Emergence of Financial Intermediaries on Electronic Markets: The Case of Online P2P Lending

Abstract: We analyze the role of intermediaries on electronic markets using detailed data of more than 14,000 originated loans on an electronic P2P (person-to-person) lending platform. On such an electronic credit market lenders bid for supplying a private loan. Screening of potential borrowers and the monitoring of loan repayment can be delegated to designated group leaders. We find that these market participants act as financial intermediaries and significantly improve borrowers' credit conditions. As suggested by traditional intermediation theory (e.g. Diamond 1984; Leland and Pyle 1976), the intermediary creates value by reducing information asymmetries between borrowers and lenders. Our findings are robust to self-selection and characteristics of the financial transactions, and may be surprising given the long discussion on disintermediation due to electronic marketplaces.

Keywords *Asymmetric information · intermediation · social lending · electronic markets*

JEL Classification *D82 · G21 · G24*

1. Introduction

The evolution of information technology in recent years has led to the development of electronic marketplaces where traditional intermediaries may be less important or even redundant for the economic interaction of market participants (Benjamin and Wigand 1995, Evans and Wurster 1997, Malone, Yates and Benjamin 1987). There has been a long debate about disintermediation and the future relevance of financial intermediaries within the financial service industry (Allen and Santomero 2001, Nellis, McCaffery and Hutchinson 2000, Schmidt, Hackethal and Tyrell 1999).

The increasing role of electronic lending marketplaces (*P2P Lending* or *Social Lending*) leads to disintermediation by replacing a bank as the traditional intermediary and enabling the brokerage of consumer loans directly between borrowers and lenders (Hulme and Wright 2006, Meyer 2007). A recent study predicts that by 2010 such social banking platforms will have a market share of ten percent of the worldwide market for retail lending and financial planning (Gartner Inc. 2008).

Nevertheless, new types of additional intermediaries emerge within these electronic marketplaces (Chircu and Kauffman 2000, Methlie and Pedersen 2002) as market participants provide paid intermediary services. We argue here that internet-based electronic commerce (e-commerce) may lead to greater rather than less intermediation as new roles for intermediaries evolve (Bakos 1991, Bakos 1998, Sen and King 2003). Intermediation might always be important in the interaction of economic agents despite electronic marketplaces taking over some functions formerly provided by traditional intermediaries.

To address this question, we examine the role of intermediaries in more than 14,000 credit transactions on the American electronic P2P lending platform *Prosper.com*. Our empirical analysis is based on the literature on intermediation (e.g. Diamond 1984, Leland and Pyle 1976) from which we derive hypotheses on the role of intermediaries in electronic marketplaces.

The electronic lending platform Prosper provides an excellent laboratory for studying intermediaries on electronic marketplaces. Prosper is the largest provider with nearly 90 Million USD in loans originated in the examination period from 2005-11 until 2007-09, as market participants were permitted to act as paid

intermediaries in this time period. All loans on Prosper have an identical maturity of 36 months. Our data sample includes detailed information on 14,321 financial transactions as well as the market participants involved and covers transactions with and without the use of an intermediary. This allows us to test for aspects of the financial transaction as well as individual factors that might influence the usage of intermediary services.

In line with traditional intermediation theory, we find that financial intermediaries on electronic P2P lending platforms have significant impact on borrowers' credit conditions, suggesting that intermediation helps to reduce the prevalent information asymmetries. The intermediary primarily contributes by screening potential borrowers. A mandatory screening process by means of the intermediary's commitment to screen every borrower within the group significantly improves borrowers' access to credit. Following diligent screening, the intermediary's recommendation of a borrower signals better information about creditworthiness and thus leads to better credit conditions. Moreover, bidding on the screened borrower's credit listing has an even stronger impact on the resulting interest rate.

Our results indicate that borrowers should consider the reputation of an intermediary as it serves as a good proxy for the future diligent assessment of borrowers. Intermediation costs can be compensated by lower interest margins for borrowers. These results are robust to self-selection regarding the choice of an intermediary and characteristics of the financial transaction. All in all, our results suggest that financial intermediaries on electronic credit marketplaces may create substantial value for borrowers and, generally, that electronic markets create business opportunities for new intermediaries.

Our approach to examining the role of financial intermediaries on electronic lending platforms makes three important contributions to the existing literature on intermediation and electronic markets. First, this is to the best of our knowledge the first study to empirically examine intermediation on an electronic P2 lending platform. Second, we provide insights into the role of intermediaries in the marketplace and estimate the impact of intermediation on borrowers' interest rates. Third, we analyze potential self-selection in the demand for intermediation services on electronic marketplaces by applying a matching procedure.

The remainder of the paper is organized as follows: the next section gives an overview of electronic marketplaces and online P2P lending platforms. Section 3 summarizes the relevant previous literature on financial intermediation and derives hypotheses about the role of intermediaries on electronic lending platforms. Section 4 overviews the methodology employed. Section 5 describes the data and presents the empirical results of our analyses. Section 6 concludes with a summary and the limitations of our study.

2. Intermediaries on electronic credit marketplaces

2.1 Electronic marketplaces and disintermediation

Markets are essential for economic activity in mediating the demand for and supply of goods and services. Intermediaries help to facilitate transactions between buyers and sellers by (1) providing transaction processing capabilities (2) bringing enhanced levels of knowledge and expertise (3) adding to the transactability of a given good or service (Chircu and Kauffman 2000).
The internet has made e-commerce possible where electronic markets are becoming more important in coordinating supply and demand (Grieger 2003, Segev, Gebauer and Farber 1999). Electronic markets can facilitate economic activity even under complex and insecure conditions (Cordella 2006), significantly reduce information and transaction costs, and may in this way displace traditional intermediaries (Malone, Yates and Benjamin 1987).
Many authors argue that once electronic markets emerge, traditional intermediaries may be threatened by an electronic brokerage effect also called *disintermediation* (see Chircu and Kauffman 2000 for a literature overview). In sharp contrast to that, the theoretical contributions on electronic markets and disintermediation have not yet been supported by convincing empirical evidence (Chircu and Kauffman 2000, Sen and King 2003). Moreover, the displacement of traditional intermediaries may never occur. Authors like Sakar (1998) or Hagel and Singer (1999) argue that electronic markets may lead to new forms of intermediation.

2.2. Electronic lending platforms

Electronic lending platforms are electronic markets that mediate between borrowers and lenders of loans. We focus here on consumer loans between individual borrowers and lenders and exclude platforms for bonds or syndicated loans (Meyer 2007, Steelmann 2006).

The electronic credit marketplace as a website in the World Wide Web constitutes the general conditions for person-to-person lending and provides the administration of current loans. Electronic lending platforms differ in the way loans are originated. Some providers mediate between borrowers and lenders themselves, whereas other providers match borrowers' credit listings and lenders' bids with an auction mechanism (Meyer 2007). There are numerous providers that operate nationally due to differing regulatory frameworks. Table 1 provides an overview of the three major Anglo-American and German providers and their business models.

< *Table 1* >

Despite differing business models, there is one distinctive feature that these marketplaces have in common. Transactions on electronic credit marketplaces occur anonymously between fictitious "screen names". Therefore information is asymmetrically distributed between borrowers and lenders. Loans are not collateralized and the marketplace faces the inherent risk of default (Steelmann 2006).

In order to reduce information asymmetries, lenders must screen potential borrowers. It can be costly or impossible to process the information available about potential borrowers given the large number of credit listings. Therefore intermediaries emerge in the electronic marketplace offering intermediary services in order to assess and limit credit risk.

2.3 Groups as intermediaries on Prosper.com

Prosper.com is America's largest people-to-people lending marketplace. In the observation period from February 2006 until September 2007 a total of 87.5 Million USD in loans were funded. Although interaction occurs anonymously between "screen names", loan listings contain additional information on potential borrowers. Lenders can evaluate individual creditworthiness through *quantitative* as well as *qualitative* figures.

As the two main *quantitative* figures, an individual rating and an indicator of indebtedness are provided by Prosper in cooperation with the credit reporting agency Experian. The informational value of these *quantitative* figures should be considered high, although the degree to which consumer credit reports are accurate, complete or consistent is in dispute (Avery, Calem, Canner and Bostic 2003).

Market participants are able to provide additional personal information about their background, their financial standing and the purpose of the loan. This *qualitative* information is mandatory and its validity is a priori not controlled. Borrowers thereby might have an incentive to overemphasize their "quality" (the present value of the prospective projects, their financial standing or payment behaviour) in their personal descriptions (*moral hazard*).

In addition to personal profiles, borrowers and lenders can form groups. These smaller communities within the marketplace review and assess the creditworthiness of individual members. Groups thus act as financial intermediaries and are potentially beneficial for market participants by providing and verifying information or obtaining additional information about borrowers that is not publicly available.

Every participant in the online lending platform can found a group and become a group leader. Group leaders set membership criteria and administer the group. Groups aim to lower the risk of defaults and therefore enable lending at better rates. Among the most important tasks of the group leader is therefore the screening of borrowers within the group (a voluntary due diligence known as "vetting"). Within groups, it is common that borrowers send personal documents regarding their identity, income and other pertinent information to the group leader. The group leader reviews the personal information disclosed and usually also establishes personal contact in order to recommend a borrower's credit listing. The incentive for borrowers to disclose information to the group leader is to attract more bids on their credit listing in order to borrow at better interest rates. Group leaders also supervise the repayment of loans within their group. In the case of default, Prosper informs the group leader who can encourage loan repayment and may arrange limited repayments (called "community payments") on behalf of a member who is not able to do so.

Group leaders were permitted to receive remuneration ("fees") for their effort, thus acting as paid intermediaries. Group leaders could collect a fee in the form of additional interest for providing intermediation services until 2007-09-12, when Prosper modified the fee concept (Prosper Marketplace Inc. 2007). Where intermediary services were concerned, borrowers faced the choice between "free" or "paid" intermediaries. It is a priori not clear if intermediation created value for the electronic marketplace and, in particular, for the borrowers. We focus here on the value of intermediation for borrowers.

3. Development of hypotheses

There is extensive research on financial intermediation. In this section we review the relevant intermediation literature in order to derive hypotheses about the role of intermediaries in electronic credit marketplaces.

Traditionally, transaction costs and information problems have provided the foundation for understanding intermediaries (Allen and Santomero 1998, Bhattacharya and Thakor 1993, Dewatripont and Tirole 1994, Santomero 1984). Due to asymmetric information between borrowers and lenders, financial markets can perform poorly or even fail when borrowers know their characteristics (the present value of the prospective projects) but lenders cannot distinguish between them. Market value then reflects average project quality (Akerlof 1970, Leland and Pyle 1976). As a result "good risks" are driven out of the market and average project quality decreases (*adverse selection*). This can be the case if borrowers cannot be expected to be entirely straightforward about their characteristics since there may be a substantial reward for exaggerating positive qualities (*moral hazard*).

In his seminal article, Diamond (1984) argues that intermediaries can help to overcome problems of asymmetric information by acting as "delegated monitors". When several lenders in a loan syndicate want to monitor a borrower and monitoring is costly, there will either be inefficiently high monitoring expenditure or a free riding problem, where no lender has an incentive to monitor. In this case, a financial intermediary as a delegated monitor minimizes the costs of monitoring. The argumentation is applicable to the lending platform Prosper for two reasons. Firstly, the capital of several lenders is syndicated into one loan. Secondly, lenders face a large number of potential borrowers in the marketplace. Lenders

benefit from additional private information about borrowers in order to better assess credit risk and the appropriate interest rate required. Acquiring private information about credit listings implies a time-consuming (repeated) interaction with the borrower which is costly. Therefore there are group leaders who act as intermediaries in producing additional private information about borrowers within groups. The intermediary realizes significant economies of scale by producing information for the marketplace.

Intermediaries can solve another information problem prevalent in electronic marketplaces. Borrowers might not be willing to disclose proprietary information to a large number of lenders in a public financial market. Following Bhattacharya and Chiesa (1995), an intermediary acts as the facilitator of knowledge sharing, whereby proprietary information is only disclosed vis-à-vis the intermediary.

In the marketplace, participants can voluntarily disclose additional private information regarding their credit listing. Within groups, borrowers may disclose proprietary information regarding their financial standing solely to the group leader. As group member, borrowers can thus avoid disclosing private information to the marketplace. Group leaders assess and recommend a borrower's credit quality based on additional private information, and at the same time preserve the privacy of proprietary information. Groups enable a better assessment of the borrowers' credit quality, resulting in potentially lower rates for borrowers. This leads to:

> *Hypothesis H1: Group leaders reduce informational asymmetries by the efficient review and assessment of credit listings within their group. Group membership leads to lower interest rates.*

With imperfect information about borrowers' credit quality, lenders can use publicly observable signals to assess credit risk (Riley 1975, Rothschild and Stiglitz 1976, Spence 1973). Observable characteristics or actions can serve as signals. On the electronic lending platform Prosper, the recommendation of a credit listing by a group leader is a strong observable signal of credit quality. Borrowers can voluntarily provide additional private information regarding their financial standing to their group leader. Group leaders can then recommend credit listings within their groups. This observable recommendation serves as a signal of good credit quality for the marketplace. This leads to:

Hypothesis H2: The recommendation of a credit listing by the group leader leads to lower interest rates.

The reliability of information produced by an intermediary is a prevalent problem in the intermediation literature. Group leaders might recommend credit listings within their group without prior diligent screening. It may be difficult or impossible for potential lenders to distinguish good information from bad. Group leaders can signal credibility of a recommendation by bidding in the recommended credit listing. The potential investment of the group leader is an observable signal for information quality (Leland and Pyle 1976). We derive:

Hypothesis H3a: A group leader's bidding serves as a credible signal for the quality of the credit listing and results in lower interest rates.

Hypothesis H3b: A group leader's bidding on a credit listing signals information quality and has a stronger impact on interest rates than a recommendation by the group leader.

Past activities within a group, especially regarding the assessment of individual borrowers by the group leader, are only imperfectly observable. In contrast, the reputation of a group in the electronic marketplace is observable from its group rating. The group rating is a measurement of a group's performance in paying back its loans in comparison with expected (historical) default rates. A defaulted loan worsens a group's rating and therefore its reputation. The group rating implies a group's ability to assess borrowers' credit quality. Tirole (1996) shows analytically how a group's good reputation positively influences individual behaviour. We deduce:

Hypothesis H4: A good group rating leads to lower interest rates.

Herding behaviour on financial markets describes excessive collective behaviour where individual investment decisions are based not on adequate information but on the behaviour of other market participants (Bikhchandani and Sharma 2000). Herding might occur also on electronic capital markets. A bigger group within the marketplace might attract more investors resulting in increased bidding for credit listings within bigger groups. This leads to:

Hypothesis H5: The probability of herding behaviour during the auctioning of a credit listing increases with group size. Increasing group size leads to lower interest rates.

Economic agents participating in capital markets are subject to self-selection (Alexander, Jones and Nigro 1997). Self-selection arises if those participating in an activity are systematically different from those who do not participate (Bjorklund and Moffitt 1987). In financial transactions, self-selection arises due to different levels of financial literacy as well as the characteristics of financial transactions (Alexander, Jones and Nigro 1997, Zumpano, Elder and Baryla 1996). Self-selection might be present in electronic marketplaces when individuals turning to intermediaries might differ significantly from those not using intermediary services. This could be the case if, for example, high risk borrowers systematically turned to intermediaries when borrowing through electronic lending platforms. Transaction characteristics like loan amount might also lead to self-selection towards using intermediary services. We conclude:

Hypothesis H6: Self-selection biases the use of groups as intermediaries on electronic lending platforms.

4 Empirical Study

4.1 Methodology

We apply OLS regression analysis in order to determine the factors that impact on the interest rate as the outcome of the credit transactions in the marketplace and test the hypotheses H1 through H5.

As a robustness test to control for potential self-selection in the choice of an intermediary and in order to test hypothesis H6, we further apply the matching method explained in section 4.5. Econometric matching techniques were developed by Rosenbaum and Rubin (1983) and extended by Heckman and Robb (1985). The methods take into account the fact that the characteristics of group members may differ significantly from those of non group members and ensure that such observed characteristics are not driving the results.

4.2 Dependent and Independent Variables

In our empirical analysis of intermediaries on an electronic P2P lending platform, the interest rates measure how successfully borrowers can access capital. Lower interest rates indicate better access to capital. The interest rates on Prosper should generally be interpreted with respect to market interest rates (de Bondt 2005). As

dependent variable we therefore analyze the spread over three-year interest rate swaps (on the use of swap rates as a proxy for the risk-free rate see Zhu 2006), measured in basis points (i.e. one hundredth of one per cent) in order to control for differing market interest rates in our data. This ensures matching maturities since all loans on Prosper have a maturity of 36 month. Daily time series of these swap yields were obtained from the website of the Federal Reserve.

To facilitate the testing of our hypotheses from chapter 3, we employ listing- and group-specific variables. We present an overview of our variables in table 2.

< *Table 2* >

In order to test hypotheses H1, H2, H3a and H3b we rely on the group-related variables *Group Affiliation*, *Certification*, *Group Leader Bid* and *Mandatory Review*. They measure the effect of group membership, a group leader's screening of potential borrowers, and the group leader's bid for a recommended loan listing. To be able to assess the usage of a paid intermediary we look at *Paid Group* as well as *Group Fee*. In order to evaluate the effect of a group's reputation in hypothesis H4, we rely on the independent variable *Group Rating*. *Group Size* measures the potential herding effect hypothesized in hypothesis H5.

We incorporate a number of *control variables* into our analyses. First we look at four criteria based on individuals' credit reports commonly used by banks (Avery, Bostic, Calem and Canner 1996). *Credit Grade* and *Debt-to-Income (DTI) Grade* reflect repayment history as well as indebtedness and are provided by Prosper in cooperation with the credit reporting agency Experian. *Amount* and *Homeownership* typically serve as additional risk characteristics.

We include two important transaction characteristics related to internet-based e-commerce. As self-disclosure may reduce uncertainty in electronic marketplaces (Tidwell and Walther 2002), we control for *Visual Self Disclosure* in borrowers' loan listings with the provision of personal photographs. We include *Auction* as a control variable reflecting use of the auction mechanism on Prosper as this may significantly influence price determination (Klemperer 2004). Borrowers can choose the auction mechanism if they want to give lenders the chance to bid down the interest rate. Not using the auction mechanism will close a loan listing as soon the requested loan amount is met by bidders.

As it is well-known that consumers tend to adopt innovations in a process over a certain time (Olshavsky, 1980), there could be distortions in the database caused

by consumers' hesitant use of intermediaries in the marketplace. Therefore we include *quarter* dummies into each regression model.

4.3 Description of data set

Our empirical analysis of financial intermediaries in the electronic P2P lending platform Prosper is based on 14,321 credit transactions between 2005-11 and 2007-09. As of 2007-09-12 the marketplace consisted of a total of 385,161 registered users.

Our data set includes detailed information about these credit transactions, and there is also comprehensive information about the course of the loan-originating auction, including individual bidding and its impact on interest rates. At this point in time the dataset is still heavily right censored with respect to subsequent information on ex post realized loan defaults. For this reason we adopt the borrowers' perspective and focus our analyses on the interest rates realized.

Table 3 presents descriptive statistics for loan amount and borrower rate by borrowers' credit grade as well as borrowers' group affiliation. Several interesting patterns emerge from this table.

< *Table 3* >

Out of a total sample of 14,321 loans, 9,187 transactions were carried out by group members and 5,134 transactions without group affiliation. 58 percent of total group-affiliated borrowers were members of paid groups. We find borrowers of all credit grades in paid and unpaid groups as well as without group affiliation. Borrowers with the best credit grades AA, A and B were in relative terms more frequent in the sub sample of borrowers without group affiliation (40 percent versus 25 of all group-affiliated borrowers).

The average loan amount over the total sample was 6,102 USD. Borrowers with a better credit grade borrowed higher loan amounts. We see a mean loan amount in the total sample for borrowers with the best credit grade AA of 8,264 USD whereas for "high risk" borrowers (credit grade HR) the amount was only about one third of that. The average loan amount was higher for borrowers without group affiliation. However, when comparing by credit grades, we find higher average loan amounts for group members than for borrowers without group association. When comparing unpaid and paid groups, we find that borrowers

with better credit grades borrowed significantly higher amounts in groups with a paid group leader than in unpaid groups.

Table 3 also lists the average borrower rate by credit grade as the spread over three-year interest rate swaps. We see that the average spread was 10.11 percent. Comparing borrowers with and without group affiliation, we find that average spreads by credit grade were lower for borrowers with group affiliation. Table 3 documents significant differences in average spreads between paid and unpaid groups. Borrowers in unpaid groups on average borrowed at lower spreads than borrowers in paid groups or borrowers without group affiliation. When comparing paid groups to borrowers without group affiliation, we find that borrowers with credit grades of AA, A, B and C (credit grades of D, E, and HR) borrowed at higher (lower) spreads in paid groups.

To gain a better understanding of the patterns documented in table 3, we offer some further insights into the role of groups in the electronic lending platform in table 4.

< *Table 4* >

The first three rows in table 4 represent the distribution of variables based on individuals' credit reports by group membership. As already presented in table 3, the median credit grade of borrowers without group affiliation tends to be better. Group affiliated borrowers are on average more indebted which is reflected in the *Debt-to-Income* (*DTI*) *Grade*. We find an average *DTI Grade* of 40 percent within groups compared to 32 percent with transactions outside groups. Within the sample, 41 percent of borrowers owned a house, and homeownership was more frequent in transactions outside groups (45 percent). Average *Credit Grade* and *DTI Grade*, as well as the distribution of *Homeownership* seem to confirm the finding that borrowers with better risk characteristics are more frequent in the sub sample of borrowers without group affiliation.

Regarding the characteristics of the transaction, we find that two out of three bidders within the sample reveal personal photographs (*Visual Self Disclosure*). This is far more often the case with transactions involving groups (71 vs. 55 percent). This corresponds with anecdotal evidence that group leaders often encourage group members to include personal pictures in their loan listings. Table 4 shows that 63 percent of all transactions within the sample made use of the marketplace's auction mechanism. Borrowers with group affiliation use the

auction mechanism more often (68 vs. 54 percent in transactions out of groups), and auctioned transactions are more frequent in paid groups. An auction enables lenders to bid down the interest rate and may lead to lower interest rates for borrowers. Not using the auction mechanism may accelerate the access to credit by potentially reducing the time until a loan is fully funded, since the loan listing is closed once the required loan amount is fully funded. Facing this trade-off, borrowers outside groups decide to use the auction mechanism less often. There are two possible explanations for this finding. It could be that borrowers with better credit grades expect to benefit less from an auction of their loan listing. As an alternative explanation, group leaders might encourage borrowers to make use of the auction mechanism.

Table 4 further presents the distribution of five group-related variables. Table 4 strongly indicates that group leaders create value by serving as intermediaries in the electronic marketplace in order to help overcome problems of asymmetric information. The majority (55 percent) of groups enforce a mandatory review process and commit to screening of every borrower within a group. Yet there is evidence of important differences in the role of group leaders in unpaid and paid groups. We find that certification of screened loan listings as well as group leaders' bidding is more frequent in paid groups. Group leaders assess and then observably signal borrower's credit quality (*Certification*) in 36 percent of transactions in paid groups compared to 24 percent in unpaid groups. Furthermore, paid group leaders bid for more than every second recommended loan listing and thus credibly signal information quality (*Group Leader Bid*). Comparing the average size of unpaid and paid groups we find that unpaid groups tend to be smaller (median of 316 vs. 459 members). Finally, table 4 presents the average costs inherent in the choice of a paid intermediary. The average fee that group leaders impose amounts to 110 basis points or about one additional percentage point of interest for the borrower. So far it is not possible to draw conclusions on the net value creation of a (paid) intermediary. In a next step we analyze the role of intermediation in the electronic marketplace in a multivariate set-up.

4.4 Empirical results

The left side of table 5 presents our analyses on the role of intermediation in the electronic lending platform. In three different regression models we look at the influence of (1) general group membership, (2) the use of a paid group, and (3) the hypothesized functions of the intermediary on borrowers' credit conditions. Several interesting patterns emerge.

< *Table 5* >

The results from regression model (1) regarding Group Affiliation as well as from model (3) regarding the group-specific variables confirm our fundamental hypothesis H1: the use of an intermediary in the electronic marketplace significantly lowers borrowers' interest rates. Group affiliation ceteris paribus lowers the credit spread by 18 basis points. In regression model (2) and (3) we shed more light on the function and value creation of the intermediary.

Should borrowers always make demands on intermediary services? Regression model (2) confirms that the choice of the intermediary matters: the choice of a paid intermediary (*Paid Group*) increases the credit spread for borrowers by 92 basis points. From a borrower's point of view, the fee associated with using a paid group makes the loan more expensive. However, the analysis from the borrowers' perspective does not evaluate the intermediary's role in overall access to credit or the long run performance of the loan thus originated. In model (3) we analyse in greater detail how the intermediary creates value for the borrower.

All group-specific variables in regression model (3) have significant impact on credit spreads. The variables *Certification* and *Group Leader Bid* in regression model (3) significantly reduce borrowers' interest rates. Hypotheses H2 and H3a cannot be rejected: an important function of the intermediary is the screening of a potential borrower. The intermediary may then recommend the borrower's credit listing. There is further evidence for the hypothesized creation of value by the intermediary: we find significant lower credit spreads in groups where the group leader committed to screen every potential borrower (*Mandatory Review*). Regression model (3) also shows that "actions speak louder than words": the group leader's bid for the borrower's credit listing exerts a significant stronger impact on borrowers' credit conditions than a recommendation. We can confirm Hypothesis H3b: the regression coefficient of *Group Leader Bid* exceeds *Certification*.

We find that a group's reputation serves as a proxy for the future diligent assessment of borrowers by the group leader. Lenders seem to bid down the interest rate in groups with a good reputation, resulting in lower credit spreads for borrowers. Hypothesis 4 cannot be rejected as a group's reputation (*Group Rating*) significantly lowers interest rates.

Table 5 further shows evidence for the negative effect of group size on interest rates. This finding seems to indicate herding behaviour in the electronic marketplace and confirms our hypothesis H5. Increased bidding activity resulting from herding behaviour seems to drive down interest rates in bigger groups.

Overall, our results show that even though the electronic P2P lending platform leads to disintermediation by enabling direct brokerage of loans between borrowers and lenders, a new type of financial intermediary emerges. Market participants become group leaders and provide intermediary services, reducing the information asymmetries prevalent in the electronic marketplace. The intermediary primarily creates value by screening potential borrowers. This finding is supported by the significant reduction in borrowers' credit spread by mandatory screening process as well as the intermediary's recommendation of a borrower (*Certification*). Moreover, bidding on the screened borrower's credit listing has an even stronger impact on the resulting interest rate. Given a mandatory screening process, the recommendation of a borrower and the group leader's bid for the recommended loan listing, the credit spread will ceteris paribus be 162 basis points lower. This more than compensates for the average required fee of 110 basis points (as shown in section 4.3).

These results are stable when controlling for borrowers' credit history as well as transaction characteristics. In all three regression models on the left side of table 5 we find that the control variables based on individual credit reports significantly influence credit conditions, and that a borrower's *Credit Grade* has the strongest impact. In model (1) for example we find that ceteris paribus a decline in credit grade by one grade is associated with an average of 281 basis points increase in credit spread. Increasing indebtedness (*DTI Grade*) or a higher loan amount (*Amount*) significantly increases credit spread. Interestingly, we cannot find any significant impact of home ownership. We further control for use of the auction mechanism (*Auction*) and self disclosure (*Visual Self Disclosure*) and find a significant and negative impact on credit spreads.

4.5 Self selection bias

The evaluation of an intermediary's impact is complicated due to the potential existence of self selection bias. Insights from practice suggest that especially borrowers with weak market access, i.e. a bad credit history resulting in a low credit score, use group membership as mitigation. This results in a more complicated evaluation of the success of an intermediary and interferes with the identification of the actual impact factors on the interest rate.

One possible way of easing the problem lies in the matching method (Rubin and Waterman 2006), by which one can construct pairs of comparable credit transactions with and without using intermediaries. Pairs are selected from both groups that do not differ in their relevant characteristics, i.e. they are identical ("statistical twins") or close to identical. It is most relevant for creating the pairs that the characteristics are linked with the relevant measure which determines the outcome of the credit transaction. Due to the similarity of the pairs with and without using intermediaries one can assume that self selection bias can be excluded from the analysis.

As there are usually a lot of explanatory variables on interest rates (Avery, Calem and Canner 2004), we need to find adequate partners matching in terms of several variables. This is also a multi-dimensional problem, which complicates the search for adequate partners for every credit transaction. As a solution, Rosenbaum and Rubin (1983) propose the use of a balancing score, i.e. a function of all relevant characteristics. The matching partners selected are similar with respect to that balancing score. The propensity score, as a special balancing score, equals the probability of using a group as an intermediary. The propensity score is usually determined using Logit or Probit models (Titus 2007).

When constructing matching pairs, all relevant characteristics of the customer are implicitly taken into consideration by the propensity score. Therefore, when searching for the matching partner, one has to consider only one dimension in terms of the propensity score (D'Agostino 1998). The multi-dimensional problem of searching an adequate matching partner is thereby reduced to a one-dimensional problem. An in-depth discussion of the method as well as adequate search algorithms is provided by Gensler et al. (2005) and Titus (2007), the

method has recently become established in finance research (e.g. Drucker and Puri 2005).

The right side of table 5 presents our estimates for the matched sub-sample. Controlling for self selection, all regression model estimates remain largely unchanged and significant. We do not find any support for self-selection bias in the use of intermediary services in the electronic credit marketplace. Hence, we cannot support hypothesis H6.

5 Conclusions

This paper presents new empirical evidence on electronic markets and disintermediation. We analyze the role of intermediaries in the American electronic P2P lending platform *Prosper.com*.

Previous literature provides arguments in favour of disintermediation due to the increasing role of electronic markets. Our analysis of an electronic credit lending platform provides differentiated results: we find that there are participants in the electronic marketplace acting as financial intermediaries, and that intermediation services significantly improve borrowers' credit conditions.

As suggested by traditional intermediation theory, the intermediary creates value by reducing information asymmetries between borrowers and lenders. We document the positive impact of the intermediary's screening activities. Based on superior private information, the recommendation of a credit listing significantly improves borrowers' credit conditions. Moreover, the intermediary's bid has an even stronger impact on the resulting interest rate. Our results indicate that intermediation costs could be more than compensated for by lower interest margins for borrowers. Our results indicate that borrowers should also consider the intermediary's reputation. These results are robust to self-selection regarding the choice of an intermediary as well as other control variables relevant to the electronic lending platform. Based on our analyses, one can quantify the effect of each possible listing feature on the credit spread.

Our results contribute to the existing literature on electronic markets and disintermediation and yield some interesting implications for the setup of online credit lending platforms and the behaviour of their participants. However, the deduction of broad conclusions from our study is limited in so far as we focus mainly on the impact of intermediation on borrowers' credit conditions. It would

be interesting to include ex post realized loan defaults into further analyses. Moreover, our data sample consists of consumer credit transactions on an American marketplace. Generalization to potential electronic markets for corporate or governmental debt, to other electronic markets, and to markets in other countries may provide interesting avenues for future research.

References

Akerlof GA (1970) The market for “lemons”: Quality uncertainty and the market mechanism. Q J Econ 84:488-500

Alexander GJ, Jones JD, and Nigro PJ (1997) Investor self-selection: evidence from a mutual fund survey. Manag Decis Econ 18:719-729

Allen F, Santomero AM (1998) The theory of financial intermediation. J Bank Finance 21:1461-1485

Allen F, Santomero AM (2001) What do financial intermediaries do? J Bank Finance 25:271-294

Avery RB, Bostic RW, Calem PS, et al. (1996) Credit risk, credit scoring and the performance of home mortgages. Fed Reserv Bull 82:621-648

Avery RB, Calem PS, and Canner GB (2004) Consumer credit scoring: do situational circumstances matter? J Bank Finance 28:835-856

Avery RB, Calem PS, Canner GB, et al. (2003) An overview of consumer data and credit reporting. Fed Reserv Bull 89:47

Bakos Y (1991) A strategic analysis of electronic marketplaces. MIS Q 15:295-310

Bakos Y (1998) The emerging role of electronic marketplaces on the Internet. Comm ACM 41:35-42

Benjamin R, Wigand R (1995) Electronic markets and virtual value chains on the information superhighway. Sloan Mgmt Rev 36:62-72

Bhattacharya S, Chiesa G (1995) Proprietary information, financial intermediation, and research incentives. J Financ Intermed 4:328-357

Bhattacharya S, Thakor AV (1993) Contemporary banking theory. J Financ Intermed 3:2-50

Bikhchandani S, Sharma S (2000) Herd behavior in financial markets. Int Monetary Fund Staff Paper 47:279-310

Bjorklund A, Moffitt R (1987) The estimation of wage gains and welfare gains in self-selection models. Rev Econ Stat 69:42-49

Chircu AM, Kauffman RJ (2000) Reintermediation strategies in business-to-business electronic commerce. Int J Electron Commer 4:7-42

Cordella AAC (2006) Transaction costs and information systems: does IT add up? J Inform Tech 21:195-202

D’Agostino RB (1998) Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. Stat Med 17:2265-2281

de Bondt GJ (2005) Interest rate pass-through: empirical results for the euro area. Ger Econ Rev 6:37-78

Dewatripont M, Tirole J (1994) The prudential regulation of banks. MIT Press, Cambridge, MA

Diamond DW (1984) Financial intermediation and delegated monitoring. Rev Econ Stud 51:393-414

Drucker S, Puri M (2005) On the benefits of concurrent lending and underwriting. J Finance 60:2763-2800

Evans PB, Wurster TS (1997) Strategy and the new economics of information. Harv Bus Rev 75:70-82

Gartner Inc. (2008) Gartner says social banking platforms threaten traditional banks for control of financial relationships. http://www.gartner.com/it/page.jsp?id=597907. Accessed 2008-02-26

Gensler S, Skiera B, and Böhm M (2005) Einsatzmöglichkeiten der Matching Methode zur Berücksichtigung von Selbstselektion. J Betriebswirtschaft 55:37-62

Grieger M (2003) Electronic marketplaces: a literature review and a call for supply chain management research. Eur J Oper Res 144:280-294

Hagel J, Singer M (1999) Net worth: shaping markets when customers make the rules. Harvard Business School Press, Boston

Heckman JJ, Robb Jr R (1985) Alternative methods for evaluating the impact of interventions. J Econometrics 30:239-267

Hulme MK, Wright C (2006) Internet based social lending: past, present and future. Social Futures Observatory, London

Klemperer P (2004) Auctions : theory and practice. Princeton Univ. Press, Princeton

Leland HE, Pyle DH (1976) Informational asymmetries, financial structure, and financial intermediation. J Finance 32:371-387

Malone TW, Yates J, and Benjamin RI (1987) Electronic markets and electronic hierarchies. Comm ACM 30:484-497

Methlie LB, Pedersen PE (2002) A taxonomy of intermediary integration strategies in online markets, 15th Bled Electronic Commerce Conference.

Meyer T (2007) The power of people : Online P2P lending nibbles at banks’ loan business. E-Banking Snapshot 22. Deutsche Bank Research, Frankfurt

Nellis JG, McCaffery KM, and Hutchinson RW (2000) Strategic challenges for the European banking industry in the new millennium. Int J Bank Market 18:53-64

Prosper Marketplace Inc. (2007) What’s new on Prosper? http://www.prosper.com/help/topics/whats_new.aspx. Accessed 31 January 2008

Riley JG (1975) Competitive signalling. J Econ Theor 10:174-86

Rosenbaum PR, Rubin DB (1983) The central role of the propensity score in observational studies for causal effects. Biometrika 70:41-55

Rothschild M, Stiglitz J (1976) Equilibrium in competitive insurance markets: an essay on the economics of imperfect information. Q J Econ 90:629-649

Rubin DB, Waterman RR (2006) Estimating causality via propensity scores : estimating the causal effects of marketing interventions using propensity score methodology. Stat Sci 21:206-222
Santomero AM (1984) Modeling the banking firm: a survey. J Money Credit Bank 16:576-602
Sarkar M, Butler B, and Steinfield C (1998) Cybermediaries in electronic marketspace: toward theory building. J Bus Res 41:215-221
Schmidt RH, Hackethal A, and Tyrell M (1999) Disintermediation and the role of banks in europe : an international comparison. J Financ Intermed 8:36-67
Segev A, Gebauer J, and Farber F (1999) Internet-based electronic markets. Electron Market 9:138-146
Sen R, King RC (2003) Revisit the debate on intermediation, disintermediation and reintermediation due to e-commerce. Electron Market 13:153-162
Spence M (1973) Job market signaling. Q J Econ 87:355-374
Steelmann A (2006) Bypassing banks. Region Focus, Fed Reserv Bank Richmond 10:37-40
Tidwell LC, Walther JB (2002) Computer-mediated communication effects on disclosure, impressions, and interpersonal evaluations: Getting to know one another a bit at a time. Hum Comm Res 28:317-348
Tirole J (1996) A theory of collective reputations (with applications to the persistence of corruptions and to firm quality). Rev Econ Stud 63:1-22
Titus M (2007) Detecting selection bias, using propensity score matching, and estimating treatment effects: an application to the private returns to a master's degree. Res High Educ 48:487-521
Zhu H (2006) An empirical comparison of credit spreads between the bond market and the credit default swap market. J Fin Serv Res 29:211-235
Zumpano LV, Elder HW, and Baryla EA (1996) Buying a house and the decision to use a real estate broker. J R Estate Finance Econ 13:169-181

Table 1 Overview of electronic P2P lending platforms. This table presents an overview over the three major Anglo-American and German P2P credit marketplaces and their business models. BR = Borrower, LN = Lender, LA = Loan Amount.

Provider	**Prosper Marketplace, Inc.**	**Zopa Ltd.**	**Smava GmbH**
URL	www.prosper.com	www.zopa.co.uk	www.smava.de
Market	USA	UK, USA, Italy, Japan (planned)	Germany
Members	484,037 [a]	170,000 [b]	25,000 [c]
Cooperating Credit Reporting Agency	Experian plc	Equifax Inc.	Schufa Holding AG
Loan Processing Bank	Wells Fargo, Inc.	The Royal Bank of Scotland plc	biw Bank für Investments und Wertpapiere AG
Maximum Amount	25,000 USD	25,000 USD	10,000 EUR
Pricing of Loans	Second Price Auction / Determined by BR	Second Price Auction	Determined by BR
Fee (% of LA)	BR initial 1%-2%; LN annual 0.5%-1% of LA outstanding	BR initial 0.5%; LN initial 0.5%	BR initial 1%

[a] As of 2007-12-31; [b] As of 2007-09-01; [c] As of 2008-01-18

Table 2 Definition of variables.

Variable	Description
BORROWER RATE	Total loan cost for borrowers defined as spread over three-year interest rate swaps in basis points.
CREDIT GRADE	Assessment of credit provided by credit reporting agency Experian. Credit grades assigned are AA,A,B,C,D,E and HR.
AMOUNT	Loan amount.
DTI GRADE	Debt-to-Income ratio based on credit report.
VISUAL SELF DISCLOSURE	Dummy variable equal 1 (0 if otherwise) if borrowers included at least one picture in loan listing.
HOMEOWNERSHIP	Dummy variable equal 1 (0 if otherwise) if borrower is home owner.
AUCTION	Dummy variable equal 1 (0 if otherwise) if loan listing in “auction” format. Allows for bidding on interest rate.
GROUP AFFILIATION	Dummy variable equal 1 (0 if otherwise) if borrower is member of a group.
PAID GROUP	Dummy variable equal 1 (0 if otherwise) if borrower is member of a group that imposes a fee.
GROUP RATING	Group’s historic repayment performance against expected (historical) default rates. Rating from 1 to 5 rating notches.
CERTIFICATION	Dummy variable equal 1 (0 if otherwise) if group leader recommends a credit listing within the group.
GROUP LEADER BID	Dummy variable equal 1 (0 if otherwise) if group leader bid on loan listing.
GROUP FEE	Optional fee group leader can impose as additional interest in basis points.
GROUP SIZE	Number of group members.
MANDATORY REVIEW	Dummy variable equal 1 (0 if otherwise) if a credit transaction requires prior approval by the group leader.

Table 3 Descriptive statistics for loan amount and borrower rate. This table reports descriptive statistics for loan amount and borrower rate by borrowers' credit grade for the total sample of 14,321 credit transactions as well as by borrowers' group affiliation. The first part reports statistics on loan amount by credit grade, with median loan amount given in parentheses. The second part reports statistics on borrower rate by credit grade, with median borrower rate in parentheses. The third part presents the distribution of borrowers among credit grades, with relative frequencies in parentheses. For details on variable definition see table 2.

	Credit Grade	***Total Sample***	***No Group (36%)***	***Group Members (64%)***		
				Total	*Paid Group*	*Unpaid Group*
Mean (Median) Loan Amount	AA	8,264 (5,000)	7,924 (5,000)	8,624 (6,000)	10,321 (8,500)	7,181 (5,000)
	A	9,170 (7,000)	8,431 (6,000)	9,835 (8,000)	10,089 (8,100)	9,466 (7,000)
	B	8,681 (7,000)	8,172 (6,000)	9,057 (7,500)	9,596 (8,000)	8,157 (6,100)
	C	7,143 (5,100)	6,402 (5,000)	7,588 (6,000)	7,877 (6,500)	7,104 (5,000)
	D	5,630 (4,750)	5,045 (4,000)	5,952 (5,000)	6,228 (5,000)	5,454 (4,500)
	E	3,917 (3,000)	3,897 (3,000)	3,926 (3,000)	3,965 (3,100)	3,872 (3,000)
	HR	2,629 (2,500)	2,616 (2,500)	2,632 (2,500)	2,625 (2,500)	2,641 (2,500)
	Total	*6,102 (4,000)*	*6,226 (4,300)*	*6,033 (4,000)*	*6,406 (4,800)*	*5,506 (3,500)*
Mean (Median) Borrower Rate	AA	130 (64)	123 (54)	137 (74)	233 (175)	55 (0)
	A	340 (275)	341 (265)	339 (284)	384 (322)	274 (224)
	B	605 (553)	611 (555)	601 (542)	662 (605)	499 (445)
	C	891 (805)	928 (875)	868 (775)	943 (870)	743 (675)
	D	1,205 (1,175)	1,297 (1,280)	1,154 (1,125)	1,212 (1,175)	1,051 (990)
	E	1,591 (1,600)	1,701 (1,819)	1,545 (1,575)	1,584 (1,575)	1,492 (1,575)
	HR	1,604 (1,675)	1,667 (1,975)	1,589 (1,670)	1,635 (1,670)	1,537 (1,675)
	Total	*1,011 (975)*	*922 (825)*	*1,060 (1,025)*	*1,116 (1,110)*	*981 (875)*
Absolute (relative) Number of Transactions	AA	1,472 (10)	756 (14)	716 (7)	329 (6)	387 (10)
	A	1,363 (9)	645 (12)	718 (7)	425 (7)	293 (7)
	B	1,768 (12)	751 (14)	1,017 (11)	636 (11)	381 (9)
	C	2,494 (17)	937 (18)	1,557 (16)	975 (18)	582 (15)
	D	2,592 (18)	920 (17)	1,672 (18)	1,075 (20)	597 (15)
	E	2,167 (15)	638 (12)	1,529 (16)	885 (16)	644 (16)
	HR	2,465 (17)	487 (9)	1,978 (21)	1,048 (19)	930 (24)
	Total	*14,321 (100)*	*5,134 (100)*	*9,187 (100)*	*5,373 (100)*	*3,814 (100)*
	% AA,A,B	31%	40%	25%	24%	26%
	% D,E,HR	50%	38%	55%	55%	55%

Table 4 Descriptive statistics for independent variables. This table reports descriptive statistics for the group related variables as well as the control variables. Statistics are presented for the total sample as well as by borrowers' group affiliation. For details on variable definition see table 2.

	Total Sample	***No Group***	***Group Members***		
			Total	*Paid Group*	*Unpaid Group*
Observations	*14,321*	*5,134*	*9,187*	*5,373*	*3,814*
CREDIT GRADE: Median	D	C	D	D	D
DTI GRADE: Mean (Median)	37% (18%)	32% (17%)	40% (19%)	43% (17%)	38% (17%)
HOMEOWNERSHIP	40.9%	45.4%	38.3%	39.7%	36.4%
VISUAL SELF DISCLOSURE	65.4%	54.7%	71.4%	72.7%	69.7%
AUCTION	63.2%	54.3%	68.1%	71.3%	63.5%
MANDATORY REVIEW			55.3%	55.7%	54.7%
CERTIFICATION			30.8%	35.8%	23.7%
GROUP LEADER BID			48.3%	55.3%	38.5%
GROUP SIZE: Median			433	458	316
GROUP FEE: Mean Basis Points				109.7	

Table 5 Effect of intermediation and characteristics of the transaction. The left side of this table reports results of OLS regression models where the depended variable is borrower rate, defined as spread over three-year interest rate swaps in basis points. The right side of this table presents coefficient estimates from regressions with a matched sub-sample. The sub-sample is compiled through a propensity-score matching. Reported are regression coefficients and standardized coefficients in italics, t-ratios in parenthesis. For details on variable definition see table 2. Significance levels are given as ***, **, and * indicating significance at 1%, 5% and 10%, respectively. All regressions include quarter dummies (not reported).

	TOTAL SAMPLE			**MATCHED SUB-SAMPLE**		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
Variable						
INTERCEPT	-204.448	-209.359	-35.685	-136.316	-199.561	-146.152
	(-13.468)***	(-13.899)***	(-1.570)	(-10.123)***	(-11.378)***	(-5.678)***
CREDIT GRADE	281.471	275.816	268.766	279.363	273.531	267.614
	0.816	*0.800*	*0.789*	*0.810*	*0.789*	*0.782*
	(140.897)***	(140.647)***	(100.106)***	(139.564)***	(118.573)***	(85.496)***
AMOUNT	0.025	0.025	0.027	0.025	0.025	0.028
	0.218	*0.212*	*0.237*	*0.218*	*0.216*	*0.242*
	(40.635)***	(39.697)***	(33.368)***	(40.704)***	(34.769)***	(29.757)***
DTI GRADE	23.075	21.843	27.930	22.362	24.598	30.261
	0.043	*0.041*	*0.058*	*0.041*	*0.046*	*0.062*
	(8.824)***	(8.414)***	(9.353)***	(8.557)***	(8.131)***	(8.666)***
VISUAL SELF DISCLOSURE	-61.7721	-71.076	-57.835	-61.651	-74.722	-65.832
	-0.045	*-0.052*	*-0.042*	*-0.045*	*-0.055*	*-0.049*
	(-9.071)***	(-10.590)***	(-6.626)***	(-9.036)***	(-9.685)***	(-6.709)***
HOMEOWNERSHIP	-5.165	-7.247	-24.573	-4.393	-12.071	-31.802
	-0.004	*-0.005*	*-0.019*	*-0.003*	*-0.009*	*-0.024*
	(-0.451)	(-1.065)	(-2.903)***	(-0.637)	(-1.510)	(-3.218)***
AUCTION	-285.510	-303.560	-236.729	-289.492	-300.499	-247.522
	-0.210	*-0.223*	*-0.174*	*-0.213*	*-0.223*	*-0.185*
	(-40.285)***	(-43.557)***	(-25.686)***	(-41.553)***	(-36.882)***	(-23.463)***
GROUP AFFILIATION	-17.979			-24.294		
	-0.013			-0.018		
	(-3.503)**			(-3.503)**		
PAID GROUP		92.122			78.006	
		0.068			*0.058*	
		(13.801)***			(10.128)***	
GROUP RATING			-27.423			-24.124
			-0.052			*-0.045*
			(-8.039)***			(-5.963)***
CERTIFICATION			-21.724			-24.664
			-0.016			*-0.018*
			(-1.995)**			(-1.913)*
GROUP LEADER BID			-76.460			-67.679
			-0.061			*-0.060*
			(-8.223)***			(-7.082)***
GROUP FEE			1.093			0.999
			0.139			*0.121*
			(19.964)***			(15.248)***
GROUP SIZE			-0.012			-0.045
			-0.051			*-0.049*
			(-6.347)***			(-4.936)***
MANDATORY REVIEW			-64.409			-46.965
			-0.051			*-0.037*
			(-6.038)***			(-3.798)***
N	14,321	14,321	14,321	10,090	10,090	10,090
Prob > F	0	0	0	0	0	0
R^2	0.688	0.692	0.692	0.827	0.838	0.843
Adj. R^2	0.687	0.692	0.692	0.684	0.702	0.710