Decentralized Matching with Transfers: Experimental and Noncooperative Analyses

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Abstract

We experimentally examine the Becker-Shapley-Shubik two-sided matching model. In the experiment, the aggregate outcomes of matching and surplus are affected by whether equal split is in the core and whether efficient matching is assortative; the canonical cooperative theory predicts no effect. In markets with an equal number of participants on both sides, individual payoffs cannot be explained by existing refinements of the core, but are consistent with our noncooperative model's predictions. In markets with unequal numbers of participants, noncompetitive outcomes, are not captured by the canonical cooperative model, but are included in the set of predictions in our noncooperative model.
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1 Introduction

The transferable-utilities (TU) two-sided matching model, developed by Shapley and Shubik (1972) and Becker (1973), has been widely used to study marriage and labor markets, both theoretically and empirically.[1] There is increasing interest in testing the model's predictions on stable/core matching and bargaining outcomes[2] in laboratory experiments, which have the advantage of creating a controlled environment that allows researchers to better understand the scope and limitations of a theory despite the small number of participants and the low incentives provided (Roth, 2015). This study conducts one of the first comprehensive experiments on the TU matching model and tests alternative noncooperative and behavioral theories on experimental findings that cannot be rationalized by the canonical cooperative theory.

Our experimental investigation starts with the smallest *balanced* markets with nontrivial matching possibilities: markets with three subjects on each side. Then we study *imbalanced* markets with three subjects on one side and four on the other. To mimic the TU matching market, we reduce frictions by allowing subjects to propose to anyone on the opposite side of the market with any division of the surplus, and no match becomes permanent until the end of the game.[3] To ensure the robustness of our main findings, we run two waves of experiments that differ in game-ending rules and payment rules.

According to the canonical theory, different surplus configurations of the market should not affect people's abilities to achieve efficient matching or stable bargaining outcomes. However, in practice, several factors may have an impact. We first investigate how two features affect matching and bargaining outcomes in balanced markets: (i) whether efficient matching is assortative and (ii) whether an equal split of each efficiently matched pair's surplus is stable/in the core. To do so, we use a two-by-two comparison. First, we hypothesize that the configurations that admit an assortative efficient matching are more straightforward and intuitive, since sorting has frequently been observed in practice. It is therefore important to investigate whether subjects in a controlled experiment indeed find it easier to match when assortative matching is available. Second, we note that an equal division of every efficiently matched pair's surplus is the pairwise Nash (1950) bargaining outcome, and is also the limit outcome of pairwise Rubinstein (1982) bargaining when subjects are infinitely patient, so subjects may find it easier and strategically more plausible to achieve and maintain such an outcome if it is also in the core.[4]

Our experiment finds that the probability of being matched and the probability of achieving efficient

[1]For a comprehensive overview of the TU matching model and its applications, see the following surveys and monographs: Galichon (2016); Chiappori and Salanié (2016); Chade et al. (2017); and Chiappori (2017). The model has been applied to explain observed assortative matching in characteristics such as education, height, race, income, and blood type (Becker, 1973; Siow, 2015; Eika et al., 2019; Pollak, 2019; Hou et al., 2022); cross-country differences in income and growth (Kremer, 1993); increases in CEO pay (Gabaix and Landier, 2008); and college and career choices (Chiappori et al., 2009; Zhang, 2020, 2021; Zhang and Zou, 2023).

[2]A matching and bargaining outcome is stable (also known as being in the core) if no pair of agents has an incentive to deviate from their respective partners to form a new pair.

[3]The features of the experiment described capture, for example, a labor market in which firms and workers—or a venture capital market in which entrepreneurs and investors—are negotiating deals simultaneously.

[4]There may be additional reasons for equal splits, including but not limited to complexity, social preferences, and focal points. When pairwise equal splits are not in the core, inequality aversion may prohibit people from forming a pair. For example, in the marriage market, a man and a woman who divide their joint surplus unequally may consider the division unfair and choose to end the relationship, even if they cannot do better by matching with someone else. This phenomenon can be explained by inequality aversion, as first introduced in the economics literature by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000).

matching are significantly higher in markets with pairwise equal splits in the core and, to a lesser extent, in markets with assortative efficient matching. These differences are stronger in wave 1 of the experiment with time limits than in wave 2 without time limits. In markets with pairwise equal splits in the core, most subjects propose equal splits and most accepted proposals feature equal splits. In contrast, in other markets, equal splits are less commonly proposed and less commonly accepted. These results suggest that having pairwise equal splits in the core and assortative efficient matching are important determinants of matching and bargaining outcomes in TU matching markets.

In the experiment, subjects tend to reach certain bargaining outcomes in the core, but existing single-valued and set-valued refinements of the core do not systematically capture the experimental payoffs. Motivated to match the experimental payoffs and to understand the general pattern of interaction, we extend the bilateral bargaining model of Rubinstein (1982) to the matching market. This captures the dynamic bargaining process in our experimental design. Our noncooperative bargaining-in-matching model features a unique equilibrium when the delay frictions are sufficiently small. Whenever the outcome of pairwise equal splits is in the core, it is also our noncooperative model's predicted outcome as frictions vanish, because each pair essentially engages in Rubinstein bargaining with their partner when outside options do not influence their bargaining outcomes in equilibrium.[5] When the outcome of pairwise equal splits is not in the core, outside threats influence players' bargaining power with their partners. Our noncooperative model incorporates these outside options. Average experimental payoffs largely coincide with the payoffs in the unique equilibrium of our noncooperative model as frictions vanish.

Finally, we investigate imbalanced markets. We duplicate the agent with the lowest bargaining power in each of the four balanced markets, which results in three agents on one side and four agents on the other.[6] According to the canonical theory, competition between the two duplicate agents would be expected to drive down their payoffs, even to zero. However, in the experiment, their payoffs rarely (i.e., in less than 1% of instances) reach zero in the experiment. In fact, in wave 1, their payoffs often do not differ much from their payoffs in balanced markets, as if there were no competition. Even when their payoffs are lower than their payoffs in balanced markets, they are significantly above zero. Our noncooperative model has a continuum of equilibria that can explain these experimental observations: (i) a class of competitive equilibria in which competitors get (near) zero payoffs, (ii) a class of noncompetitive equilibria in which there is essentially no competition between competitors, and (iii) a class of partially competitive equilibria

[5] This result helps explain without behavioral assumptions the widespread observation of equal splits. Recent papers by Elliott and Nava (2019) and Talamàs (2020) take a noncooperative approach to model matching markets but consider different bargaining protocols and agent replenishment in the market. Both papers reach similar conclusions regarding the stability of the pairwise equal splits outcome when the outcome is in the core. See also Nax and Pradelski (2015), who show that a simple dynamic learning process can lead to equitable core outcomes.

[6] A prominent application of imbalanced markets is a marriage market with an imbalanced sex ratio, in which low-income men tend to compete for wives. For example, Wei and Zhang (2011) find that the rising sex ratio in China can explain the increasing saving rates because Chinese parents with sons raise their savings competitively to increase their sons' attractiveness in the marriage market. In addition, biased sex ratio has been empirically documented to drive other competing behaviors such as dowries (Edlund, 1999; Qian, 2008; Wei and Zhang, 2011; Corno et al., 2020). Furthermore, there are long-term consequences of a biased sex ratio (Grosjean and Khattar, 2019). Another application is the labor market, in which low-skill workers, who are easy substitutes for one another, compete to be employed and receive low wages (Katz and Murphy, 1992). The theoretical studies are of interest by themselves, going back to the situation with one buyer and two sellers (Shapley, 1953; Shapley and Shubik, 1972; Hendon and Tranaes, 1991; Núñez and Rafels, 2005; Leng, 2023).

in which competitors receive positive payoffs between the payoffs in the previous two classes of equilibria. The noncompetitive and partially competitive equilibria are sustained by the credible threat that agents would fully compete if one deviates from the equilibrium. Such an equilibrium is not sustained in balanced markets, but is sustained in imbalanced markets because the threat to drive a competitor's payoff to zero is credible as part of the stable outcome only in imbalanced markets. These findings are largely consistent across the two waves of experiments, with slightly more zero payoffs in wave 2.

In addition, we explore the possibility of fairness concerns in rationalizing the experimental results. We construct a matching model in which subjects have Fehr and Schmidt (1999) inequality aversion preferences. We define a "fair core" as the prediction of the model and compare it to the experimental findings. Overall, adding fairness concerns may further reinforce the robustness of matching with equal splits in the core and explain why players' payoffs in imbalanced markets are away from zero. However, the model cannot be used as the sole explanation of the experimental behavior, because (i) in balanced markets, the fair core still has a wide range of predictions and (ii) in imbalanced markets, although the fair core no longer allows zero payoffs for players on the long side of the market, the prediction is still a singleton, which differs from the observed range of experimental payoffs.

After the literature review, the remainder of the paper is organized as follows. Section 2 presents definitions and testable implications of the canonical TU matching model. Section 3 introduces the experimental design, procedures, and hypotheses. Section 4 presents experimental results on matching and bargaining outcomes. Section 5 discusses our noncooperative and inequality aversion models and their fit with balanced and imbalanced markets in the experiment. Section 6 concludes and discusses additional experimental results.

Most matching experiments focus on nontransferable-utilities (NTU) matching models, following Gale and Shapley (1962), and take a market-design perspective to understand the stability, efficiency, and strategyproofness of different algorithms implemented by a central clearinghouse. Roth (2015) and Hakimov and Kübler (2019) provide recent surveys on this topic. A few studies consider decentralized NTU markets in which both sides can make offers, such as Echenique and Yariv (2013); Chen et al. (2015); and Pais et al. (2020). Experimental studies of trading markets (Hatfield et al., 2012, 2016; Plott et al., 2019) have also found that in the absence of a competitive equilibrium, markets tend to conform to the stable outcomes predicted by theory (Kelso and Crawford, 1982; Hatfield et al., 2013).

Several experiments test the TU matching model. Nalbantian and Schotter (1995) set up an experiment that mimics the baseball free agency market with three "managers" and three "players" negotiating salaries via phone, which effectively creates a decentralized TU matching market with incomplete information. In their experiment, subjects do not have complete information on the matching surpluses, and they negotiate through phone calls to reach permanent agreements. In contrast, our subjects have complete information on the matching surpluses and make offers that are first temporarily accepted, which reduces matching frictions. In addition, the negotiation process in our experiment is more structured than theirs, which allows us to obtain rich information on the details of subjects' proposals and their decisions to accept or reject. Otto and Bolle (2011) study the final outcome of six different 2-by-2 matching markets with price negotiation and verbal communication. In contrast, we focus on decentralized two-sided matching markets that do not feature verbal negotiation, but allow negotiation through the strategic acceptance/rejection of competing offers from potential matches. This enables us to document subjects' behavior during the negotiation process. Furthermore, our focus on more than two agents on both sides allows us to have nonassortative efficient matching patterns that cannot be captured by 2-by-2 markets. Dolgopolov et al. (2020) study a 3-by-3 assignment matching market and investigate the market outcomes under three institutions (double auctions, posted prices, and decentralized communication), which differ from ours. They find that Nash outcomes are commonly observed under double-auction rules, though efficient outcomes are not always achieved; however, markets with communication achieve higher efficiencies on average. Agranov and Elliott (2021) consider three 2-by-2 markets, but in their decentralized bargaining process, following Elliott and Nava (2019), if a pair is matched, both players leave the market. Hence, the incentives in their setting differ from ours. Agranov et al. (2022) compare matching under complete and incomplete information and find that incomplete information and submodularity jointly hinder the efficiency and stability of matching. However, their comparison is focused on two assortative markets with and without pairwise equal splits in the core. We instead consider eight different markets with complete information, which allows us to examine the role of assortativity, equal splits, and imbalance.

The experimental literature on imbalanced markets is scarce. Yan et al. (2016) reveal that agents on the short side do not capture the entire surplus, but the paper focus is on the comparison between different centralized trading mechanisms. Leng (2023) conducts experiments on 2-by-1 markets using the bargaining protocol of Perry and Reny (1994) that supposedly achieves the core outcome and finds that, contrary to the theoretical prediction but similar to the experimental results of our 3-by-4 markets, the core outcome is not achieved. This means that agents on the short side of the market do not capture the entire surplus.

In summary, our paper is distinct from other papers in several respects and provides a comprehensive study of balanced and imbalanced matching markets. Overall, our paper contributes to the literature in three ways. First, we manipulate market configurations to investigate the impact of two features—having pairwise equal splits in the core and assortativity—on matching and bargaining outcomes. Second, our findings show that agents tend to achieve certain bargaining outcomes in the core in balanced matching markets, and our noncooperative model features a unique equilibrium that aligns with these outcomes. Third, we find that agents can achieve a range of bargaining outcomes both inside and outside the core in imbalanced matching markets, and our noncooperative model helps rationalize such multiplicities.

2 Canonical cooperative theory

We briefly review the canonical cooperative TU matching model based on Shapley and Shubik (1972) and Becker (1973) to introduce notation, terms, and main testable implications. There are two sides that consist of n_M men, $M = \{m_1, \cdots, m_{n_M}\}$, and n_W women, $W = \{w_1, \cdots, w_{n_W}\}$. The entire set of players is denoted by $I = M \cup W$. We say that a market is **balanced** if $n_M = n_W$ and **imbalanced** otherwise. For any man $m \in M$ and woman $w \in W$, they produce a total surplus of s_{mw}. The surpluses of all pairs can be summarized by a surplus matrix $s = \{s_{mw}\}_{m \in M, w \in W}$. Each agent gets zero when unmatched and gets a payoff that depends on the division of the surplus when matched. Note that the surplus matrix s describes the entire market, so we can refer to a matching market simply by s.

Definition 1 (Stable outcome). *A* **stable outcome** *of market s is described by a* **stable matching** $\mu : I \to I \cup \{\emptyset\}$ *and vectors of* **stable/core payoffs** $u : M \to \mathbb{R}$ *and* $v : W \to \mathbb{R}$ *such that (i) (individual rationality) each person gets at least as much as staying single: $u_m \geqslant 0$ for all $m \in M$ and $v_w \geqslant 0$ for all $w \in W$; (ii) (surplus efficiency) each couple exactly divides the surplus: $u_m + v_w = s_{mw}$ if $m = \mu(w)$ and $w = \mu(m)$; and (iii) (no blocking pair condition) each couple divides the total surplus in such a way that no man and woman pair has an incentive to form a new pair: $u_m + v_w \geqslant s_{mw}$ for any $m \in M$ and $w \in W$.*

There is always a stable outcome in the TU matching model, which serves as the benchmark theoretical prediction for each matching market. Stable matching and payoffs satisfy some easily testable properties, which we summarize below.

Proposition 1 (Stable matching)**.** *A matching is stable if and only if it is efficient; that is, it maximizes the total surplus. Equivalently, a matching μ is stable if and only if it is the solution to the linear programming problem $\max_{\mu \in \mathcal{M}} \sum_{m \in M} s_{m\mu(m)}$, where $\mathcal{M}$ is the set of feasible matching.*

Corollary 1 (Full matching)**.** *If every element in the surplus matrix is positive, a stable matching is a* **full matching***; that is, the number of matched pairs in the stable outcome reaches the maximum possible number.*

Corollary 2 (Efficient matching)**.** *If there is a unique efficient matching, this matching is the unique matching in the stable outcome.*

We say that man m is higher ranked than man m'—i.e., $m > m'$—if $s_{mw} \geq s_{m'w}$ for any woman w with a strict inequality for some w; women's ranks are defined similarly. A key observation of Becker (1973) is that if surplus matrix s, after reordering according to rank, satisfies supermodularity, then a stable matching is positive-assortative, in that the highest ranked man is matched with the highest ranked woman, the second highest ranked man is matched with the second highest ranked woman, and the n^{th} highest ranked man is matched with the n^{th} highest ranked woman. To slightly abuse terminology for expositional convenience, we say that the surplus matrix is *assortative* if agents can be ranked and the matrix that is rearranged according to the ranks satisfies supermodularity. To formally define an assortative surplus matrix, we need to first define a reordered surplus matrix.

Definition 2 (Reordered surplus matrix)**.** *The surplus matrix $\widetilde{s}$ is a* **reordered surplus matrix** *of surplus matrix s if there exists a pair of permutations $\pi_M : M \to M$ and $\pi_W : W \to W$ such that $\widetilde{s}_{\pi_M(m)\pi_W(w)} = s_{mw}$ for any $m \in M$ and any $w \in W$.*

Definition 3 (Assortative surplus)**.** *Consider Condition (A) for a reordered matrix $\widetilde{s}$ of matrix s:*

$$\widetilde{s}_{mw} + \widetilde{s}_{m'w'} > \widetilde{s}_{mw'} + \widetilde{s}_{m'w} \quad \forall m, m' \in M \text{ and } w, w' \in W \text{ s.t. } m > m' \text{ and } w > w'. \tag{A}$$

A reordered matrix $\widetilde{s}$ is **positive-assortative** *(supermodular in Agranov et al. (2022)) if Condition (A) is satisfied and $\forall m, m' \in M, \forall w, w' \in W : m > m' \Rightarrow \widetilde{s}_{mw} \geq (\leq) \widetilde{s}_{m'w}$ and $w > w' \Rightarrow \widetilde{s}_{mw} \geq (\leq) \widetilde{s}_{mw'}$; or* **negative-assortative** *(submodular in Agranov et al. (2022)) if Condition (A) is satisfied and $\forall m, m' \in$*

$M, w, w' \in W$: $m > m' \Rightarrow \widetilde{s}_{mw} \geq (\leq)\widetilde{s}_{m'w}$, *and* $w > w' \Rightarrow \widetilde{s}_{mw} \leq (\geq)\widetilde{s}_{mw'}$. *A matrix s is* **assortative** *if there exists a reordered matrix* $\widetilde{s}$ *that is positive-assortative or negative-assortative. A matrix s is* **nonassortative** *or* **mixed** *if it is not assortative.*

Proposition 2 (Stable/core payoffs)**.** *The set of stable payoffs (Becker, 1973), or equivalently the core (Shapley and Shubik, 1972), is the set of solutions of the following linear programming problem:*

$$\min \sum_{m \in M} u_m + \sum_{w \in W} v_w \quad \text{s.t. } u_m + v_w \geqslant s_{mw} \, \forall m \in M \text{ and } w \in W.$$

With a finite number of agents, there is always a nonsingleton set of stable payoffs (given a positive surplus matrix). An equal split of the surplus for each pair in the stable matching is not always in the core (as some surplus matrices chosen in the experiment will show).

Definition 4 (Pairwise equal splits in the core)**. Pairwise equal splits is in the core** *(***ESIC***) of game s if there exists efficient matching* μ^* *such that payoffs* $u_m = s_{m\mu^*(m)}/2$ *for each matched* $m \in M$ *and* $v_w = s_{\mu^*(w)w}/2$ *for each matched* $w \in W$*. We say that* **pairwise equal splits is <u>not</u> in the core** *(***ESNIC***) of game s otherwise.*

The core is generically a nonsingleton set. Many solution concepts refine the core, but differ in their predictions. Examples in Appendix A.1 demonstrate the differences in the refined solutions such as Shapley value (Shapley, 1953), nucleolus (Schmeidler, 1969), extreme points (Shapley and Shubik, 1972), fair division point (Thompson, 1980), kernel (Rochford, 1984), and median stable matching (Schwarz and Yenmez, 2011). See Núñez and Rafels (2015) for a summary of solution concepts.

3 Experiment

In this section, we present the experimental design and procedures for the first wave of the experiment. The second wave, which has different ending and payment rules, will be introduced in Section 4.1.2.

3.1 Treatment design

We use eight surplus configurations, as shown in Table 1. Each surplus configuration represents a different matching market. The four markets shown on the left-hand side of Table 1 are balanced, and the four on the right-hand side are imbalanced. Row players are denoted by (cold color) squares and column players by (warm color) circles. In the experiment, we use squares and circles of different colors and do not index the subjects. In the exposition, we refer to row players as men and column players as women. For example, the first square is denoted by m_1.

For balanced markets, the double-underlined surpluses in each configuration show pairings in the unique efficient matching. We vary the configurations in two dimensions: (i) whether efficient matching is assortative, as defined in Definition 3, and (ii) whether the outcome of pairwise equal splits is in the core, as defined in Definition 4. Hence, each market (i) has pairwise <u>e</u>qual splits in the core (<u>E</u>SIC, or simply E) or pairwise equal splits <u>n</u>ot in the core (ES<u>N</u>IC, or simply N) and (ii) is <u>a</u>ssortative (A) or <u>m</u>ixed (M).

Table 1: Surplus configurations in the experiment

		Balanced markets (6 players)						Unbalanced markets (7 players)							
		ESIC			ESNIC			ESNIC				ESNIC			
Assortative		EA6			NA6			EA7				NA7			
		w_1	w_2	w_3	w_1	w_2	w_3	w_1	w_2	w_3	w_4	w_1	w_2	w_3	w_4
	m_1	30	40	50	90	80	70	30	40	50	30	90	80	70	70
	m_2	40	60	80	80	60	40	40	60	80	40	80	60	40	40
	m_3	50	80	110	70	40	10	50	80	110	50	70	40	10	10
Mixed		EM6			NM6			EM7				NM7			
		w_1	w_2	w_3	w_1	w_2	w_3	w_1	w_2	w_3	w_4	w_1	w_2	w_3	w_4
	m_1	30	60	80	90	60	30	30	60	80	30	90	60	30	30
	m_2	60	70	100	100	50	30	60	70	100	60	100	50	30	30
	m_3	40	40	60	80	60	40	40	40	60	40	80	60	40	40

Assortative: Efficient matching is assortative; Mixed: Efficient matching is not assortative; ESIC: equal-splits in the core; ESNIC: equal-splits not in the core. For balanced markets, the double-underlined surpluses in each configuration show pairings in the unique efficient matching. For unbalanced markets, the double-underlined surpluses in each configuration show pairings that are for sure part of efficient matching, and one of the two single-underlined surpluses in each configuration constitutes the last pair of efficient matching.

We refer to the four configurations by EA6, EM6, NA6, and NM6. We also design the surpluses to provide consistency across markets: The maximum total surplus that all agents can obtain is 200; the average total surplus that all agents can obtain is 180 if they are matched fully and randomly; and the minimum total surplus they can obtain if they are all matched is 160.

The only difference between imbalanced and balanced markets is that there is one more (warm color) circle player in each imbalanced market. Specifically, each of the four surplus matrices replicates the column player that yields the lowest surplus in the corresponding balanced market setting. Though pairwise equal splits are no longer in the core (because the duplicate players would get zero in the core), we refer to the four markets by EA7, NA7, EM7, and NM7 to clarify the connection with their balanced counterparts.

We employ a between-subjects design for both balanced and imbalanced markets and a within-subjects design for the four different configurations of each market type. That is, subjects play either the four balanced markets or the four imbalanced markets, but they play the four markets in different orders. Using the Latin square method,[7] for balanced and imbalanced markets, we each have four treatment orders:

	1	2	3	4
Treatment 1	EA	NA	EM	NM
Treatment 2	NM	EA	NA	EM
Treatment 3	EM	NM	EA	NA
Treatment 4	NA	EM	NM	EA

At the beginning of the experiment, subjects are randomly selected to form a group (of six or seven), and this grouping remains fixed throughout the experiment. They remain anonymous, and their roles can

[7] We thank Yan Chen for this suggestion.

change from round to round. Subjects within a group play the four markets in the order that corresponds to their assigned treatment. Each market is played for 7 rounds, so they play 28 rounds in total.[8] At the beginning of each round, each subject is randomly assigned a (color) shape that represents their role. A (cold color) square can only be matched with a (warm color) circle. Each market lasts at least 3 minutes. Within the 3-minute interval, anyone can propose to anyone on the opposite side. To propose, a subject clicks the color they wish to propose to and decides the division of surplus. The receiver of a proposal has 30 seconds to accept or reject. When the proposer is waiting for the response, the proposer cannot make a new proposal to anyone. If a proposal is rejected, both sides are free to make and receive new offers.

If a proposal is accepted, a temporary match is reached; information on the temporary match and division of the surplus is shown to everyone in the market. When a temporary match is reached, both subjects can still make and receive proposals. One can always break their current temporary match by forming a new temporary match (either by proposing to a new person and being accepted or by accepting another proposal). A market ends at the 3-minute mark and all temporary matches become permanent, unless someone is released from a temporary match in the last 15 seconds; in that case, they have 15 additional seconds to make a new proposal. If another subject is bumped from their temporary match as a result of the new proposal, the bumped subject gets a chance to make a proposal. This process of adding 15 seconds continues until no new proposal is accepted. Subjects can see the history of final matches in previous rounds.[9]

3.2 Procedures

The experiment was conducted at the Shanghai University of Finance and Economics. Chinese subjects were recruited from the subject pool of the Economics Lab through Ancademy, a platform for social sciences experiments; most subjects installed and used the app on their phones. In the first wave of the experiment, 296 subjects participated: 156 in balanced markets and 140 in imbalanced markets. Each subject participated only once. We ran 8 sessions for the balanced markets and 6 sessions for imbalanced markets. In each session, we ran 3–6 independent markets. For balanced markets, the number of times each treatment order is used is 7, 7, 6, and 6, which yields 728 individual rounds of games. For imbalanced markets, we used each treatment order 5 times, yielding 560 individual rounds. Subjects were mostly undergraduate students from various fields of study.

The experiment was computerized using z-Tree (Fischbacher, 2007) and conducted in Chinese. Upon arrival, each subject was randomly assigned a card with their table number and seated in the corresponding cubicle. Prior to the start of the experiment, subjects read and signed a consent form agreeing to their participation. All instructions were displayed on their computer screens. Control questions were conducted to check their understanding of the instructions. Appendix A.2 contains English translations of the

[8] One reason we choose 7 rounds for each market is to ensure an ex-ante equal opportunity for subjects in imbalanced markets, since one of the 7 subjects is for sure unmatched and gets zero payoff in each round.

[9] To be clear, historical information is based on roles (squares and circles) but not on individual subjects, so there is no way to establish a bargaining style or reputation across periods. Subjects may learn better the overall structure of the game over time and consequently perform better (as suggested by the experimental results), but they cannot learn about any particular individual over time.

instructions and screenshots.

Subjects were paid the sum of their payoffs in 28 rounds at an exchange rate of 12 units of payoffs to 1 CNY in balanced markets. To keep the average earnings comparable between balanced and imbalanced markets, we lowered the exchange rate of the experimental currency from 12 to 10 in imbalanced markets. Everything else is kept the same as in balanced markets. After finishing the experiment, subjects received their earnings in cash. Average earnings were 85 CNY (equivalent to about 12 USD, or about 20 PPP-adjusted USD) for balanced markets, and 93 CNY for imbalanced markets (equivalent to about 14 USD, or about 23 PPP-adjusted USD). Each session lasted around 2 hours.

3.3 Discussion

We briefly discuss the rationale behind some elements of our design for the first wave of the experiment. First, we impose the 3-minute soft deadline primarily for practical purposes. In each experimental session, to ensure ex-ante equal opportunity for subjects in imbalanced markets, each market type is played 7 rounds for a total of 28 rounds. If the average duration of each round is 3 minutes, we can control the entire duration of the experiment within 2 hours (including time spent explaining instructions and paying subjects). Imposing a soft deadline inevitably creates frictions. We change the game-ending rule in the second wave of the experiment to a 30-second inactivity rule, consistent with Agranov et al. (2022).

Second, we pay subjects for every round for fairness in imbalanced markets. If we instead pay only one random round, this would result in a zero payoff for at least one subject. Paying the sum of payoffs for all rounds with feedback on earnings can potentially lead to income effects, which may push for equal splits. Nevertheless, the problem is mitigated by varying the order of the games and we do see significant differences in how often subjects end up with equal splits in different markets. In the second wave of the experiment, we change the payment rule to paying randomly for one round for each of the four configurations.

Third, one may vary the appearance of each surplus matrix with reordered rows and columns to avoid the potential appearance bias that matches on the diagonal are more likely to form. However, each 6-player surplus matrix has $3! \times 3! = 36$ ways of appearing, and each 7-player surplus matrix has $3! \times 4!/2 = 72$ ways of appearing, so there are $4! \times (72^4 + 36^4) \approx 6.85 \times 10^9$ possible order and appearance treatments. It is unclear how to simultaneously vary the appearance of each matrix and the ordering of different matrices using a reasonable number of participants. Our results suggest that subjects are not making decisions based on the heuristic of matching with diagonal partners. There does not appear to be a higher frequency of diagonal pairs when the pairs are not efficient (Table 2a). Furthermore, the overall more efficient outcomes in EM6 (off-diagonal efficient matching) over NA6 (diagonal efficient matching) suggest that the appearance bias does not have a significant effect on matching and bargaining outcomes.

4 Results

In this section, we focus on the two most important aspects of the model: (i) the aggregate outcomes of matching and surplus and (ii) individual payoffs. We discuss other experimental findings in Appendix D.

4.1 Aggregate outcomes: Matching and surplus

4.1.1 Wave 1

Table 2a presents the raw distributions of matches and singles. We observe significant instances of singles and inefficient matches.

Table 2: Aggregate outcomes: wave 1

(a) Frequency of being matched and unmatched in the experiment: wave 1

EA6	w_1	w_2	w_3	$\emptyset$
m_1	92%	4%	1%	4%
m_2	4%	87%	3%	5%
m_3	1%	5%	92%	2%
$\emptyset$	4%	4%	4%	

NA6	w_1	w_2	w_3	$\emptyset$
m_1	2%	21%	70%	7%
m_2	27%	51%	6%	16%
m_3	68%	10%	2%	19%
$\emptyset$	3%	18%	21%	

EA7	w_1	w_2	w_3	w_4	$\emptyset$
m_1	53%	1%	1%	44%	1%
m_2	8%	72%	6%	9%	4%
m_3	0%	11%	88%	0%	1%
$\emptyset$	39%	16%	5%	47%	

NA7	w_1	w_2	w_3	w_4	$\emptyset$
m_1	1%	9%	46%	42%	1%
m_2	16%	59%	8%	9%	8%
m_3	76%	9%	0%	1%	14%
$\emptyset$	6%	23%	46%	47%	

EM6	w_1	w_2	w_3	$\emptyset$
m_1	0%	83%	8%	9%
m_2	3%	8%	85%	4%
m_3	91%	1%	0%	8%
$\emptyset$	7%	8%	7%	

NM6	w_1	w_2	w_3	$\emptyset$
m_1	20%	40%	9%	31%
m_2	75%	2%	6%	17%
m_3	3%	47%	37%	13%
$\emptyset$	1%	12%	48%	

EM7	w_1	w_2	w_3	w_4	$\emptyset$
m_1	0%	83%	11%	0%	6%
m_2	9%	4%	74%	8%	4%
m_3	51%	1%	0%	44%	3%
$\emptyset$	39%	11%	15%	48%	

NM7	w_1	w_2	w_3	w_4	$\emptyset$
m_1	23%	56%	6%	4%	11%
m_2	71%	2%	3%	4%	20%
m_3	1%	23%	32%	39%	5%
$\emptyset$	4%	19%	59%	54%	

Note. In each table, each cell not in the last row or column indicates the percentage of markets in which a pair has formed between the row player and column player. The last row reports the percentage of markets in which each respective column player is unmatched, and the last column reports the percentage for each row player.

(b) Tests of hypotheses on aggregate outcomes: wave 1

Hypotheses	EA6	EM6	NA6	NM6	EA7	EM7	NA7	NM7
1a: # matched pairs=3	2.88***	2.79***	2.58***	2.40***	2.93*	2.86***	2.78***	2.64***
	(4.04)	(5.61)	(8.84)	(20.91)	(2.52)	(4.79)	(4.61)	(8.18)
1b: full matching=1	0.88***	0.79***	0.58***	0.41***	0.94*	0.86***	0.78***	0.64***
	(4.04)	(5.61)	(8.84)	(21.02)	(2.65)	(4.79)	(4.61)	(8.18)
2a: # efficiently matched pairs=3	2.71***	2.59***	1.89***	1.52***	2.56***	2.53***	2.23***	1.99***
	(4.91)	(6.43)	(11.31)	(20.92)	(5.36)	(5.64)	(7.92)	(11.97)
2b: efficient matching=1	0.83***	0.74***	0.43***	0.26***	0.71***	0.69***	0.55***	0.46***
	(4.58)	(6.70)	(11.40)	(22.69)	(5.51)	(6.01)	(8.64)	(10.81)
2c: % surplus achieved	0.96***	0.93***	0.87***	0.84***	0.95***	0.92***	0.91***	0.87***
	(4.36)	(5.45)	(9.57)	(18.60)	(3.94)	(5.42)	(5.85)	(8.57)
3a: stable outcome=1	0.76***	0.54***	0.07***	0.05***	0.00	0.00	0.00	0.00
	(6.09)	(10.02)	(47.22)	(53.96)	(.)	(.)	(.)	(.)

t statistics in parentheses; standard errors clustered at group level; Stars indicate statistically significant differences between canonical theoretical predictions and experimental observations: * p<0.05, ** p<0.01, *** p<0.001;

The canonical theory predicts (1) full matching (Corollary 1), (2) efficient matching and efficient surplus (Corollary 2), and (3) a stable matching and bargaining outcome (Proposition 1). We test these predictions in several ways using different outcome measures. We state the hypotheses below.

Hypothesis 1 (Full matching)**.** *(a) The number of matched pairs is the maximum feasible number; (b) Full matching is always achieved.*

Row 1a of Table 2b shows the average number of matched pairs by market type, which ranges from 2.40

in NM6 to 2.93 in EA7. For each of the eight market types, we can reject the hypothesis that the maximum number of matched pairs is achieved. We observe comparable results in previous experiments.[10]

Nonetheless, the market does not completely break down. Row 1b of Table 2b shows the proportion of full matching by market type. It ranges from 41% in NM6 to 94% in EA7. For every market type except NM6, three pairs are matched in more than 58% of the rounds. In almost all games, there are more than two matched pairs. There is one matched pair in three of the 1,288 games (less than 0.3% of all games): two NM6 games of the 728 balanced market games and one EA7 game of the 560 imbalanced market games.

In a frictionless setting, we should expect that efficient matching—even if it is not unique—is always reached. It goes without saying that this prediction is rejected with the observation that some subjects do not match. Hence, we also test a more restrictive hypothesis: Some subjects may remain unmatched—and we remain agnostic about the reason—but when the maximum feasible number of matches is reached, the cooperative model predicts efficient matching. We report additional results in Table B1a in Appendix B.

Hypothesis 2. *(a) The number of efficiently matched pairs is the maximum feasible number; (b) Efficient matching is always achieved; (c) Efficient surplus is achieved. These hypotheses also hold given full matching.*

Rows 2a-2c of Table 2b test these hypotheses. Row 2a shows that the number of efficiently matched pairs ranges from 1.52 (in NM6) to 2.71 (in EA7), far from the maximum number of 3. Row 2b provides a breakdown of the types of matching with respect to the number of efficiently matched and inefficiently mismatched pairs. In all market types except NA6 (43%), NM6 (26%), and NM7 (46%), efficient matching is achieved in the majority of rounds. Row 2c shows that the efficiency loss due to inefficient matches is statistically significant: The total surplus achieved ranges from 92% (EM7) to 96% (in EA6) in ESIC markets, and from 84% (in NM6) to 91% (NA7) in ESNIC markets.

An outcome is stable when not only the matching is efficient, but also the combination of individual payoffs derived from pairwise surplus division is in the core. Hence, reaching a stable outcome—efficient matching along with a stable division of surpluses—is more stringent than achieving efficient matching. Because the payoffs are transferable, the matching in any stable outcome is necessarily efficient.

Hypothesis 3. *(a) A stable outcome is achieved ; (b) A stableX outcome—an outcome in which no pair of agents can improve their joint payoffs by more than X units—is achieved .*

Row 3a of Table 2b shows the probability that an outcome is stable. In EA6 and EM6—the balanced ESIC markets—in the majority of cases, subjects divide up the surplus in a way that cannot be improved upon by any blocking pair (76% and 54%, respectively).[11] However, in NA6 and NM6—the balanced ESNIC markets—efficient matching is achieved less frequently, and even when it is achieved, blocking pairs are more likely to exist.

In our imbalanced markets, stable outcomes always involve a matched subject and an unmatched subject who gets zero payoff. Strictly speaking, a stable outcome is not reached in any imbalanced markets

[10] For instance, Nalbantian and Schotter (1995) consider a 3-by-3 market with pairwise equal splits in the core and nonassortative efficient matching (i.e., a market of type EM6). In their experiment, 9.3% (14 of 150 potential matches) fail to match, which translates to 2.79 pairs, compared with 2.76 pairs in our experiment's EM6 market.

[11] Row 3a" of Table B1a shows the probability that an outcome is stable, conditioning on efficient matching. The conditional probabilities are 92% in EA6 and 74% in EM6.

in wave 1 of our experiment, because no matched subject receives zero. Even with a looser definition of stability, a significant portion of imbalanced markets have blocking pairs that can improve by more than 10 units of payoff, but they do not form a match by the end of the game. See Table B1a in Appendix B. This significant discrepancy between theory and experiment in stable payoffs suggests that players are behaving in a way that is systematically different from what the cooperative theory predicts.

4.1.2 Wave 2

The results in Section 4.1.1 show that the matching rate and efficiency rate differ significantly from 100%. One plausible reason for this could be that some subjects may not have enough time to react and form new matches after they are released by the end of the 3 minutes, even with the additional 15 seconds provided. To make sure that frictions created by the ending rule do not drive our main findings on matching patterns and surplus divisions, we run an additional wave of the experiment with an alternative ending rule as a robustness check.

In wave 2 of the experiment, we use the same eight surplus configurations as in wave 1. We again employ a between-subjects design for the balanced and imbalanced markets, and a within-subjects design for the four different configurations of each market type. The main design difference lies in the ending rule: In wave 2, the market ends when no new proposals are made within 30 seconds. In imbalanced markets, to potentially shorten the market length, we added a "Move to the next round" button. As soon as 6 of the 7 subjects press this button, the market ends. This means that the market continues as long as it is active, and ends when there is no activity for a certain period of time. To adjust to the change in the ending rule, we make another change in the design: In wave 1, the receiver of a proposal has 30 seconds to accept or reject the proposal; in wave 2, we shorten the time to 15 seconds. This is to avoid a scenario in which the market may end immediately if the receiver does not respond within 30 seconds, which leaves the proposer no time to make a new proposal. This scenario would create additional frictions in the market, so we aim to avoid it.

In addition to changing the ending rule, we also reduce the number of rounds for which subjects are paid in order to minimize the influence of income effects and coordination on surplus division. In wave 1, we pay the sum of payoffs for all rounds, but in wave 2, we only pay subjects four randomly selected rounds, one for each configuration. This helps to ensure that the results are not influenced by these factors.

The experiment was again conducted at the Shanghai University of Finance and Economics. In total, 130 subjects participated: 60 in balanced markets and 70 in imbalanced markets. Therefore, there were exactly 10 independent groups for each market type. Each subject participated only once, and did not participate in the wave 1 experiment. We ran 2 sessions for the balanced markets and 3 sessions for the imbalanced markets. Because markets tended to last longer in wave 2, we let subjects play 5 rounds instead of 7 rounds for each configuration, for 20 rounds in total.[12] At the end of the experiment, subjects were paid for four randomly selected rounds out of the total rounds they played at the exchange rate of 1 unit of

[12] In balanced markets, we initially planned to let subjects play 28 rounds (7 rounds for each configuration). However, due to a technical mistake, subjects ended up playing 5 rounds for each of the four configurations, followed by 8 rounds of the fourth configuration. We dropped these last 8 rounds from our experimental analysis.

payoff to 1 CNY. Average earnings were 140 CNY (equivalent to about 19 USD, or about 32 PPP-adjusted USD). On average, the sessions lasted 2.5 hours. The balanced markets took 3.5 minutes per market and the imbalanced markets took 5.1 minutes per market.

Table 3: Aggregate outcomes: wave 2

(a) Frequency of being matched and unmatched in the experiment: wave 2

EA6

	w_1	w_2	w_3	$\emptyset$
m_1	98%	0%	0%	2%
m_2	0%	96%	2%	2%
m_3	0%	2%	98%	0%
$\emptyset$	2%	2%	0%	

NA6

	w_1	w_2	w_3	$\emptyset$
m_1	6%	26%	68%	0%
m_2	30%	54%	16%	0%
m_3	64%	14%	10%	12%
$\emptyset$	0%	6%	6%	

EA7

	w_1	w_2	w_3	w_4	$\emptyset$
m_1	66%	6%	0%	26%	2%
m_2	6%	68%	16%	10%	0%
m_3	0%	16%	84%	0%	0%
$\emptyset$	28%	10%	0%	64%	

NA7

	w_1	w_2	w_3	w_4	$\emptyset$
m_1	0%	10%	48%	42%	0%
m_2	12%	66%	10%	12%	0%
m_3	86%	12%	2%	0%	0%
$\emptyset$	2%	12%	40%	46%	

EM6

	w_1	w_2	w_3	$\emptyset$
m_1	0%	96%	2%	2%
m_2	0%	2%	98%	0%
m_3	100%	0%	0%	0%
$\emptyset$	0%	2%	0%	

NM6

	w_1	w_2	w_3	$\emptyset$
m_1	16%	50%	22%	12%
m_2	82%	0%	8%	10%
m_3	0%	46%	48%	6%
$\emptyset$	2%	4%	22%	

EM7

	w_1	w_2	w_3	w_4	$\emptyset$
m_1	2%	80%	16%	0%	2%
m_2	10%	10%	72%	6%	2%
m_3	46%	0%	0%	52%	2%
$\emptyset$	42%	10%	12%	42%	

NM7

	w_1	w_2	w_3	w_4	$\emptyset$
m_1	2%	92%	2%	4%	0%
m_2	98%	0%	0%	0%	2%
m_3	0%	6%	50%	44%	0%
$\emptyset$	0%	2%	48%	52%	

Note. In each table, each cell not in the last row or column indicates the percentage of markets in which a pair has formed between the row player and column player. The last row reports the percentage of markets in which each respective column player is unmatched, and the last column reports the percentage for each row player.

(b) Tests of hypotheses on aggregate outcomes: wave 2

Hypotheses	EA6	EM6	NA6	NM6	EA7	EM7	NA7	NM7
1a: # matched pairs=3	2.96	2.98	2.88^{**}	2.72^{**}	2.98	3.00	3.00	2.98
	(1.00)	(1.00)	(3.67)	(3.77)	(1.00)	(.)	(.)	(1.00)
1b: full matching=1	0.98	0.98	0.88^{**}	0.74^{**}	0.98	1.00	1.00	0.98
	(1.00)	(1.00)	(3.67)	(3.88)	(1.00)	(.)	(.)	(1.00)
2a: # efficiently matched pairs=3	2.92	2.94	1.86^{***}	1.80^{***}	2.44^{**}	2.54^{***}	2.42^{***}	2.84^{*}
	(1.50)	(1.41)	(5.40)	(6.80)	(4.73)	(5.92)	(5.30)	(2.45)
2b: efficient matching=1	0.96	0.96	0.50^{***}	0.44^{***}	0.68^{**}	0.71^{***}	0.66^{***}	0.92^{*}
	(1.50)	(1.50)	(5.51)	(7.80)	(4.71)	(7.66)	(5.67)	(2.45)
2c: % surplus achieved	0.99	0.99	0.94^{***}	0.91^{***}	0.98^{**}	0.96^{***}	0.97^{**}	0.99
	(1.12)	(1.17)	(5.93)	(4.90)	(3.50)	(5.59)	(3.58)	(1.46)
3a: stable outcome=1	0.86	0.74^{**}	0.16^{***}	0.02^{***}	0.02^{***}	0.00	0.04^{***}	0.04^{***}
	(2.09)	(3.88)	(11.70)	(49.00)	(49.00)	(.)	(24.00)	(36.00)

t statistics in parentheses; standard errors clustered at group level; Stars indicate statistically significant differences between canonical theoretical predictions and experimental observations: * $p<0.05$, ** $p<0.01$, *** $p<0.001$;

The results of wave 2 are summarized in Table 3. Overall, they confirm the main findings of wave 1, although the matching rate and efficiency rate are higher in wave 2. This is likely due to the change in the ending rule, which allows more time for subjects to react and form new matches after being released by the end of the 3 minutes. Despite this, the results of wave 2 show that the efficiency rate is still significantly lower than what is predicted by the cooperative theory. In addition, the results for stable outcomes are similar to those in wave 1, with a significant discrepancy between theory and experiment in the proportion of stable outcomes achieved. These findings suggest that subjects are behaving in a way that differs systematically from what the cooperative theory predicts, regardless of the ending rule.

As shown in rows 1a and 1b, the number of matched pairs and the matching rate in most markets were not significantly different from 3 and 100%, respectively. However, in NA6 and NM6, the number of matched pairs and the matching rate were significantly lower than the predictions of the cooperative theory. In comparison, the number of matched pairs and the matching rate in NA6 and NM6 improved from wave 1 to wave 2 (from 2.58 pairs and 61% to 2.88 pairs and 88% in NA6, and from 2.40 pairs and 45% to 2.72 pairs and 74% in NM6). This improvement may be due to the change in the ending rule, which allowed more time for subjects to react and form new matches. Row 2c shows that the percentage of efficient surplus achieved ranged from 96% in EM7 to 99% in EA6 and EM6, and from 91% in NM6 to 99% in NM7. The percentage of efficient matching was not significantly different from 100% in EA6 and EM6. However, inefficient matching was still prevalent in other markets, even when full matching was achieved. Overall, by imposing an indefinite ending rule and higher stakes per market, both the number of matched pairs and the percentage of efficient surplus achieved improved compared with wave 1. However, inefficient matching was not eliminated in ESNIC markets.

Row 3a reports summary statistics on stable outcomes. Balanced ESIC markets (EA6 and EM6) have high frequencies of stable outcomes, but other markets do not, and this pattern remains when we restrict our attention to full or efficient matching (Table B1b in Appendix B). When we consider a relaxation of stable outcomes to stable10 outcomes, most blocking pairs cannot improve their payoffs by more than 10 units, but there remains a significant portion of blocking pairs who could have jointly improved their payoffs by more than 10 units. In imbalanced markets, there are some occurrences (0-4%) of stable outcomes, meaning that some matched players get zero payoffs; in comparison, there was zero instance that matched players get zero in wave 1. However, matched players getting zero payoff, the unique core prediction, remains a rare occasion. The experimental finding that the two duplicate players on the long side of the market do not have their payoffs driven to zero remains.

4.1.3 Determinants of aggregate outcomes

We vary the surplus configurations in the dimensions of whether stable matching is assortative and whether pairwise equal splits are in the core, because we conjecture that in reality, the two dimensions may influence people's actual decisions in matching. Several papers report how strategic complexity affects plays in games. Bednar et al. (2012) demonstrate that the prevalent strategies in games that are less cognitively demanding are more likely to be used in games that are more cognitively demanding. Luhan et al. (2017) and He and Wu (2020) show that subjects may not use a certain efficient strategy due to its complexity, but instead settle on a simpler but inefficient strategy. Under nonassortative efficient matching, the stable matching pattern is less obvious. Hence, nonassortative matching—even when pairwise equal splits are in the core—may be perceived by subjects as more complex and more cognitively demanding. Consequently, subjects may settle on inefficient matching patterns, such as the ones on the diagonals or accept payoffs that are not supported in the core.

Equal splits have been widely observed in bilateral bargaining, especially when they are also efficient. Two arguments are commonly used to support the prevalence of equal splits in the data: the focal point theory of Schelling (1960) and distributional social preferences (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). When equal splits are not efficient, there is mixed evidence on the trade-offs between equality and efficiency; see Roth and Malouf (1979); Hoffman and Spitzer (1982); Roth and Murnighan (1982); Roth et al. (1989); Ochs and Roth (1989), Herreiner and Puppe (2010); Roth (1995); Camerer (2003); Anbarci and Feltovich (2013, 2018); Isoni et al. (2014); and Galeotti et al. (2018), among many others, on reporting and understanding equal splits in bargaining experiments. In our experiment, efficiency is aligned with stable matching. Hence, when pairwise equal splits are stable, they are also efficient. However, when they are not in the core, subjects will face trade-offs between equality and efficiency, which may negatively affect the rate of matching, the rate of stable matching, and overall efficiency.

Hypothesis 4. *For balanced markets, (i) the number of matched pairs, (ii) the number of efficiently matched pairs, and (iii) the percentage of efficient surplus achieved are the same (i) in assortative markets as in nonassortative markets and (ii) in ESIC markets as in ESNIC markets.*

Tables 2b (wave 1) and 3b (wave 2) provide the following comparisons of balanced markets that contradict the hypothesis. First, assortative markets (EA6 and NA6) have a higher number of matched pairs, a higher number of efficiently matched pairs, and a higher aggregate surplus than the nonassortative markets (EM6 and NM6). Second, ESIC markets (EA6 and EM6) have a higher number of matched pairs, a higher number of efficiently matched pairs, and a higher surplus than ESNIC markets (NA6 and NM6). We confirm the statistical significance of these comparisons for balanced markets by running the OLS regression:

$$y_i = \beta_1 \cdot \text{ESIC}_i + \beta_2 \cdot \text{assortative}_i + \beta_3 \cdot \text{ESIC}_i \cdot \text{assortative}_i + \beta_4 \cdot \text{round}_i + \beta_5 \cdot \text{order}_i + c + \varepsilon_g, \quad (1)$$

where i indicates the index of the game (out of 728 balanced markets), y_i is the dependent variable ((log) number of matched pairs in game i, (log) number of efficiently matched pairs in game i, or (log) surplus in game i); assortative_i is an indicator of whether game i is assortative, ESIC_i is an indicator of whether game i has pairwise equal splits in the core, round_i is the round (out of 7) the same market has been played, and order_i is the order (out of 4) the game is played in. The standard errors are clustered at the group level (recall 26 and 10 groups of subjects played balanced markets and 20 and 10 groups of subjects played imbalanced markets in waves 1 and 2, respectively). We also run the probit model for whether the market achieves full matching, efficient matching, or stable outcome.

Table 4 reports the regression results. In wave 1 (wave 2), compared with other markets, ESIC markets have 11.5% (8.03%) more matched pairs, 42.6% (45.1%) more efficiently matched pairs, and 9.48% (10.4%) more surplus. In addition, ESIC markets are 32.8 percentage points (pp) (23.4 pp) more likely for full matching, 41.8 pp (46.5 pp) more likely for efficient matching, and 41.0 pp (56.5 pp) more likely for a stable outcome in wave 1 (wave 2). The effects of ESIC are comparable across the two waves. Assortativity has a modest effect on matching and efficiency. Compared with nonassortative markets, assortative markets have 5.56% (4.84%) more matched pairs, 15.3% (1.73%) more efficiently matched pairs, 3.66% (4.21%) more surplus, 14.2 pp (7.88 pp) more full matching, 15.8 pp (3.64 pp) more efficient matching, and 3.14 pp (22.3 pp) more stable outcomes in wave 1 (wave 2). Overall, the effects of assortativity are weaker in wave 2, partially due to the smaller sample size and partially due to an increase in overall efficiency.

Learning mildly improves matching outcomes. Each additional round of play of the same game is

Table 4: Determinants of aggregate outcomes in balanced markets

(a) Determinants of outcomes in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	log (# matched pairs+1)	log (# efficiently matched pairs+1)	log surplus	whether full matching	whether efficient matching	whether stable outcome
ESIC	0.115^{***}	0.426^{***}	0.0948^{***}	0.328^{***}	0.418^{***}	0.410^{***}
	(7.13)	(10.35)	(4.48)	(6.92)	(9.41)	(11.85)
assortative	0.0556^{***}	0.153^{**}	0.0366^{*}	0.142^{***}	0.158^{**}	0.0314
	(4.04)	(2.92)	(2.27)	(3.82)	(2.95)	(0.79)
ESIC*assortative	-0.0271	-0.115	0.00265	-0.0119	-0.0540	0.111
	(-1.36)	(-2.04)	(0.12)	(-0.16)	(-0.70)	(1.89)
round	0.00490^{*}	0.0206^{**}	0.00847^{***}	0.0158^{*}	0.0283^{***}	0.0239^{***}
	(2.64)	(3.50)	(3.75)	(2.53)	(4.31)	(3.99)
order	0.0139^{**}	0.0294^{*}	0.0217^{**}	0.0463^{***}	0.0514^{**}	0.0401^{**}
	(3.39)	(2.53)	(3.66)	(3.48)	(3.01)	(3.17)
constant	1.156^{***}	0.666^{***}	5.023^{***}			
	(68.30)	(12.08)	(207.72)			
observations	728	728	728	728	728	728
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of outcomes in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	log (# matched pairs+1)	log (# efficiently matched pairs+1)	log surplus	whether full matching	whether efficient matching	whether stable outcome
ESIC	0.0803^{**}	0.451^{***}	0.104^{**}	0.234^{***}	0.465^{***}	0.565^{***}
	(3.40)	(6.46)	(3.66)	(3.81)	(8.31)	(7.95)
assortative	0.0484^{*}	0.0173	0.0421	0.0788^{*}	0.0364	0.223^{**}
	(2.70)	(0.19)	(1.64)	(2.19)	(0.57)	(2.79)
ESIC*assortative	-0.0629^{*}	-0.0455	-0.0549	-0.0935	-0.0429	-0.131
	(-2.61)	(-0.44)	(-1.68)	(-1.17)	(-0.43)	(-1.16)
round	0.00935	0.0388^{*}	0.00743	0.0330^{*}	0.0487^{***}	0.0408^{**}
	(1.60)	(2.94)	(1.04)	(2.18)	(3.40)	(3.15)
order	0.0159^{*}	0.0503	0.0199^{*}	0.0451^{*}	0.0450	0.0150
	(2.28)	(2.02)	(2.97)	(2.51)	(1.70)	(0.53)
constant	1.236^{***}	0.683^{***}	5.118^{***}			
	(37.69)	(7.31)	(208.98)			
observations	200	200	200	200	200	200
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

associated with 0.49% (0.94%) more matched pairs, 2.06% (3.88%) more efficiently matched pairs, and 0.847% (0.743%) more surplus, and each 7 (5) rounds of play of other games ahead of the current game are associated with 1.39% (1.59%) more matched pairs and 2.17% (1.99%) more surplus in wave 1 (wave 2). These results are statistically significant at at least the 95% level in wave 1 (* in the tables), but are partially not significant in wave 2. In Appendix B, we provide robustness checks with alternative specifications of the regressions regarding dependent variables (no log), rounds of plays, treatment effects, and heterogeneous order effects. The results are consistent with those under our current specifications. We also test to see whether having played any particular market would influence the subsequent outcomes of other markets. We find that no market systematically influences the subsequent outcomes of other markets. In addition, we limit the analysis to only the first rounds of the markets, and the results for the first rounds are consistent with the full results.

Overall, for balanced markets, having pairwise equal splits in the core is a crucial determinant of efficient matches and surpluses, and assortativity plays a less important role. To a much lesser extent but at a statistically significant level, experience with the negotiation process slightly increases the matching rate and efficiency, but the increase is not tied to a particular market type (details in the appendix).

Furthermore, we consider the determinants of outcomes when both balanced and imbalanced markets are included. Table 5 presents the results for the following regression model:

$$\begin{aligned} y_i \quad = \quad & \beta_1 \text{ESIC}_i + \beta_2 \text{assortative}_i + \beta_3 \text{balanced}_i + \beta_4 \text{ESIC}_i \text{assortative}_i + \beta_5 \text{assortative}_i \text{balanced}_i \\ & + \beta_6 \text{round}_i + \beta_7 \text{round}_i \text{balanced}_i + \beta_8 \text{order}_i + \beta_9 \text{order}_i \text{balanced}_i + c + \varepsilon_g, \end{aligned} \tag{2}$$

where balanced_i indicates whether the market in game i is balanced.

ESIC increases the number of matched pairs by 11.5% (8.03%), the number of efficiently matched pairs by 42.6% (45.1%), and the surplus by 9.48% (10.4%) in wave 1 (wave 2), and it also increases instances of full matching, efficient matching, and stable outcomes. Assortativity has mixed results. Controlling for other changes, assortativity changes the number of matches by 2.94% (0.003%), the number of efficiently matched pairs by 6.45% (-9.17%), and the surplus by 4.32% (-0.34%) in wave 1 (wave 2). The changes by assortativity are largely insignificant in wave 2. Having one additional player increases the number of matches by 11.0% (15.0%), the number of efficient matches by 27.4% (51.2%), and the surplus by 8.31% (15.0%) in wave 1 (wave 2). Both waves show the significant effects of adding the additional player, and wave 2 is even more conspicuous. In wave 1, playing an additional round of any game increases the matching by 0.974%, efficient matching by 2.96%, and the surplus by 1.30%, but the round and order effects disappear in wave 2.

In summary, having pairwise equal splits in the core continues to play a prominent role in determining matching and efficiency, and assortativity plays a lesser role, both statistically and quantitatively. Adding an additional player helps increase matching and efficiency. Robustness checks with alternative dependent variables and alternative specifications in Appendix B reach similar conclusions.

Table 5: Determinants of aggregate outcomes in balanced and imbalanced markets

(a) Determinants of outcomes in all markets: wave 1

	(1) log (# matched pairs+1)	(2) log (# efficiently matched pairs+1)	(3) log surplus	(4) whether full matching	(5) whether efficient matching	(6) whether stable outcome
ESIC	0.115***	0.426***	0.0948***	0.307***	0.453***	0.410***
	(7.19)	(10.44)	(4.52)	(6.48)	(8.46)	(11.85)
assortative	0.0294**	0.0645*	0.0432*	0.117**	0.0487	0.0314
	(2.89)	(2.16)	(2.60)	(2.93)	(1.12)	(0.79)
balanced	-0.110***	-0.274**	-0.0831*	-0.267***	-0.382***	0
	(-4.07)	(-3.36)	(-2.16)	(-3.44)	(-3.75)	(.)
ESIC*assortative	-0.0271	-0.115*	0.00265	-0.0111	-0.0585	0.111
	(-1.37)	(-2.06)	(0.12)	(-0.16)	(-0.70)	(1.89)
assortative*balanced	0.0262	0.0888	-0.00662	0.0156	0.122	0
	(1.54)	(1.48)	(-0.29)	(0.28)	(1.65)	(.)
round	0.00974***	0.0296***	0.0130***	0.0352***	0.0381***	0.0239***
	(4.70)	(5.05)	(4.72)	(5.00)	(4.31)	(3.99)
round*balanced	-0.00483	-0.00892	-0.00455	-0.0204*	-0.00739	0
	(-1.74)	(-1.08)	(-1.28)	(-2.24)	(-0.63)	(.)
order	0.00399	0.0217	0.00694	0.0130	0.0110	0.0401**
	(0.84)	(1.70)	(1.02)	(0.74)	(0.63)	(3.17)
order*balanced	0.00993	0.00772	0.0148	0.0304	0.0447	0
	(1.58)	(0.45)	(1.65)	(1.43)	(1.74)	(.)
constant	1.265***	0.941***	5.106***			
	(59.79)	(15.53)	(170.27)			
observations	1,288	1,288	1,288	1,288	1,288	728
clusters	46	46	46	46	46	26

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of outcomes in all markets: wave 2

	(1) log (# matched pairs)	(2) log (# efficiently matched pairs+1)	(3) log surplus	(4) whether full matching	(5) whether efficient matching	(6) whether stable outcome
ESIC	0.0803**	0.451***	0.104**	0.140***	0.556***	0.361***
	(3.50)	(6.64)	(3.76)	(3.81)	(6.60)	(6.64)
assortative	0.0000332	-0.0917*	-0.00339	0.00303	-0.124**	0.0342
	(0.01)	(-2.68)	(-0.60)	(0.08)	(-3.19)	(0.58)
balanced	-0.150***	-0.512***	-0.150***	-0.284***	-0.546***	-0.105
	(-4.64)	(-4.55)	(-5.35)	(-3.83)	(-4.15)	(-1.06)
ESIC*assortative	-0.0629*	-0.0455	-0.0549	-0.0558	-0.0513	-0.0835
	(-2.69)	(-0.45)	(-1.72)	(-1.19)	(-0.44)	(-1.18)
assortative*balanced	0.0484*	0.109	0.0455	0.0440	0.167*	0.108
	(2.70)	(1.13)	(1.78)	(1.01)	(1.99)	(1.45)
round	-0.000719	0.0103	0.000223	-0.00789	0.00625	-0.0271*
	(-0.44)	(0.98)	(0.07)	(-0.51)	(0.46)	(-2.53)
round*balanced	0.0101	0.0286	0.00721	0.0276	0.0521*	0.0531***
	(1.71)	(1.73)	(0.95)	(1.54)	(2.35)	(3.91)
order	0.0000189	0.0225	0.00182	-0.000213	0.0131	0.0261
	(0.03)	(1.46)	(0.84)	(-0.03)	(0.60)	(1.13)
order*balanced	0.0159*	0.0279	0.0181*	0.0271*	0.0408	-0.0166
	(2.33)	(0.97)	(2.63)	(2.18)	(1.11)	(-0.58)
constant	1.385***	1.195***	5.268***			
	(269.34)	(17.97)	(356.45)			
observations	399	399	399	399	399	399
clusters	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

4.2 Individual payoffs

We consider the individual payoffs when efficient matching is achieved and compare them with existing solutions that refine the core (Figure B1 illustrates the core payoffs). In imbalanced markets, the core predicts a zero payoff for a matched player who has a duplicate competitor on the long side of the market. Formal Wilcoxon signed-rank test and t-tests demonstrate that these players' payoffs in the experiment are all statistically significantly above zero (Table B2 and Table B3 in Appendix B, respectively). There are only a few instances in wave 2 in which a matched player gets a zero payoff. This inconsistency between the core and the experiment warrants further attention, which we address in our noncooperative model.

Tables B4a and B4b in Appendix B present t-tests between cooperative solutions and the experimental payoffs of balanced markets in waves 1 and 2, respectively. When the t-tests do not detect statistically significant differences, the solution is consistent with the experimental finding. We consider (1) the Shapley value, which assigns each player a payoff relative to how "important" that player is to the overall surplus (Shapley, 1953); (2) the nucleolus, which is the lexicographical center of core payoffs (Schmeidler, 1969); (3) the fair division point, which is the midpoint between row- and column-optimal payoffs (Thompson, 1980); and (4) the median stable matching, which gives each player their median payoff (Schwarz and Yenmez, 2011). Among these solutions, the nucleolus and median stable matching do not match the payoffs when the matching is efficient (except for EA6). The fair division point performs well in balanced ESIC markets, but not in NM6 markets. Limit equilibrium values of our noncooperative model, which we present in the next section, match well with (i.e., fall within 2 units of) our experimental values across all markets.

5 Potential explanations

5.1 Noncooperative theory

Existing cooperative solutions—either set-valued ones like the core or singleton-valued ones like the nucleolus—depart from the experimental results in systematic ways. To rationalize the individual payoffs in the experiment, consider the following continuous-time model that captures the essence of our experimental setup. At time zero, no one is matched. At each instant $t \geq 0$, any agent can propose to anyone on the other side of the market. A person who receives a proposal must accept or reject the proposal within time length Δ. Neither a proposer nor a receiver of a proposal can make another proposal within time length Δ. At each instant, when several offers are made simultaneously, proposals from one side of the market are randomly selected to be sent, and whenever tie-breaking is needed next, proposals from the other side of the market are sent.[13] When a proposal is accepted the match becomes temporary, and the temporary match and the temporarily agreed upon division of surplus are publicly announced. People who are temporarily matched can still propose to anyone on the other side of the market other than their matched partner. The game ends when there is no new proposal in the last $\Delta \cdot (1 + \varepsilon)$ units of time, where $\varepsilon \in (0, 1)$, and all matches become final. Suppose each individual has a discount rate of r. Define $\delta \equiv e^{-r\Delta}$.

[13]We assume this tie-breaking rule for analytic convenience. Alternative tie-breaking rules, such as having each pair of conflicting proposals being independently determined at each instant, will not change the limit payoffs that match the experimental results, but will introduce complications in the expression of equilibrium payoffs due to combinatorial proposer-receiver possibilities.

Taking $\Delta \to 0$ is equivalent to taking $\delta \to 1$.[14]

We consider the Markov perfect equilibria of the game. At each instant, the state of the game is summarized by the temporary matching μ and the temporary payoffs $\{U_m\}_{m \in M}$ and $\{V_w\}_{w \in W}$. Because of the rule whereby agents cannot make another offer before Δ units of time, in equilibrium, effectively, actions occur only at times that are integer multiples of Δ. Given the specific tie-breaking rule, we can alternatively think of a discrete-time model in which agents have discount factors δ and, in the initial period agents on one side of the market are randomly chosen to propose. In subsequent periods the two sides alternate in making proposals, and the game ends when there is no proposal in a period.

5.1.1 Balanced markets

Suppose there is a unique efficient matching μ^* in a balanced matching market, as in the four balanced markets in our experiment. Consider the following (Markov perfect) equilibrium in which players propose to their partners in the efficient matching. At time zero, each man $m \in M$ proposes to woman $\mu^*(m) \in W$ with the surplus division U_m^p to m and $s_{m\mu^*(m)} - U_m^p$ to $\mu^*(m)$, and each woman $w \in W$ proposes to man $\mu^*(w) \in M$ with the surplus division $s_{\mu^*(w)w} - V_w^p$ to $\mu^*(w)$ and V_w^p to w. Each man $m \in M$ accepts the highest acceptable offer, in which an offer above $\delta \cdot U_m^r$ is weakly acceptable and U_m^r is the optimal value when m rejects the current offer. Each woman $w \in W$ accepts the highest offer, where an offer above $\delta \cdot V_w^r$ is weakly acceptable and V_w^r is the optimal value when w rejects the current offer. At each instant after time zero, each person makes an offer that maximizes their payoff given the current temporary payoffs, and each person accepts the highest acceptable offer if it is above their current temporary payoff. On the equilibrium path, each man $m \in M$ proposes to woman $\mu^*(m) \in W$ and each woman $w \in W$ proposes to man $\mu^*(w) \in M$ with the division specified above, and each person accepts the offer at time zero and does not make another offer. The proposal each man $m \in M$ makes to woman $\mu^*(m) \in W$ at time zero yields him a payoff of

$$U_m^p = s_{m\mu^*(m)} - \max\left\{\delta \cdot V_{\mu^*(m)}^r, \max_{m' \in M \setminus m}\left\{s_{m'\mu^*(m)} - U_{m'}^p\right\}\right\}, \tag{3}$$

where

$$V_{\mu^*(m)}^r = s_{m\mu^*(m)} - \max\left\{\delta \cdot U_m^p, \max_{w' \in W \setminus \mu^*(m)}\left\{s_{mw'} - \left[s_{\mu^*(w')w'} - U_{\mu^*(w')}^p\right]\right\}\right\}. \tag{4}$$

Note that $U_{m'}^p$ is the payoff of m' when $\mu^*(m')$ accepts, and $s_{\mu(w')w'} - U_{\mu(w')}^p$ is the payoff of w' when w' accepts. The offer man $m \in M$ proposes to woman $\mu^*(m) \in W$ is $s_{m\mu^*(m)} - U_m^p$, which is the maximum of (i) $\delta \cdot V_{\mu^*(m)}^r$, the continuation value that woman $\mu^*(m) \in W$ can get if she rejects, and (ii) $\max_{m' \in M \setminus \{m\}}\left\{s_{m'\mu^*(m)} - U_{m'}^p\right\}$, the highest possible deviation payoff that another man $m' \in M \setminus \{m\}$ can offer to $\mu^*(m)$. The expected payoff that woman $\mu^*(m) \in W$ gets if she rejects, $V_{\mu^*(m)}^r$, results from her proposing to man $m \in M$, while ensuring that no other woman $w' \in W \setminus \{w\}$ is able to offer $s_{mw'} - [s_{\mu^*(w')w'} - U_{\mu^*(w')}^p]$ to $m \in M$ to poach him. Analogously, the proposal each woman $w \in W$ makes

[14] The addition of frictions in the form of discount factor (and taking the frictionless limit) has been used as a tool to refine the prediction of a bargaining model since Rubinstein (1982).

to man $\mu^*(w) \in M$ at time zero is

$$V_w^p = s_{\mu^*(w)w} - \max\left\{\delta \cdot U_{\mu^*(w)}^r, \max_{w' \in W \setminus w}\left\{s_{\mu^*(w)w} - V_{w'}^p\right\}\right\}, \tag{5}$$

where

$$U_{\mu^*(w)}^r = s_{\mu^*(w)w} - \max\left\{\delta \cdot V_w^p, \max_{m' \in M \setminus \mu^*(w)}\left\{s_{m'w} - \left[s_{m'\mu^*(m')} - V_{\mu^*(m')}^p\right]\right\}\right\}. \tag{6}$$

Note that when $\delta = 1$, all core payoffs satisfy the system of $n_M + n_W$ equations for $\{U_m^p\}_{m\in M}$ and $\{V_w^p\}_{w\in W}$. When $\delta < 1$, we can show that there is a unique set of payoffs $\{U_m^p\}_{m\in M}$ and $\{V_w^p\}_{w\in W}$ that satisfy the system of equations. The proofs are provided in Appendix C.

Theorem 1. *For any $\delta \in (0, 1)$, there exists a unique solution to the system of equations (3)–(6). Moreover, if we replace μ^* with any $\mu \neq \mu^*$ in the system of equations (3)–(6), there is no solution.*

Theorem 1 establishes the existence of a unique solution to the system of equations with efficient matching, which is supported as an MPE, and that inefficient matching cannot be supported in any MPE. This result contrasts with Proposition 2, which shows that the set of stable payoffs is not a singleton in the canonical cooperative model. Furthermore, Proposition 3 implies that we should expect the outcome of pairwise equal splits as the unique equilibrium outcome in the limit if and only if it is in the core.

Proposition 3. *Suppose $s_{mw} > 0$ for any $m \in M$ and $w \in W$. There exists a $\underline{\delta} \in (0, 1)$, such that for any $\delta \in (\underline{\delta}, 1)$, when pairwise equal splits are in the core, the equilibrium values are*

$$U_m^p = \frac{s_{m\mu^*(m)}}{1+\delta} \text{ for any } m \in M \text{ and } V_w^r = \frac{s_{\mu^*(w)w}}{1+\delta} \text{ for any } w \in W.$$
$$V_w^p = \frac{s_{\mu^*(w)w}}{1+\delta} \text{ for any } w \in W \text{ and } U_m^r = \frac{s_{m\mu^*(m)}}{1+\delta} \text{ for any } m \in M.$$

When pairwise equal splits are not in the core, there exists a $\underline{\delta} \in [0, 1)$, such that for any $\delta \in [\underline{\delta}, 1)$, the equilibrium values above are not satisfied.

The expected equilibrium payoffs are $U_m \equiv U_m^p/2 + [s_{m\mu^*(m)} - V_{\mu^*(m)}^p]/2$ for each $m \in M$ and $V_w \equiv V_w^p/2 + [s_{\mu^*(w)w} - U_{\mu^*(w)}^p]/2$ for each $w \in W$. These values as $\delta \to 1$ coincide with the payoffs in the experiment. Notably, $U_m^p = U_m^r$ and $V_w^p = V_w^r$ as $\delta \to 1$ in games with pairwise equal splits in the core, but $U_m^p \neq U_m^r$ and $V_w^p \neq V_w^r$ in the two games with pairwise equal splits not in the core, even in the limit as $\delta \to 1$. This suggests that on the one hand, in markets with pairwise equal splits in the core, outside options do not play a role in equilibrium and agents effectively engage in Nash/Rubinstein bargaining in pairs; in other words, market forces are minimal. On the other hand, in markets with pairwise equal splits not in the core, outside threats alter bargaining and influence equilibrium payoffs and market forces play a significant role. These distinctions between markets with and without pairwise equal splits in the core are also observed in noncooperative games with permanently accepted offers (Elliott and Nava, 2019; Talamàs, 2020; Agranov et al., 2022; Agranov and Elliott, 2021). By calculating the equilibrium payoffs in the four balanced markets, we formalize the following hypothesis:[15]

[15]We only demonstrate men's payoffs, because women's payoffs are pinned down by men's in efficient matching.

Hypothesis 2a. *The average individual payoffs for men in the four balanced markets are* $U_1 = 15$*,* $U_2 = 30$*, and* $U_3 = 55$ *in EA6;* $U_1 = 50$*,* $U_2 = 30$*, and* $U_3 = 20$ *in NA6;* $U_1 = 30$*,* $U_2 = 50$*, and* $U_3 = 20$ *in EM6; and* $U_1 = 30$*,* $U_2 = 40$*, and* $U_3 = 30$ *in NM6.*

Figure 1a shows the match between the data and the predictions of our model for balanced markets. The theoretically predicted payoffs in efficient matching fall within the 99% confidence interval of the data mean. The theory not only matches well with the average payoff, but also with the more detailed realized behavior. The modal outcome matches the theoretical prediction, shown in Figures B2a and B2c in Appendix B for wave 1 and wave 2, respectively. The figures present the histograms of payoffs of individuals in the efficient matching, with bandwidth of 1.[16] In addition, our theory matches other experimental results in the literature with comparable experimental settings, as summarized in Table B5, which reports the surplus matrices in other experiments, their types according to categorization of assortativity, ESIC, and balancedness, as well as average payoffs of all and/or efficient matches, with standard errors included whenever they are reported. By our categorization, all of the surplus matrices in previous experiments are assortative, while some have pairwise equal splits in the core and some do not. In comparison, we vary whether pairwise equal splits are in the core and examine markets with nonassortative surplus matrices.

5.1.2 Imbalanced markets

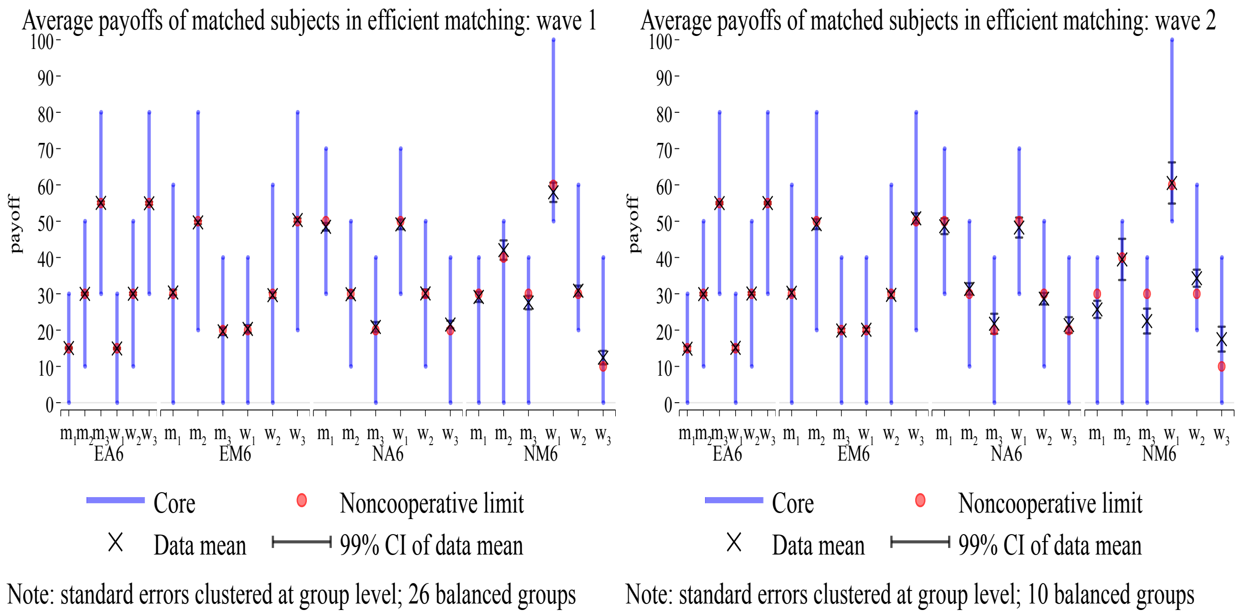
Consider an imbalanced market in which two individuals are identical in terms of the surplus they generate with anyone on the other side of the market; in the four imbalanced markets in our experiment, we have $w^*, w^{**} \in W$ such that $s_{mw^*} = s_{mw^{**}}$ for all $m \in M$. There are two efficient matching outcomes μ^* and μ^{**} such that between w^* and w^{**}, only w^* is matched and only w^{**} is matched, respectively.

There are various (Markov perfect) equilibrium outcomes in this imbalanced market, in the spirit of the folk theorem. To fix ideas, consider the simplest imbalanced matching market of one man m^* and two women w^* and w^{**}, with either pair being able to generate a surplus of $s^* > 0$. In the first type of equilibrium, man m^* proposes to either woman w^* or woman w^{**} a division of the surplus s^* into s^* for himself and 0 for her; woman w^* and woman w^{**} propose to man m^* the same division; man m^* accepts a payoff weakly above s^*; and each woman accepts any division of surplus. The equilibrium outcome is a core outcome in an imbalanced matching market, and is what we call a competitive outcome, since the two women are competing to benefit the man on the short side of the market. However, in this dynamic noncooperative setting, there are other equilibrium outcomes. Consider the following equilibrium strategies. When man m^* is unmatched, woman w^* proposes to man m^* the Rubinstein division of surplus s^* with $s^*/(1+\delta)$ for her and $\delta \cdot s^*/(1+\delta)$ for the man; man m^* proposes to woman w^* the Rubinstein division $s^*/(1+\delta)$ for himself and $\delta \cdot s^*/(1+\delta)$ for woman w^*, and accepts any offer above $\delta \cdot s^*/(1+\delta)$ and above his current temporary payoff. When m^* is matched with w^{**}, woman w^* proposes to man m^* the competitive division of surplus s^* with s^* for man m^* and 0 for woman w^*, and man proposes to woman w^* the same competitive offer. Woman w^{**} does not propose or accept any offer. This is an optimal strategy for woman w^{**}, since she knows that any proposal to or any acceptance of a proposal from man m^* would

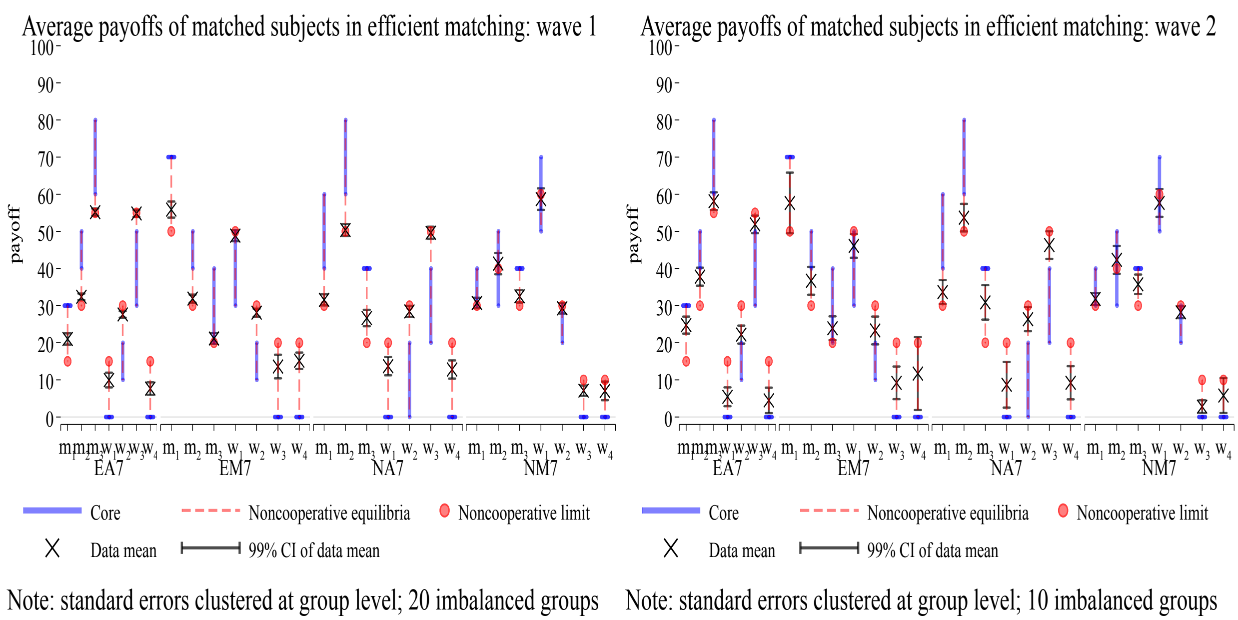
[16] The same pattern holds if we consider all matched individuals—not just the matched individuals in the efficient matching—as shown in Figure B3a and Figure B3c, for wave 1 and wave 2, respectively, in Appendix B.

Figure 1: Average payoffs of matched subjects in efficient matching

(a) Balanced markets (3 men and 3 women)



(b) Imbalanced markets (3 men and 4 women)



Note. The figures show the average payoffs of matched individuals in efficient matching. Blue intervals indicate the range of values in the core. Red dots in balanced markets indicate the noncooperative equilibrium payoffs in the frictionless limit. The red dashed lines in imbalanced markets indicate the range of noncooperative equilibria and red dots indicate the payoffs in the noncompetitive equilibrium in the frictionless limit. Crosses indicate data mean and the segments indicate 99% confidence intervals of data mean. The figures show that average experimental payoffs in balanced markets are predicted by the limit equilibrium payoffs in our noncooperative model, and average experimental payoffs in imbalanced markets are not in the core but are between the competitive and noncompetitive equilibrium payoffs in our noncooperative model.

still lead to a zero payoff for her. We call this equilibrium outcome a noncompetitive outcome, since the agents on the long side of the market—the women—are not competing. Finally, using this "grim-trigger" type of strategy, any equilibrium outcome that yields a payoff U between $\delta \cdot s^*/(1+\delta)$ and s^* for man m^* is possible if woman w^{**} accepts any offer that yields a payoff weakly above $s^* - U$. This results in a partially competitive outcome in which men benefit from some competition but not maximally.[17]

We can generalize these arguments to imbalanced matching markets with more individuals in which there are two identical women w^* and w^{**}. Consider a generalization of the noncompetitive equilibrium described above, in which each man $m \in M$ and each woman $w \in W \backslash \{w^{**}\}$ behave as if they are in the equilibrium in balanced market with μ^* being the equilibrium matching with woman $w^{**} \in W$ remaining unmatched and woman $w^{**} \in W$ not attempting to make or accept a proposal. For any woman $w \in W \backslash \{w^{**}\}$, whenever man $\mu^*(w) \in M$ is temporarily matched with woman w^{**}, woman w would choose to make a proposal that yields a payoff $s_{\mu^*(w)w^{**}}$ for man $\mu^*(w)$. Given this grim-trigger strategy of any woman $w \in W \backslash \{w^{**}\}$, woman w^{**} has no (strict) incentive to propose to or accept a proposal from any man, because she knows that eventually she will receive a payoff of 0. Analogously, we can have matching μ^{**} be sustained in equilibrium in a similar way. In this type of equilibrium, despite the imbalance of the market, the short side does not benefit from it.[18]

The second class of equilibria generalizes the other extreme of competitive equilibrium in which women w^* and w^{**} compete for man $\mu^*(w^*) = \mu^{**}(w^{**}) \equiv m^*$. In this class, both woman w^* and woman w^{**} propose to man m^* a division of surplus $s_{m^*w^*} = s_{m^*w^{**}} \equiv s^*$ with payoff s^* for man m^* and 0 for herself; meanwhile, man m^* proposes to either woman w^* or woman w^{**} the same division of surplus.

These offers yield a payoff of $U_{m^*} = s^*$ for man m^* and 0 for w^* and w^{**}. There are two possibilities for the other pairs of agents. First, they may be unaffected by these competitions between w^* and w^{**}, since they continue to obtain the noncompetitive outcome in equilibrium, and they can maintain those noncompetitive outcomes by invoking grim-trigger strategies. Second, agents on the long side of the market may be influenced by the competition with the unmatched woman w^{**}. To maximally deter the unmatched woman, matched women may actively choose to offer $s_{\mu^*(w)w^{**}}$ to man $\mu^*(w)$ so that he has no incentive to match with woman w^{**}, and woman w^{**} has no way to poach man $\mu^*(w)$. The maximum deterrence is to offer $s_{\mu^*(w)w^{**}}$ to the man, but any payoff between $s_{\mu^*(w)w} - V_w^p$ and $s_{\mu^*(w)w^{**}}$ for man $\mu^*(w)$ can be supported in equilibrium for any woman w, which generates a range of equilibrium outcomes.

In the experiment, the core payoffs—the competitive outcome—are not the most plausible predictions for these imbalanced matching markets. As a consequence, any refinement of the core with the cooperative approach will not yield a satisfying prediction for the imbalanced markets. Rather, we observe a range of payoffs for men and women between the competitive outcome and the noncompetitive outcome, as shown by the histograms of realized individual payoffs. This multiplicity is also observed in other experiments.

[17] This indeterminacy resonates with Rubinstein and Wolinsky (1990), who employ a noncooperative setting with permanently accepted offers.

[18] Note that the folk-theorem-like equilibrium multiplicity in imbalanced markets is not possible in balanced markets in which individuals can make additional nonbinding offers. A threat to a competitor in a balanced market is not credible, because the competitor has a positive "outside option" with another partner. A threat to an agent on the opposing side is also not credible, because offers can be made by both sides; think of bilateral Rubinstein bargaining as a balanced market with one agent on each side: There is a unique Markov perfect equilibrium.

For example, Leng (2023) meticulously follows the continuous-time setup of Perry and Reny (1994) that supposedly generates only core outcomes; a range of noncore outcomes analogous to our noncompetitive outcomes arises in markets with unequal numbers of participants on the two sides (to be precise, markets with one seller and two buyers).

Hypothesis 2b. *The ranges of payoffs are*
$U_1 \in [15,30], U_2 \in [30,50], U_3 \in [55,80], V_1 \in [0,20], V_2 \in [10,30], V_3 \in [30,55], V_4 \in [0,15]$ *in EA7;*
$U_1 \in [30,70], U_2 \in [30,50], U_3 \in [20,40], V_1 \in [30,50], V_2 \in [10,30], V_3 \in [0,20], V_4 \in [0,20]$ *in EM7;*
$U_1 \in [30,60], U_2 \in [50,80], U_3 \in [20,40], V_1 \in [0,20], V_2 \in [0,20], V_3 \in [20,50], V_4 \in [0,20]$ *in NA7;*
$U_1 \in [30,40], U_2 \in [40,50], U_3 \in [30,40], V_1 \in [50,70], V_2 \in [20,30], V_3 \in [0,10], V_4 \in [0,10]$ *in NM7.*

Adding one player to a balanced market shrinks the core. The payoffs of players on the short side of the market increase, and those of players on the long side decrease; some matched players' payoffs are driven to zero in the cases we consider in our experiment. However, experimentally, players' average payoffs do not change that drastically, as shown in Figure 1b. Only a few participants in wave 2 end up with the competitive core outcome of zero payoffs. The noncompetitive outcome is much more frequent. Table B6 shows the proportion of instances in predicted payoff ranges of matched players in imbalanced markets. As can be seen in the table, most individual payoffs fall in our model's predicted range supporting the hypothesis, but outside the canonical model's predicted range.

Figure B2b and Figure B2d in Appendix B show that the modal payoffs of matched players continue to be the noncompetitive payoffs in both wave 1 and wave 2; the same pattern holds if we consider all matched individuals—not just the matched individuals in efficient matching—as shown in Figures B3b and B3d in Appendix B. Furthermore, notably, although they are on the long side of the market, women with the highest bargaining power gain slightly in imbalanced markets (Figure B4). This in general supports our prediction of a noncompetitive equilibrium in imbalanced markets.

Overall, there is some competition, which is an equilibrium outcome in our noncooperative model. There is enough competition to reject the noncompetitive outcome as the sole outcome, but competition does not drive the relevant players' payoffs to zero or affect other players' payoffs drastically. Payoffs remain close to the noncompetitive outcome. In general, if the observed payoffs are not predicted by our noncompetitive limit payoffs, then the observed payoffs are between our noncompetitive limit payoffs and the lower (upper) bound of core payoffs for players on the short (long) side of the market.

5.2 Fairness concerns

The theoretic prediction that matched individuals receive no benefit or pairs divide surpluses extremely unequally occurs rarely in experiments. For example, some individuals on the long side of imbalanced markets are predicted by the core to have zero payoffs even if they are matched, because of competition with other individuals, but our experiment shows that the extremely competitive outcomes do not occur frequently, if at all. One explanation is presented above by the folk-theorem-like logic in the noncooperative setting, where many noncompetitive or partially competitive outcomes can be supported. However, the extreme outcomes can still be supported in equilibrium, and the set of equilibria may depend on the bargaining protocol. Alternatively, inequality aversion proposed by Fehr and Schmidt (1999) and Bolton and Ockenfels (2000), which is experimentally and empirically verified by the rich subsequent literature, may provide another explanation. When examining the behavior of subjects in our experiment, we find evidence that they exhibit inequality-aversion preference when they choose between proposals. The results are presented in Table D6 and discussed in Appendix D.2.

Extreme outcomes often involve unequal allocations of resources between matched partners, so for individuals who are averse to inequality, extreme outcomes may not be easily sustained. Motivated by the possible usefulness of incorporating fairness in matching settings to eliminate implausible extreme outcomes, we investigate how matching and bargaining outcomes change when individuals have additional fairness concerns in the form of inequality aversion. This investigation may lend an explanation to why firms pay wages above workers' marginal product, and may have implications for setting minimum wages.

We revise preferences over payoffs following Fehr and Schmidt (1999). Agents are averse to having a lower material payoff than their partner (*disadvantageous inequality aversion*) as well as a higher material payoff (*advantageous inequality aversion*). Namely, when one gets x and their partner gets $y = s - x$, their utility is

$$\begin{aligned} U(x,y) &= x - \alpha \cdot (x-y)_+ - \beta \cdot (y-x)_+, \\ V(x,y) &= y - \alpha \cdot (y-x)_+ - \beta \cdot (x-y)_+, \end{aligned}$$

where $\alpha \in [0,1]$, $\beta \in [0,1]$, and $z_+ = \max\{0,z\}$. In other words, when i gets x and j gets y, then i's utility is $x - \alpha(x-y)$ if $x \geq y$, and $x - \beta(y-x)$ otherwise. Their material payoffs and utilities are zero from staying unmatched. Nunnari and Pozzi (2022) synthesize that the historical estimates of 85 papers are $\alpha = 0.290$ and $\beta = 0.426$ with 95-percent confidence intervals of $[0.212, 0.366]$ and $[0.240, 0.620]$, respectively.

Let *fair core* denote the core when their utilities over payoffs are in the form above. A couple's division of surplus $x + y = s$ when expressed in terms of utilities is

$$(1+2\beta)(\max\{U(x,y), V(x,y)\} - s/2) = (1-2\alpha)(s/2 - \min\{U(x,y), V(x,y)\}).$$

Potential deviators who earn utilities U and V in their current match do not have incentives to match to divide s:

$$(1+2\beta)(\max\{U,V\} - s/2) \geq (1-2\alpha)(s/2 - \min\{U,V\}).$$

Figure B1 illustrates the core, the fair core, and noncooperative payoffs for each of the balanced and imbalanced markets. Some comments follow.

First, the fair core is far from unique. It continues to provide a broad set of predictions.

Furthermore, the fair core is not a subset of the core (and neither is the core a subset of the fair core), so it is not a refinement of the core. One may think that inequality aversion consideration shrinks the payoff gap between matched agents and consequently shrinks the set of fair core payoffs. The consideration indeed shrinks the payoff gap between matched agents when one agent is getting close to zero payoff, and hence eliminates the extreme divisions in the fair core (e.g., in imbalanced markets). However, the consideration also changes agents' outside options from negotiating with other agents, which determines their bargaining power. Because of fairness concerns, agents' outside options may improve or worsen, which in turn affect their fair core payoffs in a way that differ from their core payoffs.

Note that if the equal-splits outcome is in the core, the outcome is still in the fair core for any combination of α and β. Connecting to the experiment, this theoretical result provides an alternative justification for the robustness of matching with equal splits in the core.

In the two balanced ESNIC markets, the experimental payoffs are illustrated to be outside the fair core. This result suggests that fairness concerns cannot help predict the experimental payoffs.

In imbalanced markets, extreme divisions that involve zero payoffs are eliminated from the fair core: The payoffs below $\frac{\beta}{1+2\beta}s$—6.9, 2.9, 9.2, and 9.2, respectively—are eliminated from the predictions, because these payoffs would not give the players a utility higher than zero. This prediction is in contrast to the noncooperative prediction that extreme payoffs can still be supported as part of equilibrium. However, in the fair core, only those payoffs can be supported: Any payoffs above those will be blocked by the unmatched agent who is happy with any positive payoff. Effectively, under any point estimates of β, the fair core predicts a unique value and hence a negligible portion of the experimental payoffs.[19]

6 Conclusion

We experimentally investigated an influential class of matching models that has received extensive theoretical and empirical scrutiny. Our contributions are threefold. First, we find that factors that are abstracted away in the basic apparatus play important roles in determining the rate of matching, stability, and efficiency. Specifically, both (i) whether agents can sort on their productivity and (ii) whether agents can split their surpluses by half as a sustainable outcome influence the outcome of the two-sided matching market. Second, we provide a noncooperative theory that makes a unique prediction regarding individual payoffs in balanced markets, which is experimentally supported by our results and results in the literature. Third, we investigate imbalanced markets and find that noncompetitive outcomes may arise both theoretically and experimentally. In addition, we show that inequality aversion plays a role in affecting the subjects' behavior in the experiment. However, incorporating inequality aversion into the cooperative model cannot fully rationalize the experimental results.

In Appendix D, we investigate the determinants of the players' proposing activities. First, we find that proposers are more likely to propose to a receiver when their total surplus stands out among all of the matches the proposer can achieve. Second, they are more likely to propose to a receiver if they appear more attractive to the receiver. Third, they are more likely to propose (equally) to someone who is at their diagonal positions only when the markets are assortative, and they appear to use equal-split as a heuristic for making proposals when they are inexperienced. Fourth, the number of proposals is significantly lower in the ESIC markets than in the ESNIC markets, and this difference is entirely driven by the number of

[19] If we take a more relaxed stance on the estimates of β by using the 95-percent confidence interval $\beta \in [0.240, 0.620]$, the payoffs are predicted to be in the interval $[4.86, 8.30]$, $[1.62, 2.76]$, $[6.48, 11.07]$, and $[6.48, 11.07]$, respectively. The proportions of experimental payoffs of subjects that fall in the predicted ranges are 0%-61% in wave 1 and 1%-55% in wave 2, lower than those of noncooperative predictions.

inefficient proposals. This finding aligns with the prediction of the model that the outside options only affect equilibrium outcomes in the ESNIC markets. Finally, when deciding whether to accept or reject a proposal compared to their current matches, subjects care about not only their earnings but also the fairness level of the proposals. The existence of unmatched individuals suggests that there are still frictions present in our experimental design that prevent people from being fully matched. In this appendix, we take a detailed look at the behavior of unmatched individuals in the experiment and break down the possible reasons they remain unmatched. We also find that demographic characteristics do not play an important role.

Our experiment serves as an initial step in understanding decentralized matching and bargaining markets by considering 3-by-3 and 3-by-4 markets. Interesting next steps worth pursuing include investigating (i) the outcome when the market is larger (e.g., 6-by-6 markets or 12-by-12 markets) in order to study the effects of market thickness on stable bargaining outcomes; (ii) the effects of more imbalanced ratios of the two sides (e.g., 3-by-6 or 6-by-12 markets) and hence more competition on aggregate and individual outcomes of the market; (iii) the effects of different bargaining protocols on outcomes; and (iv) the effects of asymmetric information on outcomes.

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Appendix

A Theoretical results and experimental instructions

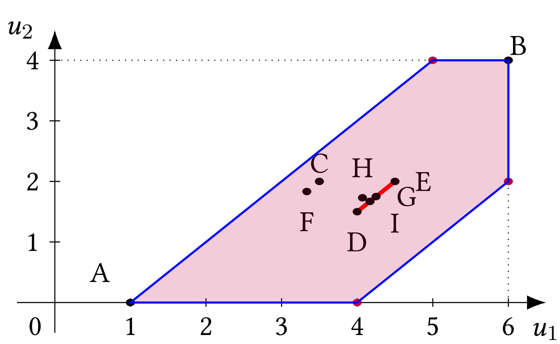
A.1 Examples of the core and alternative cooperative solutions

Consider a balanced market with two men $\{m_1, m_2\}$ and two women $\{w_1, w_2\}$ and an imbalanced market with three men $\{m_1, m_2, m_3\}$ and three women $\{w_1, w_2\}$. Surplus matrices are given by

$$s: \begin{array}{ccc} & w_1 & w_2 \\ m_1 & \underline{\underline{6}} & 5 \\ m_2 & 2 & \underline{\underline{4}} \end{array} \quad \text{and } s': \begin{array}{ccc} & w_1 & w_2 \\ m_1 & \underline{\underline{6}} & 5 \\ m_2 & 2 & \underline{4} \\ m_3 & 2 & \underline{4} \end{array}$$

By our definition, s is not an assortative surplus matrix because the two women are unranked. In this market, the unique stable matching μ^* is $\mu^*(m_1) = w_1$ and $\mu^*(m_2) = w_2$. The core satisfies $u_1 + v_1 = 6$, $u_1 + v_2 \geq 5$, $u_2 + v_2 = 4$, and $u_2 + v_1 \geq 2$, which is equivalent to two expressions that contain only u_1 and u_2: $4 \geq u_1 - u_2$ and $u_1 - u_2 \geq 1$. Taking the individual rationality conditions together, we can depict the core on a graph with u_1 on the x-axis and u_2 on the y-axis. As shown in Figure A1, the entire shaded area is the core. Equal splits $u_1 = v_1 = 3$ and $u_2 = v_2 = 2$ are in the core. Refined solutions differ in this market.

Figure A1: Cooperative solutions for market $s = (6, 5; 2, 4)$



Note. All solutions predict efficient matching. The five points on the boundary are its extreme points (Shapley and Shubik, 1972). A at $(1, 0)$ is the column-optimal allocation; B at $(6, 4)$ is the row-optimal allocation; C at $(3.5, 2)$ is the fair division point (Thompson, 1980); line segment DE from $(4, 1.5)$ to $(4.5, 2)$ is the kernel (Rochford, 1984); F at $(10/3, 11/6)$ is the Shapley value (Shapley, 1953); G at $(17/4, 7/4)$ is the nucleolus (Schmeidler, 1969); H at $(61/15, 26/15)$ is the centroid of the core; and I at $(25/6, 5/3)$ is the median stable matching (Schwarz and Yenmez, 2011).

The imbalanced market s' is generated by adding m_3, a replica of m_2, to the previous balanced market s. In this new market, there is no unique stable matching because w_2 matches with either m_2 or m_3 in efficient matching. Consider the stable matching $\widetilde{\mu}$ that retains the unique stable matching μ^* of the balanced market s in the previous example: $\widetilde{\mu}(m_1) = w_1$ and $\widetilde{\mu}(m_2) = w_2$, $\widetilde{\mu}(m_3) = \emptyset$. The core of the imbalanced market satisfies $u_1 + v_1 = 6$, $u_1 + v_2 \geq 5$, $u_2 + v_2 = 4$, $u_2 + v_1 \geq 2$ and three new conditions: $u_3 + v_1 \geq 2$, $u_3 + v_2 \geq 4$, and $u_3 = 0$. These conditions pin down $u_1 \in [1, 4]$ and $u_2 = 0$, which correspond to the bottom line of the shaded area (the core of the balanced market) in Figure A1. In general, introducing an additional player to the market shrinks the core. Competition between m_2 and m_3 not only drives m_2's core payoff to 0, but also restricts the set of core payoffs for m_1.

A.2 Experiment instructions

Experimental instructions are in Chinese. We present the English translation for balanced markets in the first wave of the experiment. The instructions for imbalanced markets and ones in the second wave of the experiment are appropriately modified. Figure A2 presents a screenshot of the experiment.

Figure A2: A (translated) screenshot of the experiment

Instructions for balanced markets

Welcome page

Welcome to this experiment on decision-making. Please read the following instructions carefully.

This experiment will last about two hours. During the experiment, do not communicate with other participants in any way. If you have any questions at any time, please raise your hand, and an experimenter will come and assist you privately.

At the beginning of the experiment, you will be randomly assigned to a group of six participants, and this is fixed throughout the experiment. Each participant sits behind a private computer, and all decisions are made on the computer screen. This is an anonymous experiment: Experimenters and other participants cannot link your name to your desk number, and thus will not know your identity or that of other participants who make the specific decisions.

Payoffs

Throughout the experiment, your earnings are denoted in points. Your earnings depend on your own choices and the choices of other participants. At the end of the experiment, your earnings will be converted to RMB at the following rate: 12 points = 1 RMB. In addition, you will receive 20 RMB as a show-up fee.

This show-up fee is added to your earnings during the experiment. Your total earnings will be paid to you privately at the end of the experiment.

There are three cold colors and three warm colors in experimental roles. Cold colors are Blue, Cyan, and Green. Warm colors are Pink, Red, and Yellow. In each of the matching games (there are 28 games in total), each of the six participants will be randomly assigned one of the six role colors. In these matching games, a cold color can only be matched with a warm color, and vice versa. Two cold colors and two warm colors cannot be matched. For example, a Cyan can match with a Pink (if they both want to).

When a cold color is matched with a warm color, they can share their total earnings. The total earnings of the two colors are depicted in the table below. In this table, you can see that a Blue and a Yellow can share total earnings of 10 points. That is, their total earnings must equal 10.

	w_1	w_2	w_3
m_1	50	20	10
m_2	20	30	60
m_3	30	50	20

Matching Stage

In order to reach a match, all of the six participants will go through a short matching stage that lasts for 3 minutes.

Proposing. Each participant can propose to any of the other three colors on the opposite side of the market. When proposing to someone, you can first click that color on the screen, and decide how you want to share the total earnings.

For example, if the Red (proposer) wants to propose to the Green (receiver), the Red has to decide how to allocate the total 60 points between them. Once the proposal is made, the Green will receive a notification of the proposal on his or her private information board. The notification contains all of the information about the proposal (who proposes and how many points each gets). Note that except for the Green (the receiver of the proposal), other people will not receive any information about this proposal.

Accepting/rejecting proposals. When a proposal is made from a proposer to a receiver, the receiver has 30 seconds to either accept or reject the proposal.

If the receiver rejects the proposal within 30 seconds or does not accept it within 30 seconds, this proposal is no longer valid and will disappear on the receiver's private information board.

If the receiver accepts the proposal within 30 seconds, a temporary match between the receiver and the proposer is made. Once a temporary match is made, a matching posting will appear on the public information board with full information (who matched and how many points each gets).

Before the receiver decides to accept or reject a proposal (and before the 30 seconds are over), the proposer of this proposal is not able to make any proposals to any other colors (or to make a new proposal to the same receiver); however, the proposer of this proposal can accept a proposal from others. In this case, his or her previous proposal becomes invalid.

Moreover, it is possible that one participant receives multiple proposals from different proposers at the same time. In this case, the receiver can choose to accept at most one proposal (or reject all of them).

Temporary match. Once a temporary match is made, the two people in this match are still able to make proposals to others, and they can also receive proposals from other proposers.

In the former case, if one's new proposal is accepted, then the previous temporary match is ended, and a new temporary match is formed. In this case, the person who was previously matched with him or her will be notified, and the matching posting will be updated on the public board.

As long as the matching stage has not ended, one can always break his or her current temporary match by forming a new temporary match (by proposing and accepting, or by accepting another proposal). One cannot break a current temporary match without forming a new match. If one is passively broken up with by someone within the last 15 seconds, he or she will be granted 15 seconds to make new proposals to others. This process of adding 15 additional seconds continues until no new proposal is accepted.

Permanent match. When the matching stage ends at the 3-minute mark, all of the temporary matches at the end of the matching stage become permanent. All participants with a permanent match will receive the points allocated to him or her in the match (as made by the proposers), and all of the remaining participants are unmatched, and will receive zero points. Once everyone receives his or her points, the game is finished.

Repetition

In this experiment, you will play four different matching games. In each of the matching games the procedures are the same; the only difference is the game payoff. The game payoff matrix will be shown to you once a new game is being played. Each of the matching games will be repeated for 7 rounds. Therefore, there are 28 rounds in total for the entire experiment. Throughout the 28 rounds, you will stay in the same group of six participants. Before the start of the 28 rounds, you will also have the opportunity to play one practice round. The goal of the practice round is to let you get familiar with the procedure; the points you receive in this round will not be included in your final earnings.

All of the six participants in a group can also see the matching results from past rounds. The matching results contain information about which colors are matched with each other and the number of points they earned in the match.

Earnings

At the end, you will receive the sum of the 240 points (endowed in the beginning) and the points from each round. Your total earnings in the experiment are equal to the total points divided by 12.

B Robustness checks

This section contains robustness checks of main empirical results and additional experimental results.

B.1 Experimental results

Table B1 reports additional tests of hypotheses on aggregate outcomes of matching and payoffs. Table B2 presents the Wilcoxon signed-rank test for payoffs of matched players with predicted zero core payoffs in imbalanced markets, and Table B3 presents the t-tests for their payoffs. Tables B4a and B4b show the average payoffs of matched players in efficient matching in balanced markets in waves 1 and 2, respectively, and their comparison to cooperative solutions. Table B6 shows the comparison for imbalanced markets.

Table B1: Additional tests of hypotheses on aggregate outcomes: wave 1 and wave 2

(a) Additional tests of hypotheses on aggregate outcomes: wave 1

	EA6	EM6	NA6	NM6	EA7	EM7	NA7	NM7
2a': # efficiently matched pairs=3	2.86**	2.87**	2.41***	2.08***	2.64***	2.71***	2.48***	2.39***
given full matching	(3.22)	(3.55)	(6.06)	(5.75)	(5.10)	(4.43)	(5.95)	(5.73)
2b': efficient matching=1	0.93**	0.94**	0.72***	0.62***	0.75***	0.80***	0.69***	0.66***
given full matching	(3.22)	(3.55)	(6.27)	(5.80)	(5.60)	(3.90)	(6.80)	(5.33)
2c': % surplus achieved=1	1.00**	1.00**	0.98***	0.97***	0.97***	0.97**	0.96***	0.96***
given full matching	(3.22)	(3.55)	(4.75)	(5.63)	(5.78)	(2.93)	(4.38)	(4.60)
3b: stable10 outcome=1	0.83***	0.74***	0.41***	0.23***	0.40***	0.09***	0.13***	0.35***
	(4.58)	(6.70)	(11.68)	(25.00)	(11.02)	(34.94)	(28.18)	(13.23)
3a': stable outcome=1	0.86***	0.69***	0.10***	0.12***	0.00	0.00	0.00	0.00
given full matching	(4.95)	(6.91)	(31.59)	(22.23)	(.)	(.)	(.)	(.)
3b': stable10 outcome=1	0.93**	0.94**	0.69***	0.56***	0.41***	0.10***	0.15***	0.50***
given full matching	(3.22)	(3.55)	(6.16)	(6.55)	(10.92)	(31.83)	(23.48)	(7.10)
3a": stable outcome=1	0.92**	0.74***	0.14***	0.21***	0.00	0.00	0.00	0.00
given efficient matching	(3.37)	(5.95)	(20.88)	(10.69)	(.)	(.)	(.)	(.)
3b": stable10 outcome=1	1.00	1.00	0.94	0.91*	0.54***	0.13***	0.22***	0.73**
given efficient matching	(.)	(.)	(1.32)	(2.42)	(6.98)	(24.48)	(14.99)	(3.62)
clusters	26	26	26	26	20	20	20	20

Stars indicate statistically significant differences between canonical theoretical predictions and experimental observations: * p<0.05, ** p<0.01, *** p<0.001; *t* statistics in parentheses; standard errors clustered at group level

(b) Additional tests of hypotheses on aggregate outcomes: wave 2

	EA6	EM6	NA6	NM6	EA7	EM7	NA7	NM7
2a': # efficiently matched pairs=3	2.96	2.96	2.06**	2.16*	2.50**	2.54***	2.42***	2.88
given full matching	(1.00)	(1.00)	(4.19)	(2.92)	(4.25)	(5.92)	(5.30)	(1.96)
2b': efficient matching=1	0.98	0.98	0.57**	0.64*	0.70**	0.71***	0.66***	0.94
given full matching	(1.00)	(1.00)	(4.22)	(3.15)	(4.51)	(7.66)	(5.67)	(1.96)
2c': % surplus achieved=1	1.00	1.00	0.96*	0.98*	0.98**	0.96***	0.97**	1.00
given full matching	(1.00)	(1.00)	(3.19)	(2.73)	(3.66)	(5.59)	(3.58)	(1.96)
3b: stable10 outcome=1	0.96	0.96	0.42***	0.34***	0.58***	0.38***	0.40***	0.78*
	(1.50)	(1.50)	(6.33)	(8.34)	(6.68)	(6.15)	(7.61)	(3.16)
3a': stable outcome=1	0.88	0.76**	0.18***	0.05***	0.02***	0.00	0.04***	0.04***
given full matching	(1.77)	(3.76)	(9.87)	(19.00)	(49.00)	(.)	(24.00)	(36.00)
3b': stable10 outcome=1	0.98	0.98	0.48***	0.50**	0.60***	0.38***	0.40***	0.80*
given full matching	(1.00)	(1.00)	(5.34)	(4.39)	(6.21)	(6.15)	(7.61)	(2.74)
3a": stable outcome=1	0.90	0.77**	0.24***	0.06***	0.05***	0.00	0.04***	0.04***
given efficient matching	(1.46)	(3.66)	(7.39)	(17.00)	(19.00)	(.)	(24.00)	(36.00)
3b": stable10 outcome=1	1.00	1.00	0.82*	0.72	0.86*	0.51**	0.59**	0.85*
given efficient matching	(.)	(.)	(2.37)	(2.24)	(2.28)	(3.82)	(4.15)	(2.35)
clusters	10	10	10	10	10	10	10	10

Stars indicate statistically significant differences between canonical theoretical predictions and experimental observations: * p<0.05, ** p<0.01, *** p<0.001; *t* statistics in parentheses; standard errors clustered at group level

Table B2: Wilcoxon signed-rank test for payoffs of matched players with predicted zero core payoffs in imbalanced markets

(a) Wilcoxon signed-rank tests for payoffs of matched players with predicted zero core payoffs in imbalanced markets: wave 1

role	#clusters	probability Ho
EA7w1	20	9.54e-07
EA7w4	20	9.54e-07
EM7w3	20	9.54e-07
EM7w4	20	9.54e-07
NA7w1	20	9.54e-07
NA7w4	20	9.54e-07
NM7w3	19	1.91e-06
NM7w4	20	9.54e-07

We average payoffs of each group and test Ho: median=0 vs Ha: median>0

(b) Wilcoxon signed-rank tests for payoffs of matched players with predicted zero core payoffs in imbalanced markets: wave 1

role	#clusters	probability Ho
EA7w1	10	.0009766
EA7w4	9	.0078125
EM7w3	10	.0009766
EM7w4	10	.0009766
NA7w1	10	.0009766
NA7w4	10	.0009766
NM7w3	10	.0019531
NM7w4	10	.0009766

We average payoffs of each group and test Ho: median=0 vs Ha: median>0

Note. In the experiment, w_3 in EA7 is never matched in one group in wave 1, and w_4 in EA7 is never matched in one group in wave 2, so the number of clusters is 19 and 9, respectively.

Table B3: T-tests for payoffs of matched players with predicted zero core payoffs in imbalanced markets

(a) T-tests for payoffs of matched players with predicted zero core payoffs in imbalanced markets: wave 1

	data	core	t-stat	#clusters	CI
EA7w1	9.57	0	16.467***	20	8.43,10.71
EA7w4	8.23	0	15.022***	20	7.16,9.30
EM7w3	14.15	0	15.121***	20	12.31,15.98
EM7w4	14.62	0	22.240***	20	13.33,15.91
NA7w1	13.77	0	15.787***	20	12.06,15.47
NA7w4	13.87	0	17.056***	20	12.27,15.46
NM7w3	8.17	0	10.823***	19	6.69,9.65
NM7w4	7.82	0	10.267***	20	6.33,9.31

t statistics in parentheses
standard errors clustered at group level
* p<0.05, ** p<0.01, *** p<0.001

(b) T-tests for payoffs of matched players with predicted zero core payoffs in imbalanced markets: wave 2

	data	core	t-stat	#clusters	CI
EA7w1	5.06	0	7.652***	10	3.76,6.36
EA7w4	5.38	0	3.754**	9	2.57,8.19
EM7w3	9.07	0	5.959***	10	6.09,12.06
EM7w4	11.25	0	4.130**	10	5.91,16.58
NA7w1	7.75	0	5.170***	10	4.81,10.68
NA7w4	8.98	0	5.997***	10	6.05,11.92
NM7w3	2.91	0	4.222**	10	1.56,4.25
NM7w4	5.75	0	3.541**	10	2.57,8.94

t statistics in parentheses
standard errors clustered at group level
* p<0.05, ** p<0.01, *** p<0.001

Note. In the experiment, w_3 in EA7 is never matched in one group in wave 1, and w_4 in EA7 is never matched in one group in wave 2, so the number of clusters is 19 and 9, respectively.

Table B4: T-tests for payoffs of matched players in efficient matching in balanced markets

(a) T-tests for payoffs of matched players in efficient matching in balanced markets: wave 1

	data mean	our model	Shapley value (Shapley, 1953)	nucleolus (Schmeidler, 1969)	fair division (Thompson, 1980)	median stable matching (Schwarz & Yenmez, 2011)
EA6m1	15.1	15.0	18.2***	15.0	15.0	15.0
		(-0.76)	(39.26)	(-0.76)	(-0.76)	(-0.76)
EA6m2	30.0	30.0	31.3***	30.0	30.0	30.0
		(0.13)	(9.69)	(0.13)	(0.13)	(0.13)
EA6m3	55.1	55.0	50.5***	55.0	55.0	55.0
		(-0.38)	(-28.86)	(-0.38)	(-0.38)	(-0.38)
EA6w1	14.9	15.0	18.2***	15.0	15.0	15.0
		(0.76)	(40.79)	(0.76)	(0.76)	(0.76)
EA6w2	30.0	30.0	31.3***	30.0	30.0	30.0
		(-0.13)	(9.43)	(-0.13)	(-0.13)	(-0.13)
EA6w3	54.9	55.0	50.5***	55.0	55.0	55.0
		(0.38)	(-28.09)	(0.38)	(0.38)	(0.38)
EM6m1	30.4	30.0	31.8***	32.5***	30.0	32.2***
		(-1.26)	(4.93)	(7.20)	(-1.26)	(6.26)
EM6m2	49.7	50.0	45.7***	47.5***	50.0	47.8***
		(1.83)	(-22.16)	(-12.02)	(1.83)	(-10.47)
EM6m3	19.7	20.0	21.8***	20.0	20.0	20.0
		(0.82)	(5.34)	(0.82)	(0.82)	(0.82)
EM6w1	20.3	20.0	18.2***	20.0	20.0	20.0
		(-0.82)	(-5.34)	(-0.82)	(-0.82)	(-0.82)
EM6w2	29.6	30.0	28.2***	27.5***	30.0	27.8***
		(1.26)	(-4.93)	(-7.20)	(1.26)	(-6.26)
EM6w3	50.3	50.0	54.3***	52.5***	50.0	52.2***
		(-1.83)	(22.16)	(12.02)	(-1.83)	(10.47)
NA6m1	48.5	50.0***	46.2***	55.0***	50.0***	55.0***
		(3.77)	(-5.63)	(16.05)	(3.77)	(16.05)
NA6m2	29.9	30.0	31.3**	30.0	30.0	30.0
		(0.26)	(3.41)	(0.26)	(0.26)	(0.26)
NA6m3	20.9	20.0	22.5**	15.0***	20.0	15.0***
		(-1.65)	(3.11)	(-11.18)	(-1.65)	(-11.18)
NA6w1	49.1	50.0	46.2***	55.0***	50.0	55.0***
		(1.65)	(-5.65)	(11.18)	(1.65)	(11.18)
NA6w2	30.1	30.0	31.3**	30.0	30.0	30.0
		(-0.26)	(2.89)	(-0.26)	(-0.26)	(-0.26)
NA6w3	21.5	20.0***	22.5*	15.0***	20.0***	15.0***
		(-3.77)	(2.37)	(-16.05)	(-3.77)	(-16.05)
NM6m1	29.1	30.0	28.0*	17.5***	20.0***	18.3***
		(1.59)	(-2.12)	(-21.60)	(-16.97)	(-20.05)
NM6m2	42.0	40.0	31.7***	20.0***	25.0***	20.6***
		(-1.97)	(-10.01)	(-21.27)	(-16.45)	(-20.73)
NM6m3	27.6	30.0**	27.7	22.5***	20.0***	22.8***
		(3.34)	(0.11)	(-7.05)	(-10.52)	(-6.66)
NM6w1	58.0	60.0	68.3***	80.0***	75.0***	79.4***
		(1.97)	(10.01)	(21.27)	(16.45)	(20.73)
NM6w2	30.9	30.0	32.0*	42.5***	40.0***	41.7***
		(-1.59)	(2.12)	(21.60)	(16.97)	(20.05)
NM6w3	12.4	10.0**	12.3	17.5***	20.0***	17.2***
		(-3.34)	(-0.11)	(7.05)	(10.52)	(6.66)
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level
Stars indicate significant differences between data and theory: * p<0.05, ** p<0.01, *** p<0.001

(b) T-tests for payoffs of matched players in efficient matching in balanced markets: wave 2

	data mean	our model	Shapley vale (Shapley, 1953)	nucleolus (Schmeidler, 1969)	fair division (Thompson, 1980)	median stable matching (Schwarz & Yenmez, 2011)
EA6m1	14.9	15.0	18.2***	15.0	15.0	15.0
		(0.47)	(12.41)	(0.47)	(0.47)	(0.47)
EA6m2	29.9	30.0	31.3***	30.0	30.0	30.0
		(0.58)	(9.59)	(0.58)	(0.58)	(0.58)
EA6m3	55.0	55.0	50.5***	55.0	55.0	55.0
		(0.08)	(-40.14)	(0.08)	(0.08)	(0.08)
EA6w1	15.1	15.0	18.2***	15.0	15.0	15.0
		(-0.47)	(11.46)	(-0.47)	(-0.47)	(-0.47)
EA6w2	30.1	30.0	31.3***	30.0	30.0	30.0
		(-0.58)	(8.44)	(-0.58)	(-0.58)	(-0.58)
EA6w3	55.0	55.0	50.5***	55.0	55.0	55.0
		(-0.08)	(-40.31)	(-0.08)	(-0.08)	(-0.08)
EM6m1	30.3	30.0	31.8**	32.5***	30.0	32.2***
		(-0.87)	(4.64)	(6.66)	(-0.87)	(5.82)
EM6m2	49.2	50.0	45.7***	47.5*	50.0	47.8*
		(1.50)	(-6.56)	(-3.16)	(1.50)	(-2.63)
EM6m3	19.9	20.0	21.8***	20.0	20.0	20.0
		(0.47)	(8.70)	(0.47)	(0.47)	(0.47)
EM6w1	20.1	20.0	18.2***	20.0	20.0	20.0
		(-0.47)	(-8.70)	(-0.47)	(-0.47)	(-0.47)
EM6w2	29.7	30.0	28.2**	27.5***	30.0	27.8***
		(0.87)	(-4.64)	(-6.66)	(0.87)	(-5.82)
EM6w3	50.8	50.0	54.3***	52.5*	50.0	52.2*
		(-1.50)	(6.56)	(3.16)	(-1.50)	(2.63)
NA6m1	48.6	50.0	46.2*	50.0	50.0	55.0***
		(1.64)	(-2.90)	(1.64)	(1.64)	(7.58)
NA6m2	31.3	30.0	31.3	30.0	30.0	30.0
		(-2.18)	(-0.03)	(-2.18)	(-2.18)	(-2.18)
NA6m3	21.8	20.0	22.5	20.0	20.0	15.0***
		(-1.64)	(0.70)	(-1.64)	(-1.64)	(-6.31)
NA6w1	48.2	50.0	46.2	50.0	50.0	55.0***
		(1.64)	(-1.95)	(1.64)	(1.64)	(6.31)
NA6w2	28.7	30.0	31.3**	30.0	30.0	30.0
		(2.18)	(4.33)	(2.18)	(2.18)	(2.18)
NA6w3	21.4	20.0	22.5	20.0	20.0	15.0***
		(-1.64)	(1.32)	(-1.64)	(-1.64)	(-7.58)
NM6m1	25.7	30.0**	28.0*	17.5***	20.0***	18.3***
		(4.69)	(2.50)	(-8.97)	(-6.24)	(-8.05)
NM6m2	39.5	40.0	31.7**	20.0***	25.0***	20.6***
		(0.24)	(-3.54)	(-8.84)	(-6.57)	(-8.58)
NM6m3	22.5	30.0***	27.7**	22.5	20.0	22.8
		(5.65)	(3.90)	(0.01)	(-1.88)	(0.22)
NM6w1	60.5	60.0	68.3**	80.0***	75.0***	79.4***
		(-0.24)	(3.54)	(8.84)	(6.57)	(8.58)
NM6w2	34.3	30.0**	32.0*	42.5***	40.0***	41.7***
		(-4.69)	(-2.50)	(8.97)	(6.24)	(8.05)
NM6w3	17.5	10.0***	12.3**	17.5	20.0	17.2
		(-5.65)	(-3.90)	(-0.01)	(1.88)	(-0.22)
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level
Stars indicate significant differences between data and theory: * p<0.05, ** p<0.01, *** p<0.001

Table B5: Payoffs in comparable experiments in the literature

Nalbantian and Schotter (1995)		m1/m2/m3			w1/w2/w3		
surplus matrix	type	theory	efficient	all	theory	efficient	all
(4, 3, 3; 3, 4, 3; 3, 3, 4)	EA6	2	2.21	2	2	1.79	2
Agranov and Elliott (2021)		m1/w2			m2/w1		
surplus matrix	type	theory	efficient	all	theory	efficient	all
(20, 15; 0 20)	EA4	10	10.0 (0.03)	9.8 (0.12)	10	10.0 (0.03)	9.8 (0.09)
Agranov and Elliott (2021)		m1/w2			m2/w1		
surplus matrix	type	theory	efficient	all	theory	efficient	all
(20, 25; 0 20)	NA4	7.5	7.5 (0.18)	6.2 (0.35)	12.5	12.3 (0.08)	12.3 (0.16)
Agranov and Elliott (2021)		m1/w2			m2/w1		
surplus matrix	type	theory	efficient	all	theory	efficient	all
(20, 30; 0 20)	NA4	5	4.9 (0.18)	3.6 (0.05)	15	15.0 (0.14)	14.2 (0.05)
Agranov et al. (2022)		m1/w1		m2/w2		m3/w3	
surplus matrix	type	theory	all	theory	all	theory	all
(8, 16, 24; 16, 32, 48; 24, 48, 72)	EA6	4	4.11 (0.06)	16	16.07 (0.37)	36	35.86 (0.1)
(8, 32, 56; 32, 48, 64; 56, 64, 72)	NA6	16	16.07 (0.37)	24	23.81 (0.25)	40	38.87 (0.45)

Note. We report results from the CIEA setting in Nalbantian and Schotter (1995), Experiment III in Agranov and Elliott (2021), and the complete-information setting in Agranov et al. (2022). We report the surplus matrices used in the experiments, their types according to our categorization of assortativity, ESIC, and number of players, and their average payoffs in all and/or efficient matches, with standard errors in parentheses whenever they are reported. Agranov et al. (2022) do not separate efficient matches from all matches, possibly because of the high efficiency achieved in their complete-information part of the experiment, while the other two papers do.

Table B6: Proportion of instances in predicted payoff ranges of matched players in imbalanced markets

(a) Proportion of instances in predicted payoff ranges of matched players in imbalanced markets: wave 1

	our model		
	proportion in predicted range our model	proportion in predicted range core	#obs
EA7m1	0.97	0.00	138
EA7m2	0.80	0.04	134
EA7m3	0.69	0.12	138
EA7w1	0.93	0.00	85
EA7w2	0.80	0.09	118
EA7w3	0.73	0.14	133
EA7w4	0.97	0.01	74
EM7m1	0.84	0.00	139
EM7m2	0.71	0.02	129
EM7m3	0.55	0.55	121
EM7w1	0.61	0.61	131
EM7w2	0.80	0.08	108
EM7w3	0.92	0.00	76
EM7w4	0.86	0.01	74
NA7m1	0.77	0.07	131
NA7m2	0.57	0.04	134
NA7m3	0.97	0.00	136
NA7w1	0.94	0.00	85
NA7w2	0.78	0.06	124
NA7w3	0.66	0.08	119
NA7w4	0.93	0.00	73
NM7m1	0.53	0.53	124
NM7m2	0.52	0.80	112
NM7m3	0.80	0.01	133
NM7w1	0.62	0.90	134
NM7w2	0.60	0.60	114
NM7w3	0.81	0.00	57
NM7w4	0.75	0.00	64

(b) Proportion of instances in predicted payoff ranges of matched players in imbalanced markets: wave 2

	our model		
	proportion in predicted range our model	proportion in predicted range core	#obs
EA7m1	0.94	0.06	49
EA7m2	0.94	0.40	50
EA7m3	0.80	0.38	50
EA7w1	0.97	0.03	36
EA7w2	0.87	0.36	45
EA7w3	0.90	0.48	50
EA7w4	1.00	0.17	18
EM7m1	0.90	0.04	50
EM7m2	0.92	0.30	50
EM7m3	0.78	0.78	50
EM7w1	0.86	0.86	49
EM7w2	0.93	0.43	44
EM7w3	0.93	0.03	30
EM7w4	0.93	0.04	27
NA7m1	0.90	0.22	49
NA7m2	0.80	0.22	49
NA7m3	1.00	0.06	49
NA7w1	1.00	0.03	29
NA7w2	0.91	0.22	45
NA7w3	0.86	0.34	44
NA7w4	1.00	0.07	29
NM7m1	0.72	0.72	50
NM7m2	0.61	0.94	49
NM7m3	0.90	0.08	50
NM7w1	0.62	0.94	50
NM7w2	0.76	0.76	49
NM7w3	0.96	0.12	26
NM7w4	0.83	0.04	24

B.2 Determinants of outcomes in balanced markets

To check the robustness of our results regarding Hypothesis 4, we present the results from regressions with alternative dependent variables and alternative specifications: We consider (i) the outcomes of interest directly as dependent variables in addition to their logged values, and (ii) the following specifications, in which specification (1) is the leading specification we presented in the main text.

$$(1) \qquad y_i = \beta_1 \cdot \text{ESIC}_i + \beta_2 \cdot \text{assortative}_i + \beta_3 \cdot \text{ESIC}_i \cdot \text{assortative}_i + \beta_4 \cdot \text{round}_i + \beta_5 \cdot \text{order}_i + c + \varepsilon_g,$$

$$(2) \qquad y_i = \beta_1 \cdot \text{ESIC}_i + \beta_2 \cdot \text{assortative}_i + \beta_3 \cdot \text{ESIC}_i \cdot \text{assortative}_i + \beta_4 \cdot \text{round}_i + \beta_5 \cdot (\text{treat}_i = 2) + \beta_6 \cdot (\text{treat}_i = 3) + \beta_7 \cdot (\text{treat}_i = 4) + c + \varepsilon_g,$$

$$(3) \qquad y_i = \beta_1 \cdot \text{ESIC}_i + \beta_2 \cdot \text{assortative}_i + \beta_3 \cdot \text{ESIC}_i \cdot \text{assortative}_i + \beta_4 \cdot \text{round}_i + \beta_5 \cdot (\text{treat}_i = 2) + \beta_6 \cdot (\text{treat}_i = 3) + \beta_7 \cdot (\text{treat}_i = 4) + c + \varepsilon_g \beta_8 \cdot (\text{order}_i = 2) + \beta_9 \cdot (\text{order}_i = 3) + \beta_{10} \cdot (\text{order}_i = 4) + c + \varepsilon_g,$$

where i is the index of a game (out of 728 balanced markets); y_i is the variable of interest or its log transformation; assortative$_i$ is the indicator of whether the market played in the game is assortative; ESIC$_i$ is the indicator of whether the market has ES in the core; round$_i$ is the round (out of 7) the same market has been played; order$_i$ is the order (out of 4) the game is played in; treat$_i$ is the treatment order (out of 4).

Table B7a–B7b presents the results for determinants of the number of matched pairs and its log. All else equal, ESIC increases the number of matches by 0.390 to 0.394 (or by 11.4% to 11.5%) in wave 1 and by 0.260 to 0.270 (or by 7.72% to 8.03%) in wave 2, and assortativity increases the number of matched pairs by 0.181 to 0.189 (or by 5.35% to 5.556%) in wave 1 and by 0.153 to 0.160 (or by 4.64% to 4.84%) in wave 2, depending on whether learning over time is controlled for. The evidence suggests that ESIC plays a more important role than assortativity in determining the number of matches. There is evidence that learning mildly improves the expected number of matches over time. Having played the same game for one more round increases the number of matches by 0.490% in wave 1 and 0.935% (insignificant) in wave 2. Having played another configuration increases the number of matches by 1.39% in wave 1 and 1.59% in wave 2.

Table B7c–B7d presents the results for determinants of the number of efficiently matched pairs. All else equal, ESIC increases the number of efficiently matched pairs by 1.071 to 1.078 (or by 42.4% to 42.6%) in wave 1 and by 1.140 to 1.162 (or by 44.1% to 45.1%) in wave 2, and assortativity increases the number of efficiently matched pairs by 0.374 to 0.388 (or by 14.9% to 15.4%) in wave 1 and by 0.0571 to 0.0600 (or by 1.62% to 1.73%, insignificant) in wave 2, depending on whether learning over time is controlled for.

Table B7e–B7f presents the results for determinants of the surplus. All else equal, ESIC increases surplus by 9.32% to 9.49% in wave 1 and 9.99% to 10.4% in wave 2, and assortativity increases surplus by 3.33% to 3.66% in wave 1 and by 3.95% to 4.21% (insignificant) in wave 2 depending on whether learning is controlled for. There is some gain from learning. Having the same game one more round increases efficiency by 0.526% to 0.847% in wave 1 and 0.743% (insignificant) in wave 2. Having played another configuration increases efficiency by 1.57% in wave 1 and 1.99% in wave 2.

Table B7: Determinants of aggregate outcomes in balanced markets

(a) Determinants of number of matched pairs in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	0.394***	0.390***	0.392***	0.115***	0.114***	0.114***
	(7.01)	(7.18)	(7.14)	(7.13)	(7.30)	(7.27)
assortative	0.189***	0.181**	0.188***	0.0556***	0.0535***	0.0556***
	(3.94)	(3.67)	(3.92)	(4.04)	(3.74)	(4.02)
ESIC*assortative	-0.0897	-0.0824	-0.0869	-0.0271	-0.0250	-0.0263
	(-1.28)	(-1.12)	(-1.26)	(-1.36)	(-1.19)	(-1.34)
round	0.0165*	0.0165*	0.0165*	0.00490*	0.00490*	0.00490*
	(2.58)	(2.57)	(2.57)	(2.64)	(2.64)	(2.63)
order	0.0474**			0.0139**		
	(3.38)			(3.39)		
treat=2		-0.0153	-0.0153		-0.00440	-0.00440
		(-0.33)	(-0.32)		(-0.33)	(-0.32)
treat=3		0.0340	0.0340		0.00908	0.00908
		(0.56)	(0.56)		(0.51)	(0.51)
treat=4		0.105*	0.105*		0.0296*	0.0296*
		(2.60)	(2.59)		(2.52)	(2.51)
order=2			0.0863			0.0248
			(1.59)			(1.60)
order=3			0.127*			0.0371*
			(2.39)			(2.41)
order=4			0.145**			0.0423**
			(2.94)			(2.94)
constant	2.208***	2.302***	2.209***	1.156***	1.184***	1.157***
	(39.03)	(64.14)	(39.20)	(68.30)	(114.31)	(69.20)
observations	728	728	728	728	728	728
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of number of matched pairs in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	0.270**	0.260**	0.268**	0.0803**	0.0772**	0.0797**
	(3.53)	(3.48)	(3.80)	(3.40)	(3.38)	(3.65)
assortative	0.160*	0.160	0.153*	0.0484*	0.0484	0.0464*
	(2.65)	(2.02)	(3.06)	(2.70)	(2.04)	(3.15)
ESIC*assortative	-0.201*	-0.180*	-0.196*	-0.0629*	-0.0565*	-0.0617*
	(-2.58)	(-2.81)	(-2.54)	(-2.61)	(-2.87)	(-2.53)
round	0.0325	0.0325	0.0325	0.00935	0.00935	0.00935
	(1.76)	(1.75)	(1.73)	(1.60)	(1.60)	(1.58)
order	0.0516*			0.0159*		
	(2.35)			(2.28)		
treat=2		-0.00833	-0.00833		0.000547	0.000547
		(-0.12)	(-0.12)		(0.03)	(0.03)
treat=3		-0.0917	-0.0917		-0.0254	-0.0254
		(-1.56)	(-1.55)		(-1.30)	(-1.29)
treat=4		-0.0500	-0.0500		-0.0114	-0.0114
		(-0.83)	(-0.83)		(-0.59)	(-0.59)
order=2			-0.00469			-0.00111
			(-0.07)			(-0.06)
order=3			0.0796			0.0258
			(1.52)			(1.51)
order=4			0.144			0.0442
			(2.00)			(1.93)
constant	2.493***	2.663***	2.611***	1.236***	1.285***	1.269***
	(23.27)	(28.04)	(23.25)	(37.69)	(43.70)	(34.77)
observations	200	200	200	200	200	200
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Determinants of number of efficiently matched pairs in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	1.078^{***}	1.071^{***}	1.076^{***}	0.426^{***}	0.424^{***}	0.426^{***}
	(10.28)	(10.11)	(10.28)	(10.35)	(10.30)	(10.28)
assortative	0.387^{**}	0.374^{**}	0.388^{**}	0.153^{**}	0.149^{*}	0.154^{**}
	(3.02)	(2.81)	(3.07)	(2.92)	(2.75)	(2.94)
ESIC*assortative	-0.261	-0.247	-0.256	-0.115	-0.110	-0.113
	(-1.82)	(-1.58)	(-1.81)	(-2.04)	(-1.84)	(-2.04)
round	0.0553^{***}	0.0553^{***}	0.0553^{***}	0.0206^{**}	0.0206^{**}	0.0206^{**}
	(3.99)	(3.98)	(3.97)	(3.50)	(3.50)	(3.49)
order	0.0878^{**}			0.0294^{*}		
	(2.85)			(2.53)		
treat=2		0.0561	0.0561		0.0278	0.0278
		(0.90)	(0.89)		(1.27)	(1.26)
treat=3		0.116	0.116		0.0441	0.0441
		(1.02)	(1.01)		(1.00)	(1.00)
treat=4		0.211^{**}	0.211^{**}		0.0849^{**}	0.0849^{**}
		(2.84)	(2.84)		(2.88)	(2.87)
order=2			0.142			0.0399
			(1.37)			(0.98)
order=3			0.267			0.0861
			(2.05)			(1.74)
order=4			0.251^{*}			0.0827^{*}
			(2.60)			(2.28)
constant	1.069^{***}	1.205^{***}	1.032^{***}	0.666^{***}	0.705^{***}	0.650^{***}
	(7.79)	(12.12)	(7.54)	(12.08)	(17.55)	(12.52)
observations	728	728	728	728	728	728
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Determinants of number of efficiently matched pairs in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	1.162^{***}	1.140^{***}	1.155^{***}	0.451^{***}	0.441^{***}	0.449^{***}
	(7.18)	(5.93)	(6.94)	(6.46)	(5.23)	(6.15)
assortative	0.0600	0.0600	0.0571	0.0173	0.0173	0.0162
	(0.27)	(0.25)	(0.24)	(0.19)	(0.17)	(0.15)
ESIC*assortative	-0.124	-0.0800	-0.110	-0.0455	-0.0254	-0.0412
	(-0.50)	(-0.35)	(-0.42)	(-0.44)	(-0.25)	(-0.37)
round	0.105^{*}	0.105^{*}	0.105^{*}	0.0388^{*}	0.0388^{*}	0.0388^{*}
	(3.13)	(3.12)	(3.09)	(2.94)	(2.93)	(2.91)
order	0.111			0.0503		
	(1.79)			(2.02)		
treat=2		0.142	0.142		0.0587	0.0587
		(0.79)	(0.79)		(0.82)	(0.81)
treat=3		0.158^{**}	0.158^{**}		0.0655^{*}	0.0655^{*}
		(3.68)	(3.65)		(2.48)	(2.46)
treat=4		-0.175^{**}	-0.175^{**}		-0.0765^{***}	-0.0765^{***}
		(-4.13)	(-4.09)		(-5.02)	(-4.98)
order=2			0.206			0.0767
			(1.00)			(0.82)
order=3			0.151			0.0792
			(0.71)			(0.85)
order=4			0.385			0.167
			(1.73)			(1.85)
constant	1.209^{***}	1.430^{***}	1.246^{***}	0.683^{***}	0.787^{***}	0.707^{***}
	(5.33)	(14.77)	(6.54)	(7.31)	(17.21)	(8.24)
observations	200	200	200	200	200	200
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(e) Determinants of surplus in balanced markets

	(1)	(2)	(3)	(4)	(5)	(6)
	s	s	s	log(s)	log(s)	log(s)
ESIC	17.02***	16.76***	16.82***	0.0949***	0.0932***	0.0935***
	(5.04)	(5.04)	(4.91)	(4.47)	(4.43)	(4.34)
assortative	6.285*	5.769	5.974*	0.0366*	0.0333	0.0346
	(2.44)	(2.04)	(2.25)	(2.27)	(1.86)	(2.05)
ESIC*assortative	0.185	0.714	0.585	0.00256	0.00600	0.00525
	(0.05)	(0.18)	(0.16)	(0.11)	(0.25)	(0.24)
round	0.821*	1.315***	1.234**	0.00526*	0.00847***	0.00792**
	(2.09)	(3.73)	(3.55)	(2.11)	(3.74)	(3.59)
order	2.409**			0.0157**		
	(3.60)			(3.55)		
treat=2		-1.071	-1.071		-0.00534	-0.00534
		(-0.36)	(-0.36)		(-0.28)	(-0.28)
treat=3		0.765	0.765		0.00209	0.00209
		(0.18)	(0.18)		(0.07)	(0.07)
treat=4		4.932	4.932		0.0275	0.0275
		(2.02)	(2.01)		(1.71)	(1.71)
order=2			-5.503*			-0.0348
			(-2.10)			(-1.97)
order=3			1.195			0.00909
			(0.44)			(0.54)
order=4			2.658			0.0178
			(0.89)			(0.96)
constant	156.9***	162.2***	162.7***	5.039***	5.074***	5.077***
	(54.63)	(77.80)	(67.95)	(239.51)	(355.22)	(306.07)
observations	728	728	728	728	728	728
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(f) Determinants of surplus in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	s	s	s	log(s)	log(s)	log(s)
ESIC	17.05**	16.40**	16.91***	0.104**	0.0999**	0.103**
	(4.62)	(4.26)	(4.81)	(3.66)	(3.52)	(3.83)
assortative	5.800	5.800	5.429	0.0421	0.0421	0.0395
	(1.56)	(1.16)	(1.60)	(1.64)	(1.26)	(1.76)
ESIC*assortative	-7.694	-6.400	-7.429	-0.0549	-0.0470	-0.0534
	(-1.59)	(-1.44)	(-1.59)	(-1.68)	(-1.54)	(-1.67)
round	1.575	1.575	1.575	0.00743	0.00743	0.00743
	(1.63)	(1.63)	(1.61)	(1.04)	(1.04)	(1.03)
order	3.236*			0.0199*		
	(3.03)			(2.97)		
treat=2		1.583	1.583		0.0103	0.0103
		(0.94)	(0.94)		(0.92)	(0.91)
treat=3		-1.083	-1.083		-0.0117	-0.0117
		(-0.55)	(-0.55)		(-0.69)	(-0.69)
treat=4		-1.000	-1.000		-0.00374	-0.00374
		(-0.53)	(-0.53)		(-0.30)	(-0.29)
order=2			0.343			-0.00363
			(0.09)			(-0.14)
order=3			5.143			0.0321
			(1.66)			(1.69)
order=4			9.200*			0.0545*
			(2.72)			(2.55)
constant	169.4***	177.5***	174.0***	5.118***	5.169***	5.150***
	(44.07)	(58.57)	(42.05)	(208.98)	(274.58)	(189.74)
observations	200	200	200	200	200	200
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.3 Determinants of outcomes in all balanced and imbalanced markets

To check the robustness of our results regarding Hypothesis 4, we present the results from regressions with alternative dependent variables and alternative specifications: We consider (i) the outcomes of interest directly as dependent variables in addition to their logged values, and (ii) the following specifications:

$$
\begin{aligned}
(1)\quad y_i = {} & \beta_1\text{ESIC}_i + \beta_2\text{assortative}_i + \beta_3\text{balanced}_i + \beta_4\text{ESIC}_i\text{assortative}_i + \beta_5\text{assortative}_i\text{balanced}_i \\
& + \beta_6\text{round}_i + \beta_7\text{round}_i\text{balanced}_i + \beta_8\text{order}_i + \beta_9\text{order}_i\text{balanced}_i + c + \varepsilon_g, \\
(2)\quad y_i = {} & \beta_1\text{ESIC}_i + \beta_2\text{assortative}_i + \beta_3\text{balanced}_i + \beta_4\text{ESIC}_i\text{assortative}_i + \beta_5\text{assortative}_i\text{balanced}_i \\
& + \beta_6\text{round}_i + \beta_7\text{round}_i\text{balanced}_i \\
& + \beta_8(\text{treat}_i = 2) + \beta_9(\text{treat}_i = 3) + \beta_{10}(\text{treat}_i = 4) + c + \varepsilon_g \\
& + \beta_{11}(\text{treat}_i = 2)\text{balanced}_i + \beta_{12}(\text{treat}_i = 3)\text{balanced}_i + \beta_{13}(\text{treat}_i = 4)\text{balanced}_i, \\
(3)\quad y_i = {} & \beta_1\text{ESIC}_i + \beta_2\text{assortative}_i + \beta_3\text{balanced}_i + \beta_4\text{ESIC}_i\text{assortative}_i + \beta_5\text{assortative}_i\text{balanced}_i \\
& + \beta_6\text{round}_i + \beta_7\text{round}_i\text{balanced}_i + \beta_8\text{order}_i + \beta_9\text{order}_i\text{balanced}_i \\
& + \beta_{10}(\text{treat}_i = 2) + \beta_{11}(\text{treat}_i = 3) + \beta_{12}(\text{treat}_i = 4) + c + \varepsilon_g \\
& + \beta_{13}(\text{treat}_i = 2)\text{balanced}_i + \beta_{14}(\text{treat}_i = 3)\text{balanced}_i + \beta_{15}(\text{treat}_i = 4)\text{balanced}_i,
\end{aligned}
$$

where i is the index of a game (out of 728 balanced markets); y_i is the variable of interest or its log (or log of #efficient matches+1); assortative_i is the indicator of whether the market played in the game is assortative; ESIC_i is the indicator of whether the market has ES in the core; round_i is the round (out of 7) the same market has been played; order_i is the order (out of 4) the game is played in; treat_i is the treatment order (out of 4). The results are very stable across the different specifications.

Table B8a–B8b shows the determinants of the number of matched pairs when both balanced and imbalanced markets are considered. ESIC and assortativity continue to have significant influences on market outcome: ESIC markets have 0.390 to 0.394 (or 11.4% to 11.5%) more matched pairs in wave 1 and 0.26 to 0.27 (or 7.72% to 8.03%) more matched pairs in wave 2, and assortative markets have 0.104 (or 2.94%) more matched pairs in wave 1, but no difference in wave 2. Having an additional player increases the number of matched pairs. In particular, 0.370 to 0.458 more pairs in wave 1 and 0.345 to 0.504 more pairs in wave 2 are matched in imbalanced markets on average, which increases the matching rate by 10.8% to 13.4% in wave 1 and by 10.3% to 15.0% in wave 2.

Table B8c–B8d shows that assortativity does not increase the number of efficiently matched pairs at a statistically significant level. In comparison, ESIC increases the number of efficiently matched pairs by 1.071 to 1.078 (or by 42.4% to 42.6%) in wave 1 and by 1.14 to 1.162 (or by 44.1% to 45.1%) in wave 2. Having an additional player increases the number of efficiently matched pairs by 0.736 to 0.986 (or by 27.4% to 37.2%) in wave 1 and by 1.264 to 1.470 (or by 51.2% to 59.0%) in wave 2.

Table B8e–B8f shows that ESIC increases surplus by 9.32% to 9.48% in wave 1 and 9.99% to 10.4% in wave 2; assortativity increases surplus by 4.32% in wave 1 and has no effect in wave 2; and having one additional player increases surplus by 7.49% to 11.4% in wave 1 and 11.1% to 15.6% in wave 2. All aforementioned effects are statistically significant at at least the 95% significance level.

Table B8: Determinants of aggregate outcomes in all balanced and imbalanced markets

(a) Determinants of number of matched pairs, all markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	0.394***	0.390***	0.394***	0.115***	0.114***	0.115***
	(7.07)	(7.24)	(7.05)	(7.19)	(7.36)	(7.17)
assortative	0.104**	0.104**	0.104**	0.0294**	0.0294**	0.0294**
	(2.97)	(2.96)	(2.96)	(2.89)	(2.88)	(2.88)
bal(anced)	-0.375***	-0.370***	-0.458***	-0.110***	-0.108***	-0.134***
	(-4.10)	(-7.17)	(-5.31)	(-4.07)	(-7.24)	(-5.30)
ESIC*assortative	-0.0897	-0.0824	-0.0897	-0.0271	-0.0250	-0.0271
	(-1.29)	(-1.13)	(-1.28)	(-1.37)	(-1.20)	(-1.36)
assortative*bal	0.0850	0.0777	0.0850	0.0262	0.0241	0.0262
	(1.44)	(1.29)	(1.44)	(1.54)	(1.38)	(1.54)
round	0.0335***	0.0335***	0.0335***	0.00974***	0.00974***	0.00974***
	(4.73)	(4.73)	(4.72)	(4.70)	(4.69)	(4.69)
round*bal	-0.0170	-0.0170	-0.0170	-0.00483	-0.00483	-0.00483
	(-1.79)	(-1.79)	(-1.79)	(-1.74)	(-1.74)	(-1.74)
order	0.0136		0.0136	0.00399		0.00399
	(0.83)		(0.83)	(0.84)		(0.84)
order*bal	0.0338		0.0338	0.00993		0.00993
	(1.57)		(1.57)	(1.58)		(1.58)
treat=2		-0.0429	-0.0429		-0.0123	-0.0123
		(-1.53)	(-1.53)		(-1.53)	(-1.53)
treat=3		-0.0571	-0.0571		-0.0164	-0.0164
		(-1.51)	(-1.51)		(-1.51)	(-1.51)
treat=4		-0.121	-0.121		-0.0358	-0.0358
		(-1.79)	(-1.79)		(-1.77)	(-1.77)
(treat=2)*bal		0.0276	0.0276		0.00793	0.00793
		(0.51)	(0.51)		(0.51)	(0.51)
(treat=3)*bal		0.0912	0.0912		0.0255	0.0255
		(1.29)	(1.28)		(1.23)	(1.23)
(treat=4)*bal		0.227**	0.227**		0.0654**	0.0654**
		(2.88)	(2.88)		(2.80)	(2.80)
constant	2.582***	2.671***	2.638***	1.265***	1.292***	1.282***
	(35.76)	(71.56)	(41.12)	(59.79)	(119.92)	(68.81)
observations	1,288	1,288	1,288	1,288	1,288	1,288
clusters	46	46	46	46	46	46

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of number of matched pairs, all markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	0.270**	0.260**	0.270**	0.0803**	0.0772**	0.0803**
	(3.63)	(3.58)	(3.60)	(3.50)	(3.48)	(3.47)
assortative	0.000115	6.48e-16	8.05e-16	0.0000332	7.06e-17	1.21e-16
	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
bal(anced)	-0.504***	-0.345**	-0.474**	-0.150***	-0.103**	-0.143**
	(-4.77)	(-3.61)	(-3.68)	(-4.64)	(-3.51)	(-3.49)
ESIC*assortative	-0.201*	-0.180**	-0.201*	-0.0629*	-0.0565**	-0.0629*
	(-2.66)	(-2.89)	(-2.64)	(-2.69)	(-2.95)	(-2.67)
assortative*bal	0.160*	0.160	0.160*	0.0484*	0.0484	0.0484*
	(2.65)	(2.04)	(2.63)	(2.70)	(2.07)	(2.69)
round	-0.00250	-0.00250	-0.00250	-0.000719	-0.000719	-0.000719
	(-0.44)	(-0.43)	(-0.43)	(-0.44)	(-0.43)	(-0.43)
round*bal	0.0350	0.0350	0.0350	0.0101	0.0101	0.0101
	(1.85)	(1.84)	(1.84)	(1.71)	(1.70)	(1.69)
order	0.0000659		-3.60e-16	0.0000189		-1.08e-16
	(0.03)		(-0.00)	(0.03)		(-0.00)
order*bal	0.0516*		0.0516*	0.0159*		0.0159*
	(2.40)		(2.38)	(2.33)		(2.31)
treat=2		-0.0167	-0.0167		-0.00479	-0.00479
		(-1.17)	(-1.17)		(-1.17)	(-1.17)
treat=3		-1.44e-16	1.08e-16		3.58e-16	4.32e-16
		(-0.00)	(0.00)		(0.00)	(0.00)
treat=4		-0.0250	-0.0250		-0.00719	-0.00719
		(-1.36)	(-1.35)		(-1.36)	(-1.35)
(treat=2)*bal		0.00833	0.00833		0.00534	0.00534
		(0.12)	(0.12)		(0.25)	(0.25)
(treat=3)*bal		-0.0917	-0.0917		-0.0254	-0.0254
		(-1.60)	(-1.60)		(-1.34)	(-1.33)
(treat=4)*bal		-0.0250	-0.0250		-0.00425	-0.00425
		(-0.41)	(-0.41)		(-0.22)	(-0.22)
constant	2.997***	3.007***	3.007***	1.385***	1.388***	1.388***
	(167.62)	(122.68)	(161.80)	(269.34)	(196.87)	(259.65)
observations	399	399	399	399	399	399
clusters	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Determinants of number of efficiently matched pairs, all markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	1.078***	1.071***	1.078***	0.426***	0.424***	0.426***
	(10.36)	(10.19)	(10.34)	(10.44)	(10.39)	(10.41)
assortative	0.139	0.139	0.139	0.0645*	0.0645*	0.0645*
	(1.75)	(1.68)	(1.74)	(2.16)	(2.07)	(2.16)
bal(anced)	-0.736***	-0.897***	-0.986***	-0.274**	-0.350***	-0.372***
	(-3.59)	(-6.45)	(-4.87)	(-3.36)	(-6.57)	(-4.77)
ESIC*assortative	-0.261	-0.247	-0.261	-0.115*	-0.110	-0.115*
	(-1.83)	(-1.59)	(-1.83)	(-2.06)	(-1.86)	(-2.06)
assortative*bal	0.248	0.234	0.248	0.0888	0.0843	0.0888
	(1.65)	(1.50)	(1.65)	(1.48)	(1.36)	(1.48)
round	0.0786***	0.0786***	0.0786***	0.0296***	0.0296***	0.0296***
	(5.10)	(5.09)	(5.09)	(5.05)	(5.04)	(5.03)
round*bal	-0.0233	-0.0233	-0.0233	-0.00892	-0.00892	-0.00892
	(-1.13)	(-1.13)	(-1.12)	(-1.08)	(-1.08)	(-1.08)
order	0.0550		0.0550	0.0217		0.0217
	(1.67)		(1.67)	(1.70)		(1.70)
order*bal	0.0328		0.0328	0.00772		0.00772
	(0.73)		(0.73)	(0.45)		(0.45)
treat=2		-0.114	-0.114		-0.0462	-0.0462
		(-1.29)	(-1.29)		(-1.44)	(-1.44)
treat=3		-0.143	-0.143		-0.0540	-0.0540
		(-1.33)	(-1.33)		(-1.36)	(-1.35)
treat=4		-0.379**	-0.379**		-0.141*	-0.141*
		(-2.77)	(-2.77)		(-2.69)	(-2.68)
(treat=2)*bal		0.170	0.170		0.0740	0.0740
		(1.58)	(1.58)		(1.91)	(1.91)
(treat=3)*bal		0.259	0.259		0.0981	0.0981
		(1.66)	(1.66)		(1.66)	(1.66)
(treat=4)*bal		0.589***	0.589***		0.226***	0.226***
		(3.79)	(3.79)		(3.76)	(3.75)
constant	1.805***	2.102***	1.964***	0.941***	1.055***	1.001***
	(11.73)	(21.43)	(14.25)	(15.53)	(29.80)	(19.16)
observations	1,288	1,288	1,288	1,288	1,288	1,288
clusters	46	46	46	46	46	46

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Determinants of number of efficiently matched pairs, all markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	y	y	y	log(y+1)	log(y+1)	log(y+1)
ESIC	1.162***	1.140***	1.162***	0.451***	0.441***	0.451***
	(7.39)	(6.11)	(7.33)	(6.64)	(5.38)	(6.59)
assortative	-0.255*	-0.266**	-0.254*	-0.0917*	-0.0962**	-0.0912*
	(-2.75)	(-2.97)	(-2.70)	(-2.68)	(-2.92)	(-2.64)
bal(anced)	-1.264***	-1.337***	-1.470***	-0.512***	-0.523***	-0.590***
	(-4.45)	(-8.57)	(-5.23)	(-4.55)	(-8.10)	(-5.47)
ESIC*assortative	-0.124	-0.0800	-0.124	-0.0455	-0.0254	-0.0455
	(-0.52)	(-0.36)	(-0.51)	(-0.45)	(-0.26)	(-0.45)
assortative*bal	0.315	0.326	0.314	0.109	0.113	0.108
	(1.36)	(1.32)	(1.34)	(1.13)	(1.06)	(1.11)
round	0.0275	0.0275	0.0275	0.0103	0.0103	0.0103
	(1.04)	(1.04)	(1.04)	(0.98)	(0.98)	(0.97)
round*bal	0.0775	0.0775	0.0775	0.0286	0.0286	0.0286
	(1.85)	(1.84)	(1.84)	(1.73)	(1.72)	(1.71)
order	0.0541		0.0550	0.0225		0.0227
	(1.20)		(1.21)	(1.46)		(1.47)
order*bal	0.0564		0.0556	0.0279		0.0276
	(0.75)		(0.74)	(0.97)		(0.95)
treat=2		-0.133	-0.133		-0.0510	-0.0510
		(-0.96)	(-0.96)		(-1.07)	(-1.07)
treat=3		-0.277	-0.280		-0.0949	-0.0959
		(-1.88)	(-1.92)		(-1.75)	(-1.79)
treat=4		-0.292*	-0.292*		-0.112**	-0.112**
		(-2.51)	(-2.50)		(-2.99)	(-2.99)
(treat=2)*bal		0.275	0.275		0.110	0.110
		(1.24)	(1.24)		(1.30)	(1.30)
(treat=3)*bal		0.436*	0.438**		0.160*	0.161*
		(2.85)	(2.89)		(2.68)	(2.72)
(treat=4)*bal		0.117	0.117		0.0352	0.0352
		(0.95)	(0.94)		(0.88)	(0.87)
constant	2.473***	2.767***	2.624***	1.195***	1.310***	1.251***
	(13.80)	(22.22)	(12.73)	(17.97)	(27.97)	(16.51)
observations	399	399	399	399	399	399
clusters	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(e) Determinants of surplus, all markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	s	s	s	log(s)	log(s)	log(s)
ESIC	17.02***	16.76***	17.02***	0.0948***	0.0932***	0.0948***
	(5.10)	(5.08)	(5.09)	(4.52)	(4.47)	(4.51)
assortative	6.786*	6.786*	6.786*	0.0432*	0.0432*	0.0432*
	(2.60)	(2.57)	(2.59)	(2.60)	(2.57)	(2.59)
bal(anced)	-14.28*	-13.09**	-19.31**	-0.0831*	-0.0749**	-0.114**
	(-2.54)	(-3.22)	(-3.35)	(-2.16)	(-2.87)	(-3.00)
ESIC*assortative	0.198	0.714	0.198	0.00265	0.00600	0.00265
	(0.05)	(0.18)	(0.05)	(0.12)	(0.25)	(0.12)
assortative*bal	-0.500	-1.016	-0.500	-0.00662	-0.00997	-0.00662
	(-0.14)	(-0.26)	(-0.14)	(-0.29)	(-0.41)	(-0.29)
round	2.121***	2.121***	2.121***	0.0130***	0.0130***	0.0130***
	(4.82)	(4.81)	(4.81)	(4.72)	(4.71)	(4.71)
round*bal	-0.805	-0.805	-0.805	-0.00455	-0.00455	-0.00455
	(-1.43)	(-1.43)	(-1.43)	(-1.28)	(-1.28)	(-1.28)
order	0.971		0.971	0.00694		0.00694
	(0.89)		(0.89)	(1.02)		(1.02)
order*bal	2.384		2.384	0.0148		0.0148
	(1.69)		(1.69)	(1.65)		(1.64)
treat=2		-2.786	-2.786		-0.0208	-0.0208
		(-0.87)	(-0.87)		(-0.98)	(-0.98)
treat=3		-2.929	-2.929		-0.0166	-0.0166
		(-0.92)	(-0.92)		(-0.85)	(-0.85)
treat=4		-10.29*	-10.29*		-0.0633	-0.0633
		(-2.03)	(-2.03)		(-1.95)	(-1.95)
(treat=2)*bal		1.714	1.714		0.0155	0.0155
		(0.39)	(0.39)		(0.55)	(0.54)
(treat=3)*bal		3.694	3.694		0.0187	0.0187
		(0.71)	(0.71)		(0.55)	(0.55)
(treat=4)*bal		15.22**	15.22**		0.0908*	0.0908*
		(2.71)	(2.71)		(2.51)	(2.51)
constant	168.8***	175.3***	172.8***	5.106***	5.149***	5.132***
	(36.80)	(50.05)	(37.31)	(170.27)	(234.75)	(175.36)
observations	1,288	1,288	1,288	1,288	1,288	1,288
clusters	46	46	46	46	46	46

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(f) Determinants of surplus, all markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	s	s	s	log(s)	log(s)	log(s)
ESIC	17.05***	16.40***	17.05***	0.104**	0.0999**	0.104**
	(4.75)	(4.38)	(4.71)	(3.76)	(3.62)	(3.73)
assortative	-0.791	-0.853	-0.788	-0.00339	-0.00378	-0.00339
	(-0.76)	(-0.84)	(-0.75)	(-0.60)	(-0.68)	(-0.59)
bal(anced)	-25.39***	-19.23***	-26.54***	-0.150***	-0.111***	-0.156***
	(-5.73)	(-5.63)	(-5.70)	(-5.35)	(-5.31)	(-5.26)
ESIC*assortative	-7.694	-6.400	-7.694	-0.0549	-0.0470	-0.0549
	(-1.64)	(-1.48)	(-1.63)	(-1.72)	(-1.58)	(-1.71)
assortative*bal	6.591	6.653	6.588	0.0455	0.0459	0.0455
	(1.75)	(1.34)	(1.73)	(1.78)	(1.40)	(1.76)
round	1.89e-15	2.05e-14	7.17e-15	0.000223	0.000223	0.000223
	(0.00)	(0.00)	(0.00)	(0.07)	(0.07)	(0.07)
round*bal	1.575	1.575	1.575	0.00721	0.00721	0.00721
	(1.46)	(1.46)	(1.45)	(0.95)	(0.94)	(0.94)
order	0.298		0.300	0.00182		0.00182
	(0.76)		(0.76)	(0.84)		(0.84)
order*bal	2.938*		2.936*	0.0181*		0.0181*
	(2.65)		(2.63)	(2.63)		(2.61)
treat=2		-2.333	-2.333		-0.0141	-0.0141
		(-0.73)	(-0.73)		(-0.75)	(-0.75)
treat=3		-1.451	-1.463		-0.00731	-0.00739
		(-1.20)	(-1.20)		(-1.10)	(-1.10)
treat=4		-1.083	-1.083		-0.00564	-0.00564
		(-1.23)	(-1.22)		(-1.21)	(-1.20)
(treat=2)*bal		3.917	3.917		0.0244	0.0244
		(1.09)	(1.09)		(1.13)	(1.12)
(treat=3)*bal		0.367	0.380		-0.00441	-0.00434
		(0.16)	(0.17)		(-0.25)	(-0.24)
(treat=4)*bal		0.0833	0.0833		0.00191	0.00191
		(0.04)	(0.04)		(0.15)	(0.14)
constant	194.8***	196.8***	196.0***	5.268***	5.280***	5.275***
	(81.70)	(113.94)	(100.18)	(356.45)	(528.62)	(459.99)
observations	399	399	399	399	399	399
clusters	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.4 Learning effects in balanced and imbalanced markets

B.4.1 Learning effects in balanced markets

The following regression directly tests whether previous experience of a particular market affects current outcome of a different market:

$$y_i = \beta_1 \cdot \text{round}_i + \beta_2 \cdot \text{playedEA6}_i + \beta_3 \cdot \text{playedNA6}_i + \beta_4 \cdot \text{playedEM6}_i + \beta_5 \cdot \text{playedNM6}_i + c + \varepsilon_g,$$

where y_i is the variable of interest restricted to each of the four types of markets (in columns (1)-(4)), and its log (in columns (5)–(8)). Table B9 shows the results for the number of matched pairs, number of efficiently matched pairs, and surplus.

There are minimal experience effects. The only significant effects of experience are that having played EM reduces the number of matched pairs in NM (by 0.233 and 7.5%) in wave 2, and having played NA increases the number of matched pairs in NM (by 0.333 and 10.4%) in wave 2. A few coefficients are shown to be statistically significant but are negligible in magnitude (on the scale of 10^{-18} to 10^{-15}).

B.4.2 Learning effects in imbalanced markets

The following regression directly tests whether previous experience of a particular market affects the outcome of a different market:

$$y_i = \beta_1 \cdot \text{round}_i + \beta_2 \cdot \text{playedEA7}_i + \beta_3 \cdot \text{playedNA7}_i + \beta_4 \cdot \text{playedEM7}_i + \beta_5 \cdot \text{playedNM7}_i + c + \varepsilon_g,$$

where y_i is the variable of interest restricted to each of the four types of markets (in columns (1)-(4)), and its log (in columns (5)–(8)). Table B10 shows the results for the number of matched pairs, number of efficiently matched pairs, and surplus.

There are mild experience effects in imbalanced markets. The only statistically significant effects of experience are (i) having played EA7 increases the number of matched pairs in EM7 in wave 1 (by 0.200, or 5.75%), (ii) having played NM7 reduces the number of matched pairs in EM7 in wave 1 (by 0.143, or 4.11%) and reduces the number of efficiently matched pairs in EM7 in wave 1 (by 0.657, or 23.6%), and (iii) having played NM7 decreases the number of efficiently matched pairs (by 0.600 or 23.7%) and the surplus (by 3.80%) in EA7 in wave 2. These effects are significant at the 95% significance level, but not at the 99% or the 99.9% level.

Table B9: Learning effects in balanced markets

(a) Learning effects on number of matched pairs in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	0.0408	0.122	0.0408	0	0.0352	0.0117	0.0117
	(.)	(0.60)	(1.13)	(0.64)	(.)	(1.13)	(0.60)	(0.64)
playedEM	0.0476	0	-0.0238	-0.0476	0.0137	-0.00685	0	-0.0137
	(0.77)	(.)	(-0.19)	(-0.53)	(0.77)	(-0.19)	(.)	(-0.49)
playedNA	0.0102	0.177	0	-0.102	0.00294	0	0.0509	-0.0266
	(0.17)	(1.55)	(.)	(-1.47)	(0.17)	(.)	(1.55)	(-1.32)
playedNM	0.0850	0.0442	0.184	0	0.0245	0.0528	0.0127	0
	(1.02)	(0.56)	(1.58)	(.)	(1.02)	(1.58)	(0.56)	(.)
round	0.0220	0.0206	0.00412	0.0192	0.00632	0.00119	0.00593	0.00618
	(1.94)	(1.38)	(0.30)	(0.88)	(1.94)	(0.30)	(1.38)	(0.94)
constant	2.730***	2.557***	2.396***	2.418***	1.309***	1.212***	1.259***	1.214***
	(31.37)	(22.02)	(24.30)	(22.97)	(52.27)	(42.75)	(37.68)	(36.82)
observations	182	182	182	182	182	182	182	182
clusters	26	26	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Learning effects on number of matched pairs in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	-5.67e-18	0.0333	0.200	0	0.00959	9.50e-18	0.0575
	(.)	(-2.19)	(0.34)	(1.93)	(.)	(0.34)	(0.05)	(1.93)
playedEM	-5.70e-17*	0	0.133	-0.233*	-6.48e-19	0.0384	0	-0.0750*
	(-3.12)	(.)	(2.23)	(-2.38)	(-0.00)	(2.23)	(.)	(-2.41)
playedNA	5.22e-17	0.0667	0	0.333*	1.81e-17	0	0.0192	0.104*
	(1.35)	(1.11)	(.)	(2.78)	(0.11)	(.)	(1.11)	(2.82)
playedNM	0.200	2.22e-18	-0.100	0	0.0693	-0.0288	-3.29e-18	0
	(1.29)	(1.77)	(-1.29)	(.)	(1.29)	(-1.29)	(-0.02)	(.)
round	0.0400	0.0200	0.0200	0.0500	0.0139	0.00575	0.00575	0.0120
	(0.96)	(0.96)	(0.66)	(1.12)	(0.96)	(0.66)	(0.96)	(0.83)
constant	2.720***	2.893***	2.827***	2.600***	1.289***	1.336***	1.356***	1.276***
	(12.10)	(29.49)	(30.96)	(24.12)	(16.55)	(50.87)	(48.02)	(37.63)
observations	50	50	50	50	50	50	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Learning effects on number of efficiently matched pairs in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	-0.122	0.204	-0.102	0	-0.0555	0.0518	-0.0355
	(.)	(-0.98)	(1.38)	(-0.75)	(.)	(-1.25)	(0.73)	(-0.52)
playedEM	0.190	0	-0.190	0.0238	0.0592	0	-0.0729	-0.0137
	(1.72)	(.)	(-0.59)	(0.09)	(1.41)	(.)	(-0.58)	(-0.13)
playedNA	-0.0374	0.272	0	0.00340	-0.00512	0.0967	0	0.00814
	(-0.24)	(1.43)	(.)	(0.02)	(-0.09)	(1.50)	(.)	(0.09)
playedNM	0.0510	0.255	0.463	0	0.0177	0.0949	0.186	0
	(0.36)	(1.78)	(1.55)	(.)	(0.36)	(1.89)	(1.56)	(.)
round	0.0179	0.0536^{*}	0.0563	0.0934^{**}	0.00379	0.0184^{*}	0.0216	0.0388^{*}
	(0.65)	(2.13)	(1.32)	(3.28)	(0.37)	(2.16)	(1.11)	(2.73)
constant	2.538^{***}	2.220^{***}	1.402^{***}	1.244^{***}	1.235^{***}	1.125^{***}	0.802^{***}	0.724^{***}
	(17.45)	(10.98)	(9.10)	(5.61)	(24.13)	(16.33)	(11.19)	(8.32)
observations	182	182	182	182	182	182	182	182
clusters	26	26	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Learning effects on number of efficiently matched pairs in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	$1.77e\text{-}17^{*}$	-0.433	0.0667	0	$-7.10e\text{-}17^{***}$	-0.208	0.0423
	(.)	(2.93)	(-1.16)	(0.17)	(.)	(-35.18)	(-1.35)	(0.27)
playedEM	-0.133	0	0.767	0.900^{*}	-0.0462	0	0.277	0.402
	(-1.11)	(.)	(1.17)	(2.31)	(-1.11)	(.)	(1.07)	(2.17)
playedNA	0.133	0.200	0	-0.0667	0.0462	0.0654	0	1.58e-16
	(1.11)	(1.93)	(.)	(-0.18)	(1.11)	(1.81)	(.)	(0.00)
playedNM	0.200	-2.22e-18	5.81e-17	0	0.0693	$4.62e\text{-}17^{***}$	0.0693	0
	(1.29)	(-0.25)	(0.00)	(.)	(1.29)	(15.19)	(0.31)	(.)
round	0.0800	-0.0200	0.0700	0.290	0.0277	-0.00811	0.0277	0.108
	(1.44)	(-0.41)	(0.71)	(1.99)	(1.44)	(-0.50)	(0.77)	(1.73)
constant	2.640^{***}	2.840^{***}	1.793^{**}	0.520	1.262^{***}	1.337^{***}	0.915^{***}	0.379^{*}
	(11.16)	(33.16)	(4.44)	(1.62)	(15.39)	(52.37)	(5.69)	(2.62)
observations	50	50	50	50	50	50	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(e) Learning effects on surplus in balanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	s	s	s	s	log(s)	log(s)	log(s)	log(s)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	-0.408	7.347	4.286	0	-0.00468	0.0412	0.0272
	(.)	(-0.09)	(1.25)	(1.53)	(.)	(-0.17)	(1.16)	(1.64)
playedEM	5.476	0	-1.667	-1.667	0.0357	0	-0.00792	-0.00985
	(1.27)	(.)	(-0.24)	(-0.26)	(1.27)	(.)	(-0.19)	(-0.20)
playedNA	-1.633	15.10	0	-3.946	-0.0131	0.0988	0	-0.0147
	(-0.37)	(1.96)	(.)	(-0.87)	(-0.47)	(2.02)	(.)	(-0.45)
playedNM	3.095	4.116	11.19	0	0.0198	0.0247	0.0674	0
	(0.56)	(0.67)	(1.68)	(.)	(0.55)	(0.63)	(1.68)	(.)
round	1.442	1.223	0.975	1.621	0.00913	0.00719	0.00602	0.0113
	(1.77)	(1.11)	(1.38)	(1.43)	(1.73)	(1.02)	(1.44)	(1.44)
constant	182.8^{***}	169.2^{***}	161.2^{***}	165.9^{***}	5.195^{***}	5.111^{***}	5.075^{***}	5.094^{***}
	(36.60)	(20.29)	(33.30)	(25.62)	(164.22)	(95.14)	(177.98)	(106.75)
observations	182	182	182	182	182	182	182	182
clusters	26	26	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(f) Learning effects on surplus in balanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	s	s	s	s	log(s)	log(s)	log(s)	log(s)
	EA6	EM6	NA6	NM6	EA6	EM6	NA6	NM6
playedEA	0	2.462	-2.093	10.16	0	0.0142	-0.0121	0.0551
	(.)	(1.31)	(-0.25)	(1.81)	(.)	(1.27)	(-0.26)	(1.57)
playedEM	3.930	0	8.248	5.804	0.0269	0	0.0455	0.00948
	(0.92)	(.)	(2.15)	(0.52)	(0.96)	(.)	(2.22)	(0.12)
playedNA	0.860	1.288	0	12.13	0.00470	0.00689	0	0.0800
	(1.27)	(1.54)	(.)	(1.93)	(1.26)	(1.53)	(.)	(1.84)
playedNM	0.969	0.258	1.116	0	0.00651	0.00138	0.00675	0
	(0.57)	(1.54)	(0.43)	(.)	(0.58)	(1.53)	(0.52)	(.)
round	1.884	0.833	1.209	1.429	0.0121	0.00518	0.00680	0.00366
	(1.00)	(0.62)	(0.66)	(0.55)	(0.97)	(0.66)	(0.65)	(0.19)
constant	191.4^{***}	195.6^{***}	182.9^{***}	169.9^{***}	5.247^{***}	5.277^{***}	5.209^{***}	5.135^{***}
	(24.53)	(44.14)	(51.77)	(44.30)	(101.91)	(201.34)	(262.99)	(216.29)
observations	50	50	50	50	50	50	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B10: Learning effects in imbalanced markets

(a) Learning effects on number of matched pairs in imbalanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	0.200*	0.0286	9.21e-17	0	0.0575*	0.00822	-4.60e-17
	(.)	(2.75)	(0.23)	(0.00)	(.)	(2.75)	(0.23)	(-0.00)
playedEM	0.114	0	1.15e-17	0.0857	0.0362	0	5.75e-18	0.0247
	(1.36)	(.)	(0.00)	(0.53)	(1.37)	(.)	(0.00)	(0.53)
playedNA	0.0571	-0.114	0	0.0571	0.0164	-0.0329	0	0.0164
	(1.75)	(-1.36)	(.)	(0.43)	(1.75)	(-1.36)	(.)	(0.43)
playedNM	-0.114	-0.143**	-0.0857	0	-0.0362	-0.0411**	-0.0247	0
	(-1.22)	(-3.80)	(-0.57)	(.)	(-1.24)	(-3.80)	(-0.57)	(.)
round	0.0321*	0.00714	0.0250	0.0696***	0.00967	0.00205	0.00719	0.0200***
	(2.10)	(0.57)	(1.25)	(4.16)	(2.09)	(0.57)	(1.25)	(4.16)
constant	2.814***	2.857***	2.700***	2.264***	1.331***	1.345***	1.300***	1.175***
	(27.98)	(40.87)	(18.74)	(19.24)	(45.10)	(66.88)	(31.36)	(34.69)
observations	140	140	140	140	140	140	140	140
clusters	20	20	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Learning effects on number of matched pairs in imbalanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	0	0	0.0667	0	0	0	0.0192
	(.)	(.)	(.)	(1.11)	(.)	(.)	(.)	(1.11)
playedEM	0.100	0	0	-1.09e-17	0.0288	0	0	-1.53e-19
	(1.29)	(.)	(.)	(-0.56)	(1.29)	(.)	(.)	(-0.02)
playedNA	-4.08e-17***	0	0	-0.0667	-1.46e-17	0	0	-0.0192
	(-8.87)	(.)	(.)	(-1.11)	(-0.08)	(.)	(.)	(-1.11)
playedNM	-0.100	0	0	0	-0.0288	0	0	0
	(-1.29)	(.)	(.)	(.)	(-1.29)	(.)	(.)	(.)
round	-0.0200	0	0	0.0100	-0.00575	0	0	0.00288
	(-0.96)	(.)	(.)	(0.96)	(-0.96)	(.)	(.)	(0.96)
constant	3.060***	3	3	2.970***	1.404***	1.386	1.386	1.378***
	(48.87)	(.)	(.)	(94.87)	(77.92)	(.)	(.)	(152.97)
observations	50	49	50	50	50	49	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Learning effects on number of efficiently matched pairs in imbalanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	0.314	0.0286	0.286*	0	0.107	0.0183	0.122*
	(.)	(1.87)	(0.11)	(2.26)	(.)	(1.88)	(0.19)	(2.37)
playedEM	0.314	0	-0.0286	0.229	0.0990	0	0.0149	0.0807
	(1.71)	(.)	(-0.10)	(0.89)	(1.49)	(.)	(0.14)	(0.77)
playedNA	0.286*	-0.0857	0	0.0571	0.112*	-0.0247	0	0.0164
	(2.60)	(-0.48)	(.)	(0.23)	(2.65)	(-0.39)	(.)	(0.17)
playedNM	-0.429	-0.657**	0.143	0	-0.148	-0.236**	0.0396	0
	(-1.82)	(-3.51)	(0.40)	(.)	(-1.85)	(-3.29)	(0.29)	(.)
round	0.0482	0.0161	0.100*	0.150**	0.0200	0.00257	0.0356*	0.0601**
	(1.40)	(0.45)	(2.73)	(3.47)	(1.49)	(0.20)	(2.49)	(3.16)
constant	2.464***	2.536***	1.743***	1.114***	1.191***	1.241***	0.939***	0.659***
	(10.25)	(11.74)	(8.53)	(6.22)	(14.00)	(16.12)	(11.38)	(7.67)
observations	140	140	140	140	140	140	140	140
clusters	20	20	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Learning effects on number of efficiently matched pairs in imbalanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	y	y	y	y	log(y+1)	log(y+1)	log(y+1)	log(y+1)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	0.133	0.200	0.267	0	0.0541	0.0924	0.0924
	(.)	(0.79)	(0.61)	(2.23)	(.)	(0.88)	(0.80)	(2.23)
playedEM	0.300	0	0.200	8.51e-17	0.139*	0	0.0811	-1.41e-17
	(1.72)	(.)	(1.29)	(0.00)	(3.11)	(.)	(1.29)	(-0.00)
playedNA	0.367	0.311	0	-0.0667	0.133*	0.105	0	-0.0231
	(2.08)	(1.95)	(.)	(-0.34)	(2.34)	(1.78)	(.)	(-0.34)
playedNM	-0.600*	0.0333	-0.400	0	-0.237*	0.00566	-0.146*	0
	(-2.31)	(0.34)	(-2.23)	(.)	(-3.02)	(0.15)	(-2.49)	(.)
round	0.0200	-0.0500	0.0800	0.0600	-1.49e-18	-0.0144	0.0347	0.0208
	(0.18)	(-0.62)	(0.90)	(1.10)	(-0.00)	(-0.54)	(0.95)	(1.10)
constant	2.540***	2.372***	2.160***	2.620***	1.248***	1.166***	1.059***	1.255***
	(6.11)	(9.56)	(5.30)	(13.76)	(8.01)	(14.09)	(6.26)	(19.01)
observations	50	49	50	50	50	49	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(e) Learning effects on surplus in imbalanced markets: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	s	s	s	s	log(s)	log(s)	log(s)	log(s)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	13.43	-1.429	4.857	0	0.0888	-0.00823	0.0390
	(.)	(1.77)	(-0.17)	(0.99)	(.)	(1.72)	(-0.16)	(1.14)
playedEM	9.429	0	-0.857	7.429	0.0697	0	-0.00342	0.0445
	(1.47)	(.)	(-0.10)	(0.75)	(1.60)	(.)	(-0.07)	(0.71)
playedNA	6.571*	-9.429	0	1.714	0.0370*	-0.0644	0	0.00233
	(2.64)	(-1.30)	(.)	(0.22)	(2.64)	(-1.29)	(.)	(0.05)
playedNM	-10.29	-17.43**	0.571	0	-0.0705	-0.100*	0.00347	0
	(-1.28)	(-2.92)	(0.06)	(.)	(-1.33)	(-2.84)	(0.06)	(.)
round	2.464*	0.161	1.964	3.893**	0.0167*	-0.000165	0.0113	0.0242**
	(2.29)	(0.16)	(2.01)	(3.64)	(2.25)	(-0.03)	(1.95)	(3.24)
constant	181.9***	188.8***	175.9***	151.6***	5.182***	5.234***	5.158***	5.006***
	(22.16)	(39.56)	(24.49)	(23.25)	(97.90)	(172.95)	(117.09)	(111.87)
observations	140	140	140	140	140	140	140	140
clusters	20	20	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(f) Learning effects on surplus in imbalanced markets: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	s	s	s	s	log(s)	log(s)	log(s)	log(s)
	EA7	EM7	NA7	NM7	EA7	EM7	NA7	NM7
playedEA	0	-3.333	4.667	5.333	0	-0.0189	0.0287	0.0321
	(.)	(-1.09)	(0.93)	(1.36)	(.)	(-1.10)	(0.97)	(1.32)
playedEM	4.000	0	-2.000	-1.38e-15	0.0223	0	-0.0108	-2.84e-19
	(1.63)	(.)	(-1.29)	(-0.00)	(1.57)	(.)	(-1.29)	(-0.00)
playedNA	0.333	3.556	0	-4.333	0.00143	0.0192	0	-0.0270
	(0.10)	(1.20)	(.)	(-1.08)	(0.08)	(1.13)	(.)	(-1.09)
playedNM	-7.000*	3.667	3.45e-15	0	-0.0380*	0.0202	0.000370	0
	(-2.74)	(1.05)	(0.00)	(.)	(-2.60)	(1.02)	(0.04)	(.)
round	-0.400	-2	1.500	0.900	-0.00241	-0.0112	0.00913	0.00533
	(-0.38)	(-1.10)	(0.99)	(1.19)	(-0.42)	(-1.11)	(0.99)	(1.17)
constant	199.2***	197.1***	186.8***	196.3***	5.295***	5.284***	5.221***	5.277***
	(58.43)	(37.27)	(21.67)	(84.88)	(287.43)	(180.30)	(99.21)	(378.25)
observations	50	49	50	50	50	49	50	50
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.5 Determinants of aggregate outcomes: First rounds

We repeat the regression analysis for the determinants of aggregate outcomes with only the first rounds, with results for balanced markets in Table B11 and imbalanced markets in Table B12. These results are consistent with those of all rounds in Tables 4 and 5.

Table B11: Determinants of aggregate outcomes in balanced markets round 1

(a) Determinants of outcomes in balanced markets round 1: wave 1

	(1)	(2)	(3)	(4)	(5)	(6)
	log (# matched pairs+1)	log (# efficiently matched pairs+1)	log surplus	whether full matching	whether efficient matching	whether stable outcome
ESIC	0.148***	0.532***	0.128*	0.399***	0.527***	0
	(4.27)	(4.61)	(2.71)	(4.26)	(6.47)	(.)
assortative	0.0817	0.262*	0.0620	0.193	0.265*	0.115
	(1.82)	(2.28)	(1.05)	(1.80)	(2.35)	(0.87)
ESIC*assortative	-0.0596	-0.182	-0.0184	-0.101	-0.162	0
	(-1.18)	(-1.15)	(-0.28)	(-0.61)	(-1.27)	(.)
order	-0.00161	0.0416	0.0109	-0.00948	0.0402	0.112*
	(-0.12)	(1.65)	(0.62)	(-0.24)	(1.23)	(2.00)
constant	1.176***	0.542***	5.029***			
	(19.88)	(5.57)	(61.16)			
observations	104	104	104	104	104	52
clusters	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of outcomes in balanced markets round 1: wave 2

	(1)	(2)	(3)	(4)	(5)	(6)
	log (# matched pairs+1)	log (# efficiently matched pairs+1)	log surplus	whether full matching	whether efficient matching	whether stable outcome
ESIC	0.126	0.714**	0.133*	0.325*	0.664***	1.489***
	(2.23)	(4.75)	(2.79)	(2.43)	(6.33)	(9.56)
assortative	0.115**	0.306	0.0857*	0.316**	0.239	1.180***
	(4.01)	(1.67)	(2.92)	(2.95)	(1.46)	(6.02)
ESIC*assortative	-0.178	-0.459	-0.138	-0.362*	-0.417	-1.207***
	(-1.98)	(-1.77)	(-1.53)	(-1.99)	(-1.60)	(-4.30)
order	0.0549	0.107*	0.0585*	0.155**	0.140***	0.0940
	(2.05)	(2.53)	(2.74)	(2.90)	(3.36)	(1.65)
constant	1.105***	0.398	4.995***			
	(12.38)	(1.99)	(72.08)			
observations	40	40	40	40	40	40
clusters	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B12: Determinants of aggregate outcomes in balanced and imbalanced markets round 1

(a) Determinants of outcomes in all markets round 1: wave 1

	(1) log (# matched pairs+1)	(2) log (# efficiently matched pairs+1)	(3) log surplus	(4) whether full matching	(5) whether efficient matching	(6) whether stable outcome
ESIC	0.148***	0.532***	0.128**	0.406***	0.610***	0
	(4.30)	(4.65)	(2.74)	(3.95)	(5.26)	(.)
assortative	0.0360	0.0448	0.0425	0.121	0.0213	0.115
	(1.72)	(0.54)	(1.04)	(1.78)	(0.26)	(0.87)
balanced	-0.121	-0.440**	-0.128	-0.302	-0.517**	0
	(-1.85)	(-3.18)	(-1.46)	(-1.73)	(-2.70)	(.)
ESIC*assortative	-0.0596	-0.182	-0.0184	-0.103	-0.188	0
	(-1.19)	(-1.16)	(-0.28)	(-0.61)	(-1.27)	(.)
assortative*balanced	0.0458	0.217	0.0195	0.0749	0.286	0
	(0.93)	(1.54)	(0.27)	(0.58)	(1.77)	(.)
order	-0.00432	0.0211	-0.00591	-0.0137	0.0128	0.112*
	(-0.41)	(0.72)	(-0.43)	(-0.40)	(0.36)	(2.00)
order*balanced	0.00271	0.0205	0.0168	0.00410	0.0338	0
	(0.16)	(0.53)	(0.76)	(0.08)	(0.65)	(.)
constant	1.296***	0.981***	5.157***			
	(45.60)	(9.90)	(160.14)			
observations	184	184	184	184	184	52
clusters	46	46	46	46	46	26

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of outcomes in all markets round 1: wave 2

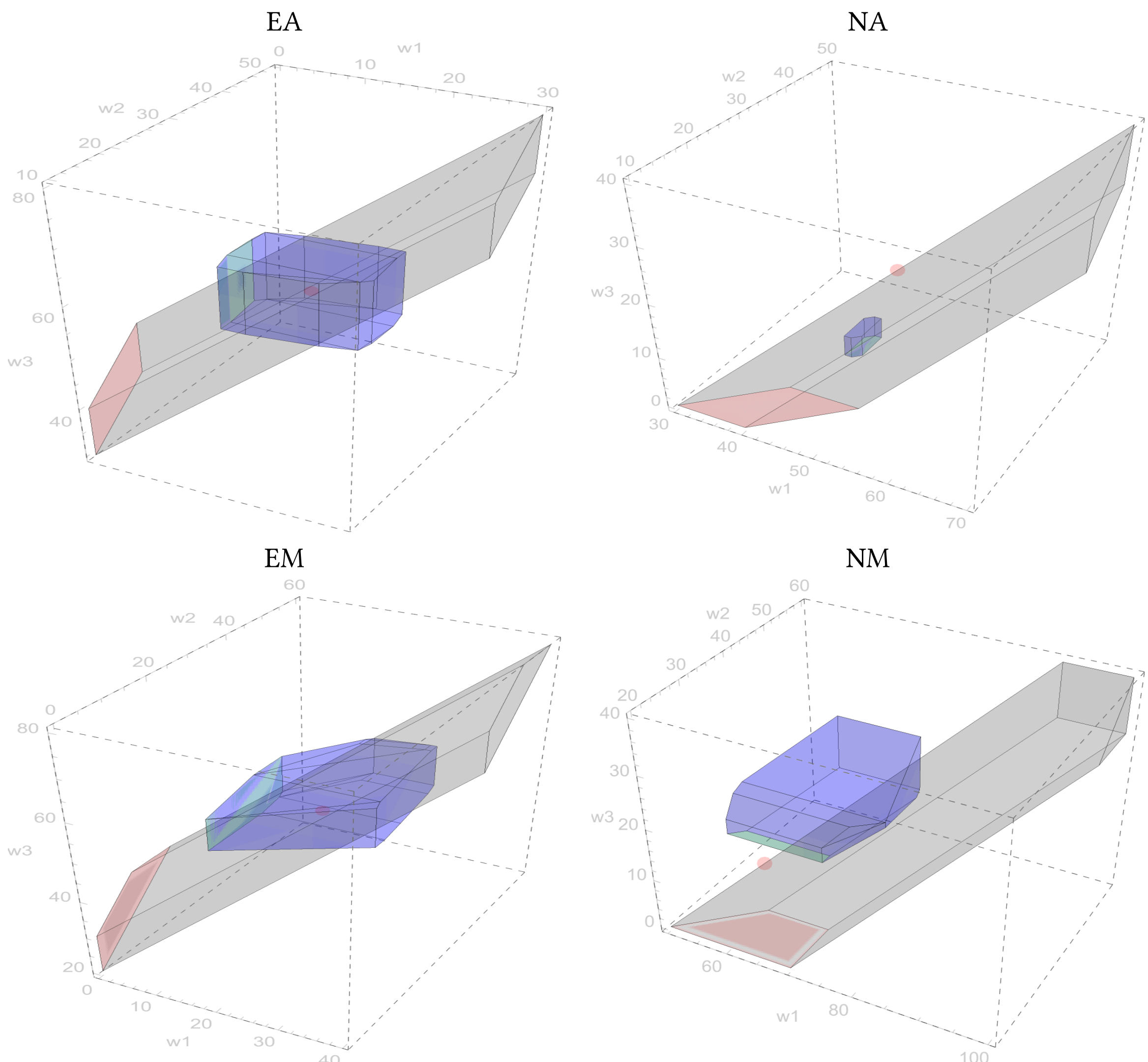
	(1) log (# matched pairs)	(2) log (# efficiently matched pairs+1)	(3) log surplus	(4) whether full matching	(5) whether efficient matching	(6) whether stable outcome
ESIC	0.126*	0.714***	0.133**	0.325*	0.839***	0.918***
	(2.30)	(4.91)	(2.89)	(2.43)	(5.08)	(6.08)
assortative	-5.28e-17	-0.208	-0.0231	0.316**	-0.210*	-0.598***
	(.)	(-1.96)	(-0.85)	(2.95)	(-2.21)	(-3.43)
balanced	-0.281**	-0.899**	-0.283***	0	-1.225***	-0.694***
	(-3.26)	(-3.81)	(-3.94)	(.)	(-6.16)	(-3.89)
ESIC*assortative	-0.178	-0.459	-0.138	-0.362*	-0.526	-0.747***
	(-2.05)	(-1.83)	(-1.58)	(-1.99)	(-1.67)	(-3.91)
assortative*balanced	0.115***	0.514*	0.109*	0	0.512*	1.329***
	(4.15)	(2.49)	(2.77)	(.)	(2.30)	(4.39)
order	-5.58e-17***	0.00216	0.000578	0.155**	-0.0500	0.0302
	(-5.69)	(0.04)	(0.05)	(2.90)	(-1.07)	(1.36)
order*balanced	0.0549*	0.104	0.0579*	0	0.227***	0.0268
	(2.12)	(1.59)	(2.41)	(.)	(3.37)	(0.66)
constant	1.386***	1.297***	5.278***			
	(3.53e+16)	(9.60)	(202.53)			
observations	80	80	80	40	80	80
clusters	20	20	20	10	20	20

t statistics in parentheses; standard errors clustered at group level
reported coefficients in columns (4)–(6) are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.6 Individual payoffs

Figure B1 shows the regions of core payoffs in balanced and imbalanced markets. Figure B2 shows the histograms of payoffs for all matched subjects in efficient matching. Figure B3 shows the histograms of payoffs of all matched subjects—rather than matched subjects in efficient matching only, as in the main text—in balanced and imbalanced markets. Figure B4 shows the average payoffs of men and women in balanced versus imbalanced markets, by time. Figure B5 shows the percentage of surplus achieved by time for balanced and imbalanced markets.

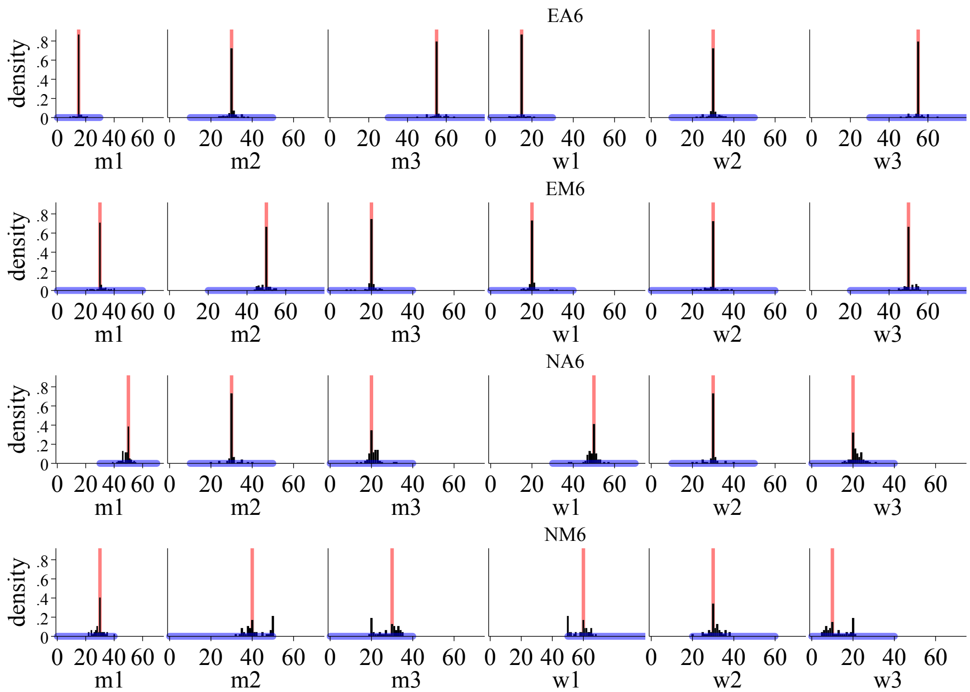
Figure B1: Core, fair core, and noncooperative payoffs



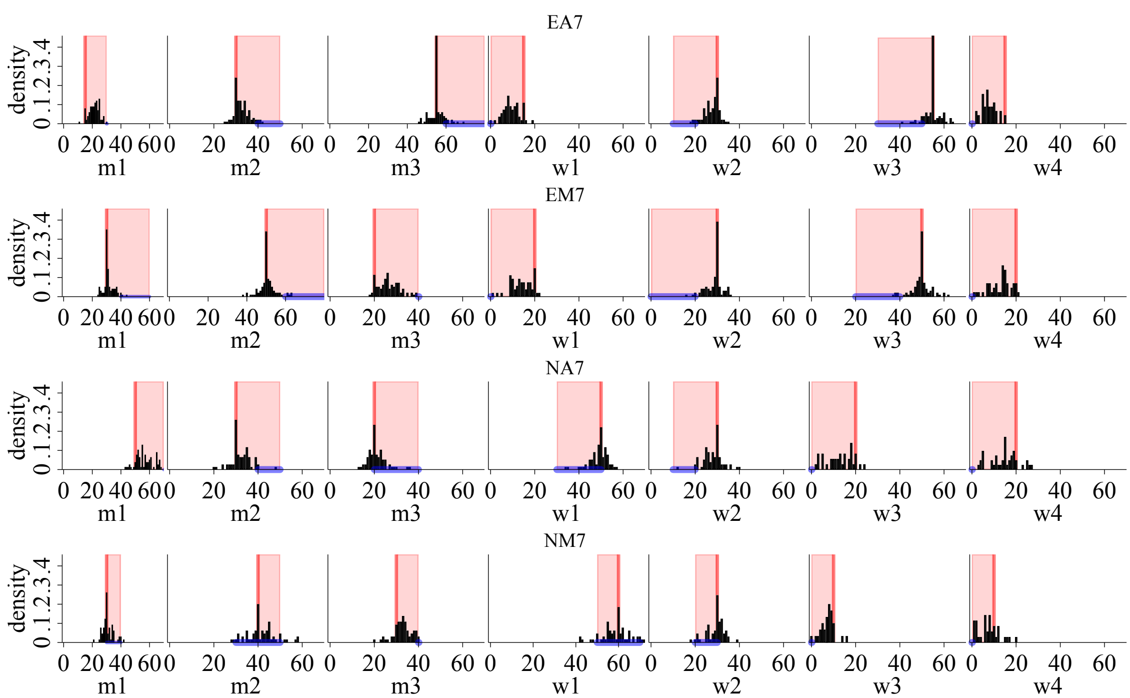
Note. In each illustration, the gray area illustrates the polyhedron of women's core payoffs in the balanced market; the blue area illustrates the polyhedron of women's fair core payoffs in the balanced market when $\alpha = 0.290$ and $\beta = 0.426$ (Nunnari and Pozzi, 2022); and the red dot represents the noncooperative payoffs. The red shaded area represents the reduced dimension of women's core payoffs in the imbalanced market and the green shaded area represents the reduced dimension of women's fair core payoffs in the imbalanced market. The sets of men's core and fair core payoffs are isomorphic to those of women's core and fair core payoffs, respectively.

Figure B2: Histogram of payoffs of matched subjects in efficient matching

(a) Histogram of payoffs of matched subjects in efficient matching in balanced markets: wave 1

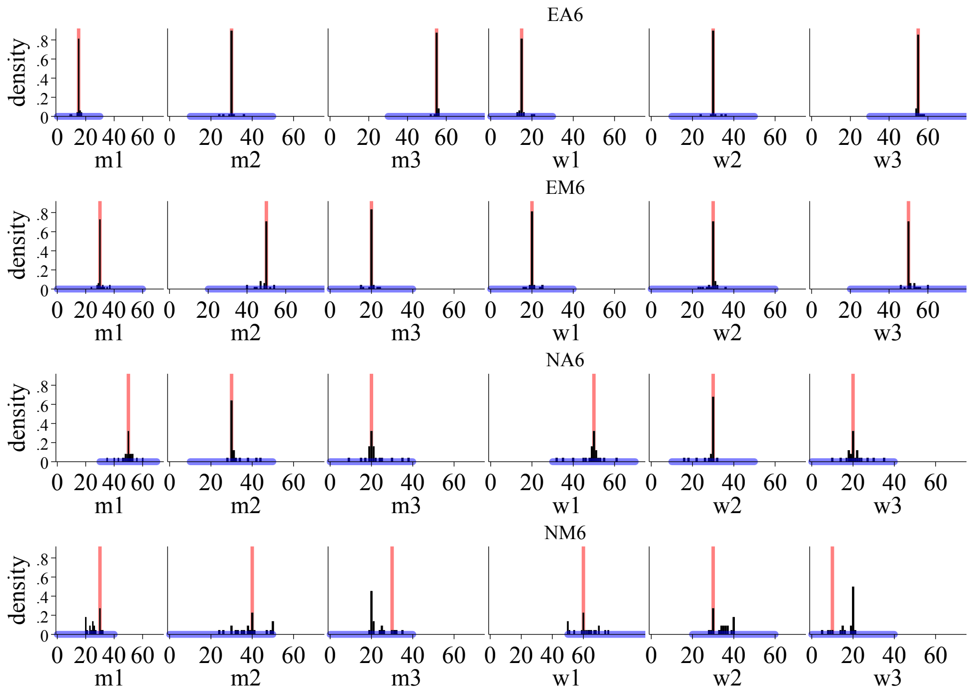


(b) Histogram of payoffs of matched subjects in efficient matching in imbalanced markets: wave 1

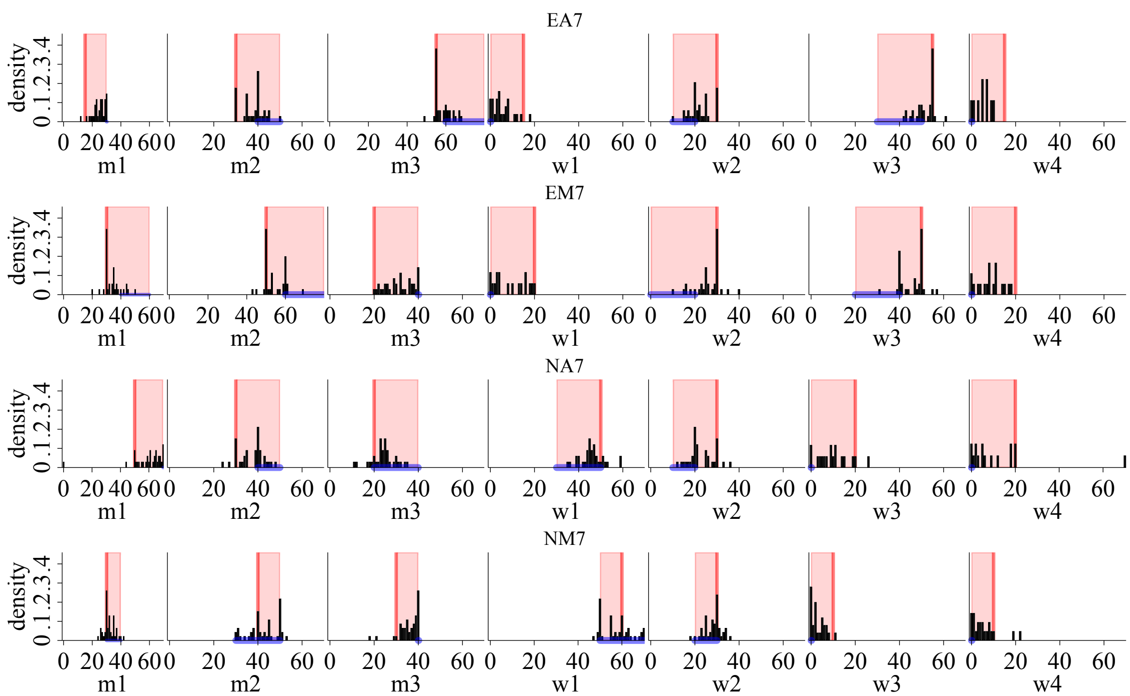


Note. Blue horizontal lines represent the range of core payoffs in the cooperative model. Red shaded areas represent the range of equilibrium payoffs in the noncooperative model, and red vertical lines represent the noncompetitive limit payoffs in the noncooperative model. The histogram is in black.

(c) Histogram of payoffs of matched subjects in efficient matching in balanced markets: wave 2



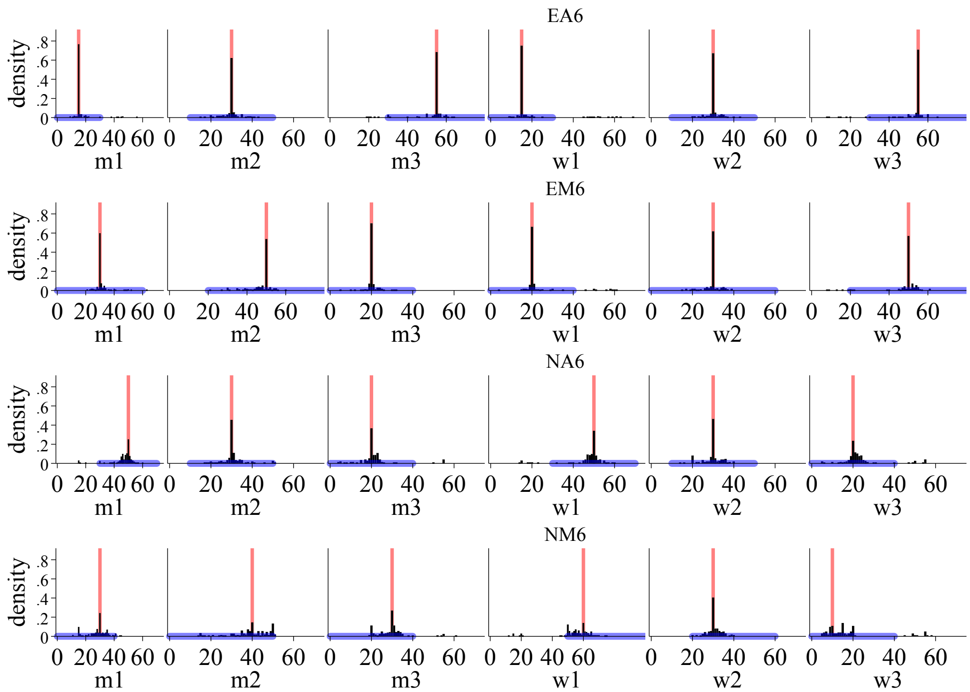
(d) Histogram of payoffs of matched subjects in efficient matching in imbalanced markets: wave 2



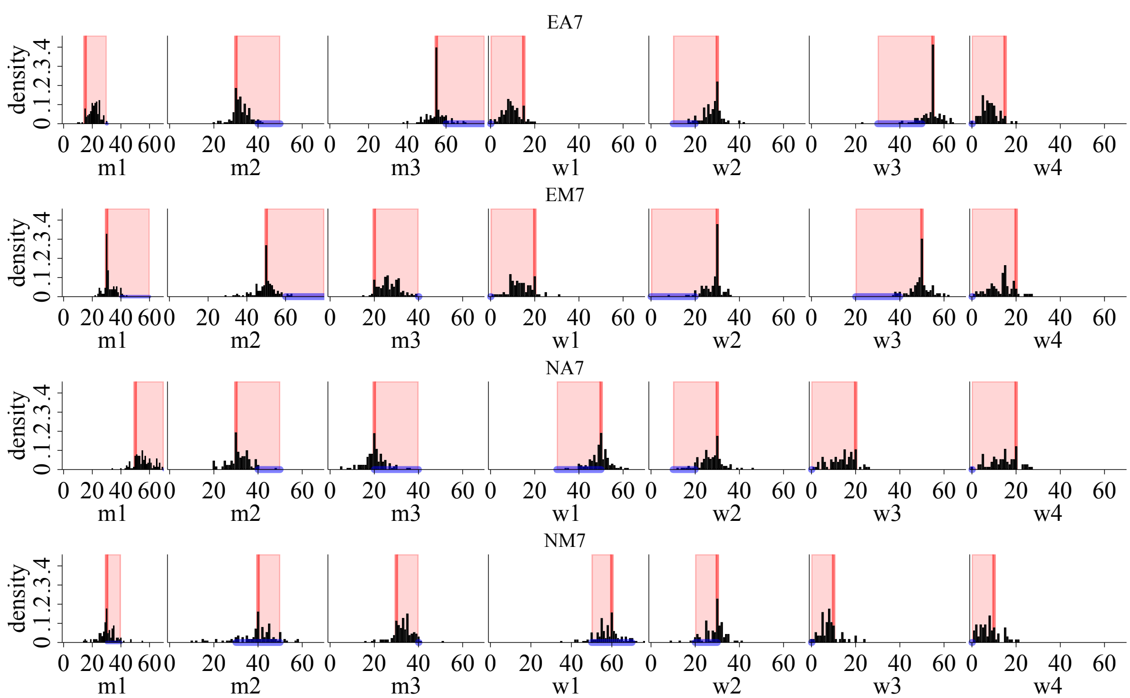
Note. Blue horizontal lines represent the range of core payoffs in the cooperative model. Red shaded areas represent the range of equilibrium payoffs in the noncooperative model, and red vertical lines represent the noncompetitive limit payoffs in the noncooperative model. The histogram is in black.

Figure B3: Histogram of payoffs of matched subjects

(a) Histogram of payoffs of matched subjects in balanced markets: wave 1

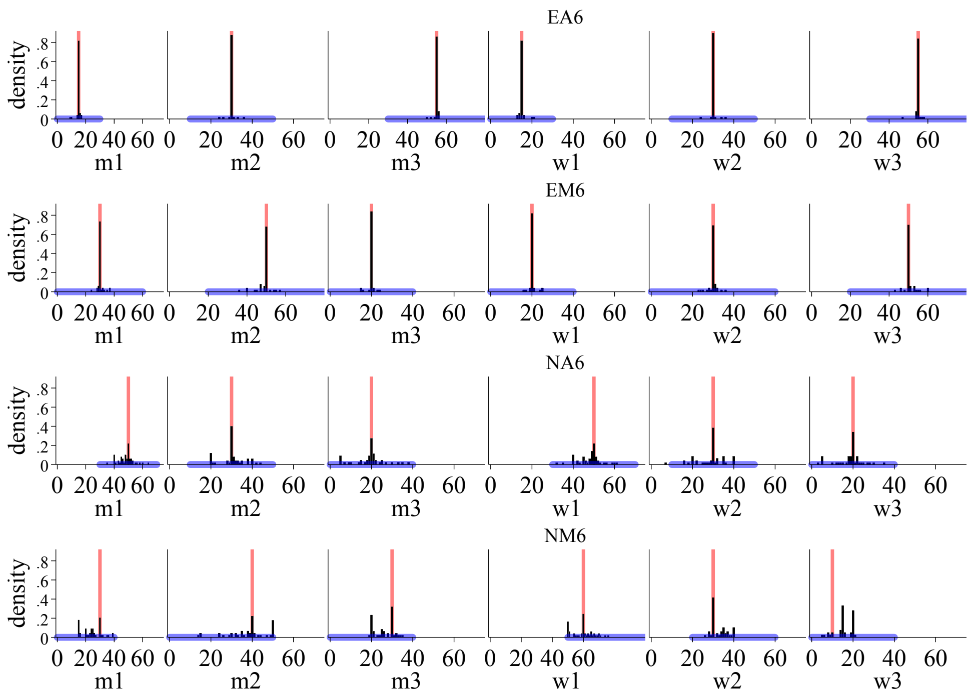


(b) Histogram of payoffs of matched subjects in imbalanced markets: wave 1

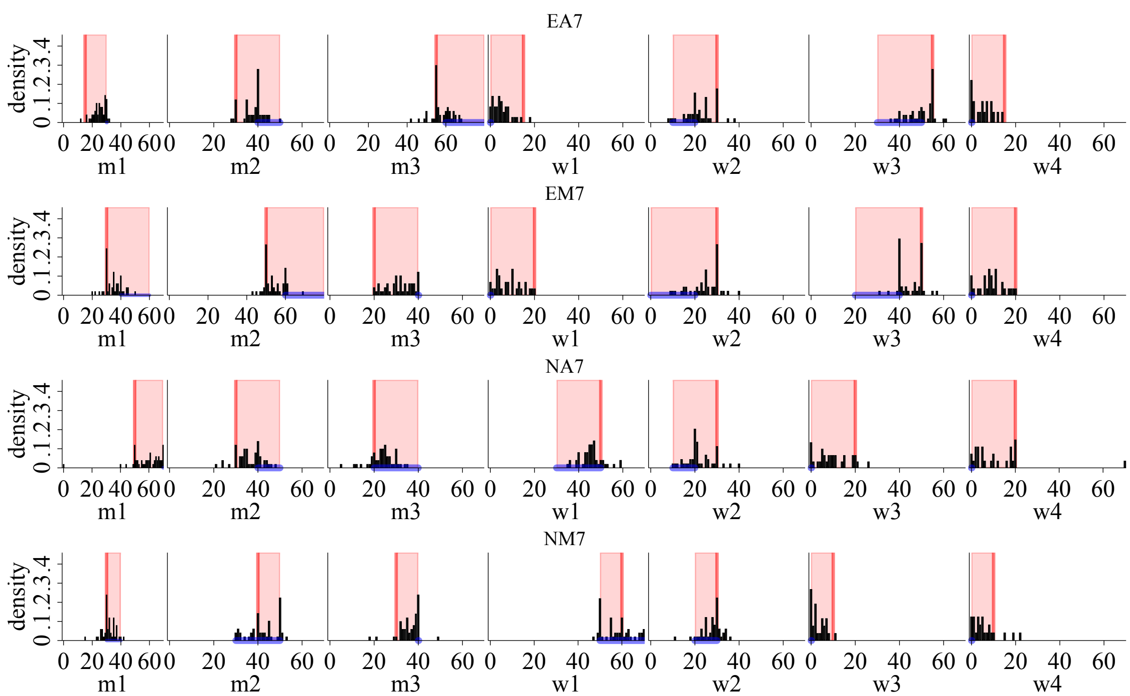


Note. Blue horizontal lines represent the range of core payoffs in the cooperative model. Red shaded areas represent the range of equilibrium payoffs in the noncooperative model, and red vertical lines represent the noncompetitive limit payoffs in the noncooperative model. The histogram is in black.

(c) Histogram of payoffs of matched subjects in balanced markets: wave 2

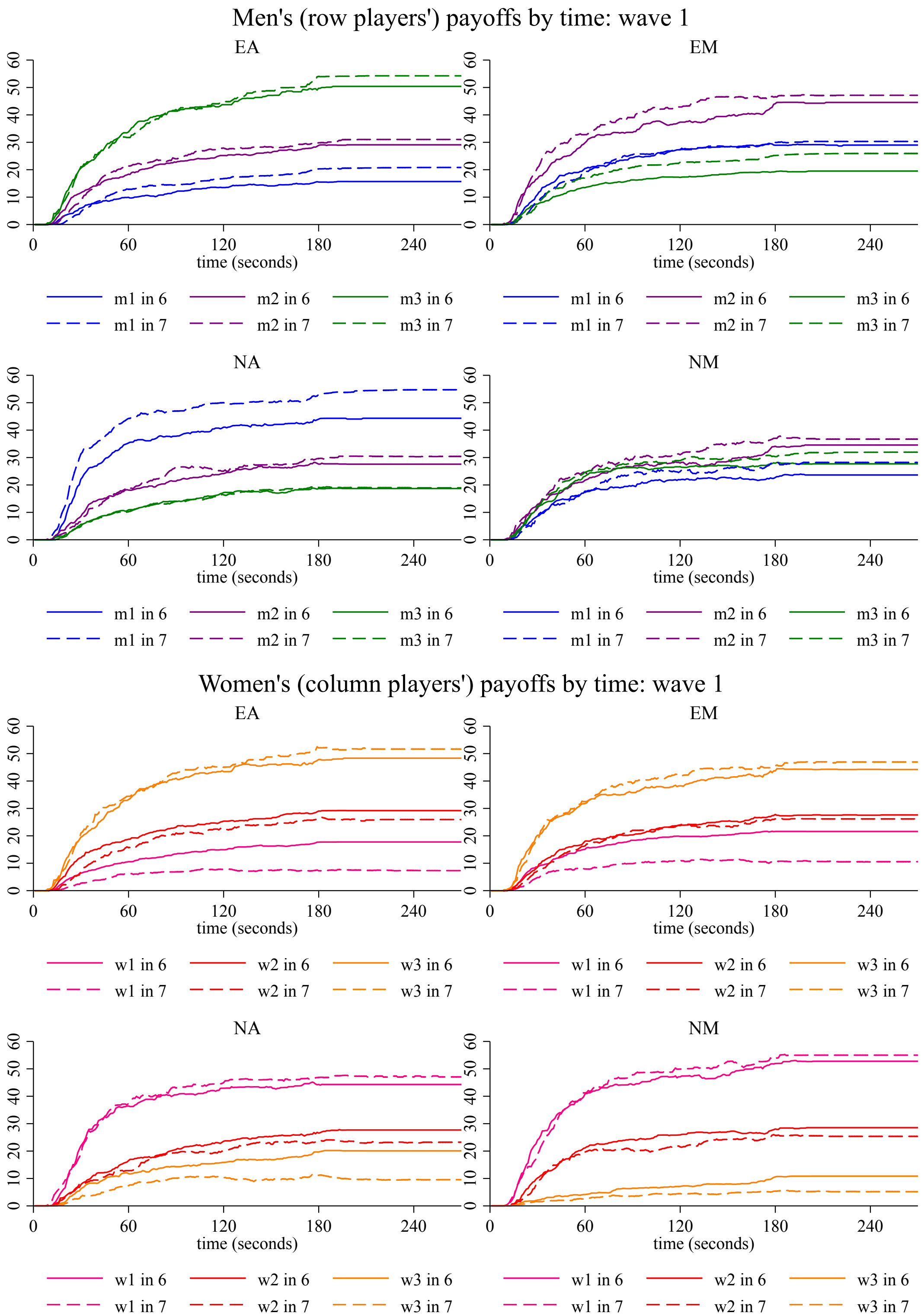


(d) Histogram of payoffs of matched subjects in imbalanced markets: wave 2

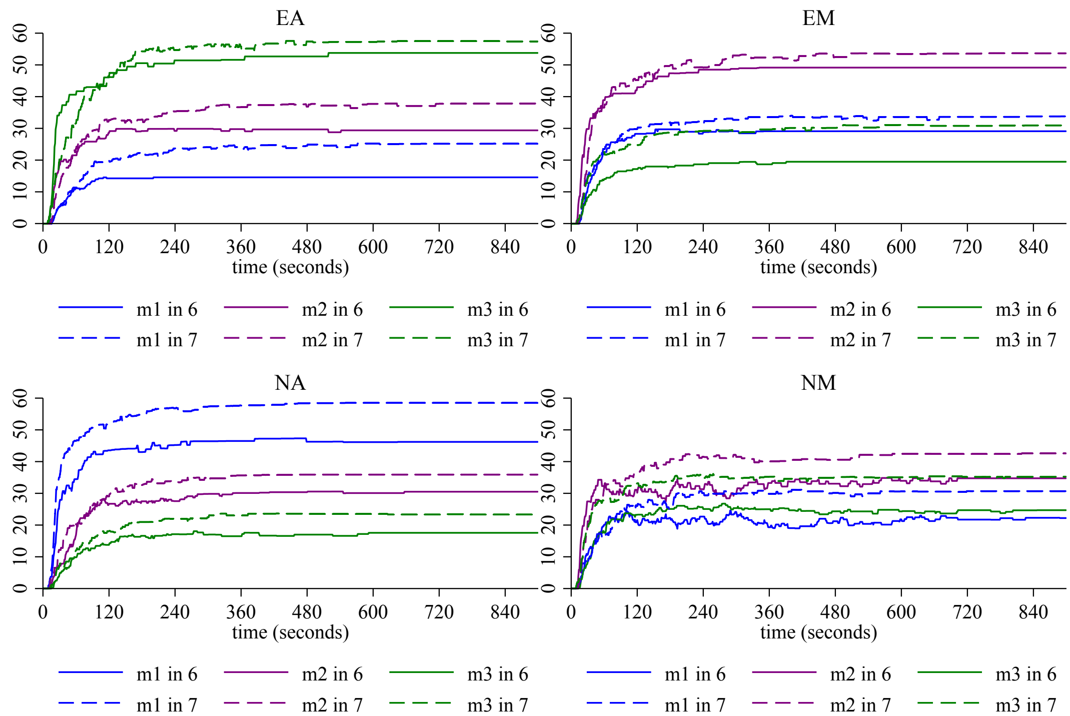


Note. Blue horizontal lines represent the range of core payoffs in the cooperative model. Red shaded areas represent the range of equilibrium payoffs in the noncooperative model, and red vertical lines represent the noncompetitive limit payoffs in the noncooperative model. The histogram is in black.

Figure B4: Men’s and women’s payoffs in balanced versus imbalanced markets



Men's (row players') payoffs by time: wave 2



Women's (column players') payoffs by time: wave 2

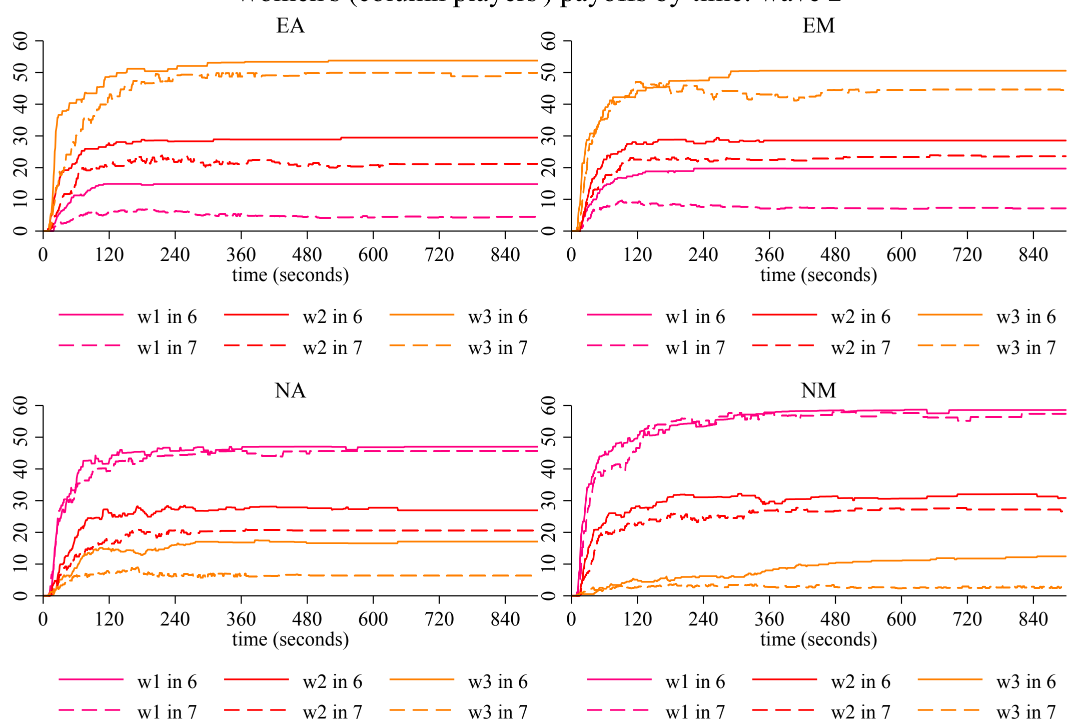
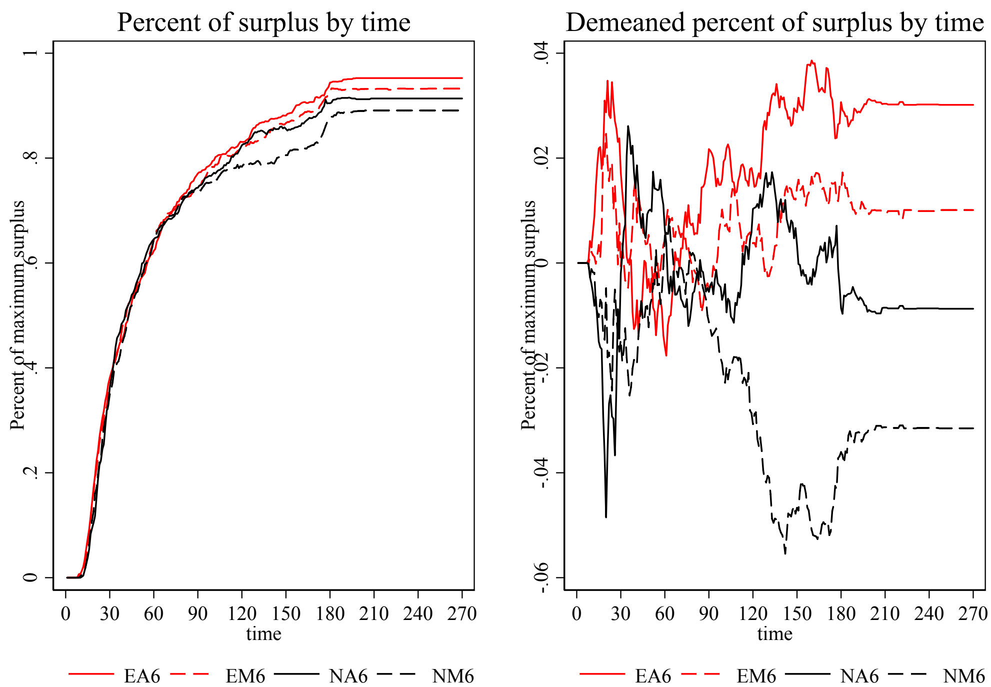
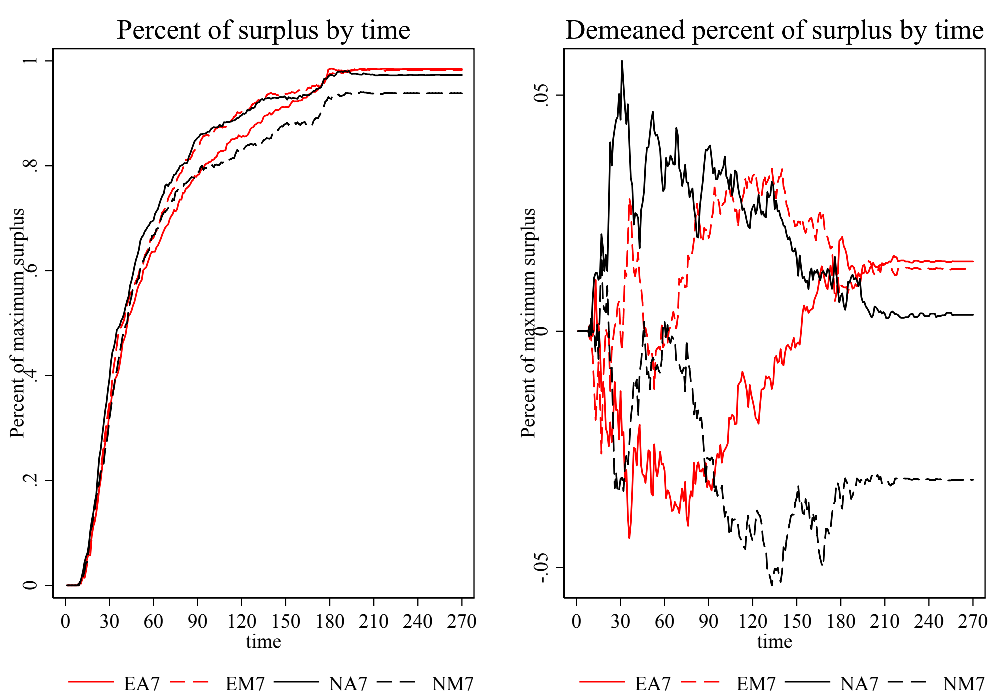


Figure B5: Percent of surplus achieved by time

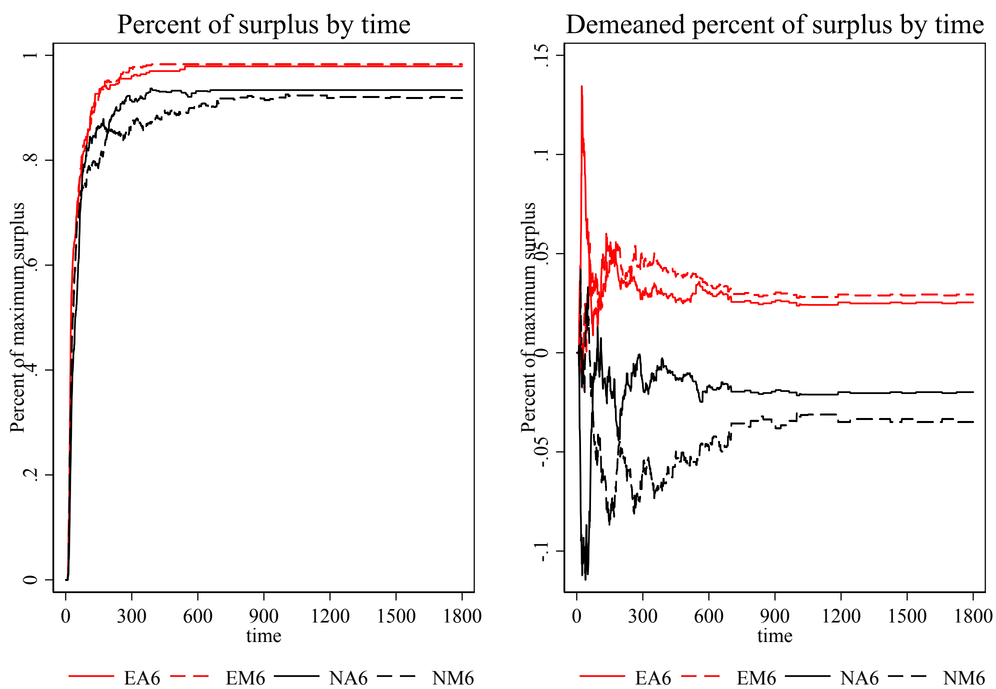
(a) Percent of surplus achieved by time in balanced markets: wave 1



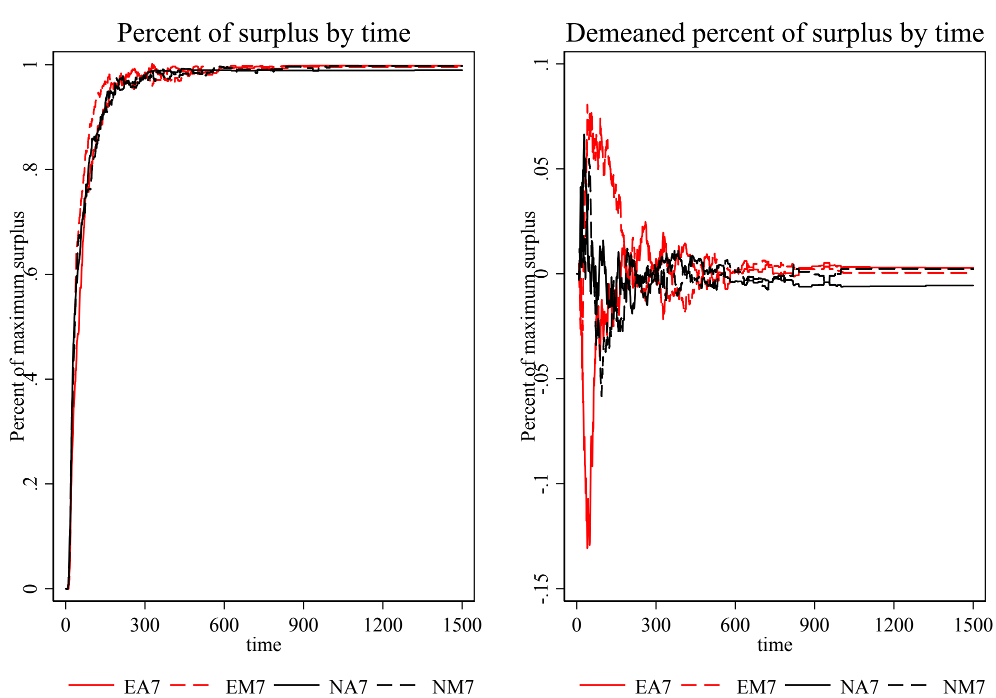
(b) Percent of surplus achieved by time in imbalanced markets: wave 1



(c) Percent of surplus achieved by time in balanced markets: wave 2



(d) Percent of surplus achieved by time in imbalanced markets: wave 2



C Omitted proofs

For Theorem 1, it suffices to show the following Lemmas 1, 2, and 3.

Lemma 1. *(1) There is at most one solution to the system of equations given a matching μ and a discount factor $\delta < 1$. (2) If there exists a solution given μ and δ, then there exists a solution given μ and any $\delta' < \delta$.*

Proof of Lemma 1. Fix a matching μ. Consider the system of equations for the cases in which men are the proposers at time zero:

$$U_m^p = s_{m\mu(m)} - \max\left\{\delta \cdot V_{\mu(m)}^r, \max_{m' \in M \setminus m}\left\{s_{m'\mu(m)} - U_{m'}^p\right\}\right\},$$

where

$$V_{\mu(m)}^r = s_{m\mu(m)} - \max\left\{\delta \cdot U_m^p, \max_{w' \in W \setminus \mu(m)}\left\{s_{mw'} - \left[s_{\mu(w')w'} - U_{\mu(w')}^p\right]\right\}\right\};$$

For notational convenience, we follow the notations from max algebra to define $a \oplus b \equiv \max\{a, b\}$ and $\sum_{i\in\{1,\cdots,I\}}^{\oplus} a_i \equiv a_1 \oplus \cdots \oplus a_I$. Consider the following system of $n_M + n_W$ equations with $n_M + n_W$ unknowns $U_{m_1}^p, \cdots, U_{m_M}^p, V_{w_1}^r, \cdots, V_{w_W}^r$.

$$\begin{cases} U_{m_1}^p = s_{m_1\mu(m_1)} - \delta V_{\mu(m_1)}^r \oplus \sum_{m' \neq m_1}^{\oplus}\left[s_{m'\mu(m_1)} - U_{m'}^p\right], \\ \ddots \\ U_{m_{n_M}}^p = s_{m_{n_M}\mu(m_{n_M})} - \delta V_{\mu(m_{n_M})}^r \oplus \sum_{m' \neq m_{n_M}}^{\oplus}\left[s_{m'\mu(m_{n_M})} - U_{m'}^p\right], \\ V_{w_1}^r = s_{\mu(w_1)w_1} - \delta U_{\mu(w_1)}^p \oplus \sum_{w' \neq w_1}^{\oplus}\left[s_{\mu(w_1)w'} - \left[s_{\mu(w')w} - U_{\mu(w')}^p\right]\right], \\ \ddots \\ V_{w_{n_W}}^r = s_{\mu(w_{n_W})w_{n_W}} - \delta U_{\mu(w_{n_W})}^p \oplus \sum_{w' \neq w_{n_W}}^{\oplus}\left[s_{\mu(w_{n_W})w'} - \left[s_{\mu(w')w} - U_{\mu(w')}^p\right]\right]. \end{cases}$$

Consider and rearrange the equation for U_m^p, for any $m \in M$:

$$U_m^p + \delta V_{\mu(m)}^r \oplus \sum_{m' \neq m}^{\oplus}\left[s_{m'\mu(m)} - U_{m'}^p\right] = s_{m\mu(m)}.$$

Then, by using the slack variable methods, we can rewrite this nonlinear equation as a set of n_M linear equations and one nonlinear condition with n_M additional unknowns $x_{mm_1}, \cdots, x_{mm_{n_M}}$:

$$\begin{gathered} U_m^p + \delta V_{\mu(m)}^r + x_{mm} = s_{m\mu(m)}, \\ U_m^p + \left[s_{m'\mu(m)} - U_{m'}^p\right] + x_{mm'} = s_{m\mu(m)} \quad \text{for any } m' \neq m, \\ x_{mm} \cdot \textstyle\prod_{m' \neq m} x_{mm'} = 0. \end{gathered}$$

We can rearrange the equation for V_w^r and apply the slack variable method to it for any $w \in W$ in a similar fashion, Then we can rewrite the entire problem as a linear programming problem with $n_M^2 + n_W^2 + n_M + n_W$ variables

$$\min \quad \sum_{m' \in M}\sum_{m \in M} x_{mm'} + \sum_{w' \in W}\sum_{w \in W} x_{ww'},$$

subject to the following $n_M^2 + n_W^2$ main constraints:

$$U_m^p + \left[s_{m'\mu(m)} - U_{m'}^p\right] + x_{mm'} - s_{m\mu(m)} \geqslant 0, \qquad \forall m' \in M \backslash m, \forall m \in M,$$
$$U_m^p + \delta V_{\mu(m)}^r + x_{mm} - s_{m\mu(m)} \geqslant 0, \qquad \forall m \in M,$$
$$V_w^r + \left[s_{\mu(w)w'} - \left[s_{\mu(w')w} - U_{\mu(w')}^p\right]\right] + x_{ww'} - s_{\mu(w)w} \geqslant 0, \qquad \forall w' \in W \backslash w, \forall w \in W,$$
$$V_w^r + \delta U_{\mu(m)}^p + x_{ww} - s_{\mu(w)w} \geqslant 0, \qquad \forall w \in W;$$

and $n_M^2 + n_W^2 + n_M + n_W$ nonnegative constraints:

$$U_m^p \geqslant 0 \quad \forall m \in M, \qquad V_w^r \geqslant 0 \quad \forall w \in W,$$
$$x_{mm'} \geqslant 0 \quad \forall m, m' \in M, \qquad x_{ww'} \geqslant 0 \quad \forall w, w' \in W.$$

First, we argue that there is at most one solution to the minimization problem. Note that the constraints are noncolinear, because each of the main constraints contains a different $x_{mm'}$, x_{mm}, $x_{ww'}$ or x_{ww}. If the constraints are satisfied, then there exists a solution. If there exists a solution, there is a unique solution, because of the following argument. All the main constraints will be binding and not all $x_{mm'}$'s and $x_{ww'}$'s will be zero, so the optimal value—if it exists—is not zero. By Dantzig's sufficient uniqueness condition that for a linear program in canonical form the optimal value is positive, the solution is unique.

The proof for the system of equations when women are the proposers in period zero is identical. This establishes part (1) of the lemma.

Second, let C^δ be the constrained set for the minimization problem when the discount factor is δ. Then for $\delta' < \delta$, $C^{\delta'}$ is a closed subset of C^δ because the parts containing δ in the main constraints are nonnegative, which makes the constraints tightened as δ decreases. Since the objective function of the minimization problem is linear, we have that when there is a solution with δ, there will be a solution with $\delta' < \delta$.[20] This establishes part (2) of the lemma. □

Lemma 1 shows that fixing a matching μ and a discount factor δ, if a solution exists, it is unique and for any discount factor smaller than δ, there exists a unique solution given μ. Lemma 1 leads to the main result on surplus division:

Lemma 2. *For any $\delta \in (0, 1)$, there exists a solution to the system of equations with μ^*.*

Since we already know that there exists a solution with efficient matching when $\delta = 1$, by Lemma 1 part (2), we must have a solution with efficient matching for any $\delta < 1$. This directly gives us Lemma 2.

Lemma 3. *Any inefficient matching μ cannot be supported by the system of equations.*

[20] When the objective function is linear, then every indifference surface is a hyperplane with the normal vector being the gradient of the objective function. Now we use this gradient vector as an axis going through the origin. That is, moving in one direction on the axis is going in the same direction as the gradient, and the other going in the opposite direction. Then every point in the entire space lies on some indifference surface of the objective function and all points on the same indifference surface can be projected to a single point where this surface intersects the gradient axis. Hence, if a minimum occurs in the set C^δ, then it is necessarily the case that a lower bound is realized on the projection of C^δ on the gradient axis (with the lower bound being oriented according to the direction of lower objective values). Since $C^{\delta'}$ is a closed subset of C^δ, its projection on the gradient axis is a closed subset of the projection of C^δ on the gradient axis, which continues to have a lower bound. This immediately implies that a minimum continues to exist when restricted to $C^{\delta'}$. We thank Van Kolpin for the suggestion.

Proof of Lemma 3. Suppose μ is an inefficient matching: The total surplus s^{μ} from this inefficient matching is less than the total surplus s^{μ^*} from the unique efficient matching μ^*. Suppose there is a solution to the system of equations for μ. Then since for any man $m \in M$,

$$U_m^p = s_{m\mu(m)} - \max\left\{\delta V_{\mu(m)}^r, \max_{m' \in M \backslash m}\{s_{m'\mu(m)} - U_{m'}^p\}\right\},$$

we must have that and for any $m' \in M \backslash m$,

$$U_m^p \leq s_{m\mu(m)} - (s_{m'\mu(m)} - U_{m'}^p).$$

In particular, the inequality holds for the man $\mu^*(\mu(m))$ that woman $\mu(m)$ would have matched with in the efficient matching μ^*:

$$U_m^p \leq s_{m\mu(m)} - \left(s_{\mu^*(\mu(m))\mu(m)} - U_{\mu^*(\mu(m))}^p\right). \tag{Um}$$

By the same logic, we have the following for each woman in W:

$$V_w^p \leq s_{\mu(w)w} - \left(s_{\mu(w)\mu^*(\mu(w))} - V_{\mu^*(\mu(w))}^p\right). \tag{Vw}$$

Sum all (Um) and (Vw) for all $m \in M$ and $w \in W$, we get

$$\begin{aligned}\sum_{m\in M} U_m^p + \sum_{w\in W} U_w^p \leq \sum_{m\in M} s_{m\mu(m)} - \sum_{m\in M}\left[s_{\mu^*(\mu(m))\mu(m)} - U_{\mu^*(\mu(m))}^p\right] \\ + \sum_{w\in W} s_{\mu(w)w} - \sum_{w\in W}\left[s_{\mu(w)\mu^*(\mu(w))} - V_{\mu^*(\mu(w))}^p\right],\end{aligned}$$

which can be simplified as follows:

$$2s^{\mu^*} \leq 2s^{\mu}.$$

This is impossible. We conclude that μ cannot be supported by the system of equations. □

Next, we consider what the unique solution to the system of equations looks like when equal split is or is not in the core. We present the following results:

Proof of Proposition 3. Since equal split is the core, for any $m' \in M$, we must have

$$s_{m'\mu^*(m)} - \frac{1}{2}s_{m'\mu^*(m')} \leq \frac{1}{2}s_{m\mu^*(m)}.$$

This implies that

$$\begin{aligned} s_{m'\mu^*(m)} - U_{m'}^p &= s_{m'\mu^*(m)} - \frac{1}{1+\delta}s_{m'\mu^*(m')} < s_{m'\mu^*(m)} - \frac{1}{2}s_{m'\mu^*(m')} \\ &\leq \frac{1}{2}s_{m\mu^*(m)} < \frac{1}{1+\delta}s_{m\mu^*(m)} = V_{\mu^*(m)}^r. \end{aligned}$$

Hence, there exists a uniform lower bound $\underline{\delta} \in (0, 1)$ such that for any $\delta \in (\underline{\delta}, 1)$, $s_{m'\mu^*(m)} - U_{m'}^p < \delta V_{\mu^*(m)}^r$

for any $m' \in M \backslash m$ and any $m \in M$.[21] This implies that for any $\delta \in (\underline{\delta}, 1)$, for any $m \in M$,

$$\begin{aligned} U_m^p &= s_{m\mu^*(m)} - \max\left\{\delta V^r_{\mu^*(m)}, \max_{m' \in M\backslash m}\left\{s_{m'\mu^*(m)} - U^r_{m'}\right\}\right\} \\ &= s_{m\mu^*(m)} - \delta \cdot V^r_{\mu^*(m)}, \end{aligned}$$

which is automatically satisfied given $U_m^p = V^r_{\mu^*(m)} = s_{m\mu^*(m)}/(1+\delta)$. Similarly, we obtain the same conclusion for the case when women are the proposers.

When ES is not in the core, there exist $m, m' \in M$, such that $s_{m\mu^*(m)} + s_{m'\mu^*(m')} < 2s_{m\mu^*(m')}$ or $s_{m\mu^*(m)} + s_{m'\mu^*(m')} < 2s_{m'\mu^*(m)}$ or both. Without loss of generality, assume that $s_{m\mu^*(m)} + s_{m'\mu^*(m')} < 2s_{m\mu^*(m')}$. Assume that

$$U_m^p = \frac{s_{m\mu^*(m)}}{1+\delta}, \text{ for any } m \in M; \; V_w^r = \frac{s_{\mu^*(w)w}}{1+\delta}, \text{ for any } w \in W.$$

Then we must have

$$\begin{aligned} &\delta V^r_{\mu^*(m)} \geqslant \max_{m'' \in M\backslash m}\left\{s_{m''\mu^*(m)} - U^p_{m''}\right\} \geqslant s_{m'\mu^*(m)} - U^p_{m'} \\ \Rightarrow \quad &\frac{\delta s_{m\mu^*(m)} + s_{m'\mu^*(m')}}{1+\delta} \geqslant s_{m\mu^*(m')}. \end{aligned}$$

Since $s_{m\mu^*(m)} + s_{m'\mu^*(m')} < 2s_{m\mu^*(m')}$, there exists a $\underline{\delta} \in [0, 1)$, such that for any $\delta \in [\underline{\delta}, 1)$, the above inequality does not hold, implying that it cannot be a solution. Similarly, we obtain the same conclusion for the case when women are the proposers. □

[21] The existence of such a lower bound for each pair of m and m' requires $s_{m'\mu^*(m')}$ to be strictly positive. Hence, as long as we assume that $s_{mw} > 0$ for any $m \in M$ and $w \in W$, we ensure the existence of a uniform lower bound.

D Other experimental results

We have rich information about the process of negotiation: who proposes to whom, the terms of the offers, and their acceptance and rejection. We can explore why agents become unmatched at the end of the game, and whether demographic characteristics such as gender and major affect bargaining outcomes.

D.1 Tests on the noncooperative model

We investigate the factors that affect the chance a player will propose to someone on the opposite side. Table D1 provides two patterns.

Table D1: Frequency distribution of proposals sent to players on the opposite side

(a) balanced markets: wave 1 and wave 2

	EA6			NA6		
	w1	w2	w3	w1	w2	w3
m1	(52%,56%)	(28%,6%)	(19%,0%)	(35%,32%)	(31%,61%)	(33%,81%)
m2	(4%,26%)	(54%,49%)	(42%,12%)	(63%,34%)	(30%,34%)	(7%,15%)
m3	(0%,18%)	(10%,45%)	(90%,88%)	(79%,35%)	(18%,5%)	(3%,4%)
	EM6			NM6		
	w1	w2	w3	w1	w2	w3
m1	(1%,2%)	(49%,53%)	(50%,17%)	(65%,30%)	(32%,46%)	(3%,29%)
m2	(2%,40%)	(12%,43%)	(87%,81%)	(94%,68%)	(4%,7%)	(2%,21%)
m3	(62%,58%)	(15%,4%)	(23%,2%)	(37%,2%)	(49%,47%)	(14%,50%)

(b) imbalanced markets: wave 1 and wave 2

	EA7				NA7			
	w1	w2	w3	w4	w1	w2	w3	w4
m1	(32%,57%)	(17%,10%)	(17%,3%)	(34%,56%)	(53%,35%)	(12%,50%)	(20%,78%)	(15%,77%)
m2	(7%,30%)	(49%,54%)	(37%,23%)	(7%,29%)	(61%,31%)	(31%,42%)	(5%,19%)	(3%,19%)
m3	(4%,13%)	(20%,36%)	(75%,74%)	(1%,15%)	(75%,34%)	(20%,8%)	(3%,3%)	(2%,4%)
	EM7				NM7			
	w1	w2	w3	w4	w1	w2	w3	w4
m1	(2%,5%)	(48%,48%)	(48%,28%)	(2%,5%)	(58%,33%)	(37%,47%)	(3%,14%)	(2%,16%)
m2	(7%,34%)	(9%,48%)	(80%,69%)	(4%,35%)	(92%,61%)	(6%,7%)	(2%,13%)	(0%,15%)
m3	(36%,61%)	(4%,4%)	(23%,3%)	(37%,60%)	(35%,6%)	(42%,46%)	(13%,73%)	(10%,69%)

Notes. In each table, the first number in each cell indicates the percentage of proposals sent from the row player to the column player, the second number in each cell indicates the percentage of proposals sent from the column player to the row player.

First, proposers are more likely to propose to a receiver when their total surplus stands out among all of the matches the proposer can achieve. For example, in NM6, m_2 proposes to w_1 much more frequently than w_1 proposes to m_2. This is potentially because w_1's alternative matches have relatively better surpluses than m_2's alternative matches. Similar patterns can be seen in pairs m_2w_3 in EM7, m_2w_1 in NM7, and m_1w_3 and m_3w_1 in NA6 and NA7. To account for this factor, we create a variable

$$Attract_{ij} = s_{ij} \Big/ \frac{\sum_k s_{kj}}{3},$$

which measures player i's attractiveness to player j, where s_{ij} is the surplus generated when players i and j are matched, and k denotes the three possible matches for player j. (In imbalanced markets, we treat the two duplicate players as a single player.)

Second, proposers are more likely to propose to a receiver if they appear more attractive to the receiver. For example, for player m_3 in EM7, although the total surplus is identical when they are matched with either w_1 or w_2, m_3 proposes to w_1 much more frequently than they propose to w_2, potentially because they are relatively more attractive to w_1 than to w_2. Similar patterns can be observed in pair m_1 w_1 in both EA6 and EA7. To account for this factor, we create another variable, *RelativeAttract*$_{ij}$, which measures player i's relative attractiveness to player j among all the possible matches player i could achieve.

$$RelativeAttract_{ij} = Attract_{ij} \Bigg/ \frac{\sum_k Attract_{ik}}{3},$$

where Attract$_{ij}$ is the variable defined above, representing the attractiveness of player i to player j, and k denotes the three possible matches for player i.

Table D2 presents regression results of the determinants of whom to propose to and the frequency of equal-spilt proposals. In the regressions, *Attract*$_{rp}$ captures the receivers' attractiveness to the proposer, and *RelativeAttract*$_{pr}$ captures the proposer's relative attractiveness to the receiver. C$_p$ and C$_r$ are dummy variables, which equal 1 if the proposer or the receiver has a duplicate player in imbalanced markets. The variable *diag_both* is also a dummy, which equals 1 if the proposer and the receiver are at main diagonal or anti-diagonal positions to each other. Finally, the dummy variable *assortative* equals 1 if the markets are assortative, including both positive and negative assortativity.

We first look at the determinants of whom to propose to. In columns (1) and (2) of Table D2, the dependent variable is the rate of each player's proposal to a certain receiver. OLS regression results show that in the first round of each game, the attractiveness of receivers to proposers (*Attract*$_{rp}$) plays a significant role in proposers' proposing choices. When it comes to the fifth round of each game, *Attract*$_{rp}$ still has a significant effect, but the effect is much smaller. In contrast, the relative attractiveness of the proposer to the receiver (*RelativeAttract*$_{pr}$) becomes more important over time. In imbalanced markets, we find that proposers with a duplicate competitor are less likely to propose to a more attractive receiver, and they are more likely to propose to someone when they find themselves more attractive to them, even in the first round. Finally, proposers are more likely to propose to someone who is at their diagonal positions only when the markets are assortative, and such a tendency disappears when the markets are nonassortative. This result suggests that subjects do not make proposing decisions based on the heuristic of matching with diagonal partners.

We consider now the numbers and types of proposals. The aggregate surplus gradually increases from time zero (Figures B5) through a series of proposals, so subjects in general make efficiency-enhancing proposals. In balanced markets, the number of proposals is 12.4% (resp., 26.6%) fewer in assortative settings and 30.5% (resp., 94.1%) fewer in settings with pairwise equal splits in the core, in wave 1 as shown in Column (2) in Table D3a (resp., wave 2 as shown in Column (2) in Table D3b). The number of proposals also decreases by round: An additional round decreases the number of proposals by 2.93% (resp. 8.91 %), and having played 7 (resp. 5) rounds of other market games ahead of the current market decreases the

Table D2: Determinants of whom to propose to and equal-spilts proposals: waves 1 and 2

	Rate of proposing to someone		Rate of proposing equally to someone	
	Round=1	Round=5	Round=1	Round=5
total surplus	0.00158	0.00158	-0.00313***	-0.00246*
	(1.89)	(1.68)	(-3.94)	(-2.61)
Attract*rp*	0.519***	0.250***	0.174*	0.0882
	(7.34)	(3.68)	(2.38)	(1.22)
RelativeAttract*pr*	0.146	0.598***	-0.163	-0.200*
	(1.71)	(6.96)	(-1.60)	(-2.46)
Attract*rp**C*p*	-0.646***	-0.559***	-0.140	-0.0687
	(-4.87)	(-5.65)	(-1.01)	(-0.80)
Attract*rp**C*r*	0.625	0.614	-0.772	0.520
	(0.75)	(0.85)	(-1.69)	(1.46)
RelativeAttract*pr**C*p*	0.675***	0.573***	0.00260	-0.0444
	(5.14)	(5.38)	(0.02)	(-0.58)
RelativeAttract*pr**C*r*	-0.322	-0.239	0.427	-0.452
	(-0.64)	(-0.51)	(1.29)	(-1.92)
diag_both	-0.0211	-0.0411	0.0180	0.0580
	(-0.80)	(-1.03)	(0.35)	(1.07)
diag_both*assortative	0.0771*	0.173**	0.165*	0.216**
	(2.10)	(2.67)	(2.36)	(2.93)
wave=2	0.0184	0.0236	0.0340	-0.00108
	(0.79)	(0.80)	(1.20)	(-0.04)
EA=1			-0.0314	0.00584
			(-0.94)	(0.19)
EM=1			-0.0288	0.0242
			(-0.79)	(0.53)
NA=1			-0.0524	-0.0925*
			(-1.40)	(-2.62)
constant	-0.424***	-0.608***	0.431***	0.447***
	(-6.38)	(-7.39)	(4.55)	(4.61)
observations	264	254	264	254
clusters	63	64	63	64

t statistics in parentheses; standard errors clustered at group level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

number of proposals by 9.96% (resp. 8.91%), which averages to 1.42% (resp., 1.78%) per round, in wave 1 as shown in Column (2) of Table D3a (resp., wave 2 as shown in Column (2) of Table D3b). In both waves, 1 and 2, the effect of assortativity disappears in the analysis regarding balanced and imbalanced markets, but the effect of having pairwise equal splits in the core persists (Columns (3)-(4) of Table D3a and Table D3b).

Recall that in Section 5.1.1, we show that if players engage in bargaining in balanced markets, outside options should only affect the equilibrium outcomes of the ESNIC markets but not the ESIC markets. Therefore, if we observe that the higher number of proposals in the ESNIC markets is entirely driven by outside options, which are reflected by the inefficient proposals, it shall provide support for our noncooperative model. In the final two columns of both Table D3a and Table D3b, we introduce the count of inefficient proposals as an extra control factor, in contrast to the regression analyses conducted in the initial two columns. We find that, when controlling for the number of inefficient proposals, the effect of "whether the market is ESIC" on the number of proposals is no longer significant. This result suggests that subjects in balanced markets might indeed engage in bargaining with the consideration of outside options.

D.2 Tests on the fairness model

Table D4 tests the determinants of individual equal-split outcomes. ESIC markets produce 32%–40% more equal-split outcomes; assortativity reduces equal-split outcomes by around 10%; and having earned more cumulative payoffs does not increase the chance of an equal-split outcome: A $1 increase in cumulative payoffs increases an individual's chance of an equal-split outcome by less than 1% (-1.43% to 0.858% in wave 1 and -3.04% to 0.0493% in wave 2) at statistically insignificant levels.

Columns (3) and (4) of Table D2 show when proposers propose an equal split. In these two regressions, we use NM markets as the benchmark, and adopt dummy variables EA, EM, and NA to represent other market types. We find that, while subjects in the first round prefer to propose equally to those who are more attractive, over time, as subjects gain more experience, they become less likely to propose equally when they are relatively more attractive. Moreover, we find that subjects are more likely to propose equally to someone who is at their diagonal positions, but only when the markets are assortative. Finally, compared to NM markets, subjects in NA markets are less likely to make equal-split proposals.

Next, we investigate whether individuals use equal-split as a heuristic when making proposals. Table D5 shows the rate of equal-split proposals for each market type, and for round 1 and 5, respectively. It shows that, in the first round of balanced markets, the rates of equal-split proposals are higher than one third in all types of markets (53.3% in EA6, 47.9% in EM6, 36.9% in NA6, and 46.2% in NM6), and these rates are mostly insignificantly different between each other. Only the rate of NA6 markets is significantly lower than that of EA6 and NM6 (two-sided Mann-Whitney tests, $p < 0.01$, $n = 36$). In contrast, by the fifth round of balanced markets, these rates become significantly different from each other in most cases, with the rate in NA6 (20.4%) smaller than that of NM6 (37.8%), which is smaller than EM6 (59.2%) and EA6 (68.4%). All differences are highly significant (two-sided Mann-Whitney tests, $p < 0.001$, $n = 36$). Similarly, we find that, while the rates in imbalanced markets do not differ between market types in the first round (26.1% in EA7, 23.0% in EM7, 24.3% in NA7, and 24.8% in NM7), the rate in NA7 becomes significantly lower than other markets by the fifth round (8.5% in NA7, 19.0% in NM7, 19.8% in EA7, 25.5% in EM7, significant difference with $p < 0.001$, $n = 30$). Moreover, after controlling for other factors, columns (3) and (4) of Table D2 reveal that the rates of equal-split proposals do not differ across market types in the first round, but significant differences appear in the fifth round. These results indicate that, when subjects are inexperienced, they likely use equal-split as a heuristic when proposing to others, leading to almost equally high rates of equal-split proposals in different markets at the beginning. However, once they gain experience, subjects in the ESNIC markets tend to shy away from equal-split proposals compared to the ESIC markets, which is consistent with the theory, suggesting that their behavior is not driven by unequal outcomes being less intuitive.

Finally, Table D6 presents when subjects prefer a proposal over their current matches. We use the final matches of each subject as a benchmark, and compare them with all other relevant proposals. Specifically, we first include proposals that subjects reject between the final match and the temporary match before the final match, as well as the ones after the final match. Given that subjects reject those proposals and stay in their final match, they reveal that these proposals are worse than their final matches. Moreover, we include proposals subjects make to others while they are on their final matches, which are revealed to be better than the final matches. The dependent variable is a dummy, which equals 1 if the proposal is better than the final matches, and equals 0 otherwise. The independent variable *Earnings* captures the surplus difference between one's final match and the proposals. The independent variables *Unfair(adv)* and *Unfair(adv)* capture the differences in unfairness level between the final matches and the proposals, following the definitions of Fehr and Schmidt (1999). The former reflects cases in which one earns more than their opponents, and the latter reflects cases where one earns less than their opponents. Specifically, they are defined as follows: Unfair (adv)=Unfair (adv) index (final match) - Unfair (adv) index (proposal), where Unfair (adv) index = max {Profit (proposal) - Profit (final match), 0}. Similarly, Unfair (disadv) = Unfair (disadv) index (final match) - Unfair (disadv) index (proposal), where Unfair (disadv) index = max {Profit (final match) - Profit (proposal), 0}.

Columns (1)–(3) of Table D6 show that in balanced markets, subjects prefer proposals that yield a higher earning for themselves, and dislike proposals that are more disadvantageously unfair to themselves, which is mostly driven by the wave 1 sample. However, they do not appear to care if a proposal is more unfair when they earn more than the others. Columns (4)–(6) of Table D6 show that, in imbalanced markets, the preference for higher earnings persists. Moreover, subjects are averse to both advantageous and disadvantageous unfairness, but only in wave 1. Additionally, in both waves, the competitive players' proposals are more likely to be rejected, and they are more likely to accept others' proposals. Overall, these results indicate that subjects exhibit inequality aversion preferences when choosing between proposals, but only when the markets have a fixed ending time.

D.3 Reasons for being unmatched in balanced markets

In wave 1, 33.8% of balanced markets end up with unmatched agents (12% of EA6, 21% of EM6, 42% of NA6, and 60% of NM6), and 11.22% of agents end up unmatched (3.83% in EA6, 7.17% in EM6, 13.83% in NA6, and 20.05% in NM6). It is worthwhile to understand why they end up unmatched, because a significant amount of potential surplus is left unrealized, and the loss due to being unmatched far exceeds the loss due to inefficient mismatches.

To this end, we categorize a few reasons for being unmatched in wave 1. Namely, we define four categories. A person is **unlucky** if he/she was matched after 150 seconds of the game but was left unmatched by the end. A person is **unattractive** if he/she was unmatched for the last 30 seconds, was never proposed to, proposed to but was rejected by others. A person is **picky** if the person was unmatched for the last 30 seconds, did not propose to anyone in the last 30 seconds, and rejected any incoming proposals in the last 30 seconds of the game. A person is **trying** if the person has both been rejected and rejected others in the last 30 seconds of the game.

Table D7a lists the reasons for individuals being unmatched. The leading factor is that a person is suddenly released from a match within 30 seconds of the end of the game. More than half (45.2% in EA6, 57.5% in EM6, 49.4% in NA6, and 50.0% in NM6) are left unmatched for this reason. For the rest of the unmatched subjects, a little less than half are left unmatched because they are unattractive—i.e., in the last 30 seconds their offers were not accepted and no one proposed to them. For the last quarter of the unmatched subjects, half were picky—i.e., they did not make any offer and rejected all incoming proposals in the last 30 seconds—half of them were actively participating without success.[22]

Table D7b shows the effects of the environment on being unmatched. There is no strong evidence that unmatched types show up in different ways in different configurations. The "individual efficient surplus" is the theoretically predicted total surplus an individual can generate in the match. The "individual random surplus" is the expected total surplus an individual obtains with their partner. For example, for m_1 in AE, the individual efficient surplus is 30 and the individual random surplus is $(30+40+50)/3 = 40$. The larger these factors, the higher the surplus an individual can provide. Therefore, as row 2 of Table D7b shows, a higher individual random surplus is associated with a lower chance of being unmatched, and—conditional on being unmatched—a lower chance that an agent is left single for being unattractive.

In wave 2, when time limits are removed, the proportion of balanced markets with unmatched agents decreases to 11.4% (3.9% of EA6, 2.0% of EM6, 12.0% of NA6, and 27.5% of NM6) and the proportion of unmatched agents decreases to 4.41% (2.0% in EA6, 0.7% in EM6, 4.5% in NA6, and 13.5% in NM6). Among markets with unmatched pairs, in 99.7% of cases in wave 1 and 99.0% of cases in wave 2, one pair remains unmatched. Because by design players in wave 2 make no proposal in the last 30 seconds of the game, the reasons for being unmatched in wave 1 no longer apply. Therefore, we explore additional reasons for being unmatched in both waves. According to the variable $Attract_{ij}$ we introduced in Section D.1, we categorize all pairs (both matched and unmatched) into "mutually unattractive," "unilaterally unattractive," and "mutually attractive." A pair is "mutually unattractive" if the attractiveness of both sides is lower than one, "unilaterally unattractive" if the attractiveness is lower than one for exactly one side, and "mutually attractive" otherwise.[23]

Table D8 presents the determinants for pairs being unmatched in both waves. We present results from three probit regressions, in which column (1) contains all pairs, column (2) contains only efficient pairs, and column (3) contains only inefficient pairs.[24] First, we find that removing the time limits (wave=2) significantly decreases the rate of being unmatched, both for efficient and inefficient pairs. Next, we find that the efficient pairs and the inefficient pairs are unmatched for very different reasons. While "mutually unattractive" and "unilaterally unattractive" have significant positive effects on inefficient pairs to be unmatched, neither of them could explain the reasons for being unmatched for the efficient pairs. However, we find that the efficient pairs are less likely to be unmatched in ESIC markets as well as when subjects gain experience in later periods. These factors have no effects on inefficient pairs.

[22] We also check whether some subjects tend to always be unlucky, picky, unattractive, or trying, and this is not the case. The majority of subjects who have been unlucky, picky, unattractive, or trying experienced this only once or twice.

[23] In Section D.1 we also create a variable $RelativeAttract_{ij}$ to measure player i's relative attractiveness to player j among all of the possible matches player i could achieve. We do not include this variable as one of the potential reasons for being unmatched. This is because for markets with unmatched players in both waves, in over 90% of the cases, only two agents remain unmatched, and hence relative attractiveness should not be a major concern.

[24] When there are two unmatched agents in a market, we classify them as an efficient (inefficient) pair if they form an efficient (inefficient) pair when matched. When there are four unmatched agents in a market, we include each potential pair of these four agents in the regressions.

D.4 Demographic characteristics

We investigate whether individual characteristics have any effects on the number of matches and payoffs in each configuration. Using regressions with group fixed effects, Table D10 shows the effect of age, gender, grade, and major on the number of matched pairs a subject reaches and the total payoff a subject obtains in each of the eight markets. There is hardly any effect of these characteristics, except for two instances listed below that result in statistical significance. In wave 1, economics/business majors in EM6 markets are 5.36% more likely to be matched. Males are associated with a 7.28% decrease in total payoff in EA7. In wave 2, a year older is associated with an 11.1% decrease in total payoff in NM6. These results indicate a modest role of age, gender, and major in the two-sided matching markets.

D.5 Other experimental results

D.5.1 Bargaining activities

Table D9 shows alternative specifications for regression on determinants of the number of proposals for balanced markets. The alternative specifications yield conclusions similar to our leading specification (3), presented in Column (2) of Table D3.

D.5.2 Demographic characteristics

Using regressions with individual fixed effects, Tables D10 shows the effect of age, gender, grade, and major on the number of matched pairs a subject reaches in each of the eight markets.

Table D3: Determinants of number of proposals per player per round

(a) Determinants of number of proposals per player per round in balanced and all markets: wave 1

	(1) # proposals	(2) log # proposals	(3) # proposals	(4) log # proposals	(5) # proposals	(6) log # proposals
ESIC	-0.508***	-0.310***	-0.508***	-0.310***	0.122	-0.0350
	(-4.59)	(-4.98)	(-4.63)	(-5.02)	(1.52)	(-0.69)
assortative	-0.270**	-0.128*	-0.0454	-0.0232	-0.0747	-0.0422
	(-2.97)	(-2.66)	(-0.50)	(-0.69)	(-1.15)	(-1.34)
ESIC*assortative	0.324	0.134	0.324	0.134	0.0691	0.0223
	(1.98)	(1.63)	(1.99)	(1.65)	(0.69)	(0.39)
round	-0.0388**	-0.0293**	-0.0229	-0.0136*	0.0338**	0.00249
	(-3.21)	(-3.22)	(-1.61)	(-2.22)	(3.58)	(0.46)
order	-0.159**	-0.0997***	0.0162	-0.00121	-0.0185	-0.0381*
	(-3.58)	(-4.91)	(0.34)	(-0.06)	(-0.71)	(-2.63)
balanced			0.430	0.272**		
			(1.69)	(2.74)		
assortative*balanced			-0.225	-0.104		
			(-1.76)	(-1.79)		
round*balanced			-0.0159	-0.0156		
			(-0.85)	(-1.44)		
order*balanced			-0.176**	-0.0985***		
			(-2.70)	(-3.57)		
#Inefficient proposals					0.194***	0.0847***
					(22.07)	(7.70)
constant	3.039***	1.204***	2.609***	0.933***	0.952***	0.291*
	(17.07)	(16.02)	(14.18)	(14.23)	(6.23)	(2.42)
observations	728	728	1,288	1,288	728	728
clusters	26	26	46	46	26	26

t statistics in parentheses; standard errors clustered at group level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of number of proposals per player per round in balanced and all markets: wave 2

	(1) # proposals	(2) log # proposals	(3) # proposals	(4) log # proposals	(5) # proposals	(6) log # proposals
ESIC	-3.380**	-0.939**	-3.380***	-0.939***	0.355	-0.207
	(-4.76)	(-4.03)	(-4.89)	(-4.14)	(1.35)	(-1.13)
assortative	-1.869**	-0.263	-0.394	0.00387	0.150	0.133
	(-3.38)	(-1.95)	(-0.63)	(0.03)	(0.60)	(1.29)
ESIC*assortative	1.557**	0.138	1.557**	0.138	-0.128	-0.192
	(3.26)	(0.60)	(3.35)	(0.62)	(-0.52)	(-1.16)
round	-0.268*	-0.0728*	-0.209	-0.0328	0.0513	-0.0103
	(-2.61)	(-2.79)	(-0.94)	(-0.93)	(0.80)	(-0.41)
order	-0.392	-0.130	-1.462*	-0.306**	0.0734	-0.0386
	(-1.82)	(-1.50)	(-2.59)	(-3.31)	(0.93)	(-0.65)
balanced			-0.772	-0.00326		
			(-0.33)	(-0.01)		
assortative*balanced			-1.475	-0.267		
			(-1.79)	(-1.49)		
round*balanced			-0.0589	-0.0400		
			(-0.24)	(-0.92)		
order*balanced			1.069	0.176		
			(1.78)	(1.41)		
#Inefficient proposals					0.325***	0.0637***
					(18.87)	(5.08)
constant	7.007***	1.819***	7.779**	1.823***	0.0627	0.459*
	(6.03)	(8.69)	(3.79)	(6.88)	(0.16)	(2.26)
observations	200	200	399	399	200	200
clusters	10	10	20	20	10	10

t statistics in parentheses; standard errors clustered at group level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D4: Determinants of equal-split outcome

(a) Determinants of equal-split outcome: wave 1

	(1) equal-split outcome	(2) equal-split outcome	(3) equal-split outcome
ESIC	0.323^{***}	0.323^{***}	0.326^{***}
	(4.89)	(4.86)	(4.95)
assortative	-0.0981^{**}	-0.0984^{**}	-0.0950^{**}
	(-2.95)	(-3.05)	(-2.88)
ESIC*assortative	0.200^{***}	0.200^{***}	0.194^{***}
	(3.94)	(3.95)	(3.84)
cumulative payoff	0.00858	0.00637	-0.0143
	(1.60)	(1.13)	(-1.63)
round		0.0135^{**}	0.0213^{***}
		(2.81)	(4.85)
order			0.0581^{*}
			(2.18)
constant	0.306^{***}	0.263^{***}	0.188^{**}
	(6.69)	(5.50)	(3.18)
observations	3,874	3,874	3,874
clusters	26	26	26

t statistics in parentheses; standard errors clustered at group level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of equal-split outcome: wave 2

	(1) equal-split outcome	(2) equal-split outcome	(3) equal-split outcome
ESIC	0.401^{***}	0.401^{***}	0.402^{***}
	(5.16)	(5.15)	(5.12)
assortative	-0.113	-0.113	-0.113
	(-1.77)	(-1.78)	(-1.78)
ESIC*assortative	0.213^{*}	0.212^{*}	0.209^{*}
	(3.10)	(3.05)	(2.92)
cumulative payoff	0.000493	0.00155	-0.0304
	(0.06)	(0.21)	(-1.47)
round		-0.00943	0.00610
		(-0.85)	(0.41)
order			0.0823
			(1.53)
constant	0.409^{***}	0.433^{***}	0.326^{*}
	(6.10)	(5.69)	(2.91)
observations	1,154	1,154	1,154
clusters	10	10	10

t statistics in parentheses; standard errors clustered at group level
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Determinants of equal-split outcome in rounds 1: wave 1

	(1) equal-split outcome	(2) equal-split outcome	(3) equal-split outcome
ESIC	0.149	0.149	0.148
	(1.98)	(1.98)	(1.96)
assortative	-0.132	-0.132	-0.134
	(-1.46)	(-1.46)	(-1.50)
ESIC*assortative	0.211*	0.211*	0.218*
	(2.20)	(2.20)	(2.26)
cumulative payoff	-0.0104	-0.0104	0.0155
	(-0.95)	(-0.95)	(0.53)
order			-0.0708
			(-0.91)
constant	0.449***	0.449***	0.528***
	(6.04)	(6.04)	(4.75)
observations	542	542	542
clusters	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Determinants of equal-split outcome in rounds 1: wave 2

	(1) equal-split outcome	(2) equal-split outcome	(3) equal-split outcome
ESIC	0.399**	0.399**	0.398**
	(4.06)	(4.06)	(4.11)
assortative	0.0455	0.0455	0.0447
	(0.61)	(0.61)	(0.60)
ESIC*assortative	-0.0348	-0.0348	-0.0354
	(-0.25)	(-0.25)	(-0.26)
cumulative payoff	0.0168	0.0168	-0.00220
	(1.59)	(1.59)	(-0.05)
order			0.0477
			(0.44)
constant	0.375***	0.375***	0.324
	(6.14)	(6.14)	(1.97)
observations	222	222	222
clusters	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D5: Two-sided Mann-Whitney tests on the rate of equal-split proposals

	Types of balanced markets (Round 1/5)			
	EA6	EM6	NA6	NM6
Equal-split proposals (%)	53.3/68.4	47.9/59.2	36.9/20.4	46.2/37.8
EA6		(0.250/0.150)	(0.005/$<$ 0.001)	(0.338/$<$ 0.001)
EM6			(0.114/$<$ 0.001)	(0.710/$<$ 0.001)
NA6				(0.007/$<$ 0.001)
	Types of imbalanced markets (Round 1/5)			
	EA7	EM7	NA7	NM7
Equal-split proposals (%)	26.1/19.8	23.0/25.5	24.3/8.5	24.8/19.0
EA7		(0.408/0.399)	(0.663/$<$ 0.001)	(0.767/0.923)
EM7			(0.842/$<$ 0.001)	(0.695/0.348)
NA7				(0.684/$<$ 0.001)

Notes: p-values in parentheses. n = 36 for all balanced markets, n = 30 for all imbalanced markets.

Table D6: Proposals compared to the final match

	Balanced markets			Imbalanced markets		
	all waves	wave 1	wave 2	all waves	wave 1	wave 2
Earning	0.0323***	0.0354***	0.0211***	0.0232***	0.0266***	0.0150***
	(13.82)	(13.38)	(4.01)	(16.65)	(15.95)	(4.84)
unfair(adv)	-0.00206	-0.00255	-0.000592	-0.00138	-0.00314***	0.000891
	(-1.83)	(-1.91)	(-0.32)	(-1.67)	(-3.33)	(0.88)
unfair(disadv)	-0.00522***	-0.00599***	-0.00276	-0.00194*	-0.00347**	0.000444
	(-4.61)	(-4.08)	(-1.80)	(-2.26)	(-3.15)	(0.49)
wave2=1	-0.251***			-0.223***		
	(-6.16)			(-11.75)		
Cp				-0.203***	-0.248***	-0.0833***
				(-13.14)	(-14.66)	(-3.32)
Cr				0.192***	0.219***	0.114***
				(7.29)	(6.14)	(3.99)
observations	6,976	5,430	1,546	5,492	3,907	1,585
clusters	36	26	10	30	20	10

t statistics in parentheses; standard errors clustered at group level
reported coefficients are marginal effects from probit
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D7: Reasons and determinants for individuals being unmatched: wave 1

(a) Reasons for individuals being unmatched: wave 1

Single reason	EA6	EM6	NA6	NM6	Total
	%	%	%	%	%
unlucky	45.2	57.5	49.4	50.0	50.6
unattractive	23.8	12.5	20.3	26.6	22.1
picky	11.9	10.0	20.3	11.7	14.1
trying	19.0	20.0	10.1	11.7	13.1
Total	100.0	100.0	100.0	100.0	100.0

(b) Determinants of reasons for individuals being unmatched: wave 1

	(1)	(2)	(3)	(4)	(5)
	unmatched	unlucky	unattractive	picky	trying
individual efficient surplus	0.0238	-0.449	0.655^{**}	0.151	-0.222
	(0.36)	(-1.39)	(2.67)	(0.57)	(-0.88)
individual random surplus	-0.101^{***}	0.282^{***}	-0.314^{***}	-0.0499	0.0309
	(-7.97)	(3.45)	(-3.60)	(-1.46)	(0.53)
ESIC	-0.115^{***}	0.0545	-0.169^{**}	-0.0322	0.0895
	(-5.53)	(0.65)	(-2.73)	(-0.68)	(1.67)
assortative	-0.0463^{***}	-0.00629	-0.0278	0.0686^{*}	-0.00425
	(-3.84)	(-0.11)	(-0.65)	(2.35)	(-0.08)
ESIC*assortative	-0.0116	-0.122	0.136	-0.0440	-0.00864
	(-0.39)	(-0.95)	(1.06)	(-0.57)	(-0.11)
round	-0.00257	0.0208	-0.0195^{*}	-0.00424	-0.00280
	(-1.12)	(1.73)	(-2.01)	(-0.64)	(-0.39)
period	-0.00268^{***}	0.000929	-0.00367	-0.00332	0.00386
	(-3.62)	(0.28)	(-1.44)	(-1.74)	(1.57)
observations	4,368	502	502	502	502
clusters	26	26	26	26	26

Table D8: Determinants of outcomes in balanced markets: waves 1 and 2

	(1) unmatched (All pairs)	(2) unmatched (Efficient pairs)	(3) unmatched (Inefficient pairs)
mutually unattractive	0.139***	-0.00560	0.496***
	(10.67)	(-0.37)	(19.24)
unilaterally unattractive	0.0858***	0.0256	0.258***
	(4.75)	(1.64)	(7.72)
wave=2	-0.113***	-0.0770***	-0.186***
	(-7.55)	(-5.56)	(-3.94)
ESIC	-0.0928***	-0.0366**	0.123**
	(-4.80)	(-2.91)	(2.97)
assortative	-0.0464**	-0.0333*	0.0920**
	(-3.13)	(-2.18)	(3.14)
ESIC*assortative	0.0166	0.0191	-0.176**
	(0.67)	(0.85)	(-2.86)
period	-0.00228**	-0.00160*	-0.00216
	(-3.22)	(-2.32)	(-1.41)
round	-0.00293	-0.00425*	0.00864
	(-1.47)	(-2.06)	(1.43)
observations	2,792	2,170	622
clusters	36	36	36

t statistics in parentheses; standard errors clustered at group level

reported coefficients are marginal effects from probit

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D9: Determinants of logged number of proposals in balanced markets

(a) Determinants of logged number of proposals in balanced markets: wave 1

	(1) log proposals	(2) log proposals	(3) log proposals	(4) log proposals
ESIC	-0.243***	-0.303***	-0.310***	-0.310***
	(-5.42)	(-4.45)	(-4.98)	(-4.98)
assortative	-0.0530	-0.112*	-0.128*	-0.128*
	(-0.93)	(-2.28)	(-2.66)	(-2.66)
ESIC*assortative		0.118	0.134	0.134
		(1.27)	(1.63)	(1.63)
round			-0.0293**	-0.0150
			(-3.22)	(-1.72)
order			-0.0997***	
			(-4.91)	
period				-0.0142***
				(-4.91)
constant	2.592***	2.622***	2.996***	2.896***
	(44.79)	(42.27)	(39.86)	(43.47)
observations	728	728	728	728
clusters	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Determinants of logged number of proposals in balanced markets: wave 2

	(1) log proposals	(2) log proposals	(3) log proposals	(4) log proposals
ESIC	-0.870***	-0.923**	-0.941**	-0.941**
	(-4.83)	(-3.86)	(-4.04)	(-4.04)
assortative	-0.212	-0.266	-0.266	-0.266
	(-1.57)	(-2.26)	(-1.98)	(-1.98)
ESIC*assortative		0.107	0.143	0.143
		(0.45)	(0.62)	(0.62)
round			-0.0891**	-0.0712*
			(-3.33)	(-2.76)
order			-0.0891	
			(-1.42)	
period				-0.0178
				(-1.42)
constant	3.114***	3.141***	3.631***	3.542***
	(18.48)	(19.64)	(16.42)	(19.24)
observations	200	200	200	200
clusters	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D10: Individual characteristics determinants of outcomes

(a) Individual characteristics determinants of outcomes in balanced markets: wave 1

	(1) log match EA6	(2) log match EM6	(3) log match NA6	(4) log match NM6	(5) log payoff EA6	(6) log payoff EM6	(7) log payoff NA6	(8) log payoff NM6
Age	0.00474	-0.000388	0.0239	-0.0101	0.0193	0.0206	0.0376	-0.0181
	(0.38)	(-0.02)	(0.98)	(-0.69)	(0.98)	(0.88)	(1.24)	(-0.96)
Male	0.00724	-0.0482	0.00705	0.0427	0.0132	-0.0574	-0.0563	0.0654
	(0.31)	(-1.52)	(0.22)	(1.45)	(0.29)	(-1.30)	(-1.51)	(1.88)
Grade of study	-0.00250	0.0161	-0.0364	0.0176	-0.00692	0.00896	-0.0345	0.0343
	(-0.12)	(0.67)	(-1.09)	(0.76)	(-0.26)	(0.27)	(-0.75)	(1.23)
Econ/Business	-0.00597	0.0536*	-0.0323	-0.00180	-0.00143	0.0514	-0.0926	0.00292
	(-0.26)	(2.06)	(-0.79)	(-0.08)	(-0.04)	(1.16)	(-1.79)	(0.09)
Constant	1.728***	1.733***	1.316**	1.941***	4.938***	4.842***	4.606***	5.569***
	(8.86)	(6.45)	(3.18)	(8.39)	(15.29)	(12.20)	(9.14)	(17.92)
observations	156	156	156	156	156	156	156	156
clusters	26	26	26	26	26	26	26	26

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(b) Individual characteristics determinants of outcomes in imbalanced markets: wave 1

	(1) log match EA7	(2) log match EM7	(3) log match NA7	(4) log match NM7	(5) log payoff EA7	(6) log payoff EM7	(7) log payoff NA7	(8) log payoff NM7
Age	0.00601	0.00592	0.00209	0.00942	0.00767	0.0147	-0.00505	0.0148
	(0.68)	(0.44)	(0.24)	(0.72)	(0.51)	(0.83)	(-0.36)	(0.78)
Male	-0.0339	-0.0857	0.00414	0.0158	-0.0782*	-0.124	0.00686	-0.0137
	(-1.58)	(-1.79)	(0.11)	(0.40)	(-2.16)	(-1.99)	(0.14)	(-0.19)
Grade of study	-0.00249	-0.00312	0.00379	-0.00260	-0.00150	0.000535	0.00121	-0.00124
	(-0.84)	(-0.46)	(1.29)	(-0.51)	(-0.28)	(0.06)	(0.18)	(-0.20)
Econ/Business	0.0294	-0.0187	0.0360	0.0227	-0.0153	-0.00145	0.0509	0.0359
	(0.76)	(-0.43)	(0.77)	(0.36)	(-0.28)	(-0.04)	(0.84)	(0.41)
Constant	1.620***	1.620***	1.640***	1.423***	5.085***	4.899***	5.245***	4.778***
	(7.99)	(6.49)	(9.05)	(5.23)	(15.97)	(14.00)	(19.35)	(12.14)
observations	140	140	140	140	140	140	140	140
clusters	20	20	20	20	20	20	20	20

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(c) Individual characteristics determinants of outcomes in balanced markets: wave 2

	(1) log match EA6	(2) log match EM6	(3) log match NA6	(4) log match NM6	(5) log payoff EA6	(6) log payoff EM6	(7) log payoff NA6	(8) log payoff NM6
Age	-0.00548	-0.0107	0.0136	-0.00941	0.0689	0.00351	-0.00644	-0.111*
	(-1.14)	(-1.02)	(0.85)	(-0.37)	(1.69)	(0.06)	(-0.12)	(-2.91)
Male	0.00759	0.0161	0.0273	-0.0300	-0.0107	0.0170	0.0622	-0.0162
	(0.90)	(1.05)	(1.32)	(-1.38)	(-0.17)	(0.24)	(1.32)	(-0.29)
Grade of study	0.00270	0.0165	-0.0368	-0.0463	-0.130	-0.0142	-0.0388	0.00704
	(0.60)	(1.03)	(-1.57)	(-1.31)	(-1.98)	(-0.18)	(-0.71)	(0.15)
Econ/Business	0.00399	0.0177	-0.0160	0.0141	-0.0403	0.0442	0.0353	-0.117
	(0.49)	(1.27)	(-0.73)	(0.31)	(-0.46)	(0.58)	(0.61)	(-1.43)
Constant	1.692***	1.747***	1.412***	1.847**	4.135***	5.025***	5.247***	7.332***
	(24.63)	(12.35)	(5.21)	(4.69)	(5.66)	(5.26)	(5.67)	(11.30)
observations	60	60	60	60	60	60	60	60
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

(d) Individual characteristics determinants of outcomes in imbalanced markets: wave 2

	(1) log match EA7	(2) log match EM7	(3) log match NA7	(4) log match NM7	(5) log payoff EA7	(6) log payoff EM7	(7) log payoff NA7	(8) log payoff NM7
Age	0.0600	0.0134	0.0109	0.00179	0.0104	0.0147	0.00599	-0.0251
	(1.82)	(0.36)	(0.33)	(0.04)	(0.19)	(0.31)	(0.10)	(-0.43)
Male	-0.0591	0.0101	0.0138	-0.0264	-0.138	0.0899	-0.0180	-0.0947
	(-1.00)	(0.22)	(0.33)	(-0.33)	(-1.79)	(1.24)	(-0.20)	(-0.74)
Grade of study	-0.109	-0.0258	0.0194	0.0163	-0.0428	0.00226	0.0703	0.0874
	(-2.08)	(-0.72)	(0.48)	(0.48)	(-0.64)	(0.04)	(1.20)	(1.13)
Econ/Business	-0.0188	0.0594	-0.107	0.0589	-0.0340	-0.0168	-0.131	0.0701
	(-0.40)	(0.64)	(-1.85)	(0.48)	(-0.30)	(-0.25)	(-0.95)	(0.90)
Constant	0.596	1.175	1.244	1.285	4.886**	4.534***	4.640**	5.055***
	(1.08)	(1.83)	(2.07)	(1.53)	(4.45)	(5.52)	(4.02)	(4.86)
observations	70	70	70	70	70	70	70	70
clusters	10	10	10	10	10	10	10	10

t statistics in parentheses; standard errors clustered at group level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$