Volume 20 · Number 2 · June 2010

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Electronic Markets
The International Journal on Networked Business

University of St.Gallen

Springer

FOCUS THEME

Analyzing the impact of intermediaries in electronic markets: an empirical investigation of online consumer-to-consumer (C2C) auctions

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Abstract It has been widely believed that the Internet and electronic markets will eliminate traditional intermediaries. However, a close examination of the market mechanism indicates that the impact of intermediaries is indispensable. Specifically, we consider intermediaries' impacts in price discovery and trust building. Intermediaries provide a buffer for temporary misalignment between supply and demand by buying low and selling high, and also help build trust by engaging in transactions with risk-averse buyers and sellers who otherwise will not participate in the market. Using a dataset from eBay's online auctions, we examine empirically these two impacts of human intermediaries. We find that the presence of brokers has a significant impact on market liquidity, resulting in more successful trades and higher auction prices. In addition, we find that brokers are more likely to engage in transactions with less established sellers. Their presence reduces reputation penalty faced by these players and further facilitates the successful sale of items in auctions.

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Introduction

The past decade has witnessed an explosive growth of electronic markets supported by the new Internet-based technologies. Electronic markets are communities through which multiple buyers and sellers exchange information about products and prices, identify and select trading partners, and transact using the Internet technologies (Pavlou and Gefen 2004). The ability of electronic markets to efficiently bring together buyers and sellers has transformed businesses, given rise to many success stories, and redefined the roles of traditional intermediaries. It was widely believed that the availability of real-time market information, reduced search cost, and direct, instant, and efficient electronic transactions would allow buyers and sellers to cut traditional human intermediaries out of the market (Bakos 1991, 1997; Barclay et al. 2006). Experience over the past years, nevertheless, has shown little evidence to support such a belief (Choudhury et al. 1998). Just as asserted by Russell Braziel (2001): "*[traditional] Intermediaries are not inefficiencies to be wrung out of spot markets by e-commerce. Instead, they are key to the development of efficient, electronic transaction processes.*"

Electronic markets include Business to Business (B2B), Business to Consumer (B2C), Consumer to Consumer (C2C), and etc., among which C2C electronic markets are one of the most successful forms. Internet auctions, as one of the most popular e-commerce business models, also prevail in C2C electronic markets. Prominent examples of such markets include eBay, Yahoo!, and Amazon's online auctions. The web behemoth eBay is by far the most popular and successful C2C electronic market, with hundreds of millions of registered users and billions of gross revenues.[1] eBay has

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[1] Daytona Beach News Journal, June 19, 2005

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initially and long been viewed as a virtual garage sale. While eBay does provide a marketplace to millions of users to sell off their unwanted stuff, currently most of the trade volume on the site is conducted by actual businesses.[2] For instance, the top 5% of eBay's music sellers, who are often retailers, generate over 50% of the sites' business.[3] eBay was originally founded as an auction site. Since the addition of the "Buy it Now"[4] feature which allows the seller to set a price, a growing volume of transactions are done at fixed prices, which are often offered by brokers and retailers. Traditional human Intermediaries (e.g., brokers and retailers) not only still exist, but also seem to play an important role in electronic markets. As the leading representative of the C2C electronic markets, auction sites on the Internet have enjoyed tremendous popularity and success, thus promoting academic research on various issues of the impact of auction formats, bidding strategies, and bidding behavior (Bajari and Hortaçsu 2003; Goes et al. 2010, forthcoming; Hinz and Spann 2008; Lucking-Reiley 1999; Park and Bradlow 2005; Roth and Ockenfels 2002). Nevertheless, to our knowledge, there are no extant studies examining how traditional human intermediaries influence the structure and efficiency of C2C electronic markets. In this paper, we aim to take the initial step to examine the impact of human intermediaries in C2C electronic markets.

The key impact for traditional intermediaries to exist in the first place is to make transactions take place, i.e., provide liquidity in the market (Cosimano 1996). Previous economics and finance literature suggest that intermediaries can make markets more liquid by increasing the probability of successful trade and stabilizing market price (Cosimano 1996; Barclay et al. 2006; Grossman 1992). Such a function is still indispensable in electronic markets. For an electronic market, liquidity is about a critical mass of transactions that draws sufficient number of buyers and sellers to the market. For the buyers and sellers, liquidity can be defined as the capability to get transactions done quickly at a fair price.

In this research, we consider two main impacts of human intermediaries in helping provide liquidity in electronic markets: price discovery and trust building. Intermediaries provide buffer for temporary misalignment between supply and demand by buying low and selling high, which provides product liquidity to buyers and sellers in online markets and increases prices. Intermediaries also help build trust by engaging in transactions with risk-averse buyers and sellers who otherwise will not participate in the market.

We empirically examine these two impacts of human intermediaries using stamp auction data from eBay. Our

results suggest that the presence of stamp brokers has a significant impact on market liquidity, resulting in more successful trades and higher auction prices. In addition, our findings indicate that brokers are more likely to engage in transactions with less established buyers and sellers. Such findings imply that the presence of brokers and their willingness to generate transactions may reduce reputation penalty faced by less established players and further improves market liquidity. This study contributes to academics by adding to the literature on the impact of intermediaries in online C2C electronic markets. This research is also beneficial to practitioners in better understanding the impact of human intermediaries in electronic markets, thus helping them gain better knowledge of the market structure. The e-commerce websites also benefit from this research to improve the design of the sites and strategically encourage the participation of human intermediaries to improve the market efficiency.

The rest of the paper is structured as follows. In the next section we provide a brief review of related literature, followed by the development of hypotheses. Data are described and empirical analyses are presented in the following two sections. The paper is concluded by discussing implications, limitations, and future research.

Related literature

The impact of intermediaries

Many issues of the impact of intermediaries (brokers and other third parties and institutions) in the economic system have long been studied in the economics and finance literature (Cosimano 1996; Diamond 1984; Garman 1976; Ho and Stoll 1981; Lizzeri 1999; Winkler 1989). In particular, it has been suggested that intermediaries can make the product more liquid by lowering the probability of unsuccessful trade and stabilizing market prices (Cosimano 1996). Especially for human intermediaries, extant literature has shown that their knowledge of the market may facilitate quicker and more efficient matching of customer orders (Grossman 1992). When information asymmetry is high, the repeated interactions between a human intermediary and its customers allows better trust building and better price offer (Barclay et al. 2006; Seppi 1990).

The proliferation of electronic trading systems and electronic markets has appealed to new thoughts as to the impact of intermediaries (Bhargava and Choudhary 2004; Weber 2006). It is predicted that the rise of electronic markets will make traditional intermediaries obsolete by matching buyers and sellers directly (Malone et al. 1987; Bakos 1997). It is also anticipated that such a promise will be fulfilled through the emergence of *digital intermediaries*

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[2] Forrester research report 2005
[3] Music Trades, August, 2004.
[4] Currently, eBay also offers the optional feature of "or Best Offer" along with the "Buy it Now"

or *cyber intermediaries*, who are the advanced digital technologies and platforms to bring buyers and sellers together (Hawkins et al. 1999; Malone et al. 1989). However, such predictions of the vanishing of traditional intermediaries have seen little anecdotal support. Using data from Aircraft parts industry, Choudhury et al. (1998) found that the extent to which brokers are used is not influenced by the implementation of an electronic inventory location system. Barclay et al. (2006) tested the impact of human intermediaries in the U.S. Treasury securities market. They found that the market share of trading through human intermediaries is significantly higher than that through automated trading systems for less active securities. Human intermediaries' expertise of the market can uncover hidden liquidity and facilitate matching of customer orders. Chircu and Kauffman (2000) described various forces that lead to disintermediation through new technologies for e-commerce. They argue that digital intermediaries, as new Internet-focused competitors, can take various approaches to achieve short-run competitive advantages. In the long-run, nevertheless, the market will move toward *re-intermediation*, in which the traditional intermediaries, who have once been driven out of the market, are able to re-establish themselves by exploiting the capability of technologies.

Online auctions

The online auction business model is one in which participants bid for products and services over the Internet. The functionalities of buying and selling in an online auction are made possible through auction software which regulates the various processes involved. Online auctions have recently gained tremendous popularity and are one of the most successful forms of e-commerce (Bajari and Hortaçsu 2003). There is an extensive body of research on the empirical analysis of online auction data. While a complete literature review on the empirical research on Internet auctions is beyond the scope of this paper, we present a few recent and relevant studies.

Bajari and Hortaçsu (2003) investigate a unique dataset of eBay coin auctions to examine what determines the seller and bidder behavior, especially the influence of winner's curse and last-minute bidding. A recent study by Goes et al. (2010, forthcoming) examines willing-to-pay (WTP) formation of repeat bidders in sequential online auctions, aiming to explain how bidders in such an environment learn from the information, then form and update their WTP. Since our paper studies the impact of brokers in trust building, it is closely related to recent studies investigating trust building in online auctions. Extant literature has focused on investigating whether online feedback and reputation systems induce trust and lead to higher auction prices, but the results are mixed. Ba and Pavlou (2002)

found that sellers' feedback profile plays a very important role in auction price premiums. Melnik and Alm (2002) showed that sellers' reputation has a small positive impact on prices in eBay's coin auctions. Dewan and Hsu (2004) examined adverse selection in electronic markets. They found that the stamp auction prices on eBay are significantly lower than those in a traditional stamp auction site. Such adverse selection discount is attributed to the higher quality uncertainty in the Internet auctions. They also demonstrated that sellers' feedback score has modest effect on stamp auction prices and probability of sale.

This paper focuses on examining the impact of brokers in online C2C electronic markets. We are particularly interested in the impact of brokers as market participants instead of being just an outside intermediary. To our knowledge, the impact of traditional intermediaries in market structure and efficiency in C2C markets has not been addressed by previous literature. This research aims to take the initial step to fill this gap in contributing to the literature in understanding the impact of human intermediaries in C2C electronic markets.

Hypotheses

Extant economics and finance literature suggest that intermediaries can help provide liquidity in the make by increasing the probability of successful trade and stabilizing market price (Cosimano 1996; Barclay et al. 2006; Grossman 1992). Such a function of brokers is still indispensable in electronic markets. Brokers are often professionals with substantial product knowledge. Especially for collectible and private value items such as stamps, coins, antiques, and works of art, brokers have the expertise of identifying product value. Brokers are also active participants of the C2C markets, gaining unique insights into market dynamics. Brokers' knowledge of products and the market enables them to buy low and sell high in the market and to match unsynchronized supply and demand over time. Accordingly, the presence of brokers increases the probability of trade. In addition, brokers also can be more resilient to changes in transaction volume in the market given their large inventory. They can choose to strategically enter or exit the market as opposed to other occasional buyers and sellers, thus providing liquidity of the product. Furthermore, existence of brokers also provides product quality and price references for other buyers and sellers, which facilitate price discovery in the markets, resulting in higher market prices (Barclay et al. 2006; Cosimano 1996; Seppi 1990). This gives rise to the following hypotheses in the paper:

H1a: The presence of brokers in electronic markets increases probability of trade in the market.

H1b: The presence of brokers in electronic markets increases market prices.

Electronic markets are suggested to be particularly susceptible to information asymmetry between buyers and sellers (Dewan and Hsu 2004; Pavlou and Gefen 2004). First, buyers face higher uncertainty of product quality in online markets without direct observations than in conventional brick and mortar stores. Second, participants in electronic markets are often remote buyers and sellers who have little or no prior interactions. Third, electronic transactions expose participants to an even greater risk with the lack of enforceable regulatory policies. Building trust has therefore become a crucial factor in influencing trading in electronic markets (Ba and Pavlou 2002). Existing literature has addressed the impact of third parties, institutions, and feedback and reputation systems in evaluating sellers' credentials and improving trust building (Pavlou and Gefen 2004). Consequently, new entrants would face the barrier of establishing reputation in the market before they can be fully recognized.[5] The presence of brokers can reduce such reputation penalty in dealing with less established buyers and sellers. Brokers often have established reputation and can bear more risks in buying and selling. They can gain more sales in online markets from risk-averse buyers. Brokers are also willing to take the risk to purchase from less established sellers in exchange for lower prices. This leads to the following hypotheses we test in the paper:

H2a: Sellers with lower feedback scores are more likely to generate higher price premium from brokers as buyers.

H2b: Brokers as sellers are more likely to generate higher price premium from buyers with lower feedback scores.

Data and descriptive statistics

The eBay stamp auction data

Millions of items are listed on eBay on any given day, which are organized into thousands of categories and subcategories. In this research we focus on the stamp auctions on the eBay US site, which is well-suited for our research objectives. First, stamps are one major category in online auction sites such as eBay where there are more than 100,000 listings every day. Second, stamps are widely recognized as the private value items that require specialty knowledge to evaluate. Third, the stamp auction market traditionally has the dominant feature of

having quality variation in the items, which imposes more risks in electronic markets. Finally, the retail value of stamps can be obtained from various stamp catalogs. One of the most widely referenced stamp catalogues is the Scott Standard Postage Stamp Catalogue (SCC). SCC is updated and published annually according to the survey of stamps brokers worldwide. In this study we use 2006 Scott Value as a proxy for the book value of stamps (Dewan and Hsu 2004).

We collected data from one of the eBay's stamp auction subcategories: "1941-Now: Unused US Stamps", which has a consistently large number of listings (more than 2,000 listings on each day). We collected all the completed listings, which included all the items that have already finished the auctions (with or without bids), between February and March 2006. For each item, our data collection includes listing details, descriptive information, bidding history and each individual bid information, as well as final transaction information. The completeness of history makes it possible to compile an ample data set with great wealth of information. Table 1 provides the description of some key variables of our data.

For the purpose of our research, it is important to identify brokers in the market. Stamp brokers usually hold bulky inventory and sell large number of stamps, who also take the opportunity of buying low and selling high to make profits. They are usually stamp collectors themselves who have expertise on stamp assessment. Brokers can be readily identified through their seller level, descriptions and trading history. Many users even prominently identify themselves

Table 1 Variable description

Variable	Description
Auct_Len	Describes the number of days the seller wants the listing to be active
Bid_Count	Number of bids placed against the item.
Weekend	A dummy variable indicate whether the auction ends at the weekend
Buyer_FbScore	The aggregate feedback score for the buyer
Seller_FbScore	The aggregate feedback score for the seller
Seller_Broker	If true, the seller is a typical stamp broker in the market
Buyer_Broker	If true, the buyer is a typical stamp broker in the market
Seller_Level	The seller's eBay PowerSeller tier from 1 to 7
Broker_Seller_Level	The stamp broker's eBay PowerSeller tier from 1 to 7
Start_Price	Value of start price specified by the seller
StartPrice/Value	Ratio of the start price and the Scott Value
End_Price	Transaction price of the item
EndPrice/Value	Ratio of the transaction price and the Scott Value

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[5] Many listings on eBay are specified to be only sold to buyers with more than 25 feedback scores.

as a "stamp broker" on their listing pages and choose a user name clearly attached with the word "stamp".

Descriptive statistics

To generate some initial insights for our research questions, we first analyze our data by generating various descriptive statistics. To control for the cross-product heterogeneity and ensure the accuracy of evaluation, our analysis is restricted to the single-item auction listings for commemorative stamp sets. We also eliminate items that no Scott value can be identified. Our final sample includes around 3,000 completed listings. As reported in Table 2, the average book value of stamps is $16.82, ranging from $0.2 to $750, reflecting the wide dispersion of stamp book values. The average normalized (price to value ratio) start price is 0.78 with a fluctuation from 0.00004 to 31.78, indicating the variation of sellers' expertise on stamp values. While some sellers may set a very low start price with the strategic consideration of attracting more buyers, there is no rational justification for setting a start price much higher than the book value. Such variances of starting values suggest that sellers in the market may have drastically different level of knowledge and evaluation of the products. This also suggests that sellers may employ markedly different auction strategy due to their different objectives and understanding of the market.

Sellers' feedback scores vary from 0 to 21,485 with an average around 4,000, indicating that the market accommodates both novices and veterans. Feedback score is an aggregation of feedbacks from both buyers and sellers for the specific registered user. To further differentiate sellers, eBay provides a "PowerSeller" ranking system with tiers from Bronze to Titanium. Qualified sellers must sustain a consistently high volume of monthly sales and a high level of total Feedback. To be recognized as a "PowerSeller", the seller must maintain a 98% or better positive rating by other eBay users. We assign a numeric value to the descriptive ranking, so that None equals to 1, CustomerCode equals to 2… and Titanium equals to 7. In Table 2, we see that the average seller level is around 2, suggesting that there are many inexperienced sellers in the market. Table 2 also shows that there are about 65% listings are from brokers and a little more than half (55.75%) items are successfully sold.

Table 3 demonstrates the summary statistics for items that have been successfully sold. The mean of the normalized start price is 0.61 which is lower than the average start value of the total sample (0.78). The normalized end price ranges from 0.02 to 4.14 with a mean of 0.84. This suggests that on average the end price of sold items is lower than their book value. However, some listings can even be sold at a price 3–4 times higher than their book values. Such a variance in the market well exhibits the opportunity of generating profits of buying low and selling high. Table 3 also tells us that around 64% sold items are from brokers, but only about 2% buyers are brokers. It is also worth noting that the average buyers' feedback score (294.42) is much lower than sellers' (3,533.82). The buyers' seller level is also fairly low with a mean of 1.08 and maximum of only 4, suggesting that most buyers in the market are relatively inexperienced.

Our data can be further classified into two categories: the commemorative year set (CYS) and the souvenir sheet set (SSS). CYS includes all the commemorative stamps released in a specific year. For example, the CYS for year 2009 include all the commemorative stamps released only in year 2009. SSS is usually a set of stamps specially designed for a person, a character, a special event, and etc. An example of a SSS is a Souvenir Sheet of 12 42-cent Celebrating Lunar New Year (2009): Year of the Ox commemorative stamps. Both categories are very popular in the stamp market with high collection values. The values of SSS are easily identified even for stamp novices, but to evaluate different year sets (the complete set of commemorative stamps in a specific year) requires considerable effort and expertise. As shown in Table 4, the percentage of brokers in the category of CYS (83.67%) is higher than that in SSS (50.45%), given that the total number of listings is pretty similar. In addition, the average seller feedback score is much higher in CYS (5,148.01) than that in SSS (2,905.48), indicating that there are much more experienced sellers in CYS. Com-

Table 2 Summary statistics

Variable	N	Mean	SD	Min	Max
Auct_Len	3,015	6.74	1.04	1.00	10.00
Scott_Value	3,015	16.82	36.48	0.20	750.00
StartPrice/Value	3,015	0.78	0.93	0.00004	31.58
Seller_FbScore	3,015	3,921.50	5,895.03	0.00	21,485.00
Seller_Level	3,015	2.11	1.18	1.00	7.00
Broker_Seller_Level	1,975	3.48	1.20	2.00	7.00
% Seller_Broker	1,975 (65.51%)				
% Sold	1,681 (55.75%)				

Table 3 Summary statistics for sold items

Variable	N	Mean	Std. Dev.	Min	Max
Auct_Len	1,681	6.79	0.94	1.00	10.00
Bid_Count	1,681	3.17	3.39	1.00	28.00
StartPrice/Value	1,681	0.61	0.51	0.00004	3.93
EndPrice/Value	1,681	0.84	0.55	0.02	4.14
Seller_FbScore	1,681	3,533.82	5,779.58	0.00	21,485.00
Buyer_FbScore	1,681	284.42	573.09	0.00	4,053.00
Buyer_Seller_Level	1,681	1.08	0.39	1.00	4.00
% Seller_Broker	1,077 (64.07%)				
% Buyer_Broker	28 (1.67%)				

paring these two categories allows us to identify the impact of brokers in different markets.

Empirical analyses

In order to test the impact of brokers on the success rate of trade, we run a logistic regression with the probability of sale as the dependent variable. The key independent variables are a binary specification indicating whether the item was listed by a broker, and the interaction term between broker and their feedback scores. Drawing from previous empirical auction literature (e.g., Bajari and Hortaçsu 2003; Dewan and Hsu 2004), we also include other variables that are likely to influence the possibility of sale such as the auction length, starting price, and whether the auction ends in weekend. The longer the auction, the lower the starting price, and auction ends in weekend have shown to increase the possibility of sale. As evidenced in Table 5, brokers' listings enjoy a significantly higher probability of sale. In addition, the results show that for a broker, the success rate of sale no longer depends on his feedback score. This finding is demonstrated by adding the coefficients of broker and the interaction term (0.13+−0.19=−0.06), which is not statistically significant. Therefore, the presence of broker increases the probability of sale in the market, regardless of their

feedback scores. The logistic regression results support our hypothesis (H1a) that the presence of brokers provides liquidity in the market by increasing the probability of sale.

We also compare the two markets of CYS and SSS in light of whether brokers play a role in facilitating trade. As shown in Table 6, brokers significantly increase the success rate of sale only in CYS, but not in SSS. Given that the percentage of sold listings in CYS (54.17) and SSS (57.06) are very similar, this result suggests that brokers' influences are more pronounced in the market that requires expertise knowledge of the product with greater information asymmetry between sellers and buyers.

While logistic regression does compute correlation measures (as in linear regressions) to estimate the strength of the relationship, (pseudo R^2 measures, such as Nagelkerke's R^2), these correlation measures do not really tell us much about the accuracy or errors associated with the model (Wooldridge 2002). In Tables 5 and 6, we report the pseudo R^2 for reference. A more useful measure to assess the utility of a logistic regression model is classification accuracy, which compares predicted group membership based on the logistic model to the actual, known group membership, which is the value for the dependent variable (Wooldridge 2002). We, therefore, run the classification test and report the *correctly classified percentage* in Tables 5 and 6. The *correctly classified*

Table 4 Summary statistics for CYS and SSS

	Variable	N	Mean	Std. Dev.	Min	Max
CYS	EndPrice/Value	740	1.01	0.61	0.04	4.14
	StartPrice/Value	1,366	0.94	0.79	0.005	11.86
	Seller_FbScore	1,366	5,148.01	5,781.21	3.00	21,480.00
	% Broker	83.67%				
	% Sold	54.17%				
SSS	EndPrice/Value	941	0.71	0.45	0.02	3.93
	StartPrice/Value	1,649	0.65	1.01	0.000004	31.58
	Seller_FbScore	1,649	2,905.48	5,795.99	0.10	21,485.00
	% Broker	50.45%				
	% Sold	57.06%				

Table 5 Logistic regression result

Variable	Parameter estimate	
Seller_Broker	1.40[a]	(0.37)
log (Seller_FbScore)	0.13[a]	(0.04)
Seller_Broker*log(Seller_FbScore)	−0.19[a]	(0.06)
log (Auction_Len)	0.72[a]	(0.21)
log (StartPrice/Value)	−0.88[a]	(0.06)
Weekend	0.15[c]	(0.08)
Constant	−2.33	(0.48)
Pseudo R^2	0.12	
Correctly classified	64.31%	
Number of Observations	3,015	
Log-Likelyhood	−1,874.14	

The dependent variable is whether the item has been sold

[a] Denote significance at 1%

[b] Denote significance at 5%

[c] Denote significance at 10%

percentages in all three estimations signify satisfactory model fit.

To test if there is any multicollinearity problem, we calculate the Variance Inflation Factor (VIF) for logistic regressions reported in Tables 5 and 6. We do find Seller_Dealer, log(Seller_FbScore), and the interaction term (Seller_Dealer*log(Seller_FbScore)) have VIF values greater than 10, indicating the possible multicollinearity problem between these two variables. We then drop the log (Seller_FbScore) and the interaction term from the model. The estimation results for the remaining variables are qualitatively very similar to the original model, still rendering strong support for H1a. And the VIF values for all the variables are smaller than 2. We, therefore, choose to present the results in the original model in order to demonstrate that brokers have significant influence on the probability of sale regardless of their feedback school, although we have to be aware that most brokers have very high feedback scores.

To test the influence of brokers on the market price (H1b) and their interactions with buyers and brokers (H2a and H2b), we run a regression using the normalized end price as the dependent variable. The key independent variables are dummy variables indicating whether the seller or the buyer is a broker, the dummy variables indicating whether sellers or buyers have low or high feedback scores (Seller_FbScore_d or Buyer_FbScore_d),[6] and their interactions. We also add other control variables including

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[6] The binary user feedback score is determined by the median of the sample feedback score. For example, for data with buyer feedback score greater the sample median, the dummy variable Buyer_Fb-Score_d equals to 1, otherwise equals to 0.

auction length, the normalized start price, number of bids, and the indication of whether the auction ends in weekend. Table 7 shows the regression results. We calculate the VIF value for all the independent variables. All VIF values are smaller than 4, which indicate no multicollinearity concerns for the model. We can see that the participation of brokers as either a seller or a buyer increases the normalized end price. This validates our hypothesis H1b of brokers' impact of buying low and selling high in the market, providing liquidity as well as increasing prices.

H2a is also supported in the results that the influence on price by brokers is more pronounced for sellers with lower feedback scores (the interaction term of Buyer_Broker*-Seller_FbScore_d is negative and significant). H2b is not supported in the regression results. A possible explanation is that we only consider the final buyer's feedback score, which may not be able to fully capture how brokers' items draw attention from more buyers with lower feedback scores, thus increasing the final price. The interaction between brokers and buyers shall be further investigated in future research by examining the entire bidding process in the auction. Our findings suggest that brokers are more likely to engage in transactions with less established sellers. Such a result provides initial support for our hypothesis that brokers can bear more risk and help trust building among inexperienced players in the market, thus reducing the reputation penalty faced by those less established buyers and sellers. In addition, our results indicate that brokers, as knowledgeable traders, can estimate the true value of the merchandise more accurately due to their knowledge. They, therefore, can take advantage of the opportunity to buy low and sell high in the market.

Implications, limitations, and future research

Recent development in e-commerce and other digital technologies have dramatically altered the way sellers and buyers can interact and connect with each other. These changes have spawned significant growth in electronic markets, which serve as the cornerstone for new business models that promise to transform traditional commerce. It has been suggested by many scholars that traditional intermediaries will be eliminated by the emergence of electronic market places due to its capability to significantly lower the search cost and allow direct and efficient transactions between sellers and buyers. Many anecdotal evidences, however, demonstrates that the traditional intermediaries still play an important role even in electronic markets. In this study, we examine the key impact that traditional intermediaries, such as brokers, have on C2C electronic markets, which is to help generate liquidity in the market. Our empirical analyses of the eBay stamp auction

Table 6 Logistic regression result

Variable	Year_Set		Sheet_Set	
	Parameter estimate			
Seller_Broker	5.24[a]	(0.75)	0.15	(0.46)
log(Seller_FbScore)	0.56[a]	(0.11)	0.03	(0.05)
Seller_Broker*log (Seller_FbScore)	−0.80[a]	(0.13)	−0.02	(0.07)
log(Auction_Len)	1.89[a]	(0.34)	−0.15	(0.31)
log(StartPrice/Value)	−0.86[a]	(0.09)	−0.96[a]	(0.08)
Weekend	0.19	(0.12)	0.16	(0.11)
Constant	−6.92	(0.88)	−0.36	(0.67)
Pseudo R^2	0.13		0.10	
Correctly classified	65.23%		64.16%	
Number of Observations	1,366		1,649	
Log-Likelyhood	−817.14		−1,026.20	

The dependent variable is whether the item has been sold

[a] Denote significance at 1%

[b] Denote significance at 5%

[c] Denote significance at 10%

data indicate that the presence of brokers help provide liquidity in electronic markets. Our data show that over 50% of the volume is contributed by brokers. Our empirical results suggest that the presence of brokers improve the probability of sale especially for the stamp category that requires more knowledge and expertise. Moreover, the analyses indicate that brokers are more likely to engage in transactions with less experienced sellers, which further facilitate generating liquidity in the market.

Our study provides new perspectives in understanding the impact of human intermediaries in electronic markets. Information asymmetry is still very severe in today's e-commerce environment. The vast amount of information available on the Internet has created information overload among online users (Jones et al. 2004). In particular,

Table 7 Regression result for normalized end price

Variable	Parameter estimate	
Seller_Broker	0.15[a]	(0.03)
Buyer_Broker	0.36[a]	(0.11)
Seller_FbScore_d	0.16[a]	(0.03)
Buyer_FbScore_d	−0.07[c]	(0.03)
Seller_Broker*Buyer_FbScore_d	0.08[c]	(0.04)
Buyer_Broker*Seller_FbScore_d	−0.59[a]	(0.17)
log(Auction_Len)	0.05	(0.06)
log(StartPrice/Value)	0.43[a]	(0.01)
log(Bid_Count)	0.39[a]	(0.02)
Weekend	0.005	(0.02)
Constant	−0.53	(0.12)
Number of Observations	1,681	
Adj. R^2	0.48	

[a] Denote significance at 1%

[b] Denote significance at 5%

[c] Denote significance at 10%

products have become increasingly sophisticated, and assessment of their value and features often requires extensive knowledge about the products. Moreover, the number of competing products has grown exponentially as a result of the Internet's reach. For example, the stamp listings on eBay have been grown almost every day. Buyers often find that they lack the time and knowledge to make the optimal choices. Our study suggests that intermediaries appear to help mitigate the information asymmetry problem, due to their knowledge and experience of products and markets. They can act as a "new" source of information that is useful in determining the value the product and the outcome of the transaction. Additionally, our study indicates that intermediaries may facilitate building trust among sellers and buyers, which is a critical driver of successful transactions in electronic markets where the environment is relatively unstructured. Even though more conclusive insights are expected to be generated from larger and more comprehensive analysis in future studies, our current results lay the foundation of the development of the stream of research on exploring the impact of traditional intermediates in electronic markets.

This paper has a number of limitations. First, there might be unobserved factors intrinsic to the market and/or timing that could potentially influence the price and transaction probability. The current dataset and analysis may not be able to fully control such factors. This matter, however, could be addressed as an interesting extension in future research by investigating longitudinal datasets and incorporating more market environmental factors. Second, H2b is not supported in our analysis. To further explore this issue, besides examining larger data size and longer time period, it would be very interesting in future research to study the whole bidding history for each item in order to better investigating buyer' bidding behavior. Third, this study only investigates one month auction data, which does

not allow us to further explore the relationship between intermediaries and other players in the market. Hence, the analysis should be extended to longer time periods to capture the dynamics of the impact of intermediaries in the market. Future research also calls for more extensive examinations on "trust building" between intermediaries and other uses in the online auction market, which has important implications in designing business based on online networks. Fourth, in this study, we only consider stamp auction data, which may limit the generalizability of the results. Therefore, the analysis calls for extension beyond auction data, which should include the comparison and contrast with other formats such fixed price and best offer, as well as investigating more product categories. Last but not the least, recent development of Web 2.0 technologies has spawn significant growth and interest in online social networks. Online C2C markets, such as eBay, are often composed of networks of sellers and buyers. Such a network feature has not been considered in this study. A very interesting and important extension to this study would be to investigate the impact of intermediates in networks of buyers and sellers in today's electronic markets.

References

Ba, S., & Pavlou, P. A. (2002). Evidence of the effect of trust building technology in electronic markets: price premiums and buyer behavior. _MIS Quarterly, 26_(3), 243–268.

Bajari, P., & Hortaçsu, A. (2003). The winner's curse, reserve prices and endogenous entry: empirical insights from eBay auctions. _RAND Journal of Economics, 34_(2), 329–355.

Bakos, J. Y. (1991). A strategic analysis of electronic marketplaces. _MIS Quarterly, 15_(3), 295–310.

Bakos, J. Y. (1997). Reducing buyer search costs: implications for electronic marketplaces. _Management Science, 43_(12), 1676–1692.

Barclay, M. J., Hendershott, T., & Kotz, K. (2006). Automation versus intermediation: evidence from treasuries going off the run. _Journal of Finance, LXI_(5), 2395–2414.

Bhargava, H. K., & Choudhary, V. (2004). Economics of an information intermediary with aggregate benefits. _Information Systems Research, 15_(1), 22–36.

Braziel, R. R. (2001). Delivering liquidity: Intermediaries gain new respect. _@Markets_.

Chircu, A., & Kauffman, R. (2000). Reintermediation strategies in business-to-business electronic commerce. _International Journal of Electronic Commerce, 4_(4), 7–42.

Choudhury, V., Hartzel, K. S., & Konsynski, B. R. (1998). Uses and consequences of electronic markets: an empirical investigation in the aircraft parts industry. _MIS Quarterly, 22_(4), 471–507.

Cosimano, T. F. (1996). Intermediation. _Economica, 63_, 131–143.

Dewan, S., & Hsu, V. (2004). Adverse selection in electronic markets: evidence from online stamp auctions. _The Journal of Industrial Economics, LII_(4), 497–516.

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. _Review of Economic Studies, 51_, 393–414.

Garman, M. B. (1976). Market microstructure. _Journal of Financial Economics, 13_, 257–75.

Grossman, S. (1992). The information role of upstairs and downstairs markets. _Journal of Business, 65_, 509–529.

Goes, P. B., Karuga, G. G., & Tripathi, A. K. (2010). Understanding willingness-to-pay formation of repeat bidders in sequential online auctions. _Information Systems Research_, forthcoming.

Hawkins, R., Mansell, R., & Steinmueller, W. E. (1999). Toward digital intermediation in the information society. _Journal of Economic Issues, 33_, 383–391.

Hinz, O., & Spann, M. (2008). The impact of information diffusion on bidding behavior in secret reserve price auctions. _Information Systems Research, 19_(3), 351–368.

Ho, T., & Stoll, A. (1981). Optimal dealer pricing under transactions and return uncertainty. _Journal of Financial Economics, 60_, 977–990.

Jones, Q., Ravid, G., & Rafaele, S. (2004). Information overload and the message dynamics of online interaction spaces: a theoretical model and empirical exploration. _Information Systems Research, 15_(2), 194–120.

Lizzeri, A. (1999). Information revelation and certification intermediaries. _RAND Journal of Economics, 30_(2), 214–231.

Lucking-Reiley, D. (1999). Using field experiments to test equivalence of between auction formats: magic on the internet. _American Economic Review, 89_(5), 1063–1080.

Malone, T. W., Yates, J., & Benjamin, R. I. (1987). Electronic markets and electronic hierarchies. _Communication of the ACM, 30_(6), 484–497.

Malone, T. W., Yates, J., & Benjamin, R. I. (1989). The logic of electronic markets, _Harvard Business Review, 67_(3), 166–169.

Melnik, M. I., & Alm, J. (2002). Does seller's ecommerce reputation matter? Evidence from eBay auctions. _The Journal of Industrial Economics, L_(3), 337–349.

Park, Y., & Bradlow, E. T. (2005). An integrated model for bidding behavior in internet auctions: whether, who, when, and how much. _Journal of Marketing Research, XLII_, 470–482.

Pavlou, P. A., & Gefen, D. (2004). Building effective online marketplaces with institution-based trust. _Information Systems Research, 15_(1), 37–59.

Roth, A. E., & Ockenfels, A. (2002). Last-minute bidding and the rules for ending second-price auctions: evidence from eBay and Amazon auctions on the internet. _American Economic Review, 92_(4), 1093–1103.

Seppi, D. (1990). Equilibrium block trading and symmetric information. _Journal of Finance, 45_, 73–94.

Weber, B. W. (2006). Adoption of electronic trading at the international securities exchange. _Decision Support Systems, 41_(4), 728–746.

Winkler, G. M. (1989). Intermediation under trade restrictions. _Quarterly Journal of Economics, 104_, 299–324.

Wooldridge, J. M. (2002). _Econometric analysis of cross section and panel data_. Cambridge: MIT.