Markets versus Negotiations:

An Experimental Investigation*

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March, 2005

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* We are grateful for the suggestions made by Gary Bornstein, Itzhak Gilboa, Daniele Paserman, Marc Rysman, and seminar audiences at the Hebrew University, and at the ESA Meeting in Strasbourg. An associate editor and two anonymous referees provided useful comments. Financial support from the Aims Byudks foundation is gratefully acknowledged.

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Abstract

We consider the consequences of competition between two types of experimental exchange mechanisms, a “decentralized bargaining” market, and a “centralized” market. It is shown that decentralized bargaining is subject to a process of “unraveling” in which relatively *high value traders* (buyers with a high willingness to pay and sellers with low costs) continuously find trading in the centralized markets more attractive until few opportunities for mutually beneficial trade remain outside the centralized marketplace.

JEL Classification Numbers: C78, D40, L10

Keywords: centralized markets, decentralized markets, decentralized bargaining, market design, market formation.

1. Introduction

What determines buyers' and sellers' choices of how and where to trade? Existing answers typically presuppose that traders' choices are done within the context of some *single* specific exchange mechanism -- that is, in most models traders are typically not allowed to choose the mechanism through which to trade. The purpose of this experimental paper is to shed light on the factors that affect traders' choices among different mechanisms.

Specifically, we consider the consequences of competition between two types of experimental exchange mechanisms, a "decentralized bargaining" market, and a "centralized" market. Competition assumes the following form: in every period, members of a heterogeneous population of privately-informed traders who each wish to buy or sell one unit of some homogenous good may opt for trading through either (1) direct negotiations with other buyers and sellers (a decentralized bargaining market), or (2) a centralized market mechanism.[1]

It is important to emphasize that in order to predict the outcome of such competition it is not enough to analyze the properties of different exchange mechanisms in isolation. Because traders' choices of where to trade are endogenous, the very existence of a competing exchange mechanism may affect the outcome in any given mechanism. In other words, the question is what kind of exchange mechanisms is likely to flourish when traders are free to choose through which mechanism to transact. We demonstrate that the presence of a competing exchange mechanism introduces interesting dynamics into

[1] Note that we restrict our attention to the case of homogenous goods only. If goods are not homogenous, then issues of quality and credibility might arise, which may further complicate traders' choices (see, e.g., Brown et al., 2002).

traders' choices of where to trade. One of the main insights presented in this paper is that different *types* of buyers and sellers generally prefer different mechanisms. Once traders are given the opportunity to express their preferences, the distribution of buyers' and sellers' types in the two competing mechanisms changes, which causes traders to further change their preferences, and so on.

In a recent theoretical paper, Neeman and Vulkan (2000) suggest that for the case of homogenous goods centralized markets may come to dominate decentralized markets because of a process of "unraveling" in which relatively *high value* traders (buyers with high willingness to pay and sellers with low costs) continuously find trading in centralized markets more attractive until no opportunities for mutually beneficial trade remain outside the centralized marketplace.

We examine experimentally the main insight contained in Neeman and Vulkan's work, namely that high value traders' types would be relatively better off in a centralized compared to a decentralized market, and should therefore also be relatively more inclined to trade in the centralized market. The decentralized bargaining market in the experiment is operationalized as follows: traders are matched into pairs of one buyer and one seller and are asked to specify bid and ask prices. If the bid price is larger than or equal to the ask price, then the buyer and seller trade at a price equal to the average of the bid and ask prices. Notably, transaction prices in such a market generally vary across the different matches. In contrast, our experimental centralized market is a form of exchange with a single transaction price. It is operationalized as a sealed-bid double-auction: buyers and sellers specify bid and ask prices, respectively, from which market demand and market supply curves are constructed. A market clearing price is determined and the buyers who submitted bids above the market clearing price trade with the sellers whose submitted ask prices were below the market clearing price. This form of exchange resembles a *call market* which is used in many real exchanges around the world.

The results we obtain lend support to Neeman and Vulkan's (2000) main insight. Although the unraveling of trade outside the centralized market does not go all the way towards eliminating trade through direct negotiations, the relative willingness of different types of traders to trade through different forms of exchange is the same as predicted by their analysis.

These results are consistent with anecdotal evidence from e-commerce: A recent study of a large data set of transaction prices for new cars purchased both online and off-line by Morton, Zettelmeyer, and Silva-Risso (2003) concludes "the Internet is disproportionately beneficial to those who have personal characteristics that put them at a disadvantage in negotiations" (see also Zettelmeyer, Morton, and Silva-Risso, 2001). These disadvantaged traders are our "high value" traders' types.

To the best of our knowledge, very little has been written on the subject of the endogenous choice of market mechanisms, which is an important aspect of the more general subject of the endogenous formation of markets. Existing theoretical literature, for the most part, has confined its attention to the analysis of different market mechanisms in isolation. When comparisons between different market mechanisms were made, they were usually done from the perspective of the seller, asking which mechanism a single seller would prefer under the assumption that buyers have no choice but to participate in the chosen mechanism (as in, e.g., Milgrom and Weber, 1982). A small number of papers have considered the endogenous distribution of mechanisms (see, e.g., McAfee, 1993; Peters, 1994; and the references mentioned in Neeman and Vulkan, 2000) but in models where competing sellers choose a type of auction through which to sell and buyers select in which seller's auction to participate. That is, the implication of the assumption that traders are free to choose the exchange mechanism through which to trade on the outcome of competition between different mechanisms was mostly studied in asymmetric models that favor sellers over buyers. In contrast, we consider an environment in which buyers and sellers are treated symmetrically.[2]

Likewise, the experimental literature also confines its attention to the analysis of different market mechanisms in isolation (see, e.g., Plott and Smith, 1978; Ketcham et al., 1984; Cason et al. 2003; and the references therein). Experimental literature on the endogenous choice among different market forms is almost non existent. Three notable exceptions are the papers by Campbell, LaMaster, Smith, and Van Boening (1991), Brown, Falk, and Fehr (2004), and Kirchsteiger, Niederle, and Potters (2003). Campbell et al. (1991) study the extent of off-floor trading in an open (not sealed-bid) double-auction market with a bid-ask spread. They show that off-floor trades inside the bid-ask spread are used to privately split the gain represented by the bid-ask spread without publicly revealing a willingness to make price concessions. Despite the superficial similarity of this paper's experimental setup to ours, which is due to the fact that off-floor trading is a form of direct negotiations and an open double-auction resembles a centralized market, Campbell et al.'s (1991) result is different from ours. The difference is due to the following reason. Unlike our sealed-bid double auction, their open double-auction admits a positive bid-ask

[2] A number of papers have recently examined the consequences of competition between two *identical* market forms (see Ellison, Fudenberg, and Mobius, 2004, and the references therein). These papers establish conditions under which there exists a "plateau" of equilibria with different market sizes. In this paper, rather than asking if and when two identical markets can co-exist, we examine conditions under which one market form is strictly preferred over another.

spread. Therefore, the traders in Campbell et al.'s experiment, and especially those who are interested in trading large quantities, have a strong incentive to take advantage of the existence of a positive bid-ask spread and free-ride on the process of price discovery in the double-auction by privately negotiating some transactions outside the organized double-auction market. The other two papers are very different from ours. Brown et al. (2004) focus on principal-agent relations in markets. They show that in markets with complete contracts, employers and workers are indifferent with whom they transact and the majority of transactions are one-shot. In contrasts, in markets with incomplete contracts (with non-homogenous goods), contracting parties are concerned about the identities of their partners and consequently form long-term bilateral relations. Finally, Kirchsteiger et al. (2003) study the results of an experiment in which traders may choose to whom to communicate their price offers. They show that sellers communicate their price offers to all of the buyers but to none of the sellers, and vice-versa. They also survey the scant experimental literature devoted to endogenous market structure.

The rest of the paper proceeds as follows. The next section is devoted to a description of Neeman and Vulkan's main result and the sense in which it can be experimentally tested. In section 3, we describe the experimental design, and in Section 4, the results. Section 5 offers a brief conclusion.

2. Theoretical Foundations

Neeman and Vulkan obtain the following main result (for a fuller description of Neeman and Vulkan's work, see the online appendix to this paper).

Proposition (Neeman and Vulkan, 2000): In every equilibrium, in every period in which the centralized market operates, almost all those buyers and sellers who trade, trade through the centralized market.

Intuitively, because a single trader's willingness to pay or cost hardly affects the price in a large centralized market, centralized markets protect high value traders' types from paying high prices if they happen to be buyers and accepting low prices if they happen to be sellers. In contrast, under direct negotiations, exactly because of their high value, buyers with a higher willingness to pay are likely to pay relatively high prices and low cost sellers are likely to be forced to accept low prices. As such high value types of both buyers and sellers opt for trading in the centralized market, the price in the centralized market remains relatively unaffected. In contrast, as high value types of buyers and sellers opt out of direct negotiations, the distribution of remaining buyers' and sellers' types puts relatively more weight on relatively lower value types, which again, forces those buyers and sellers with relatively high value types to pay higher prices and accept low prices, respectively. This unraveling eventually pushes all "serious" traders (i.e., traders who could potentially trade in the centralized market) towards trading in the centralized marketplace. Once all serious traders decline to engage in direct negotiations, no other trader can profitably trade through direct negotiations.

The proposition implies that in any particular period only two outcomes are consistent with Nash equilibrium: one in which all trade in that period occurs through the centralized market, and another where the centralized market does not operate in that period and all trade occurs through direct negotiations. While the former outcome is consistent with a *perfect* Nash Equilibrium, the latter is not. That is, while the first outcome arises as part of a Nash equilibrium that is robust to "trembles" or uncertainty about traders' choices, the second does not. If in some period *t* the traders "tremble" by, say, choosing to trade through either the centralized market or direct negotiations with probability at least ε for some small $\varepsilon > 0$, then a large enough number of traders would opt for trading in the centralized market. This implies that the centralized market would operate, and the Proposition would apply. It therefore follows that once trembles are introduced, opting for direct negotiations cannot possibly be a best response, and so the outcome where all traders trade through direct negotiations cannot be part of a perfect Nash Equilibrium.

The main insight provided by Neeman and Vulkan is that direct negotiation is subject to unraveling once the option of trading in a centralized market becomes available to the traders. This is the insight that we wish to examine experimentally in this paper.[3]

We thus predict that everything else equal, traders with higher value types would exhibit a stronger tendency to opt for the centralized market, and that this tendency would become more pronounced with time. We therefore expect that trade under direct negotiations would unravel over time. For the same reason, we also expect that traders who have high values on *average* would switch faster to the centralized market. This is because over time, such traders acquire more experience as high value types and are thus expected to obtain more accurate beliefs about the relative advantage of trading through the centralized market.

[3] Note that Neeman and Vulkan's theoretical analysis suffers from the weakness that it cannot describe the "emergence" of the centralized market. It has to be assumed that a centralized market is active in every period in order to derive the conclusion about the unraveling of direct negotiations. No such assumption needs to be made in the experimental design. In this sense, the experiment provides a fuller description of the process of endogenous market formation than the theoretical model that underlies it.

3. The Experiment

3.1 Participants

200 undergraduate students from the Hebrew University took part in the experiment. They were recruited by campus advertisements promising monetary reward for participation in a group decision-making task. Participants were divided into 10 cohorts of 20, and were paid according to their and others' decisions as specified below.

3.2 Design and Procedure

The experimental design included two treatments:

(1) The *one distribution* treatment (U treatment). In this treatment the 20 participants were divided into two groups: one consisting of 10 buyers, and the other consisting of 10 sellers. All buyers and sellers each drew their willingness to pay and costs from the same distributions of willingness to pay and cost, respectively. We refer to this treatment as the U treatment because buyers and sellers each had the same (*uniform*) average type in every round under this treatment.

(2) The *two distributions* treatment (H/L treatment). In this treatment, the 20 participants were divided into two groups: one consisting of 10 buyers, and the other consisting of 10 sellers. Then, the groups of buyers and sellers were each divided into two equal subgroups of buyers and sellers. The buyers and sellers within each subgroup each drew their types from the same two distributions of willingness to pay and cost, respectively. The two distributions of willingness to pay were distinguished by the fact that they had different supports. One was supported on high and the other on low values of willingness

to pay. Similarly, the two distributions of cost were distinguished by the fact that they had different supports. One was supported on high and the other on low costs. Thus, both buyers and sellers each had two different “average types” in every round, one with a high average value, and the other with a low average value. For this reason, we call this treatment the High/Low (H/L) treatment.

In the one distribution (U) treatment, the values (types) of both buyers and sellers were drawn from distributions with supports on the interval [0,100]. In the two distribution (H/L) treatment the values of high-average-value buyers and low-average-value sellers were drawn from distributions with supports on the interval [25,100], while the values of low-average-value buyers and high-average-value sellers were drawn from distributions with supports on the interval [0,75].[4] Five sessions were run under each treatment.

The experiments were held in the RatioLab -- a computerized laboratory for interactive decision research in the Hebrew University of Jerusalem. Upon arrival to the laboratory participants were seated in a single room and randomly assigned to one of the experimental treatments. The roles of buyers and sellers and the distribution from which each trader drew its willingness to pay and cost, respectively, were held constant throughout the experiment.

The participants were given verbal instructions concerning the rules and the payoffs of the game, followed by a quiz to test their understanding. Participants were assured in advance that their decisions and their eventual payment would remain confidential. In both treatments the stage game was repeated 80 times.

[4] The two distributions, each, of willingness to pay and cost, respectively, were chosen in such a way that the overall distributions of traders’ willingness to pay and cost in the two treatments were identical.

The games were fully computerized enabling data collection and online information concerning the previous rounds' results and each participant's total earnings. Each participant was seated in front of a personal monitor on which decisions were made and information presented.

At the beginning of each round every participant was notified of his or her personal value of the object to be bought or sold in the current round. This value (type) was private information, and was randomly drawn from known "noisy"[5] distributions.

After being notified of the realization of his or her type for each round, each participant was asked to choose the institution through which he or she prefers to trade in the current round, and then to specify his or her bid for selling or buying the object. After all participants made their decisions, the computer summed up the results and declared the profits as explained bellow, allowing the next round to begin. At the end of the experiment participants were debriefed as to the intention of the experiments, and paid according to their profits.

The centralized market was operationalized as a sealed-bid double-auction (a call market), where the transaction price is given by the midpoint of the intersection of the constructed demand and supply curves.[6] All buyers with a bid higher than the price, and all sellers with a bid lower than the price were able to trade. In case of a shortage or a

[5] In a pilot study we conducted, buyers' and sellers' types were independently drawn from two fixed distributions. Convergence to the centralized market was very fast, and in every round, the centralized market price was very close to the expected market clearing (Walrasian) price. In the debriefing, participants told us they opted for the centralized market because they realized they can trade there at "an almost constant price." In order to make the outcome in the centralized market more unpredictable, in both treatments, we drew buyers' and sellers' types from distributions that followed a simple Markov process. This introduced a significant amount of aggregate noise into the experiment, and in particular, caused the price in the centralized market to vary widely across different rounds.

[6] The fact that traders were each constrained to either buy or sell one unit of the object implies that demand and supply were given by step functions, and their intersection was given by an interval.

surplus, the allocation was carried out as far as possible by assigning priority to sellers whose offers were the smallest and buyers whose bids were the largest. If this did not complete the allocation, then a fair lottery was used to determine which of the remaining traders on the long side of the market would trade. The payoff for each trader who traded was the difference between the market price and the private value of the traded object. Buyers with a lower bid than the price and sellers with a higher bid than the price did not trade, and earned nothing in that round.

Direct negotiations assumed the following form: Buyers and sellers who opted to trade in direct negotiation were matched into pairs of one buyer and one seller. Participants who were not matched were not able to trade in that round. In any given match, if the buyer's bid was higher than the seller's bid, then the buyer and seller traded at a price equal to their average bid. Each was given a payment equal to the difference between the price and his or her private value of the object. If the buyer's bid was lower than the seller's bid then the buyer and seller did not trade and their payoffs were zero at that round. Given the buyers' and sellers' bids, the matching between buyers and sellers was designed to maximize the numbers of transactions, and, having fulfilled this requirement, to maximize social surplus.[7] This matching protocol gives the decentralized market a better shot than random matching, or any other obvious non-Walrasian protocol. Calculations based on traders' bids in the first five and ten rounds of the experiment reveals that compared with one round of random matching, the matching function we used generated an expected per-round payoff to traders that was about twice as large for

[7] See Rich and Friedman (1998) for an experimental study of this matching protocol.

every trader's type in the first five and ten rounds of the experiment.[8] In addition, the matching function we used, that would arise naturally if organized by intermediaries who are paid a small fraction of transaction prices, or per transaction, also obviates the need for re-matching.

4. Results

We summarize the experimental results using three different measures. First, we describe the change in the volume of trade through the two exchange mechanisms. Second, we describe the corresponding change in overall efficiency. And third, we describe the dynamics of the traders' choices between the two exchange mechanisms.

4.1 The Change in the Volume of Trade

We compare the number of transactions in the centralized market and in direct negotiations for each treatment. To facilitate the presentation of the results and to minimize the effects of round-to-round fluctuations, the eighty rounds were divided into eight blocks of ten rounds each. The mean number of transactions in each institution for each block of rounds is reported in Figure 1 below.

<Insert Figure 1 here>

Figure 1 shows a clear pattern of unraveling of direct negotiations: In the first block there were on average 2.3 transactions in the centralized market and 1.1 in direct negotiations. As time progressed, the number of transactions in the centralized market increased (3.6 transactions in the last block), while the number of transactions in direct negotiations

[8] Because, with random matching, the probability of not being matched at all, or of being matched with a trader with whom it is impossible to conduct mutually beneficial trade, is high.

decreased (0.8 transactions in the last block). Notice that the unraveling is more pronounced in the H/L treatment, where the number or transactions in the centralized market increased from 2.4 in the first block, to 4.03 in the last block (the difference in slopes is not statistically significant, but we show a significant interaction between condition and trial in the probit model below). We believe that this is due to the fact that in the H/L treatment, buyers and sellers who draw their types from the distribution that is supported on higher values (higher willingness to pay for buyers and lower cost for sellers) learn faster to recognize the advantage of switching to the centralized market than buyers and sellers in the U treatment who have fewer chances to experience the consequences of having high willingness to pay and low costs, respectively.

The number of transactions in the centralized market was analyzed in a two-way mixed ANOVA[9] with one between-subject (experimental treatment) factor, and one within-subject (block number) factor. The analysis reveals:

(1) A significant effect of treatment ($F(1,8) = 6.85$, $p < .05$). That is, the mean number of total transactions in the H/L treatment is larger than in the U treatment.

(2) A significant block effect ($F(7,56) = 12.75$, $p < .001$). That is, the overall number of transactions increases as time progresses.

(3) No significant interaction ($F(7,56) = 1.96$, n.s.). That is, the increase in the volume of trade over time (the slope) does not depend on the experimental treatment.

4.2 The Change in Efficiency

[9] ANOVA (analysis of variance) is a statistical technique designed to check whether differences in means between experimental conditions are significant. In particular, it allows us to test whether it is possible to reject the hypothesis that the means in the two treatments are equal.

Figure 2 below depicts the change over time of the total number of transactions that is generated by the experiment (centralized market and direct negotiations).

<Insert Figure 2 here>

As can be seen from Figure 2, the H/L treatment induces a larger number of transactions overall. A two-way mixed ANOVA with one between-subject (experimental treatment) factor, and one within-subject (block number) factor reveals a marginally significant effect of treatment $F(1,8) = 3.76$, $p = .09$) (The H/L treatment more efficient than the U treatment), a significant block effect ($F(7,56) = 6.43$, $p < .001$) (efficiency increases with time), and no significant interaction ($F(7,56) = 1.74$, n.s.).

To summarize, in both treatments the number of transactions, which is slightly higher in the first (H/L) treatment than in the second (U) treatment, increases with time. This change can be explained as follows. In the first periods of the game the participants experimented with both trading institutions and therefore not all beneficial transactions took place. As the game progressed, the number of traders in the centralized market increased. Consequently, more transactions took place there. This tendency was more pronounced in the H/L treatment because convergence to the centralized market was faster there.

4.3 The Change in Traders' Choices

In line with Neeman and Vulkan's theoretical model, in both treatments we expect to find that the process of unraveling starts with traders who have high values (high willingness to pay and low cost). Furthermore, in the H/L treatment, we expect to find that the process of unraveling starts with the traders in the subgroups of buyers and sellers whose values are drawn from the distribution that is supported on higher values. We thus expect both that (1) everything else equal, trader with higher values in both treatments would opt for the centralized market faster; and (2) everything else equal, traders with higher average values in the H/L treatment (that is buyers and sellers who draw their valuations from the distribution with the higher and lower support, respectively) would opt for the centralized market faster than traders with lower average values in the H/L treatment, and faster than traders in the U treatment. The first prediction is an immediate consequence of Neeman and Vulkan's (2000) theoretical model. The second is due to our belief that because traders with high average values have more experience with having "high" values, they should learn faster that switching to the centralized market would indeed be beneficial for them.

Figure 3 below shows the proportion of traders who opt for trading in the centralized market according to the distribution from which they draw their types.

<Insert Figure 3 here>

We first analyze the data with a two-way ANOVA with one between subject (average trader's type) factor, and one within subject (block number) factor. Upon inspection of the figure and the analysis several conclusions emerge:

(1) The proportion of traders who opted for trading in the centralized market was above a half regardless of the distribution from which they drew their types. That is, traders preferred, on average, to trade through the centralized market than to trade through direct negotiations.

(2) The proportion of traders who opted for trading in the centralized market increased over time for each one of the three distributions (H/L high; H/L low; U) from which traders drew their types. This block effect is marginally significant ($F(7,56) = 2.39$, $p < .08$).

(3) In line with our first prediction, traders with high-on-average valuations exhibited the strongest preference for the centralized market over direct negotiations. This resulted in a significant effect of distribution ($F(1,8) = 4.33$, $p < .05$). The interaction effect is not significant ($F(7,56) = .62$, n.s.).

Figure 4 below shows the proportion of traders who opted for trading in the centralized market by realized value, or type, per round. For the purpose of this figure, define a buyer's type as high, intermediate, and low if its willingness to pay belongs to the set $\{67,...,100\}$, $\{34,...,66\}$, and $\{0,...,33\}$, respectively; and define a seller's type as high, intermediate, and low if its cost belongs to the set $\{0,...,33\}$, $\{34,...,66\}$, and $\{67,...,100\}$, respectively.

The conclusions derived from Figure 4 are similar to those that were derived from Figure 3. Namely, high and intermediate types opted for the centralized market faster than low types (there is a significant effect of type ($F(2,7) = 23.52$, $p < .01$) which reflects the fact that high types opted for the centralized market more often, and a marginally significant interaction effect ($F(3,7) = 1.94$, $p = .08$) which captures the fact that higher types opted for the centralized market relatively faster than intermediate types).

Low traders' types were unlikely to trade in the centralized market because their costs and willingness to pay were likely to be above and below the centralized market price, respectively. They were therefore indifferent between direct negotiations and the centralized market. As time progressed, they found it more and more difficult to trade through both mechanisms (significant effect of time, $F(3,7) = 3.37$, $p < .05$).

<Insert Figure 4 here>

To summarize, the proportion of traders who opted for the centralized market as a function on their realized value (type) and the distribution from which they drew their value, or average-type, in the last 20 rounds of the game are presented in table 1.

<Insert Table 1 here>

As can be seen from the table, both high and high-on-average types have a relatively stronger preference for the centralized market than low and low-on-average types. And, moreover, this effect is stronger for participants in the H/L treatment than for those in the U treatment.

To further strengthen our claims, we also analyze the participants' choices of the mechanism through which to trade in each round using a random effects (panel data) probit model (that is, we treat the data as panel data, which allows us to control for individual effects).[10] The probit model predicts the probability of opting for the centralized market depending on the treatment, the round, the treatment×round interaction, the player's value (divided by 100 to avoid very small coefficients), the value×round interaction, the lagged payoff (payoff in previous round), lagged decision

[10] We analyzed the data using other probit models as well: two variations of pooled probit models (with standard errors adjusted for clustering on sessions) that are appropriate under the assumptions that individuals' decisions over time are conditionally independent, and dynamic completeness; and two random effects probit models, with and without lagged decisions and lagged covariates. Because the results under all the variants of these models were almost identical, we only report the results of the most elaborate model here.

(decision in previous round) and lagged-payoff×lagged-decision interaction[11]. Table 2 shows the results of this analysis.

<Insert Table 2 here>

Inspection Table 2 reveals a positive significant effect of treatment: as predicted, the probability of choosing the centralized market is higher in the H/L treatment as compared with the U treatment. The round number has a weak negative coefficient, but the round×treatment interaction is positive. This suggests that the effect of the treatment is accentuated with the progression of time.

The coefficients of both value and value×round are positive and significant, in line with our prediction that high value traders opt for the centralized market and that this tendency becomes stronger over time.

The interpretation of the values of the coefficients of the lagged variables should be done with caution. The most interesting finding is about the interaction between lagged payoff and previous decision. The positive significant coefficient means that a high payoff in any round in which the player opted for the centralized market increased the probability that the player would also opt for trading in the centralized market in the subsequent round. Such behavior is consistent with the type of behavior that would be predicted by a simple reinforcement learning model. Because the model includes the lagged-payoff×lagged-decision interaction, the negative coefficients of the lagged payoff and lagged decision suggest a tendency to switch from the centralized market to direct negotiations after receiving a low payoff in the centralized market.

[11] This is an appropriate model for the analysis of the data under the assumption that there is no correlation between lagged values of the covariates and the errors. The model does not account or correct for possible dependence between traders within a session. However, an adjustment for clustering in simpler models (see footnote 10) yields similar results.

5. Conclusion

As more and more companies use the Internet to trade with their clients and suppliers, both centralized and decentralized electronic markets are becoming increasingly popular for trading all kinds of goods and services.[12] This makes the question of what form of exchange is likely to attract large volumes of trade an important theoretical and practical problem.

The experiment reported in this paper suggests that different types of traders may have different preferences over the set of available market institutions, and that given an opportunity, they would exercise their preferences in a way that would strongly affect the viability of certain market institutions.

We believe that this insight applies much more generally. The study of the extent to which it does offers interesting directions for future research.

[12] For example, many firms can now purchase raw materials such as metal, cement and steel via a Web-based market, in a number of auction sites, or by direct negotiation with a number of suppliers. For a discussion of the economic issues related to business e-commerce see chapter 4 in Vulkan (2003).

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Figure 1: The number of transactions in the two mechanisms, by treatment

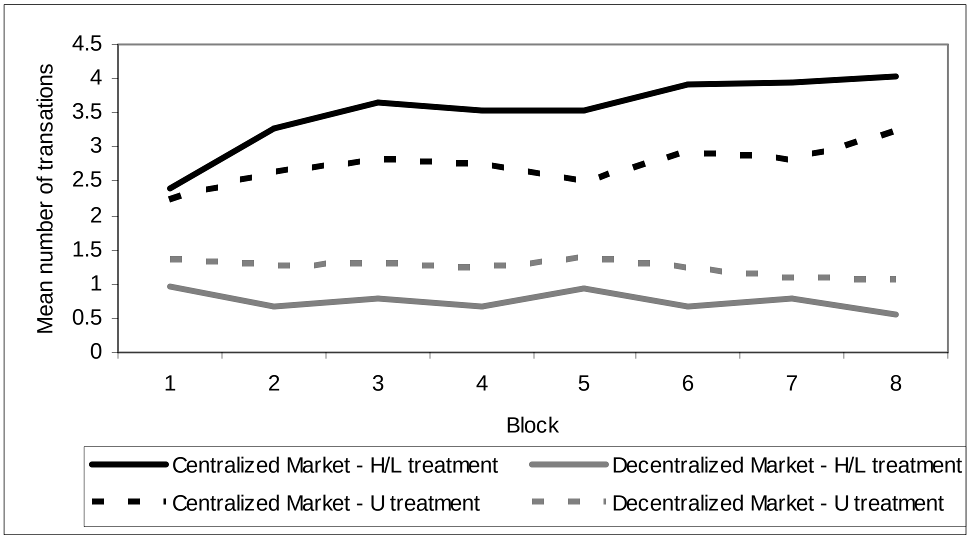

Figure 2: The total number of transactions, by treatment

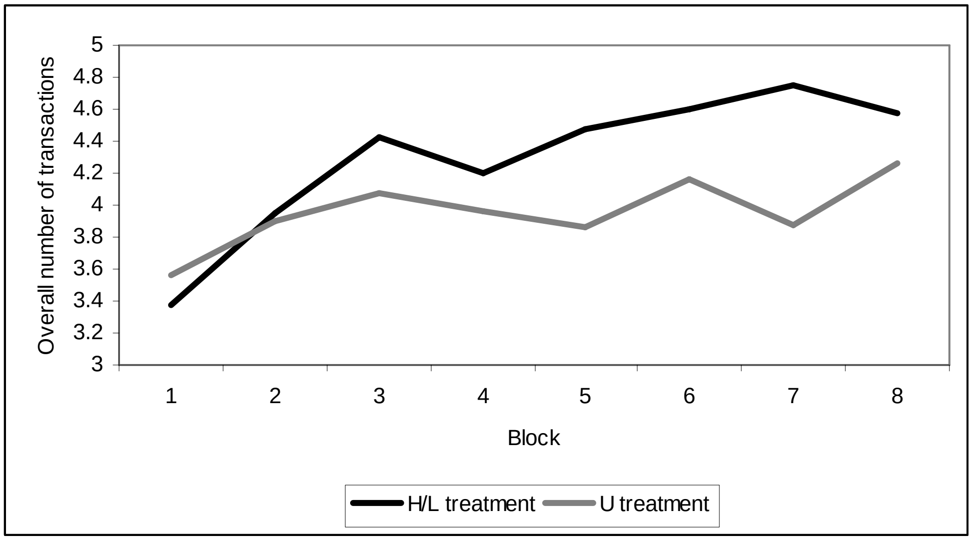

Figure 3: The proportion of traders who opted for the centralized market by the distribution from which they drew their types

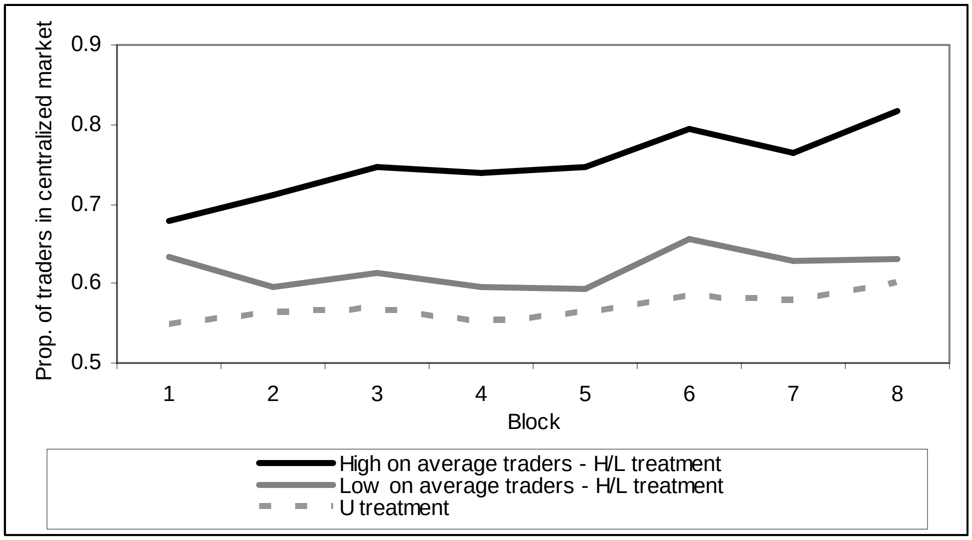

Figure 4: The proportion of traders who opted for the centralized market by type

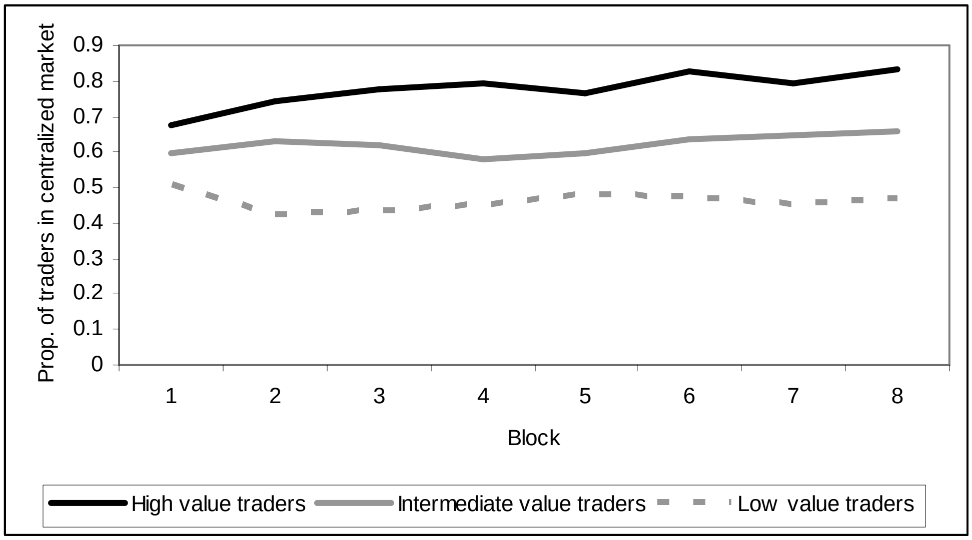

Table 1: Traders' choices by distribution (average type) and value (type)

value (type) distribution (avg. type)	H	Intermediate	L
H	.87	.76	.60
L	.85	.72	.48
U	.77	.58	.42

Table 2: Results of probit model for predicting the decision of where to trade

Variable	Coefficient (Standard errors in parenthesis)
Treatment (1=H/L)	0.306** (0.07)
Round/100	-0.18 (0.13)
Treatment × Round	0.19* (0.11)
Value/100 (Reversed for sellers)	1.2** (0.1)
Value × Round	0.88** (0.22)
Lagged Payoff	-0.013** (0.002)
Lagged Decision	-0.001 (0.03)
Lagged Payoff × Decision	0.013** (0.002)

* Significant at p=.10; ** Significant at p=.05