlations (n = 116,417)[a]

	Variable	1	2	3	4	5	6	7	8	9	10	11	12
1.	Request for quotation												
2.	Buyer institutional quality	0.01											
3.	Buyer is limited liability company	0.00	0.06										
4.	Buyer is corporation	0.00	0.28	-0.90									
5.	Buyer active	0.02	0.32	-0.19	0.26								
6.	Buyer region value added per capita	0.01	0.86	0.06	0.25	0.51							
7.	Seller institutional quality	0.00	0.02	0.01	0.00	0.00	0.01						
8.	Seller is limited liability company	0.00	0.02	0.01	0.00	0.02	0.02	-0.03					
9.	Seller is corporation	0.00	-0.02	-0.01	0.01	-0.01	-0.02	0.19	-0.68				
10.	Seller attractive	0.25	0.00	-0.01	0.01	0.02	0.01	0.00	-0.03	0.01			
11.	Seller # other buyers	0.09	0.00	0.00	-0.01	-0.01	0.00	0.03	0.00	0.02	0.00		
12.	Seller region value added per capita	0.00	0.01	0.01	0.00	0.00	0.00	0.86	-0.01	0.18	0.02	0.03	
13.	Seller region marketplace representation	0.01	0.02	0.01	0.00	0.01	0.01	0.44	-0.04	0.14	0.02	0.03	0.63
14.	Relative institutional quality seller	0.00	-0.45	-0.01	-0.15	-0.12	-0.40	0.87	-0.03	0.18	0.00	0.03	0.75
15.	Relative legal status seller lowest	0.00	0.05	-0.16	0.17	0.05	0.04	-0.18	-0.43	-0.29	0.03	-0.02	-0.19
16.	Relative legal status seller low	0.00	0.11	-0.20	0.25	0.08	0.11	-0.04	0.81	-0.62	-0.03	0.00	-0.03
17.	Relative legal status seller high	0.00	-0.24	0.43	-0.54	-0.15	-0.20	0.04	-0.11	0.21	-0.01	0.02	0.04
18.	Relative legal status seller highest	0.00	-0.47	-0.03	-0.21	-0.11	-0.42	0.02	-0.09	0.13	0.00	0.00	0.02
19.	Same region	0.01	0.08	-0.02	0.03	0.11	0.15	0.26	-0.01	0.07	0.01	0.03	0.35
20.	Same legal status	0.00	0.04	0.14	-0.11	-0.04	0.02	0.16	-0.46	0.75	0.01	0.01	0.15
21.	Same industry	0.04	0.08	-0.03	0.00	0.05	0.06	0.03	-0.02	0.02	-0.01	0.00	0.03
22.	Geographic distance	-0.02	-0.09	0.02	-0.05	-0.05	-0.10	-0.49	0.03	-0.11	-0.04	-0.04	-0.52
23.	Prior quotation requests in focal marketplace	0.29	0.01	-0.01	0.01	0.03	0.02	-0.02	-0.01	0.00	0.65	0.02	-0.01
24.	Mean value of $Y_{i,j}$ for all prior dyads with i or j	0.29	0.02	0.00	0.00	0.04	0.03	0.00	-0.01	0.01	0.65	0.24	0.01

	Variable	13	14	15	16	17	18	19	20	21	22	23
13.	Seller region marketplace representation											
14.	Relative institutional quality seller	0.38										
15.	Relative legal status seller lowest	-0.11	-0.18									
16.	Relative legal status seller low	-0.04	-0.09	-0.39								
17.	Relative legal status seller high	0.03	0.15	-0.09	-0.20							
18.	Relative legal status seller highest	0.01	0.28	-0.04	-0.08	-0.02						
19.	Same region	0.46	0.19	-0.06	-0.01	0.00	-0.03					
20.	Same legal status	0.11	0.11	-0.30	-0.65	-0.16	-0.06	0.06				
21.	Same industry	0.02	0.00	0.00	-0.02	0.01	0.02	-0.06	0.02			
22.	Geographic distance	-0.41	-0.37	0.07	0.02	0.01	0.06	-0.66	-0.09	-0.01		
23.	Prior quotation requests in focal marketplace	0.01	-0.02	0.02	-0.01	0.00	0.00	0.02	0.00	-0.01	-0.03	
24.	Mean value of $Y_{i,j}$ for all prior dyads with i or j	0.03	-0.01	0.01	-0.02	0.00	0.00	0.02	0.01	0.03	-0.04	0.62

a. Though time, industry, and geographic location fixed effects are included in the multivariate analysis, we omitted them from the correlation table.

TABLE 7
Rare Events Logistic Regression Models of the Likelihood That a Buyer Requests a Quotation from a Seller (n = 116,417)[a]

	1	2	3	4	5	6
Buyer institutional quality	2.490	2.233	2.772	2.516		1.165
	[3.593]	[3.572]	[3.525]	[3.495]		[3.311]
Buyer is limited liability company	0.676	0.688	0.652	0.671	0.735	
	[0.738]	[0.751]	[0.727]	[0.745]	[0.739]	
Buyer is corporation	1.035	1.045	0.939	0.953	0.933	
	[0.756]	[0.768]	[0.736]	[0.752]	[0.747]	
Buyer active	-0.110	-0.101	-0.106	-0.097	-0.010	0.066
	[0.266]	[0.266]	[0.267]	[0.267]	[0.243]	[0.251]
Buyer region value added per capita	9.763***	9.588***	9.559***	9.298**	11.016***	8.830**
	[2.886]	[2.902]	[2.856]	[2.873]	[2.897]	[2.937]
Seller attractive	-0.568	-0.403	-0.230	-0.028	-0.027	-0.018
	[0.619]	[0.613]	[0.636]	[0.631]	[0.629]	[0.616]
Seller # other buyers	0.851***	0.904***	0.836***	0.893***	0.891***	0.885***
	[0.129]	[0.131]	[0.129]	[0.131]	[0.132]	[0.134]
Seller region value added per capita	0.370	-0.066	-0.008	-0.520	-0.527	-0.403
	[0.928]	[0.810]	[0.964]	[0.848]	[0.848]	[0.842]
Seller region marketplace representation	1.272	1.788*	1.529*	2.124**	2.144**	2.141**
	[0.719]	[0.720]	[0.743]	[0.757]	[0.759]	[0.756]
Same region	-0.044	0.036	-0.063	0.025	0.014	0.083
	[0.208]	[0.211]	[0.211]	[0.216]	[0.215]	[0.213]
Same legal status	0.232	0.247	-0.001	0.006	0.013	
	[0.136]	[0.136]	[0.223]	[0.224]	[0.224]	
Same industry	1.063***	1.084***	1.058***	1.077***	1.107***	1.036***
	[0.150]	[0.151]	[0.150]	[0.151]	[0.151]	[0.148]
Geographic distance	-0.172**	-0.158**	-0.188**	-0.174**	-0.179**	-0.159**
	[0.059]	[0.059]	[0.059]	[0.059]	[0.060]	[0.059]
Prior quotation requests in focal marketplace	0.104***	0.102***	0.101***	0.098***	0.097***	0.098***
	[0.026]	[0.026]	[0.026]	[0.025]	[0.025]	[0.025]
Mean value of $Y_{i,j}$ for all prior dyads with i or j	10.649***	10.512***	10.228***	10.039***	10.038***	10.133***
	[1.685]	[1.671]	[1.698]	[1.684]	[1.684]	[1.647]
H1: Seller institutional quality		1.292***		1.366***		1.376***
		[0.327]		[0.334]		[0.331]
H2: Seller is limited liability company			0.507**	0.549**	0.532**	
			[0.188]	[0.192]	[0.192]	
H2: Seller is corporation			0.645*	0.684*	0.667*	
			[0.295]	[0.298]	[0.298]	
H3: Relative institutional quality seller					3.691***	
					[0.870]	
H4: Relative legal status seller lowest						-0.670**
						[0.225]
H4: Relative legal status seller low						-0.039
						[0.140]
H4: Relative legal status seller high						-0.355
						[0.376]
H4: Relative legal status seller highest						-0.400
						[1.162]
Constant	-22.387*	-24.739**	-22.727*	-25.140**	-20.513***	-19.812*
	[9.493]	[9.538]	[9.462]	[9.491]	[4.425]	[8.478]
Log likelihood	-1,391.30	-1,383.73	-1,385.87	-1,377.53	-1,377.39	-1,379.92
Pseudo R-squared	0.517	0.520	0.519	0.522	0.522	0.521

Robust standard errors in brackets; *** p<0.001, ** p<0.01, * p<0.05. All tests are two-tailed.

a. Table A1 in the Appendix shows estimates of the time, industry, and geographic location fixed effects included in all models.

APPENDIX

TABLE A1
Time, Industry, and Geographic Location Fixed Effects for Rare Events Logistic Regression Models in Table 7

	1	2	3	4	5	6
First quarter	1.053***	1.076***	1.105***	1.138***	1.133***	1.122***
	[0.246]	[0.249]	[0.249]	[0.253]	[0.254]	[0.252]
Second quarter	2.675***	2.702***	2.757***	2.796***	2.814***	2.761***
	[0.401]	[0.404]	[0.407]	[0.412]	[0.414]	[0.408]
Third quarter	4.986***	5.031***	5.020***	5.074***	5.084***	5.074***
	[0.356]	[0.362]	[0.360]	[0.367]	[0.369]	[0.366]
Year 2000	-5.031***	-5.059***	-5.040***	-5.072***	-5.090***	-5.058***
	[0.242]	[0.246]	[0.243]	[0.246]	[0.248]	[0.244]
Buyer in SIC20	0.735*	0.723*	0.757*	0.747*	0.780*	0.801*
	[0.312]	[0.312]	[0.312]	[0.311]	[0.312]	[0.320]
Buyer in SIC30	-0.816**	-0.826**	-0.792**	-0.799**	-0.818**	-0.729*
	[0.304]	[0.302]	[0.303]	[0.301]	[0.303]	[0.307]
No buyer SIC	0.101	0.098	0.117	0.114	0.133	0.167
	[0.405]	[0.402]	[0.404]	[0.401]	[0.394]	[0.398]
Seller in SIC20	-3.090***	-3.083***	-3.100***	-3.094***	-3.122***	-2.991***
	[0.306]	[0.308]	[0.307]	[0.311]	[0.313]	[0.315]
Seller in SIC30	-2.628***	-2.613***	-2.670***	-2.651***	-2.654***	-2.561***
	[0.286]	[0.287]	[0.286]	[0.288]	[0.290]	[0.292]
Seller in SIC50	-2.059***	-2.029***	-2.083***	-2.057***	-2.059***	-1.977***
	[0.319]	[0.321]	[0.322]	[0.324]	[0.325]	[0.330]
Seller in SIC51	-2.891***	-2.722***	-3.046***	-2.877***	-2.874***	-2.754***
	[0.398]	[0.387]	[0.418]	[0.405]	[0.403]	[0.408]
Seller in SIC73	-2.465***	-2.450***	-2.533***	-2.525***	-2.526***	-2.486***
	[0.287]	[0.287]	[0.289]	[0.291]	[0.293]	[0.291]
Buyer in Central Italy	1.020	0.897	1.172	1.051	-0.191	0.502
	[1.195]	[1.188]	[1.171]	[1.160]	[0.466]	[1.085]
Buyer in Southern Italy	10.241	9.716	10.528*	9.960	3.262	6.824
	[5.319]	[5.283]	[5.274]	[5.229]	[2.375]	[4.675]
Seller in Central Italy	0.810***	1.592***	0.841***	1.678***	1.683***	1.680***
	[0.197]	[0.295]	[0.201]	[0.308]	[0.307]	[0.304]
Seller in Southern Italy	0.563	2.526***	0.532	2.597***	2.606***	2.642***
	[0.518]	[0.706]	[0.519]	[0.707]	[0.698]	[0.704]
Seller in Sardinia	0.154	-0.301	0.189	-0.288	-0.328	-0.260
	[1.013]	[1.018]	[0.944]	[0.945]	[0.961]	[0.878]

Robust standard errors in brackets; *** p<0.001, ** p<0.01, * p<0.05. All tests are two-tailed.

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