

EXECUTIVE SUMMARY

for

Decisions under Uncertainty in Decentralized Online Markets: Empirical Studies of Peer-To-Peer Lending and Outsourcing

by

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Doctoral Dissertation Defended on
November 18th, 2010

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Acknowledgement:

I thank the Ewing Kauffman Foundation for the generous financial support through the Dissertation Fellowship program. All errors remain my own.

ABSTRACT

Online markets create exciting new opportunities for entrepreneurs to obtain resources, or provide products and services. They also, however, present unique challenges unseen in traditional commerce. My dissertation comprises three empirical studies of how transactional ties are formed under asymmetric information in these markets. The first two essays show how online social networks and offline geography affect investor decisions, respectively, in online peer-to-peer lending. The third essay shows how technology-enabled monitoring allows outsourcing clients to substitute historical, second-hand “reputation”, with their first-hand interaction with the seller, mitigating the Matthew Effect (“rich get richer”) of online feedback systems. I further discuss theoretical, practical and policy implications of these findings.

My dissertation includes three empirical studies of decentralized online markets, with an emphasis on how small players form transactional ties under asymmetric information. In Essay 1, I investigate the role of online social networks in mitigating information asymmetry in online peer-to-peer lending, and find that relational dimensions of these networks are especially effective for this purpose. Essay 2 exploits a natural experiment in the same marketplace to study the effect of shared geographical ties on investor decisions, and find that “home bias” is not only robust but also has an interesting interaction pattern with rational decision criteria. In Essay 3, I study how technology-enabled contract monitoring allows buyers to substitute historical, second-hand information in online reputation systems, with their first-hand interaction with the seller, thereby mitigating the Matthew Effect (“rich get richer”) in online feedback systems. These three essays present new empirical evidence of how agents leverage various network ties, signals and incentives to facilitate transactions in decentralized online markets, form transactional ties, and reap the benefits enabled by the transformative power of information technologies.

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Developments in information technologies, especially Internet and Web2.0 technologies, have not only reduced the costs of communication but also created new mechanisms for individuals and firms to interact with each other. One of the most salient changes is the emergence of Internet-based, highly decentralized marketplaces populated with large numbers of small participants. Without the Internet, these atomistic individuals are likely to find the transaction costs prohibitively high, so they either choose not to enter the market at all, or enter via intermediaries. By reducing the fixed cost of business transactions, the Internet has significantly changed this landscape. A “long tail” now exists not only in product variety, but also in the number of buyers and sellers of goods and services. On the other hand, while more opportunities for trade are likely to increase social welfare, the growing number of suppliers and buyers inevitably increases the costs of effectively matching them. Information asymmetry problems that plague traditional markets still exist in these nascent marketplaces – only to be exacerbated by the anonymity and small-stake nature of individual transactions. A better understanding of the matching process in this marketplace has implications for academic researchers, policymakers, as well as entrepreneurs who seek to leverage the power of these online markets.

With this as the background, I set out to empirically study how individuals in these markets make decisions under uncertainty to form transactional ties. Two emerging industries serve as the contexts for my research. The first one is online peer-to-peer lending, where individual lenders make unsecured loans to borrowers. This market has experienced significant growth worldwide in the past few years. Data from Prosper.com, one of the largest peer-to-peer lending websites in the United States, is used for the first two essays. The second one is online software outsourcing, where buyers and sellers of customized software from around the world can transact with each other via the

Internet. Proprietary data from a leading online software-outsourcing marketplace are used in the third essay. Both contexts present degrees of asymmetric information that are significantly higher than online product markets such as eBay, due to the nature of financial products (Essays 1 and 2) and software development contracts (Essay 3).

The first essay in my dissertation specifically addresses the role of online social networks in addressing adverse selection in financial lending. I seek to link social network metrics to loan-level transactional outcomes, distinguishing between structural and relational aspects of the network. I emphasize the different identities, roles and actions of a borrower's friends, and whether a particular dimension of social networks can serve as an effective mechanism to mitigate information asymmetry. I test and find that *online* social networks serve as "prisms" that help signal the credibility of a borrower to those outside the network. More importantly, the more verifiable these ties are, the more strongly they are associated with the ex-post riskiness of the loan. This effect survives a large number of robustness tests, such as the inclusion of contents of loan descriptions, and images used in the loan request. Online social networks indeed can help mitigate asymmetric information and improve transaction efficiency in online peer-to-peer lending.

The second essay delves further into the networks on Prosper.com to study the dyadic relationship among market participants. Drawing on theories of homophily and home bias, I investigate whether investors are more likely to invest in borrowers from their home state. To address this question, I exploit a natural experiment on Prosper.com where lenders were constrained to one state, while borrowers came from almost all states. The start and end of the 10-day window were also largely unexpected. These unique features allow me to circumvent many empirical analysis issues in prior studies, such as endogeneity, strenuous data reduction, and specialized statistical methods. I find that even though this is an online marketplace, investors are still more

likely to bid on loan requests from same-state borrowers; however, such benefit only accrues to borrowers with good credit grades. In fact, there is a bias *against* less creditworthy borrowers from the home state of investors. I further show that the economic distance between borrower and lender states has a stronger effect on the decision of lenders than the spatial distance. These results represent very conservative evidence of home bias, and how shared-geographical ties between borrowers and lenders affect lender behavior.

The third essay uses data from the emergent online market for software outsourcing, where software buyers and sellers (developers) from around the world participate in a decentralized online marketplace. The development in technologies allows buyers in such online labor markets to effectively monitor the effort level of sellers, making it possible for buyers and sellers to enter pay-for-time contracts. I study how the change in contract formats – pay-for-time contracts versus pay-for-deliverable contracts – affect how buyers interpret different signals from sellers, and choose the seller to work with. I focus on two signals that the literature has shown to be effective signals in online markets: online reputation and certifications. Data used in this study include comprehensive information about all developers who compete for buyers' contracts, including those who lost in the auctions. While the literature typically holds that the online reputation system has a strong influence on individual choice in e-commerce, in this context, I find that it is only under pay-for-deliverable (PFD) contracts that higher reputations lead to better chances of winning a contract. When the contract format is changed to pay-for-time (PFT), buyers are more likely to take risk, giving new entrants (sellers) more opportunities to grow. In other words, changes in the contract mechanism can help reduce market concentration and increase competition. On the other hand, certifications do not have statistically significant impact on buyers' choice under either contract forms. I further conduct exploratory textual analysis of the private communication between buyers and developers. Results

show that different categories of information have different impact on buyers' choice under different contract mechanisms. Whereas prior empirical studies of outsourcing were often restricted to buyer-seller dyads that were ultimately in the contract, this dataset provides insights into the choice process of outsourcing clients. Most importantly, results in this essay show that as technology enables new contracting forms, the "Matthew Effect" in online reputation systems can be mitigated, as buyers substitute second-hand information from other buyers with first-hand information gathered through their own interaction with sellers. This in turn allows a lower "barrier to entry" for market participants, since newer and smaller software developers will have a better chance of obtaining business. Better competition will further enhance overall social welfare.

Overall, the three essays of my dissertation investigate two industries where the development of information technologies has not only significantly changed the relationship between trading partners, but also enable new mechanisms that allow efficient matching. These studies contribute to the literature and practice in the following ways.

First, the three studies of my dissertation provide rich empirical evidence on how transactional ties in decentralized online markets are formed. These transactional ties can be borrowing and lending, or software development. Essay 1 focuses on the role of online social networks in this process; Essay 2 emphasizes the role of shared demographic information (geography); and Essay 3 examines the moderating effect of contract mechanism on the relation between various signals and the formation of transaction ties.

Second, my dissertation contributes to a growing literature on trust and reputation mechanisms in online markets. The first essay highlights online social networks as a new mechanism to mitigate information asymmetry and encourage trusting relationships; Essay 2 emphasizes homophily-based trusting behavior; and the third essay, in particular, directly examines the

effectiveness of online reputation systems. While online reputation systems have a tendency to create a Matthew Effect whereby larger sellers are more likely to be chosen, we can potentially alleviate this issue by revisiting the contracting relationship between trading partners.

Third, findings from the three essays of my dissertation also have significant policy implications. The value of social networks demonstrated in the first essay suggests that leveraging a borrower or an entrepreneur's social ties may have value in the funding process of their loan requests. The home bias of investor decision making, as shown in the second essay, suggests that artificially constraining market access, even if only to one side of the market, can potentially reduce the overall social welfare¹. The combination of new contract forms and new monitoring technologies, as shown in the third essay, can significantly reduce the barriers to entry in online markets. This fosters healthy competition and will further generate better social welfare.

Last but not the least, all three studies share a focus on “small” players in these emerging markets, including entrepreneurs. Entrepreneurs can be on either side of the online lending market, and can also be on either side of the software development market. While the peer-to-peer lending model can serve as a new channel for small business financing, online software outsourcing can help small business buyers reduce the costs for software development, and enable developers to expand their market scopes. With an emphasis on the unique features of these markets, the findings of these studies can potentially increase the efficiency of these markets and further benefit market participants.

¹ As of the time of writing, prosper.com and lendingclub.com – two major players in the US peer-to-peer lending market – both face regulatory constraints such that a number of states only allow borrowers to participate in Prosper.com, but not lenders.