MATCHING AND SEGREGATION: AN EXPERIMENTAL STUDY*

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Abstract

Social segregation is a ubiquitous feature of human life. People segregate along the lines of income, religion, ethnicity, language, race, and other characteristics. This study provides the first experimental examination of decentralized matching with search frictions and institutionalized segregation. The findings indicate that, without a segregation institution, high types over-segregate relative to the equilibrium prediction. We observe segregation attempts even when equilibrium suggests that everyone should accept everyone else. In the presence of a segregation institution, high types successfully segregate themselves from low types in most sessions, despite chasing behavior of some low types. However, high type over-segregation behavior destroys the efficiency gain from the segregation institution.

Keywords: decentralized matching, segregation, experiment

JEL Classification: C78, D83

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1 Introduction

Segregation manifests itself in various aspects of the social and economic structure. In housing markets, there is a substantial degree of residential segregation by income across school districts. Despite the civil rights legislation, especially the Fair Housing Act of 1968, residential racial segregation persists in many cities in the United States (Cutler, Glaeser and Vigdor 1999). Metropolitan areas, such as Detroit and Chicago, have become what a pop tune describes as "chocolate city, vanilla suburbs" (Farley *et al* (1978), Farley and Frey (1994)). Furthermore, sociological studies of marriage markets across cultures (Kalmijn (1991), Smits, Ultee and Lammers (1998)) show that people have a tendency to match on social origins (the ascriptive dimension of status homogamy), as well as on educational attainments (the achievement dimension of status homogamy).

Segregation also occurs when forming communities for social interactions. In these situations, people choose with whom they interact. Book clubs, bowling leagues and country clubs are traditional forms of social communities. More recently, cyberspace has become the home of thousands of online communities, i.e., groups of people who meet to share information, discuss mutual interests, play games and carry out business. Many of them, such as the Usenet,[1] have no central authority. Instead, the formation and maintenance of these online communities are completely voluntary. Many online groups provide not only information exchange, but also companionship, social support and a sense of belonging. For example, while the majority of users of "SeniorNet" report joining the Net to seek information, 47 percent also join to find companionship (Wellman and Gulia 1999). Such social communities lead to several interesting questions. How do these communities emerge? How do they evolve over time? Who joins which community?

Economists have long been interested in who interacts/trades with whom and how clubs form to facilitate interaction and trade. The earliest such work can be attributed to Becker (1973), who predicts that, without search frictions, perfect assortative matching arises when agents productively interact in a complementary fashion. Based on this work, Mortensen (1982), Diamond (1982) and Pissarides (1990) develope a decentralized matching framework with search frictions. This framework has proved to be a useful tool in labor economics, macroeconomics and monetary theory. Examples include the decision of a worker and a firm to enter into a employment relationship; the decision of a man and a woman to marry; and the decision of a buyer and a seller to complete a transaction. These models make clear equilibrium predictions of who matches with whom and whether agents with higher productivity spend more or less time searching than those with lower productivity before finding a suitable match. In particular, they predict that agents apply a threshold strategy, i.e. they accept types above a certain threshold and reject lower types. Furthermore, the thresholds are increasing in the types. Since higher types do not accept types below certain threshold, unsuccessful matches occur. The reduction of unsuccessful matches motivates a new stream of studies on matching and segregation.

Building on matching models with search frictions, several studies independently discover the perfect segregation result (Collins and McNamara (1990), Smith (1992), Bloch (2000), Morgan (1995), Burdett and Coles (1997), Chade (2001) and Eeckhout (1999)). This result indicates that, when it is possible to segment the market into multiple markets, there exists matching equilibria where agents sorted by ability (type) form clusters and mate only within these clusters. In this

[1] The Usenet is the largest conferencing system on the Internet. "It is composed of a distributed database of messages that is passed through an informal global network of systems that agree to a standard message format." (Kollock and Smith 1999)

scenario, when type qualities are complementary in the production function, segregation improves market efficiency by reducing search costs and thus ameliorating the negative externality inflicted by low types. Morgan (1995) calls this result a theory of *club formation*, while Smith (1997) calls it *perfect segregation*. Burdett and Coles (1997) call it *formation of class*.

While the decentralized matching literature in economics attributes segregation behavior to the desire to decrease search costs and strategic complementarity in production, sociologists have examined the economic status of each type, as well as the inherent preferences of different types for segregation. For example, in studying residential racial segregation, Farley *et al* (1993) examine the housing expenditures between races, as well as the neighborhood preferences of blacks and whites in the Detroit area. They find that, while blacks express a preference for mixed neighborhoods and are willing to enter such areas, whites are reluctant to remain in neighborhoods where blacks are moving in and will not buy homes in already-integrated areas. They identify this difference in neighborhood preference as the main driving force for segregation. Schelling (1971) presents a related dynamic model of segregation, where a mild preference for neighbors of one's own race may lead to completely segregated neighborhoods.

Empirical studies of matching and segregation mostly use survey data. For example, Wong (2003) uses a structural approach to estimate a two-sided matching model largely based on Burdett and Coles (1997). She uses the Panel Study of Income Dynamics (PSID, 1968-1993) and finds that wage is a more desirable trait than education in predicting marriageability for white men, while education is more desirable for black men. Fisman, Iyengar, Kamenica and Simonson (2004) examine racial preferences in dating in a field experiment. They find stronger same race preferences for blacks and Asians than for Hispanics and whites. Their results suggest that same race preference is a contributor to the low rate of inter-racial marriage.

While field studies are valuable to further our understanding of segregation, they are limited by the information available in field data. First, agent preferences are not observable. As a result, it is difficult to assess the welfare changes caused by institutionalized segregation. Second, we do not have detailed field data about how segregation occurs. In comparison, controlled laboratory studies permit us to induce agent preferences, to observe how segregation occurs, to separate rational and nonrational segregation, and to compare the efficiency difference with and without segregation institutions at a level of detail unavailable in field data.

We now summarize our main findings and compare them to the theoretical predictions. In our experiment, we implement treatments with and without segregation institution. We examine segregation attempts at both the individual level and the institution level. Our most important finding concerns the fact that high types oversegregate relative to the equilibrium prediction, suggesting strong segregation forces beyond those captured by theory. These individual attempts at oversegregation prevail in the presence and the absence of a segregation institution. Even in those environments where equilibrium predicts that everyone should accept everyone else, high types typically refuse to be matched with low types. We can explain this oversegregation by a noisy best reply model which indicates that, given the empirical distribution of acceptance thresholds, the observed behavior is a noisy best response.

In the presence of a segregation institution, when there are two equilibria, a segregation equilibrium where agents sort themselves into different markets and mate only within each respective market, and a collocation equilibrium where all agents collocate and mate in the same market, the segregation equilibrium is selected. We observe high types successfully segregate themselves from low types in most sessions, despite chasing behavior of some low types. Theory also predicts that efficiency increases with a segregation institution. However, due to the oversegregation of high types, the predicted efficiency gains of the segregation institution do not materialize.

This study provides the first experimental examination of decentralized matching with search frictions and institutionalized segregation. Although a fair number of experimental papers test the related search theory (see Cason and Friedman (2003) and Cason and Noussair (2003) for recent examples), they do not address the problem of social segregation. Another related experimental literature on matching, e.g., Kagel and Roth (2000) and Chen and Sönmez (2002), studies the incentive effects of various centralized clearinghouse mechanisms. This literature, sometimes called centralized matching, does not deal with the issue of segregation either.

The remainder of this paper is organized as follows. In Section 2, we present the experimental design for a modified one-population decentralized matching model. We choose the one-population model, as it is the simplest one in this stream of research. Section 3 presents hypotheses. Section 4 presents the main results. Section 5 concludes.

2 Experimental Design

Our experimental design reflects both theoretical and technical considerations. The goal of the design is to test the theoretical predictions about equilibrium strategies, the role of institutions which facilitate segregation (hereafter called *segregation institution*), and welfare comparisons between treatments with and without segregation institution.

Our experiment is based on the following model. In a typical matching model, a continuum of heterogeneous agents search for a partner. Each agent is characterized by its productivity or type. In each period, each agent pays a fee to be matched with one other agent.[2] Each agent costlessly observes the other's type and decides whether the other is an acceptable mate. If each finds the other acceptable, then the pair mates. Mated agents then leave the market forever. When a mated pair exits the market, it is replaced by two unmated agents of the same respective types. If the paired agents do not mate, then they separate and remain alone until the next period. The utility from a mate increases in his or her type. We focus on environments with complementary production functions. In such an environment, there exists a unique perfect mating equilibrium in which all agents use reservation value search strategies, i.e., each agent only accepts a mate whose type is above a certain threshold.

With complementary production functions, search cost has two negative effects on efficiency. First, if a matched pair does not mate, we have a deadweight loss. Second, search cost changes the equilibrium strategies. For instance, it can decrease the threshold of high types, resulting in suboptimal mating. Hence, social welfare generated by the market can be improved by segmenting the market. In this context, a segment is a set of types that search and mate only among themselves. A mating equilibrium is inefficient if high types are obliged to sample from the the entire population of types, thereby reducing the chance that a high type will locate another high type on the next try and so making it rational for high types to accept lower types, a socially suboptimal action. Segregation provides higher types with a means of reducing search costs and ameliorating the negative externality inflicted by lower types. If utilities from a partner is increasing in his or her type, there exists a matching equilibrium in which agents partition into segments and mating occurs only

[2]Morgan (1995) and Chade (2001) model search cost as a fixed cost per period, while the other studies model it as pure time cost and thus use discounting.

among agents belonging to the same segment. The resulting assignment of types to segments is incentive-compatible for all types. In this scenario, segregation improves market efficiency.

The setup of the theoretical models is challenging for laboratory studies. For example, a typical decentralized matching model assumes a continuum of agents. To preserve stationary distribution of types on the market, the model assumes that a mated pair exits the market and is replaced by two unmated agents of the same respective types. These assumptions are difficult to implement in a laboratory setting. In our study, we relax some of these assumptions and numerically compute the equilibrium.

We implement a 2×2 design. To test the robustness of the theoretical predictions with regard to changes in the environment, we use two different payoff matrices. For each payoff matrix, we implement two treatments, one with a single market (with no social institution to facilitate segregation) and one with two markets where agents can choose which market to join and trade exclusively in (with an institution to facilitate segregation).

Our design is based on the theoretical literature, but is adapted to the laboratory setting. Our game departs from the theoretical models in two ways. First, as it is not feasible to have a continuum of agents in the laboratory, we use a discrete number of agents. Second, after each mated pair exits the market, they enter a queue and then enter the market again as new types. The latter is designed to reuse the same group of subjects but give them different types. The introduction of the queue is a novel feature of the experimental design. Without a queue, the likelihood that an agent leaving the market will assume the same type upon entering the market again is high, when the number of agents exiting the market is small. The queue reduces this likelihood, and therefore, allows each subject to make multiple rounds of decisions and learn about this rather complicated game. At the same time, it preserves the stationarity of the distribution of types on the market. As agents tend to assume different types in different "lives", this design feature minimizes motives such as envy and snobbery, which might appear if an agent has a fixed type throughout the experiment. These motives are not part of the theory. Therefore, we think that letting an agent be different types in different "lives" gives theory the best chance.

Since theory requires a stationary distribution of types on the market, we fix the distribution of types to a set of discrete points, $\{1, 2, \cdots, 6\}$. In our experiment, participants know the exact set of types. Each session has sixteen participants. During any given period, twelve of the participants are on the market(s) and four are in a queue. We randomly assign each of the twelve participants their types from the set, $\{1, 2, \cdots, 6\}$. Each type is assigned to exactly two participants, which allows for the possibility for each type to be matched with another of its own type. The four participants in the queue do not have types assigned to them. For treatments with one market (hereafter **no segregation institution**), the experiments uses the following procedure.

1. At the beginning of each period, each participant on the market is informed of his type, t_i. Each then submits a threshold value, τ_i, i.e., a reservation value which specifies the lowest type he is willing to accept.

2. The twelve participants in the market are randomly matched into six pairs. Each participant in a pair is informed of his match's type, t_j, and therefore, whether his match is acceptable or not, i.e., whether $t_j \geq \tau_i$. Furthermore, he is informed of whether his match accepts or rejects him, i.e., whether $t_i \geq \tau_j$. Participants are not informed of their match's threshold.

    (a) A mating is successfully made if and only if both partners accept each other. In this case, the mated pair exits the market, each with a profit of the payoff derived from mating, $\mu(t_i, t_j)$, minus the per period search cost, c.

   (b) Otherwise, participants remain on the market and keep their types, while incurring a search cost of c.

3. The four participants in the queue do not make any decisions and incur no search cost.

4. At the end of each period, all those who exit the market that period are put to the end of the queue in a randomized order. Participants in the queue enter the market sequentially, getting randomly assigned the types of the exiting participants.

5. At the end of each period, one of the participants throws a ten-sided die. The experiment ends when the numbers eight or nine show up. In other words, the discount factor is 0.8.

6. If there is an insufficient number of periods,[3] we start a new run from the very beginning. This means that all participants are randomly reassigned their roles. Twelve participants are assigned to the market with new types, while four participants are assigned to the queue.

7. Each participant is informed of her earnings for a period, as well as her cumulative earnings, at the end of each period. Subjects are paid for all periods.

The procedure for the treatments with two markets (**segregation institution**) is similar to that for the treatments with no segregation institution, except that participants need to choose between the two markets at the beginning of each period. More specifically,

1. At the beginning of each period, each of the participants independently and simultaneously decide whether to enter market A or market B.

2. If there are an even number of participants in both markets, pairs can be formed. However, if there are an odd number of participants in each market, this is not feasible. Whenever this *odd problem* occurs, one participant is chosen randomly to stay in a market which is not his choice. The selection of this participant is subject to the following constraints:

   (a) In the first period, those who choose to stay in market B have priority to stay in B. One of the participants who wants to go to A is randomly chosen to stay in B.

   (b) In subsequent periods, those who have been in a market in the previous period have priority to stay in that market. One of the participants who wants to switch markets is randomly chosen not to switch.

   (c) Participants who wanted to switch in the previous period have priority in choosing to go to a market.

3. After being informed about the market they belong but without knowing the composition of each market, each participant submits a threshold. Once everyone submits a threshold, each participant is informed of how many participants opt for market A, in addition to the information in treatments with no segregation institution. The periods proceeds as in treatments with no segregation institution.

[3]Operationally, we start a new run if the sum of periods of all runs is less than 40. Subjects do not know this information.

As we have a discrete number of types, we resort to numerical methods to compute the optimal reservation values (i.e., thresholds), the expected payoffs for each type, as well as the equilibrium segregation patterns for each treatment. A description of the algorithm is in Appendix A.

[Table 1 about here.]

Table 1 presents the two payoff matrices in our experiments. Payoff matrix 1 is generated from the supermodular payoff function, $(t_i t_j)^{1.4}$, where t_i and t_j are the types of a matching pair of agents. We take the integer part of this function, and modify the matrix so that the segregation equilibrium is (1–2) and (3–6). We choose an asymmetric segregation equilibrium so that subjects can not use a focal point, such as (1–3) and (4–6), to segment themselves. In this payoff matrix, with two markets, there exist a segregation equilibrium as well as a collocation equilibrium.

While payoff matrix 1 has a segregation and a collocation equilibrium in the presence of a segregation institution, we design payoff matrix 2 to check whether segregation occurs even when theory does not predict it. The latter is motivated from the sociological studies of residential segregation where neighborhood preferences rather than economic forces are the main cause for segregation. In payoff matrix 2 without segregation institution, in equilibrium, there is no segregation, i.e., everyone always accepts everyone else. Furthermore, with segregation institution, there is no pure strategy segregation equilibrium. In this environment, where economic forces do not lead to stable segregation patterns, we are interested in whether socio-psychological forces lead agents to segregate.

[Figure 1 about here.]

Figure 1 is a three-dimensional representation of the two payoff matrices. Note that the payoff landscape of payoff matrix 1 is much steeper than that of payoff matrix 2. This difference creates different levels of incentives for high types to accept low types, which will be discussed in detail in Section 4.

[Table 2 about here.]

Table 2 summarizes the features of our experimental sessions, including the payoff matrix, segregation institution, session number, number of runs in each session and total number of periods in each session. Each session has sixteen subjects. As explained before, at the end of each period, one of the participants throws a ten-sided die to determine whether a run ends that period. Therefore, each run has a different number of periods, ranging from 1 to 33. If the total number of periods is less than 40, we start a new run. This way, the participants in each session have sufficient opportunity to learn about the game. The total number of periods in each session varies from 40 to 60.

For each of the four treatments, we conduct four independent sessions. Overall, sixteen independent computerized[4] sessions were conducted at the University of Zürich from December 2001 to January 2002. Our subjects are students from the University of Zürich and the Swiss Federal Institute of Technology (ETH). No subject is used in more than one session. This gives us a total of 256 subjects. Each session lasts between one hour thirty minutes to one hour fifty minutes, with

[4]We use zTree (Fischbacher 1999) to program our experiments.

the first thirty to thirty-five minutes being used for instructions. The exchange rate is ten points for SFr 0.23 for payoff matrix 1, and SFr 0.42 for payoff matrix 2. The average earning[5] is SFr 31.20. The experimental instructions are included in Appendix B. Data are available from the authors upon request.

3 Hypotheses

In this section, we summarize the matching equilibrium of the game based on numerical computations described in Appendix A, and formally state a set of hypotheses regarding the thresholds submitted by participants, the segregation patterns, and efficiency comparisons between treatments with and without segregation institution. Our notion of equilibrium is the standard *matching equilibrium* in the theoretical literature (see, e.g., Chade (2001)). Intuitively, a matching equilibrium is a profile of stationary strategies such that each agent uses an optimal strategy given her conjecture about the strategies chosen by other agents, and these conjectures are correct in equilibrium. In computing the matching equilibria, we ignore the "odd problem"[6] described in Section 2.

For payoff matrix 1, without segregation institution, the equilibrium threshold for types 1 and 2 is 1, for type 3 is 2, and for types 4–6 is 3. Therefore, we have the following hypothesis.

HYPOTHESIS 1 *For payoff matrix 1, without segregation institution, types 1–2 will submit a threshold equal to 1, type 3 will submit a threshold of 2, while types 4–6 will submit a threshold equal to 3.*

For payoff matrix 1, with segregation institution, there are two equilibria, a segregation equilibrium and a collocation equilibrium. In the segregation equilibrium, types 1–2 will join one market, while types 3–6 will join the other market. The equilibrium threshold for types 1 and 2 is again 1, while that for types 3–6 is 3. If all agents are in the same market, however, no matching is possible in the empty market. In this case, an agent has no incentive to unilaterally change to the other market. Therefore, all agents in the same market always constitutes a matching equilibrium. We call this second type of equilibrium a collocation equilibrium. In the collocation equilibrium, all types remain in the same market and they are mutually acceptable to each other. Therefore, we have the following two hypotheses.

HYPOTHESIS 2 *For payoff matrix 1, with segregation institution, agents will segregate into two markets, i.e., types 1–2 will join one market, while types 3–6 will join the other market.*

HYPOTHESIS 3 *For payoff matrix 1, with segregation institution, agents will collocate in one market.*

[5] The exchange rate between Swiss francs and U.S. dollars at the time of the experiments was approximately $1 = SFr 1.65.

[6] Since agents staying in a market can always remain in that market (see how we solved the "odd problem" in Section 2), an agent who wants to unilaterally change to another market cannot do so. Therefore, if we do not ignore the odd problem, any composition with an even (but non-zero) number of agents in each market would be an equilibrium, because choosing the other market has no effect and therefore does not affect the agent's payoff. For this reason, when we numerically compute the equilibrium, we assume that agents who want to change to another market can always do so, i.e., we ignore the "odd problem." In our algorithm, an agent is matched any other agent in the market with equal probability.

In other words, for payoff matrix 1, when there are two markets, Hypothesis 2 predicts perfect segregation between the high and low types, while Hypothesis 3 predicts collocation. It will be interesting to see which equilibrium is selected.

For payoff matrix 2, without segregation institution, in equilibrium, all types are mutually acceptable to each other. With segregation institution, however, there is no pure strategy segregation equilibrium.

HYPOTHESIS 4 *For payoff matrix 2, with or without segregation institution, all types will submit a threshold equal to 1.*

For payoff matrix 2, with segregation institution, high types have an incentive to form their own club, while low types have an incentive to join this club. Therefore, we expect the low types to chase the high types. As a result, we do not expect stable segregation.

HYPOTHESIS 5 *For payoff matrix 2, with segregation institution, low types will chase high types.*

The next two hypotheses concern how the availability of a segregation institution affects efficiency.

HYPOTHESIS 6 *For payoff matrix 1, segregation institution will improve efficiency.*

HYPOTHESIS 7 *For payoff matrix 2, segregation institution will not affect efficiency.*

Hypothesis 6 is derived from the numerical computation. Hypothesis 7 is based on the fact that chasing behavior and noise cannot systematically improve efficiency.

4 Results

In this section, we present the results from our experiment. We first examine segregation attempts at the individual level by looking at the submitted thresholds. For the treatments with segregation institution, we examine the segregation patterns in each treatment. We then examine matching frequency and efficiency in each treatment.

In our experimental setting, segregation can occur at two levels. At the individual level, attempts to segregate manifest themselves as submitted thresholds, i.e., the lowest type an agent is willing to accept as a trading partner. This type of segregation occurs in all treatments. At the institution level, segregation manifests itself by separating agents into two markets. We investigate each level of segregation and their effects on matching frequency and efficiency. For simplicity of exposition, we call types 1 and 2 low types, types 3 and 4 medium types, and types 5 and 6 high types.

4.1 Individual Segregation Attempts: Submitted Threshold

First, we examine the submitted threshold from each type in each of the four treatments. Note that the submitted threshold is meaningful in treatments with segregation institution, as subjects submit their thresholds each round before observing the market composition of that round.

[Figure 2 about here.]

Figure 2 presents the average submitted thresholds of each type in each treatment, as well as the corresponding theoretical predictions (the empty squares and black dashes). The top panels present the average submitted threshold in payoff matrix 1, while the bottom panels present the average submitted threshold in payoff matrix 2. From Figure 2, we can see that the average submitted threshold largely conforms with the theoretical predictions in payoff matrix 1. In particular, with segregation institution, the segregation equilibrium fits the data better than the collocation equilibrium. However, in payoff matrix 2, high type thresholds are markedly higher, although theory predicts everyone should accept everyone else. The following result formally states this finding.

RESULT 1 (Distribution of thresholds) *The mode of the distribution coincides with the theoretical prediction for five out of six types in payoff matrix 1 with no segregation institution. The mode coincides with the theoretical prediction for four out of six types in payoff matrix 1 with segregation institution. For payoff matrix 2, while the mode coincides with the theoretical prediction for types 1, 2 and 3, high type thresholds are much higher than the equilibrium prediction.*

[Table 3 about here.]

SUPPORT: Table 3 presents the empirical distribution of submitted threshold by each type in each of the four treatments. In each panel, for a given type, each row reports the proportion of submitted threshold by that type. Boldfaced numbers are the mode of the distribution in each row, while shaded and framed numbers represent equilibrium predictions. ∎

Result 1 indicates that theory, as formulated in Hypotheses 1, predicts reasonably well in payoff matrix 1 with no segregation institution. The mode of distribution overlaps with the theoretical prediction for most types. It is interesting to note that when both segregation and collocation equilibria exist with segregation institution, the segregation rather than collocation equilibrium is selected. However, for payoff matrix 2, the results do not correspond as well to the theoretical predictions. What is striking about the submitted thresholds in payoff matrix 2 is that, even though theory predicts that everyone accepts everyone else, i.e., all submitted thresholds should equal one, high types try to segregate at the individual level by submitting much higher thresholds.

To investigate this high-threshold puzzle, we use two different approaches. The first approach uses a static noisy best response model in a similar spirit as the quantal response equilibrium model (McKelvey and Palfrey 1995) to explain the distribution of thresholds across treatments. The second approach analyzes the adjustment dynamics of threshold choices.

In the first approach, we check whether the chosen thresholds can be rationalized given the behavior of other players. Using simulation analysis, we determine the payoff difference between accepting and rejecting a particular type, assuming the empirical distribution. From the submitted threshold, we compute the probability of mutual acceptance between types, i.e., who mate with whom. We next use the empirical distribution of submitted thresholds (Table 3) and the probabilities of mutual acceptance, to compute the probability that an agent leaves the market. We then compute the probability distribution that a given type will be in various positions in the queue after mating. Next, we compute the expected value for each type, following the same iterative algorithm described in Appendix A. Finally, we use these values to compute the payoff difference between accepting and rejecting a type.

[Table 4 about here.]

Table 4 presents our simulation results. In Table 4, each entry represents the payoff difference between accepting and rejecting a given type. This payoff difference indicates the optimal decision rule given the empirical distribution of thresholds. The sign of the payoff difference indicates whether a player should accept a given type, while the magnitude of the payoff difference indicates the strength of the incentives. For example, in the last line at the bottom panel (PM2: Segmentation Institution), we examine a type 6's optimal decision rule. Given the empirical distribution, a type 6's expected payoff difference between accepting and rejecting a type 1 is -14, indicating that she should not accept a type 1. Similarly, she should not accept a type 2. Accepting types 3 and above gives her a positive expected payoff difference. However, the payoff difference between accepting and rejecting a type 3 is only 3, which does not provide a strong incentive, while the payoff difference between accepting and rejecting a type 4 is 11, which provides a stronger incentive. Comparing this line with the last line in Table 3, where 46% of the participants submitted a threshold of 4, the empirical distribution is consistent with the simulation results. From our simulation, we find that the simulated payoff differences are largely consistent with the modes of empirical distribution presented in Table 3. In particular, the high thresholds in payoff matrix 2 is optimal given the empirical distribution of thresholds.

[Table 5 about here.]

While the above analysis looks at the distribution of thresholds over all runs, Table 5 presents the distribution of thresholds in the first (left panel) and last run (right panel) of each treatment. When comparing the distribution of thresholds between the first and last run of each treatment, we find a fair amount of learning across all types. For example, the proportion of type 1 equilibrium thresholds increases from between 70 and 80 percent in the first run, to nearly 100 percent in the last run. The proportion of equilibrium thresholds for type 2s also increases, by a substantial margin. While we see improvement of equilibrium play in medium and high types, this improvement is not nearly as dramatic.

This comparison of the first and last run behavior leads to our second approach, which examines the dynamics of the submitted thresholds. In particular, we are interested in how prior experience changes a subject's decision. We use the following specification to look at whether a subject increases or decreases her threshold if she is accepted by her match in the previous period and if that match is successful:

$$\text{Threshold}_i^t - \text{Threshold}_i^{t-1} = a + b * \text{Accepted-by-other}_i^{t-1} + c * \text{Accepted-by-other}_i^{t-1} * D_{mate}^{t-1} + e_i^t, \tag{1}$$

where Accepted-by-other$_i^{t-1}$ is a dummy variable which equals one if a subject is accepted by her match in the previous round and zero otherwise, and D_{mate}^{t-1} is a dummy variable which equals one if the two players are mutually acceptable and zero otherwise. To examine threshold adjustment, we consider two cases. In the first case, an agent is accepted by her partner, but does not accept her partner in round $t-1$. In round t, she might realize that she is too picky and therefore might want to lower her threshold. Therefore, we expect $b<0$. In the second case, two agents are mutually acceptable to each other and therefore the match is successful in round $t-1$. If the agent in round t is endowed with the same type again, we expect that she does not change her threshold, i.e., $b+c=0$. We test this model by examining the case when an agent keeps the same type in two consecutive periods.

RESULT 2 (Dynamic Adjustment of Threshold) *An agent significantly decreases her threshold if she is accepted by her partner but the match is unsuccessful in the previous period. The threshold remains the same if a match is successful in the previous period.*

[Table 6 about here.]

SUPPORT: Table 6 reports the OLS regression results from six specifications using Equation (1). In each of these specifications, robust standard errors are adjusted for clustering at the session level.[7] The bottom panel presents the null and alternative hypotheses, as well as the corresponding p-values for the F-tests. For all types, we can reject $H_0 : b = 0$ in favor of $H_1 : b < 0$ at the 1% or 5% level. Furthermore, for types 1, 2, 4 and 5, we cannot reject $H_0 : b + c = 0$. For type 3, however, we can reject the null at the 5% level. Therefore, if successfully matched in the previous period, a type 3 upgrades her threshold by 0.16. This upgrade is statistically significant at the 5% level, but not economically significant, as the mean threshold for type 3s is 2.15. ∎

Result 2 indicates that agents learn to adjust their thresholds from prior experience. As a result, a comparison of the distribution of submitted thresholds in the first and the last run of each session indicates a substantial increase in the proportion of equilibrium thresholds, especially by low types.

[Table 7 about here.]

We note from the previous analysis that the increase in equilibrium thresholds from medium and high types is not as dramatic. We now use probit analysis to examine whether the proportion of equilibrium thresholds decreases with type. Table 7 reports the results of probit regressions with Equilibrium Threshold as the dependent variable. In these regressions, Equilibrium Threshold is a dummy variable, which equals one if a submitted threshold is an equilibrium and zero otherwise. The independent variables are Own Type and a constant. In all specifications, standard errors are adjusted for clustering at the session level. From Table 7, we see that coefficients of Own Type in all four specifications are negative and highly significant, indicating that the proportion of equilibrium threshold indeed decreases with type. This result could be due to two reasons. First, a higher type might face a more complex decision problem than a lower type. For example, if agents accept own type or lower, then a type 2 agent's problem is whether to accept type 1, while a type 6's decision is whether to accept any of the types lower than himself. Second, consistent with our simulation analysis presented earlier, higher thresholds by high types are optimal given the empirical distribution.

[7] As observations within a session are not independent, clustering at the session level allows the error term to be heteroscedastic, and correlated across both individuals and rounds, but independent across sessions.

4.2 Segregation Institution

We now examine the effects of segregation institution in each of the two environments. Recall that theory predicts that, in payoff matrix 1, the segregation equilibrium should be (1–2)(3–6), i.e., types 1 and 2 should be in one market, while types 3 – 6 should be in another market, and the collocation equilibrium should be (1–6). In payoff matrix 2, there is no pure strategy segregation equilibrium.

We first investigate the segregation desires expressed by the participants. In this situation, we are interested in whether the segregation or the collocation equilibrium is selected in payoff matrix 1, and whether all types stay in the same market in payoff matrix 2.

To study segregation desires, we use a probit specification with clustering at the session level. The dependent variable is Desired Market, which equals one if market A is preferred, and zero otherwise. The independent variables are the number of low, medium, and high types in the previous two periods, respectively. We also explore specifications with the number of each type as independent variables. However, as the number of types 1 and 2 tends to have the same effects, as does the number of types 5 and 6, we aggregate each respective pair into one variable. The number of types 3 and 4 in previous periods sometimes gives different predictions; therefore, we keep them as two separate independent variables in the regressions. In determining how many periods participants look back on to make their decisions, we try specifications with one, two and three periods, and find that the two-period model is the simplest one which captures all the basic insights. Thus we report our results using the two-period model. Results from the analysis are summarized below.

RESULT 3 (Segregation Desires) : *In both payoff matrices, medium and high types prefer to be in the market which contains high types in the previous periods, and prefer not to be in the market which contains low types in the previous periods. While low types prefer to be in markets which contain low types in the previous periods, type 1 in PM1 and type 2 in PM 2 also prefer to be in markets which contain high types in previous periods.*

[Table 8 about here.]

SUPPORT: Table 8 presents the results of our probit regressions. In both payoff matrices, coefficients for $n_{1,2}^{t-1}$ are positive and significant for types 1 and 2, and negative and significant for types 4 and 6. Additionally, the coefficients for $n_{5,6}^{t-1}$ are positive and significant for types 3 to 6 in both payoff matrices, for type 1 in payoff matrix 1 and for type 2 in payoff matrix 2. ∎

Result 3 indicates that, in payoff matrix 1, medium and high types try to separate themselves from the low types, while low types prefer to stay in the "low" market, although type 1s also desire to enter the "high" market. This finding is largely consistent with the prediction in Hypothesis 2, i.e., the segregation equilibrium is selected.

In payoff matrix 2, theory predicts that there is no pure strategy segregation equilibrium. However, we observe that medium and high types try to segregate themselves from low types. The results for low types are mixed. That is, while low types generally prefer to stay in the "low" market, type 2s try to enter the market which contains higher types in the previous periods. One can interpret this result as type 2s chasing the high types. Therefore, by Result 3, we partially accept Hypothesis 5.

A straightforward implication of theory is that the same type should always be in the same market. In the experiment, due to the odd problem,[8] limited computation capacity and other reasons, we observe many different segregation patterns. To quantify these segregation patterns, we define a segmentation index. This *segmentation index* is the difference of the mean of types of all participants between market A and B.[9] The sign of the index indicates which market the high types are in, while the dynamic movement of the index indicates the stability of the segmentation. For example, when market A has two type 1s and two type 3s, while market B contains the rest of the four types, the segmentation index of -2.25,[10] which indicates that the high types are concentrated in market B. Note that the segmentation index is in the range of $[-3.5, 3.5]$. The segregation equilibrium for payoff matrix 1, (1-2)(3-6), produces segmentation indexes of ± 3. If all types stay in the same market, the corresponding segmentation indexes are defined to be ± 3.5.[11]

[Figure 3 about here.]

Figure 3 presents the dynamic paths of the segmentation indices in each of the eight sessions with segregation institutions. The first column in Figure 3 presents the four sessions of payoff matrix 1. The second column presents the fours sessions of payoff matrix 2. Figure 3 indicates that, in some sessions, e.g., sessions 9 and 16, high types successfully segregate themselves into one market, while in other sessions, e.g., sessions 12 and 15, there are considerable moving and chasing between markets.

To examine segregation stability, we test the null hypothesis that the segmentation indices in each period are drawn from a random distribution. That is, any pattern of segmentation is equally likely to happen. We test this hypothesis against the alternative hypothesis that the observed distribution is greater (or less) than the random distribution. To obtain the random distribution, we first draw from all possible segmentation patterns, discarding patterns with an odd number of agents in each market, and then compute the segmentation index for each. Finally, we compare the distributions of the random and the observed segmentation indices using the Kolmogorov-Smirnov equality of distribution tests. Note that whether the empirical distribution is greater or less than the random distribution is not important, as it merely indicates whether the high types coordinate themselves into market A or B.

[Table 9 about here.]

Table 9 presents the alternative hypotheses, the largest difference between the two distribution functions, D, and the approximate p-values of the Kolmogorov-Smirnov tests.

RESULT 4 (Segregation Stability) : *In all four sessions under payoff matrix 1, high types consistently segregate themselves into market A. In two out of four sessions under payoff matrix 2, high types consistently segregate themselves into either market A or B.*

[8] The odd problem affects 4.3% of the subjects on the market per period in our experiment.

[9] We perform all analysis using the difference of the median types in each market. Results are not significantly different.

[10] It is equal to $(2 \times 1 + 2 \times 3)/4 - (2 \times 2 + 2 \times 4 + 2 \times 5 + 2 \times 6)/8 = -2.25$

[11] Note that when all types stay in the same market, the segmentation index is not well defined, as the average type of the empty market is not well defined. In this case, we define the average type of the empty market to be zero, therefore, the segmentation index is ± 3.5. Alternatively, we can define the segmentation index to be zero. We have done all subsequent analysis using the alternative definition, and find the results similar to what we present here.

SUPPORT: Table 9 presents the results of the Kolmogorov-Smirnov tests. For sessions 9, 10, 11, 13, and 14, we reject the null hypothesis that the two distributions are equal in favor of the alternative hypothesis that the observed distribution is greater than that of the random distribution. For session 16, we reject the null hypothesis of equal distribution in favor of the alternative hypothesis that the observed distribution is smaller than that of the random distribution. ∎

Result 4 indicates that high types are fairly successful in segregating themselves under payoff matrix 1, a finding that supports the segregation equilibrium (rather than the collocation equilibrium) prediction. However, under payoff matrix 2, high types are successful in only half of the sessions. The remaining two sessions (12 and 15) are characterized by chasing and instability.

As indicated, the main benefit of segregation from an economic standpoint, is increased efficiency as a result of more frequent acceptance of a mate and thus reduced search costs. However, whether the theoretical efficiency gain from segregation institutions can be realized depends on two factors: whether participants can successfully segregate themselves, and whether they accept other types in the same market.

We first investigate the effects of segregation institution on submitted thresholds by comparing thresholds in treatments with and without segregation institution. The findings in Figure 2 indicate that, while submitted thresholds from each type are not much different under payoff matrix 2 (top panels), they are different for types 3 and 6 under payoff matrix 1 (bottom panels). More specifically, with segregation institution, type 3s lower their thresholds, while type 6s raise their thresholds. Using OLS regressions, with threshold as the dependent variable, and segmentation dummy as the independent variable, we find that these effects are significant. That is, under payoff matrix 1, the coefficient for the segmentation dummy for Type 3 is negative and significant at the 1% level, while the corresponding coefficient for Type 6 is positive and significant at the 10% level. None of the other coefficients is significant.[12] One interpretation of this finding is that the increase in thresholds of the high type drives down the thresholds of type 3. In other words, if type 3 is not accepted by the high types, he might be able to increase profit by accepting lower types.

This change of submitted thresholds destroys the theoretical prediction of an increased matching success rate for payoff matrix 1. In payoff matrix 1, Mann-Whitney tests of matching success rate at the session level between treatments with and without segregation institution is not significant (p-value = 0.2482). In payoff matrix 2, however, the session level matching success rate with segregation institutions is weakly higher than that without: the Mann-Whitney test yields a p-value = 0.0833. Comparing matching success rates between the two payoff matrices, we find that, while matching success rates across payoff matrices are not significantly different with no segregation institutions (p-value=0.3865), payoff matrix 2 has a significantly higher matching success rate than does payoff matrix 1 with segregation institutions (p-value = 0.0209). This higher matching success rate increases efficiency.

RESULT 5 (Segregation and Efficiency) : *In payoff matrix 1, efficiency is not significantly different with or without segregation institution. In payoff matrix 2, efficiency weakly increases with segregation institution.*

SUPPORT: In payoff matrix 1, Mann-Whitney tests of session level aggregate profit between sessions with and without segregation institution is not significant (p-value = 0.4008). In payoff

[12] Tables are available from the authors upon request.

matrix 2, the session level aggregate profit with segregation institution is weakly higher than that without: the Mann-Whitney test yields a p-value = 0.0833. ■

Result 5 leads us to reject Hypothesis 6 and accept Hypothesis 7. In payoff matrix 2, we observe a greater number of successful matchings and, therefore, higher efficiency. Although there is no pure strategy equilibrium in this situation, the different types successfully separate into two markets in half of the sessions. Furthermore, participants do not change their submitted thresholds. Hence, a greater number of successful matchings occurs. By contrast, in payoff matrix 1, even though high types successfully segregate themselves from low types, their thresholds also change with segregation institution. In particular, type 6s raise thresholds while type 3s reduce thresholds. Therefore, the effects of segregation institution are mixed. Overall, there is a slight but insignificant increase in number of successful matchings. For efficiency, it is most important for the high types to be successfully matched. Therefore, a (weakly significant) increase of thresholds for the highest type leads to a slight but insignificant decrease in the total profit, and thus efficiency.

5 Conclusions

The formation of trading relationships, marriages, clubs, classes and communities has long fascinated both economists and sociologists. Decentralized matching theory with search frictions and endogenous segregation offers one plausible explanation of how people form such matchings. This theory predicts that, in a perfect mating equilibrium, a coarser version of Becker's assortative matching occurs, where blocks of agents sorted by ability mate with each other. Furthermore, this theory predicts that, when it is possible to segment the market into multiple markets, there exists a unique matching equilibrium where agents partition into segments and matching occurs only among agents belonging to the same segment. With complementary production functions, as segregation provides high types with a means to reduce search costs and ameliorate the negative externality inflicted by low types, the theory predicts that segregation will improve market efficiency.

This paper reports results from the first experimental study of decentralized matching theory with search frictions in the laboratory. In this experiment, we operationalize segregation institution by providing two markets. We then compare agent strategies with and without segregation institution. To test the robustness of the theoretical predictions, we use two different environments, payoff matrix 1 and payoff matrix 2. In payoff matrix 1, in the segregation equilibrium, there are two groups of mutually-accepting agents with or without segregation institution. In payoff matrix 1, in the collocation equilibrium, all agents collocate in the same market and they are mutually acceptable to each other. In payoff matrix 2, in equilibrium, everyone accepts everyone else without the segregation institution. However, with segregation institution in payoff matrix 2, there is no pure strategy segregation equilibrium.

We study segregation at both the individual and institution level. At the individual level, agents segregate by raising their thresholds. At the institution level, agents segregate by going into different markets. We find that equilibrium predictions about the threshold for mating are supported in payoff matrix 1, where agents partition themselves into two asymmetric groups. However, the theory is not well supported in payoff matrix 2, where in equilibrium everyone should accept everyone else. In this latter environment, we find that high types try to segregate themselves by raising their thresholds to exclude low types. We use simulations to evaluate the decisions of those agents. Our simulations indicate that, when agents take the empirical distribution of thresholds as given, their decisions are indeed close to optimal.

Our findings also indicate that, when formal segregation institutions exist, i.e., when there are two markets in our experimental setting, then both medium and high types prefer to be in the market which contains high types in the previous periods, and prefer not to be in the market which contains low types in the previous periods. Conversely, while most low types prefer the market containing low types in the previous periods, some low types try to chase high types. Despite these low type attempts to chase high types, high types consistently segregate themselves into one market in all sessions of payoff matrix 1, and in half of the sessions in payoff matrix 2.

Furthermore, we find that segregation institution weakly increases both the matching success rate and efficiency in payoff matrix 2, as in half of the sessions, high types successfully segregate themselves and thresholds remain unchanged. However, in payoff matrix 1, although high types successfully segregate themselves, the highest types raise their acceptance threshold while the marginal types lower their threshold in the presence of segregation institution, thus destroying the efficiency gain from segmentation.

Overall, while decentralized matching theory works well in a "regular" environment, its prediction is not as well supported in an environment where there is no segregation in equilibrium. In this latter environment, we find segregation attempts at both the individual and institution level. Our results are consistent with the preference based theories from sociological studies of residential segregation. In our experiment, high types' reluctance to accept low types becomes a noisy best response, given the empirical distribution of behavior.

As the first laboratory study of this kind, we restrict ourselves to the simplest one-population model. A natural extension is to study the two-population model in the laboratory to see if the main findings in this paper still hold. Furthermore, we use a neutral design where markets A and B are almost completely symmetric. This feature can again be extended in future work by introducing a small fee for one of the markets, so that they become asymmetric. We predict that, in the presence of such club fees, high types can segregate more successfully, as coordination becomes easier. This also mimics the entrance or membership fee for many clubs.

In sum, this study provides the first experimental examination of segregation behavior in the laboratory. It also provides an intriguing framework for future experimental work on how and why segregation occurs, as well as the consequences of market segmentation. We believe that thorough laboratory studies of decentralized matching with search frictions and segregation might shed light on market design, for example, on whether providing multiple markets might facilitate job search in Yahoo!'s HotJobs, and matching success rate at online dating sites such as match.com.

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Appendix A. Description of the Numerical Method

In this appendix, we summarize the algorithm which we use to numerically compute the equilibria of the game. Interested readers can find the complete algorithm at http://www.si.umich.edu/ ˜yanchen/ .

In computing the equilibrium, we iterate through all combinations of reservation values for the six types of agents. For each combination of reservation values, we check whether it is an equilibrium by going through the following procedure.

For a given combination of reservation values, for each type, we first compute the probability distribution that this type will be in various positions in the queue after mating. We call this the *probability distribution of queue positions*. We calculate the probability distribution by exhaustively going through all matching combinations, and calculating the probability that a type is mated and ends at a particular position in the queue. We then use Bayes rule to compute the conditional probability that a type is in a particular position in the queue after being mated,[13] as well as the distribution of types leaving the queue and re-entering the market.

Next, we compute the *expected value* for each type, and the expected value of being reborn when an agent leaves the queue and enters the market. We call the latter an agent's *rebirth value*. Note that, for each treatment, there is an expected value for each type and a rebirth value for all types. We start with an initial value for the expected value of each type, and an initial value for the rebirth value. We then recalculate these values in the following way.

- The expected value of a type x consists of two parts: If he is mated, he receives this value and the discounted rebirth value, where the discount factor is computed by using the probability distribution of queue positions. If he is not mated, he receives the discounted expected value. We then subtract the search cost.

- The expected rebirth value is the weighted sum of the values, i.e., for each type, the value of that type is weighted by the probability distribution that the type leaves the market and enters the queue.

If an initial value is correct, it will be confirmed. If not, we replace that initial value with the recalculated new value. We repeat this procedure until all expected values and rebirth values converge.

Given the excepted values for a combination of reservation values, we check the equilibrium conditions. Given the combination of reservation values of other agents, if none of the agents can be made better off by using other reservation values, then we have found an equilibrium.

[13] This probability is not independent of the type. If, for instance, type x accepts types above $x-1$, then the extreme types are less likely to be mated than are the middle types. However, on the other hand, if they are mated, they are more likely to leave the queue early, as the mating of extreme types puts less restriction on the possibility of other matings.

Appendix B. Experimental Instructions

The original instructions are in German. We present the English translation of a treatment with segregation institution. Instructions for treatments with no segregation institution are identical except they do not contain the "Two Markets" section nor parts related to two markets. Hence we omit these instructions here. Interested readers can find the complete set of instructions at http://www.si.umich.edu/˜yanchen/ .

You are taking part in an economic experiment, which is being financed by various research-promoting foundations. If you read the following instructions carefully, you can - depending on the decisions you will make - earn money in addition to the 10 francs start-up capital you receive as a fee for your participation. It is, therefore, important indeed that you accurately pay attention to the instructions given below.

The instructions distributed are intended for your personal information only. **Absolutely no communication whatsoever is allowed for the duration of the experiment.** Please address any questions you might have to us directly. The violation of this rule automatically leads to exclusion from both the experiment itself and all pertaining payments.

During this experiment, we do not deal with francs, but with points. In each period you will, therefore, earn points. The total amount of points earned in the course of the 10 periods will, on completion of the experiment, be converted into francs at the rate of

1 point equals 23 centimes.

General Idea of the Experiment

In this experiment, you will do business with the other participants. Both you and the other participants are allotted different assets, i.e., a figure which represents the value of the asset of the person who is making the deal. There are two different markets, market A and market B. First, you choose one of the two markets. Then you are matched with a partner of "your" market, you learn the value of his asset, and you decide whether or not you want to make a deal with him. If both partners come to an agreement, the deal is on and both you and your partner give away their asset. If you and your partner are not in agreement, the deal is off. Both you and he keep your respective assets and can make a deal with another partner in the next period.

The experiment's completion is not determined in advance, meaning that, at the end of each period a dice decides if the experiment is to be continued.

On the following pages we explain the procedure in detail.

The Experiment's Procedure in Detail

Allotment of Assets

At the beginning of the experiment, 12 out of 16 participants are each allotted an asset at random between 1 and 6. Each asset is allotted to exactly two individuals. So, two participants receive an asset of one, two participants receive an asset of two, etc. With the asset received, the participants can make one deal. The 12 participants with an asset at their disposal go on the market; the 4 participants with no asset are put on hold on a waiting list.

The Two Markets

You can choose between the possible markets, A and B. At the start, all participants in a market are on market B. However, they can decide if they want to move into market A or if they want to remain in market B. The participants of both markets are then, at random, matched as pairs, i.e., each participant in the market is, for the duration of a period, linked with a partner with whom he can make a deal. Pairs are matched within one market. If you choose market A, you will be matched with a partner of market A. If you remain on market B, you will be matched with a partner of market B. Both participants of one pair are informed of their respective partner's asset and decide, simultaneously and independently, whether or not to make a deal with their partner. The deal is on if both partners are in agreement, in which case both leave the market and are put on hold on a waiting list. The income earned from one deal depends on the involved partners' assets.

In order to join the participants of a market in pairs, each of the two markets must include an even number of participants. It may, thus, happen that not every participant can join the market he opts for. In such a case, a participant not able to enter the market of his choice is randomly chosen, in which event the following two rules prevail: 1) all participants insisting to remain on the market chosen can do so. 2) participants who in the previous period wished to change the market take precedence over the participants who wish to change the market in the current period.

How to Calculate Incomes

In the event of a deal reached, both partners achieve a profit depending on one's own and the partner's asset. The table below lists the profits resulting for each partner, if they agree on a deal. Suppose you have an asset of 2 and agree on a deal with a partner having an asset of 5. Then both you and your partner achieve a profit of 27 points.

As you see from the table, the profit from a deal is higher, the higher the respective partners' assets are. So, the higher your own asset, the higher is your profit from the deal. In addition, your profit is also higher, the higher your partner's asset is. If, for instance, you have an asset of 3, the profit achieved in the deal is 4, if you reach an agreement with a partner having an asset of 1. It is 74, if you reach an agreement with a partner having an asset of 6. The same applies to your partner: The higher his asset is, the higher is his profit from a deal, and the higher your own asset, the higher is the profit your partner makes from the deal.

Table: Profit from a deal achieved by each partner

		your partner's asset					
		1	2	3	4	5	6
your asset	1	1	2	4	6	10	17
	2	2	6	10	14	27	38
	3	4	10	25	39	57	74
	4	6	14	39	50	68	89
	5	10	27	57	68	90	116
	6	17	38	74	89	116	150

In **each period** you are on the market, you have to bear a **cost of 2 points**. In the event that in one period you make no deal, you have to bear the cost of only these 2 points. If a deal is reached, you make the profit as per the table minus the cost of 2 points. If you have an asset of, say, 4 and agree on a deal with a partner having an asset of 3, your earnings from the current period result in 37 points.

When on hold on the waiting list, you can make no decision. Neither do you make any profit nor do you bear any cost.

At the End of a Period

All participants having made a deal leave the market and are randomly put on hold on the waiting list. (Keep in mind that not those participants are first put on hold who decided first in the current period.) The assets of the participants who made a deal during the current period are randomly transferred to the first participants on hold on the waiting list. These latter participants can make a deal with these assets during the next period.

The participants having agreed on no deal keep their assets and remain on the market.

If you are on hold, you have to wait your turn until other participants reach an agreement and you can take over the asset of one of the leaving participants. In the event that you find yourself at the head of the waiting list, you get a leaving participant's asset at random. This may already be the case at the end of the period in which you yourself made a deal, provided that, in the current period, more than two pairs agreed on a deal. In the other event, you have to stay on hold, and wait for a new asset for one or several periods.

This experiment allots an asset between 1 and 6 to exactly two individuals. However, this asset does not belong to the same individuals each time. Let's assume that two persons are allotted the asset of 3. In different periods, however, this asset may belong to different participants: If, for instance, you get an asset of 3 and, in an earlier period, you were matched with a partner having an asset of 3, and a few periods later you are again matched with a partner having an asset of 3, it does not mean that you will also deal with the same participant.

End of the Experiment

The experiment does not end after a predetermined number of periods. At the end of each period, the participant occupying the place A2 will throw a 10-face dice. The experiment reaches its end when either 8 or 9 is thrown. In each of the other events, the experiment continues.

Should the experiment last too few periods, it will be repeated from the very start. Above all, the assets will be allotted anew. By this, all participants, those on the market and those on hold, have the same prospect of being allotted a certain asset.

Example for the Experiment's Procedure

The following table illustrates how the experiment is run. The table is explained in detail below.

Period	1	2	3	4	5	6	7	8	9	10	11
your asset	2	2	2	2	W	W	5	5	4	4	4
partner's asset	1	3	6	5			6	4	6	3	3
you accept	no	yes	no	yes			yes	yes	no	no	no
partner accepts	no	no	yes	yes			no	yes	no	yes	no
deal	no	no	no	yes			no	yes	no	no	no
profit				27	-	-		68			
cost	2	2	2	2	-	-	2	2	2	2	2
earnings	-2	-2	-2	25	0	0	-2	66	-2	-2	-2

In the first period, you are allotted the asset of 2. You choose and receive market A. Hence, you are matched with a partner from market A. Your partner is allotted the asset of 1. Both you and your partner decline the deal. The deal is off. As a result, your cost in this period amounts to 2 and your profit is -2.

In the second period, you still have the asset of 2. You again choose market A, and again you are matched with a partner from market A. Your partner has an asset of 3. You accept the deal, whereas your partner does not. The deal is not on, and your cost is again 2 and your earnings result in -2.

In the third period, you choose and receive market B. You are matched with a partner from market B. Your partner is allotted the asset of 6. In this period, your partner accepts the deal, but you don't. No deal is on. Again you have a cost of 2 and, hence, a loss of -2.

In the fourth period, you again opt for market B. You are again matched with a partner from market B. He is allotted an asset of 5. Both you and your partner accept the deal. The deal is on and you earn a profit of $27 - 2 = 25$ points in this period.

During the next two periods, you are on hold on the waiting list. Neither cost nor earnings result for you.

In the seventh period, you are allotted an asset of 5 with which you make a deal in the eighth period. In period 8, a great many participants reach a deal, so that you enter the market again in period 9. You are allotted an asset of 4. As the experiment is terminated after period 11 (participant A2 throws the number 8 on the die), you can no longer make any deal with the asset of 4.

Procedure on the Computer

You are informed when you are on hold on the waiting list.

In the event that you are not on hold, you first decide which market you want to enter. The following screen is presented for you to enter your choice. The left side of the screen shows the number of participants who, in earlier periods, opted for market A. It also indicates how many participants received asset 1 in market A, how many received asset 2 in market A, etc.

The right side of the screen again shows your asset. Furthermore, you are reminded of the market in which you currently are dealing. You make your entry below by activating either the button “market A” or the button “market B.” In case you enter market A, you are matched with a partner in market A. If you enter market B, you are matched with a partner in market B.

When you have decided on the market to enter, you will be shown the following screen. You are again informed of your asset and have to make up your mind whether or not to reach a deal with your partner. You do so by determining a **threshold value**, indicating the minimum value you accept as your partner's asset in order to agree on a deal. You must decide on a threshold value before you know your partner's actual asset. Whether the deal is accepted is determined by both the threshold value and your partner's actual asset: If your partner's asset is at least as high as the amount of your threshold value, the deal is accepted; otherwise, it is not. If you insert a threshold value of, suppose, 4, and your partner has an asset of 1, 2, or 3, the deal is not accepted (and the deal is off). If you insert a threshold value of 4, and your partner has an asset of 4, 5, or 6, however, the deal is accepted. (The deal is on if your partner accepts it, too.)

You insert your threshold value on the following screen. As soon as your decision is made, mouse-click the “OK” button. As long as you don't activate the OK button, you can revise your decision by highlighting your input and inserting a new figure.

When all participants have reached a decision, the screen below shows your earnings. On the left side, you are informed of how many participants opted for market A. In addition, you can see the value of your asset, the value of your partner's asset, and the threshold value you determined. You also learn if your partner was prepared to make the deal (however you do not see his threshold value) and, finally, the resulting profits from the decisions made and both the cost and earnings of the current period. At last, the total income from the experiment is shown. (In the event that the experiment is repeated, the total income is reduced to 0 again. Of course, you will be paid *all* the money earned during all experiments.)

As soon as all participants have mouse-clicked the “continue” button, or when time is up, one period is complete. A2 throws the ten-face dice. If he throws a figure between 0 and 7, the experiment goes on. If he throws the figures 8 or 9, the experiment is discontinued. In case the experiment has too few periods, it is repeated.

Control Questions

1. Your asset is 5 and you determine a threshold value of 2. Your partner is willing to make a deal with you. What is your income from this period, if ...
   (a) ... your partner's asset is 1 ? ....
   (b) ... your partner's asset is 2 ? ....
   (c) ... your partner's asset is 3 ? ....
   (d) ... your partner's asset is 4 ? ....
   (e) ... your partner's asset is 5 ? ....
   (f) ... your partner's asset is 6 ? ....
2. You have an asset of 1. Your partner has an asset of 4.
   (a) What is your income from this period, if you decide on a threshold value of 1 and your current partner is prepared to deal? ....
   (b) What is your income from this period, if you decide on a threshold value of 2 and your current partner is not prepared to deal? ....
   (c) What is your income from this period, if you decide on a threshold value of 3 and your current partner is prepared to deal? ....
   (d) What is your income from this period, if you decide on a threshold value of 4 and your current partner is not prepared to deal? ....
   (e) What is your income from this period, if your decide on a threshold value of 5 and your current partner is prepared to deal? ....
   (f) What is your income from this period, if you decide on a threshold value of 6 and your current partner is not prepared to deal? ....
3. Suppose you have an asset of 5 and opt for market A. Apart from you, there are five other participants in market A, of which one has an asset of 1, one has an asset of 2, one has an asset of 3, one has an asset of 4, and one has an asset of 6. What is the probability of your partner having ...
   (a) ... the asset 1 ? ....
   (b) ... the asset 2 ? ....
   (c) ... the asset 3 ? ....
   (d) ... the asset 4 ? ....
   (e) ... the asset 5 ? ....
   (f) ... the asset 6 ? ....

4. Suppose you have an asset of 4 and opt for market A. Apart from you, there are three other participants in market A, of which two have an asset of 5 and one has an asset of 6. What is the probability of your partner having ...
   (a) ... the asset 1 ? ....
   (b) ... the asset 2 ? ....
   (c) ... the asset 3 ? ....
   (d) ... the asset 4 ? ....
   (e) ... the asset 5 ? ....
   (f) ... the asset 6 ? ....
5. What is your income in the event that you are on hold on the waiting list? ....

Payoff Matrix 1						
Type	1	2	3	4	5	6
1	1	2	4	6	10	17
2	2	6	10	14	27	38
3	4	10	25	39	57	74
4	6	14	39	50	68	89
5	10	27	57	68	90	116
6	17	38	74	89	116	150
Payoff Matrix 2						
Type	1	2	3	4	5	6
1	10	11	12	13	14	16
2	11	13	16	18	21	24
3	12	16	20	24	28	33
4	13	18	24	30	35	41
5	14	21	28	35	43	51
6	16	24	33	41	51	60

Table 1: Two Payoff Matrices

Payoff matrix	Segregation Institution	Session	Number of runs															Total # of Periods
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1	no	1	6	1	12	8	33											60
1	no	2	6	4	3	5	3	5	3	7	6							42
1	no	3	2	14	1	2	1	1	1	7	9	3						41
1	no	4	1	1	11	3	4	2	12	3	11							48
1	yes	9	11	6	2	3	4	11	1	1	2							41
1	yes	10	4	4	6	4	7	1	4	9	6							45
1	yes	11	4	1	8	1	7	3	5	20								49
1	yes	14	3	3	3	4	3	4	1	3	18							42
2	no	5	1	13	1	7	1	4	4	2	4	2	3					42
2	no	6	1	2	10	5	2	7	2	8	4							41
2	no	7	5	1	7	6	6	5	1	3	18							52
2	no	8	6	8	3	4	1	1	9	2	9							43
2	yes	12	1	1	3	9	5	3	16	1	1							40
2	yes	13	3	3	1	1	1	2	4	1	3	4	6	3	1	3	7	43
2	yes	15	9	1	8	2	3	1	1	2	2	1	4	2	9			45
2	yes	16	2	1	4	13	2	5	4	4	3	4						42

Table 2: Features of Experimental Sessions

Payoff Matrix 1: No Segregation Institution						
	Submitted Threshold					
Type	1	2	3	4	5	6
1	**0.93**	0.04	0.03	0.01	0.00	0.00
2	**0.70**	0.22	0.04	0.02	0.01	0.00
3	0.24	0.22	**0.48**	0.06	0.01	0.00
4	0.17	0.15	**0.49**	0.18	0.00	0.00
5	0.12	0.13	**0.54**	0.16	0.04	0.01
6	0.13	0.10	**0.38**	0.30	0.10	0.00

Payoff Matrix 1: Segregation Institution						
	Submitted Threshold					
Type	1	2	3	4	5	6
1	**0.92**	0.03	0.03	0.02	0.01	0.00
2	**0.74**	0.19	0.04	0.01	0.02	0.00
3	**0.34**	0.32	0.27	0.07	0.00	0.00
4	0.17	0.12	**0.49**	0.21	0.01	0.00
5	0.15	0.07	**0.35**	0.32	0.11	0.00
6	0.11	0.04	0.30	**0.36**	0.17	0.02

Payoff Matrix 2: No Segregation Institution						
	Submitted Threshold					
Type	1	2	3	4	5	6
1	**0.92**	0.02	0.03	0.01	0.01	0.01
2	**0.89**	0.07	0.03	0.01	0.01	0.00
3	**0.42**	0.34	0.20	0.03	0.01	0.00
4	0.24	0.29	**0.34**	0.13	0.01	0.00
5	0.15	0.20	**0.33**	0.26	0.05	0.00
6	0.15	0.07	**0.36**	0.26	0.15	0.01

Payoff Matrix 2: Segregation Institution						
	Submitted Threshold					
Type	1	2	3	4	5	6
1	**0.96**	0.02	0.01	0.00	0.00	0.01
2	**0.88**	0.10	0.01	0.01	0.00	0.00
3	**0.49**	0.36	0.14	0.01	0.00	0.00
4	0.29	0.29	**0.36**	0.06	0.00	0.00
5	0.23	0.17	**0.38**	0.21	0.01	0.00
6	0.19	0.10	0.18	**0.46**	0.08	0.00

Note:
1. Boldface indicates mode of distribution.
2. Grey shade and frame box indicate equilibrium threshold.

Table 3: Distribution of Submitted Thresholds by Type: All Runs

PM 1: No Segregation Institution						
	Payoff Difference					
Type	1	2	3	4	5	6
1	24	25	27	29	33	40
2	18	22	26	30	43	54
3	-3	3	18	32	50	67
4	-14	-6	19	30	48	69
5	-26	-9	21	32	54	80
6	-35	-14	22	37	64	98

PM 1: Segregation Institution						
	Payoff Difference					
Type	1	2	3	4	5	6
1	9	10	12	14	18	25
2	5	9	13	17	30	41
3	-14	-8	7	21	39	56
4	-29	-21	4	15	33	54
5	-43	-26	4	15	37	63
6	-55	-34	2	17	44	78

PM 2: No Segregation Institution						
	Payoff Difference					
Type	1	2	3	4	5	6
1	6	7	8	9	10	12
2	4	6	9	11	14	17
3	-1	3	7	11	15	20
4	-5	0	6	12	17	23
5	-10	-3	4	11	19	27
6	-13	-5	4	12	22	31

PM 2: Segregation Institution						
	Payoff Difference					
Type	1	2	3	4	5	6
1	6	7	8	9	10	12
2	4	6	9	11	14	17
3	0	4	8	12	16	21
4	-6	-1	5	11	16	22
5	-10	-3	4	11	19	27
6	-14	-6	3	11	21	30

Table 4: Simulated Payoff Difference between Accepting and Rejecting a Match

Payoff Matrix 1: No Segregation Institution												
	Submitted Threshold: First Run						Submitted Threshold: Last Run					
Type	1	2	3	4	5	6	1	2	3	4	5	6
1	**0.83**	0.13	0.03	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00
2	**0.60**	0.17	0.20	0.03	0.00	0.00	**0.86**	0.12	0.02	0.00	0.00	0.00
3	0.13	0.27	**0.53**	0.07	0.00	0.00	0.28	0.14	**0.57**	0.01	0.00	0.00
4	0.23	0.07	**0.67**	0.03	0.00	0.00	0.18	0.24	**0.37**	0.22	0.00	0.00
5	0.07	0.10	**0.57**	0.23	0.03	0.00	0.13	0.21	**0.56**	0.09	0.01	0.00
6	0.13	0.03	0.17	**0.57**	0.10	0.00	0.12	0.13	**0.51**	0.18	0.06	0.00

Payoff Matrix 1: Segregation Institution												
	Submitted Threshold: First Run						Submitted Threshold: Last Run					
Type	1	2	3	4	5	6	1	2	3	4	5	6
1	**0.73**	0.11	0.09	0.05	0.02	0.00	**0.95**	0.01	0.03	0.01	0.00	0.00
2	**0.61**	0.27	0.05	0.05	0.02	0.00	**0.77**	0.16	0.04	0.01	0.00	0.01
3	0.18	**0.41**	0.25	0.16	0.00	0.00	0.41	0.24	**0.26**	0.09	0.00	0.00
4	0.20	0.18	**0.48**	0.09	0.05	0.00	0.11	0.14	**0.45**	0.29	0.01	0.00
5	0.18	0.09	**0.34**	0.16	0.23	0.00	0.15	0.01	0.36	**0.37**	0.11	0.00
6	0.11	0.07	**0.32**	0.30	0.18	0.02	0.11	0.00	0.28	**0.40**	0.18	0.02

Payoff Matrix 2: No Segregation Institution												
	Submitted Threshold: First Run						Submitted Threshold: Last Run					
Type	1	2	3	4	5	6	1	2	3	4	5	6
1	**0.73**	0.12	0.08	0.04	0.00	0.04	**0.99**	0.00	0.00	0.00	0.01	0.00
2	**0.58**	0.27	0.04	0.04	0.08	0.00	**0.99**	0.01	0.00	0.00	0.00	0.00
3	**0.38**	0.31	0.23	0.08	0.00	0.00	**0.49**	0.38	0.09	0.01	0.03	0.00
4	0.12	0.15	**0.46**	0.27	0.00	0.00	**0.43**	0.38	0.18	0.00	0.01	0.00
5	0.04	0.23	**0.42**	0.27	0.04	0.00	0.19	**0.38**	0.26	0.10	0.06	0.00
6	0.08	0.08	**0.42**	0.19	0.23	0.00	0.21	0.09	**0.34**	0.28	0.09	0.00

Payoff Matrix 2: Segregation Institution												
	Submitted Threshold: First Run						Submitted Threshold: Last Run					
Type	1	2	3	4	5	6	1	2	3	4	5	6
1	**0.80**	0.10	0.03	0.00	0.00	0.07	**1.00**	0.00	0.00	0.00	0.00	0.00
2	**0.83**	0.13	0.03	0.00	0.00	0.00	**0.90**	0.10	0.00	0.00	0.00	0.00
3	0.33	**0.47**	0.20	0.00	0.00	0.00	**0.38**	0.33	0.29	0.00	0.00	0.00
4	0.13	0.30	**0.47**	0.10	0.00	0.00	0.21	0.26	**0.48**	0.05	0.00	0.00
5	0.13	0.30	**0.43**	0.10	0.03	0.00	**0.31**	0.26	**0.31**	0.12	0.00	0.00
6	0.07	0.07	0.23	**0.53**	0.10	0.00	0.24	0.10	0.21	**0.43**	0.02	0.00

Note:
1. Boldface indicates mode of distribution.
2. Grey shade and frame box indicate equilibrium threshold.

Table 5: Distribution of Submitted Thresholds by Type: First vs. Last Run

	Dependent Variable: Change in Submitted Threshold					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
Accepted-by-other^{t-1}	-1.321	-0.686	-0.149	-0.195	-0.538	
	(0.226)***	(0.117)***	(0.059)**	(0.047)***	(0.243)**	
Accepted-by-other*D_{mate}^{t-1}	1.307	0.756	0.31	0.233	0.422	0.441
	(0.226)***	(0.116)***	(0.068)***	(0.037)***	(0.063)***	(0.066)***
Constant	0.003	-0.052	-0.129	0	0.25	-0.349
	-0.013	(0.022)**	(0.043)***	-0.047	-0.242	(0.034)***
Observations	787	670	578	556	579	611
Adjusted R-squared	0.114	0.059	0.053	0.036	0.074	0.077
$H_0 : b = 0$, $H_1 : b < 0$	0.01	0.01	0.01	0.01	0.05	-
$H_0 : b + c = 0$,						
$H_1 : b + c \neq 0$	0.64	0.21	0.02	0.43	0.66	-

Notes:

1. Robust standard errors in parentheses are adjusted for clustering at the session level.
2. Significant at: * 10%; ** 5%; *** 1%.
3. The variable Accepted-by-partner is dropped in the last column since type 6s are always accepted by their partners.
4. The bottom panel presents the null and alternative hypotheses, as well as the corresponding p-values for the F-tests.

Table 6: Change in Submitted Threshold as a Function of Prior Experience

	Dependent Variable: Equilibrium Threshold			
	Payoff Matrix 1		Payoff Matrix 2	
	No Seg. Institution	Seg. Institution	No Seg. Institution	Seg. Institution
Own Type	-0.22	-0.26	-0.56	-0.54
	(0.03)***	(0.04)***	(0.05)***	(0.05)***
Constant	0.91	1.32	1.85	1.92
	(0.11)***	(0.12)***	(0.08)***	(0.10)***
Observations	2,292	2,124	2,136	2,040

Notes:

1. Robust standard errors in parentheses are adjusted for clustering at the session level.
2. Significant at: *** 1% level.

Table 7: Probit: Proportion of Equilibrium Play and Own Type

	Dependent Variable: Desired Market at Round t					
	Payoff Matrix 1					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
$n_{1,2}^{t-1}$	0.1867	0.2616	0.0693	-0.1435	-0.0172	-0.1158
	(0.0624)***	(0.1078)**	(0.1114)	(0.0683)**	(0.0844)	(0.0221)***
n_{3}^{t-1}	0.0582	0.0012	0.2517	-0.0134	-0.0057	-0.2159
	(0.1623)	(0.0736)	(0.1493)*	(0.1243)	(0.0466)	(0.1588)
n_{4}^{t-1}	-0.0970	-0.0048	-0.0129	0.2701	-0.0318	-0.0591
	(0.0549)*	(0.0922)	(0.2176)	(0.2221)	(0.1481)	(0.1891)
$n_{5,6}^{t-1}$	0.1009	0.0039	0.1298	0.4303	0.5617	0.4937
	(0.0292)***	(0.0956)	(0.0582)**	(0.0657)***	(0.0670)***	(0.0480)***
$n_{1,2}^{t-2}$	0.0598	0.0839	-0.0837	-0.0710	-0.2036	0.1132
	(0.0362)*	(0.0285)***	(0.0642)	(0.0490)	(0.0543)***	(0.0705)
n_{3}^{t-2}	0.0964	-0.1188	-0.1559	0.0579	0.0388	-0.0903
	(0.1130)	(0.1218)	(0.0655)**	(0.0590)	(0.0718)	(0.0592)
n_{4}^{t-2}	-0.0352	0.1813	-0.0153	-0.0574	0.0976	0.0819
	(0.0475)	(0.1012)*	(0.0474)	(0.1253)	(0.0853)	(0.0832)
$n_{5,6}^{t-2}$	-0.0313	-0.0880	0.1159	-0.0228	0.0448	0.0902
	(0.0964)	(0.0424)**	(0.0903)	(0.1451)	(0.0521)	(0.1066)
Constant	-0.9213	-0.5270	-0.4788	-0.5159	-0.5581	-0.8223
	(0.3902)**	(0.5394)	(0.2294)**	(0.5326)	(0.3193)*	(0.6058)
Observations	338	338	338	338	338	338
	Payoff Matrix 2					
	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
$n_{1,2}^{t-1}$	0.3549	0.2076	0.0106	-0.1557	-0.1150	-0.2085
	(0.1308)***	(0.0898)**	(0.0387)	(0.0383)***	(0.0716)	(0.0994)**
n_{3}^{t-1}	0.0398	-0.1540	0.2739	-0.1144	-0.0482	-0.1058
	(0.1131)	(0.0810)*	(0.1831)	(0.1645)	(0.0952)	(0.1215)
n_{4}^{t-1}	0.0962	-0.0492	-0.0821	0.3128	0.2170	0.3650
	(0.1240)	(0.0383)	(0.0916)	(0.1489)**	(0.0781)***	(0.1582)**
$n_{5,6}^{t-1}$	-0.0126	0.1289	0.3282	0.2984	0.3583	0.3961
	(0.0497)	(0.0575)**	(0.1097)***	(0.0762)***	(0.0661)***	(0.1023)***
$n_{1,2}^{t-2}$	0.0073	0.0673	-0.0774	0.0030	-0.0787	0.0510
	(0.0313)	(0.0696)	(0.1347)	(0.1223)	(0.0934)	(0.0711)
n_{3}^{t-2}	-0.1099	-0.2707	0.2237	0.0885	0.2802	-0.1323
	(0.1145)	(0.0614)***	(0.1020)**	(0.1333)	(0.1031)***	(0.1285)
n_{4}^{t-2}	0.0447	0.1765	0.0380	-0.0425	-0.0519	-0.0069
	(0.0322)	(0.1297)	(0.0831)	(0.1146)	(0.0300)*	(0.2080)
$n_{5,6}^{t-2}$	-0.0933	-0.0653	0.0446	0.1538	0.1543	0.2769
	(0.1287)	(0.1156)	(0.0711)	(0.1033)	(0.0556)***	(0.1102)**
Constant	-0.4944	-0.0755	-1.0625	-0.8655	-1.1178	-1.1681
	(0.2376)**	(0.3458)	(0.5521)*	(0.6723)	(0.2436)***	(0.4505)***
Observations	324	324	324	324	324	324

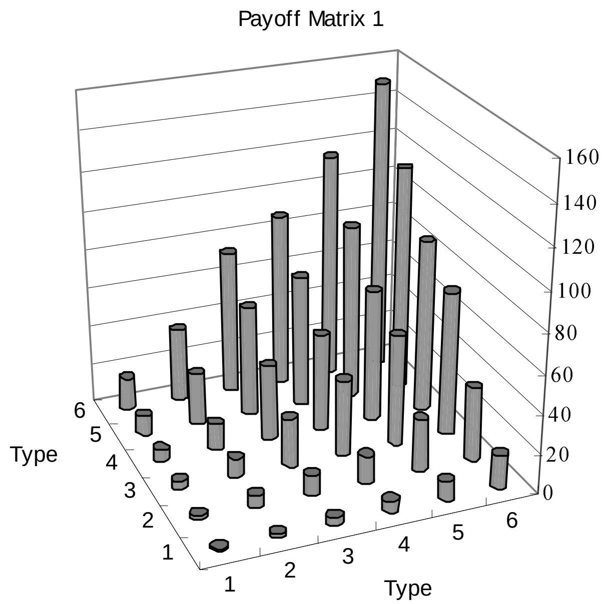
Notes:

1. Independent variable, $n_{1,2}^{t-1}$, denotes the number of types 1 and 2 in market A at round $t-1$, etc.
2. Robust standard errors in parentheses are adjusted for clustering at the session level.
3. Significant at: * 10% level; ** 5% level; *** 1% level.

Table 8: Desired Market Under Each Payoff Matrix

Payoff Matrix 1			
Session #	H_1	D	P-value
Session 9	Observed $>$ Random	0.5798	0.000
Session 10	Observed $>$ Random	0.2677	0.002
Session 11	Observed $>$ Random	0.3762	0.000
Session 14	Observed $>$ Random	0.2106	0.035
Payoff Matrix 2			
Session #	H_1	D	P-value
Session 12	Observed $<$ Random	-0.1378	0.373
Session 13	Observed $>$ Random	0.2480	0.007
Session 15	Observed $>$ Random	0.1432	0.164
Session 16	Observed $<$ Random	-0.6837	0.000

Table 9: Kolmogorov-Smirnov Equality of Distribution Tests for Comparison of Observed and Random Distribution of Segmentation Indexes



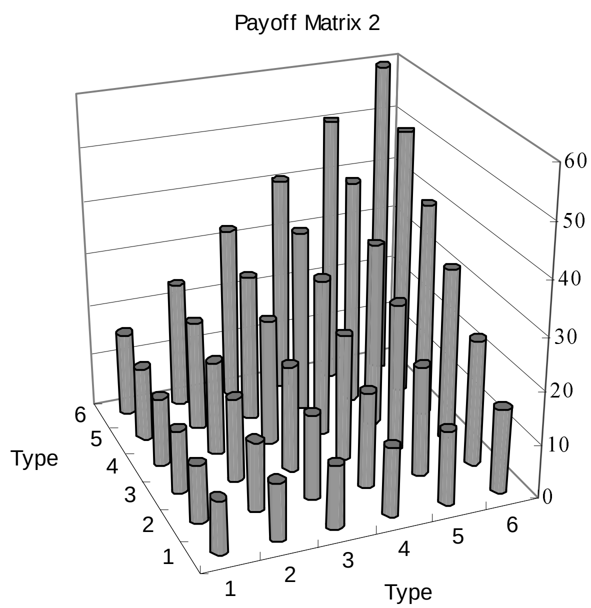


Figure 1: Payoff Matrices 1 and 2

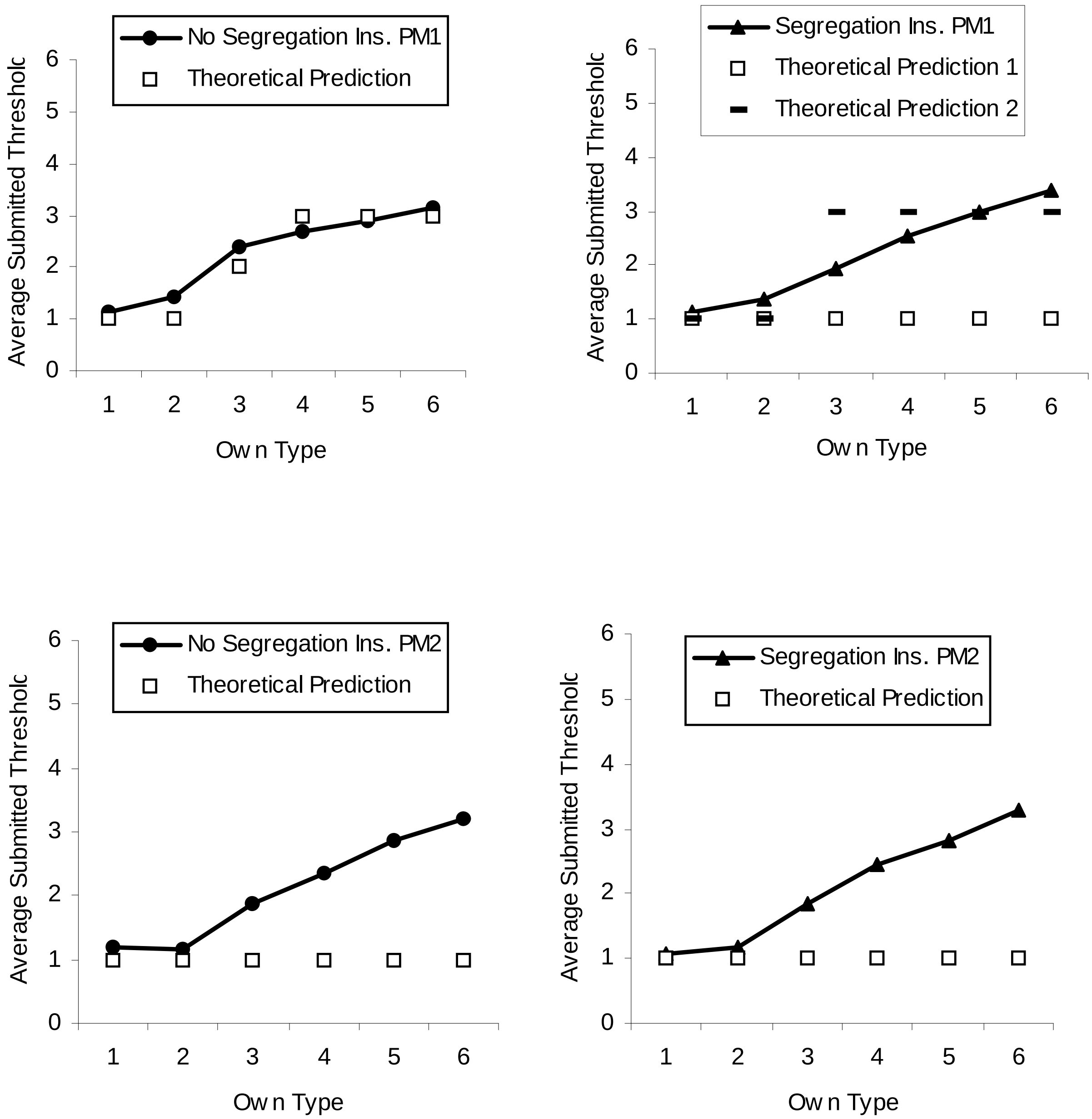


Figure 2: Average Threshold in Payoff Matrices 1 and 2

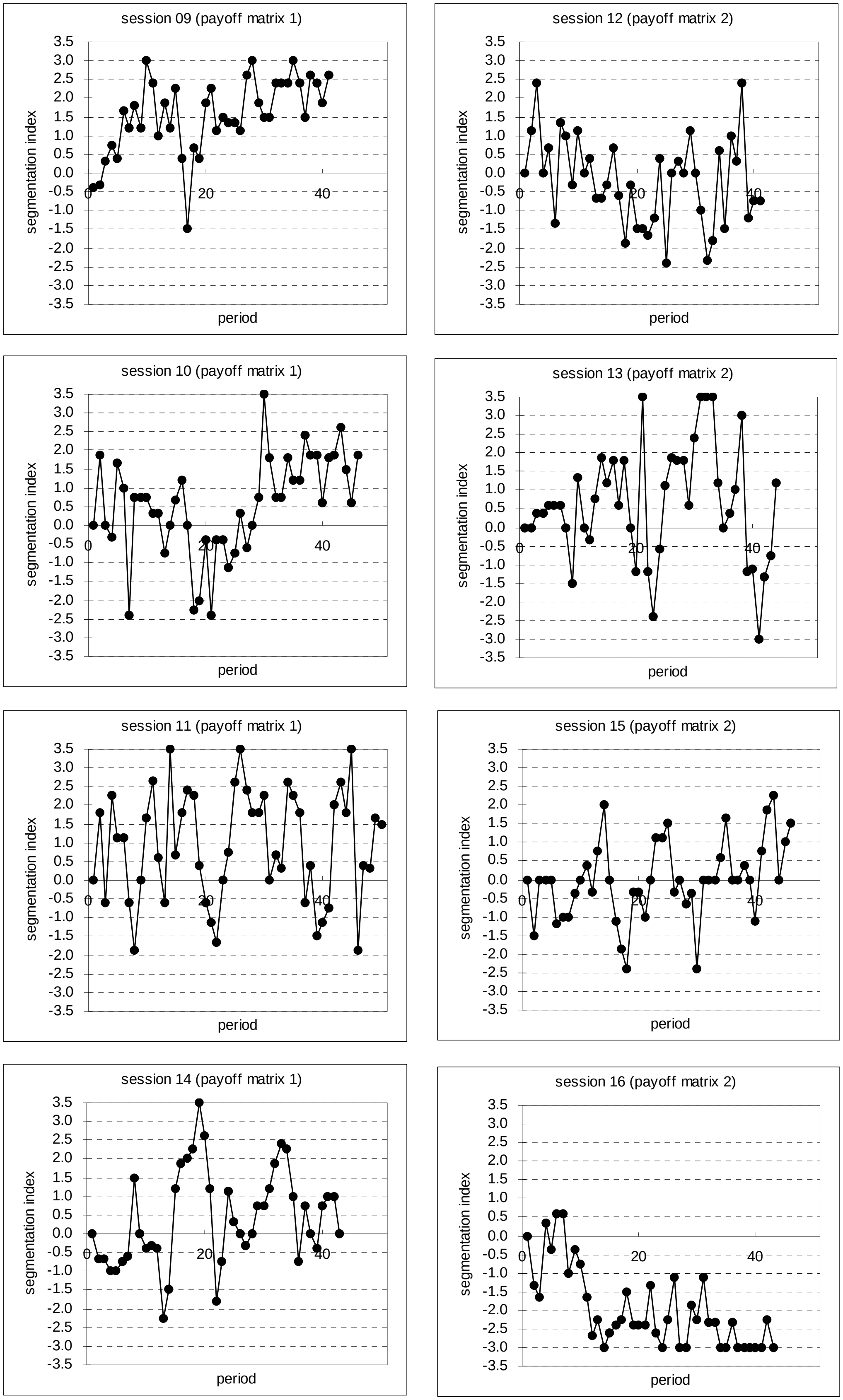


Figure 3: Dynamics of the Segmentation Indexes