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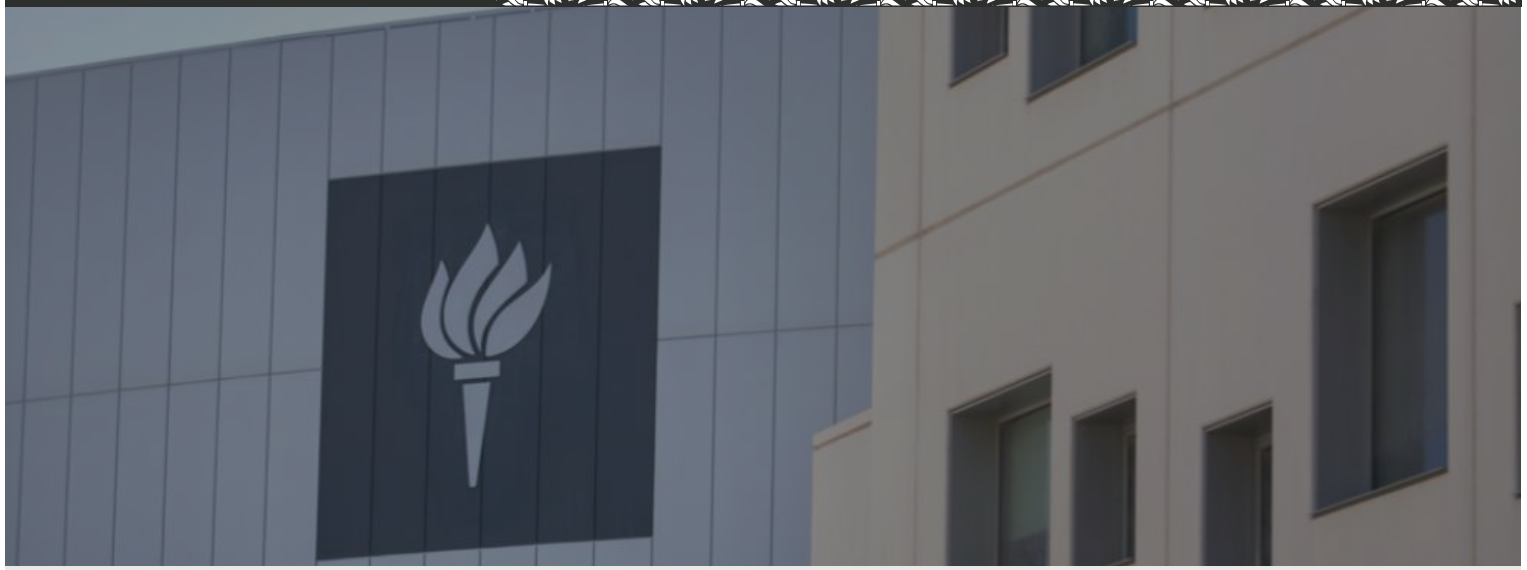

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An Experiment on Gender Representation in Majoritarian Bargaining*

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September 23, 2021

Abstract

Women are underrepresented in political and business decision-making bodies across the world. To investigate the causal effect of gender representation on multilateral negotiations, we experimentally manipulate the composition of triads in a majoritarian, divide-the-dollar game. A gender gap in earnings arises in mixed-gender groups. Experiments with different subject pools show that distinct bargaining dynamics can underlie the same inequitable outcomes: While gender-biased outcomes may be caused by outright discrimination, they can also follow from more complex dynamics due to gender differences in bargaining strategies. For example, men are more likely to make opening offers and women are less likely to fight back when excluded from a coalition. Men also earn more in same-gender groups because they reach agreements faster than women, thus incurring lower delay costs. Finally, inclusive splits and unanimous agreement rates are highest in all-female groups and lowest in all-male groups suggesting that female representation increases fairness.

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1 Introduction

Corporate boards of directors, boards of trustees, self-managed teams, academic departments, legislatures, and panels of judges are a few examples of the many settings where members typically engage in bargaining to reach agreements. Evidence from multiple studies and surveys reveal that women are largely underrepresented in decision-making bodies all over the world across business, economic, and political domains.[1] This imbalance has led to widespread calls for policies aiming to close the gender gap of female representation in decision-making bodies (e.g., European Commission Gender Equality Strategy 2020-2025 and United Nations 2030 Sustainable Development Goals).

Besides a first-order equity concern for gender parity, it is often argued that women's under-representation in committees may systematically lead to *less desirable outcomes* and affect women negatively.[2] Such considerations may become more important if decisions are reached via majority voting since members of the gender majority might coalesce and discriminate against members of the minority, further diminishing women's actual effect on decision-making.[3] However, the precise way in which the gender composition of committees causally affects multilateral bargaining outcomes is not known and warrants a careful investigation. Are agreements more inclusive as the number of women increases? Are women faster at reaching agreements than men? Will majority members discriminate against minority members, and if so, which gender is more prone to doing so? Are men more likely than women to make an opening offer or does this depend on the gender of the bargaining partners? Do men and women behave differently when left-out of a coalition?

To answer these questions, we conduct a laboratory experiment in which subjects are randomly assigned to one of the following treatment conditions: *all female* (FFF), *female majority* (FFM), *male majority* (MMF), or *all male* (MMM). In the experiment, participants

[1] In the 116th United States Congress (2019-2021), only 23% of members of Congress and 26% of Senators are women. In 2019, 24.9% of all members of parliamentary bodies around the world were women (Interparliamentary Union, 2020). Women represent only 22% of chief executives in the United States (Huang et al., 2019).

[2] For example, Bourreau-Dubois et al. (2020) find that French judge panels impose higher child support payments when the judges are all women (regardless of the gender of the creditor) compared to mixed panels, but there is no difference with all male panels. Boyd et al. (2010) find that males in judge panels lacking women are less likely to rule in favor of plaintiffs in cases of discrimination in the United States. All-female groups in a management game are more likely to invest in social corporate responsibility. However, they perform lower compared to mixed and all male groups (Apesteguia et al., 2012). Female students randomly assigned to male-majority study groups in an economics course are more likely to drop the course than women in other groups (Shan, 2020). We discuss the relationship of our work with this literature in our discussion section.

[3] Note that such behavior could be vetoed by the minority members under a unanimity rule.

are placed in groups of three in order to divide a sum of money through a free-form bargaining protocol. Agreements are reached via majority voting, and importantly, delays are monetarily costly because the amount of money available to divide shrinks over time. To reach a final agreement, subjects must first enter a temporary pre-agreement which will become *ratified* only if at least two members in the triad continuously support it for a predetermined ratification time period (10 seconds in the experiment). During the ratification period, a member who is not a party to the pre-agreement may engage in making offers in order to lure partners into a new coalition, thus impeding the ratification. Also, parties to the preliminary agreement are free to reconsider and propose alternatives. To the best of our knowledge, we are the first to experimentally study the impact of committees' gender composition on multilateral bargaining agreements and dynamics.

Previous laboratory studies that endogenously vary gender pairing in bargaining have focused exclusively on bilateral bargaining settings such as the dictator and ultimatum games (Eckel and Grossman, 2001; Solnick, 2001; Sutter et al., 2009; Eriksson and Sandberg, 2012; Hernandez-Arenaz and Iriberri, 2020; Exley et al., 2020). Taken together, the results from the previous studies indicate that women are more generous than men (Engel, 2011; Bilén et al., 2020; Eckel et al., 2008). While bilateral settings are a natural starting point for investigating bargaining behavior and valuable insights have been gained by focusing on them, we believe they do not capture essential elements inherent to more general bargaining processes.

Coalition formations and dissolutions are central to the back-and-forth negotiations typically described in legislative bodies in which temporary informal agreements can be dissolved later and new coalitions may form. Moreover, in many contexts, it is rarely preestablished who makes the first proposal, which is fixed in experiments using a structured bargaining protocol such as the dictator, ultimatum, or power-to-take games. And, critical to the aim of the present paper, bilateral bargaining protocols do not allow for studying the impact of changing the representation of women from minority to majority status or the behavior of members left out of coalitions.

Our experimental setting presents three novel features that differentiate it from previous studies of gender in bargaining games. First, by implementing a multilateral setting, we naturally allow for agreements to include both minimum winning coalitions (MWCs) and grand coalitions (GCs) in which all members receive a positive share.[4] Second, our setting endogenizes the *first mover*. That is, because any member of a bargaining triad can make

[4]In a MWC, only two subjects receive a positive share. In a GC, three subjects receive a positive share.

an offer at any point in time, we can assess whether there exists a gender difference in making an opening offer. Third, to capture the behavior of members excluded from a coalition, our protocol requires a ratification period before a temporary agreement becomes binding in which we can observe the behavior of excluded members.

Gender differences in bargaining have also been studied in the field (Castillo et al., 2013; Leibbrandt and List, 2015; Andersen et al., 2018; Hernandez-Arenaz and Iriberri, 2018; Säve-Söderbergh, 2019). These studies offer valuable insights regarding the negotiation of wages, how the supply-side treats men and women bargainers when on the demand-side, the gender choice of bargaining partners, and the role of culture.[5] However, due to the innate hurdles associated with implementing a field experiment, these studies also rely on simple bargaining transcripts that cannot fully capture the bargaining dynamics that we aim to study. The practical difficulties with conducting a field experiment that tackles our proposed research are evident—which make a laboratory experiment desirable as a first step. Moreover, a laboratory experiment allows us to design controlled counterfactual settings to identify causal relationships, which is particularly appropriate for addressing the research question presented in this paper.

We also contribute to the vast experimental economics literature on gender differences, which has found that men are more inclined to enter competitions (Niederle and Vesterlund, 2007), contribute ideas (Coffman, 2014), lead a team (Born et al., 2020), or give advice on how to play strategically (Cooper and Kagel, 2016). Importantly, by now, there are robust findings showing that women's decision-making is influenced by gender stereotypes, as well as by gender composition, when the domain is stereotypically perceived as disadvantageous for women (Coffman, 2014; Bordalo et al., 2019; Geraldes, 2020). Thus, understanding the role of gender in multilateral bargaining outcomes and dynamics will enhance our understanding of the behavioral patterns that have been documented.

In our *Main* experiment, which we conducted with 242 participants from the BEElab subject pool (Maastricht University), we uncover a gender gap in earnings. Men earn 21% more than women in MMF and 2.1% more in FFM. We replicate this finding in a different sample (n=240) with participants from the LINEEX subject pool (University of Valencia), albeit with a wider gap in FFM, with men earning approximately 20 percent more than women.

The mechanism that gives rise to the gender gap in earnings is not unique. The first

[5]See also Recalde and Vesterlund (2020) who thoroughly review the field experiments focusing on wage bargaining and prices report that men are more successful when negotiating over labor-market outcomes than women, especially when there is uncertainty regarding what can be negotiated.

behavioral regularity we identify is that men are more prone to make opening offers (in line with our hypothesis), which makes them more likely to be part of a coalition and gives rise to a payoff advantage. Importantly, males benefit from proposing first, but females do not. Hence, even if women attempted to mimic male behavior in opening offers, there is no reason to expect that this will aid in closing the gender gap in earnings.

It is natural to ask whether majorities discriminate against minorities, and if such behavior could contribute to the gender gap. We find that 67% of MWCs are mixed-gender in FFM, while only 58% in MMF. Note that perfect randomization in partner choice means that the coalition will be mixed-gender 2/3 of the time, which coincides with what we observe for FFM. While this may suggest that men discriminate against women in MMF, an exploratory investigation of the bargaining process reveals this is not the case in the *Main* experiment. In fact, when males make the first offer, they invite the only female in the triad more often (56% of the time). However, left-out males are quite aggressive and insistent in their attempts to break the mixed-gender MWC, and included males more likely to break out the interim agreement. These two findings are not in line with a taste-based explanation for the gender gap in earnings in which males directly or intentionally discriminate against females. Instead, it underscores the relevance of studying in detail the endogenous bargaining dynamics that arise in a negotiation. Our findings concerning gender differences in the behavior of members who are left out of coalitions were exploratory in nature and unexpected. Moreover, we had hypothesized no differences in the prevalence of mixed-gender coalitions between male majority (MMF) and female majority (FFM) triads, but this hypothesis was rejected. Because both of these findings are important in explaining the gender gap in earnings that we uncovered, we pre-registered and conducted a second experiment at the University of Valencia focusing on mixed-gender treatments. In our *Follow-up* experiment, we find very similar bargaining outcomes, thus confirming the robustness of our results and the novel gender gaps we documented earlier. However, the bargaining dynamics in the second experiment differ in some important aspects. While men are more likely to propose first in both experiments, whom they propose to differs. In the *Follow-up* experiment, we find that men display a preference for partnering with each other in male majority treatments (MMF), which was not the case in the *Main* experiment.

Taken together, the results from both experiments reveal three mechanisms through which women can be at a disadvantage in majoritarian, multilateral bargaining. Two of these channels stem from bargaining dynamics that do not appear *intentionally discriminatory*. First, men propose first more often than women, and second, women do not attempt

to break existing coalitions as much as men do when they are left out. The third channel is that men coalesce with other men more often than with the woman in the triad when they are in a male-majority triad. These results highlight that gender differences in strategic behavior and male homophillic preferences may contribute to the gender gap, which has important practical implications for institutional designers seeking to mitigate gender inequality. Specifically, our results suggest that tailoring interventions to promote gender equality in earnings within a bargaining setting can be context-dependent.

We also hypothesized that all-female triads would reach agreements faster than all-male triads, but we find the opposite: agreements are reached significantly faster in MMM compared to FFF, and thus, efficiency is lowest in FFF. This finding holds robustly in both experiments and also gives rise to a gender gap in earnings when comparing same-gender treatments. Finally, we find that the overall distribution of shares becomes more inclusive as the number of females increases, with GCs averaging 26 percent of agreements in FFF and 13 percent in MMM. Hence, our experiment provides a causal link between female representation and outcome fairness. While there is no direct trade-off in the set of feasible proposals that would create a tension between equality and efficiency as in Fehr et al. (2006), we identify another domain in which men favor efficiency, and women, equality. Again, this result underscores the relevance of studying in detail the endogenous bargaining dynamics.

This article proceeds as follows. In Section 2, we present the design of the *Main* experiment. Next, in Section 3, we formulate our research hypotheses based on a review of the existent literature. In Section 4, we present our main results. Section 5 presents the results of the *Follow-up* experiment. Finally, section 6 discusses and concludes the article.

2 Experimental Design

2.1 The Bargaining Game

Subjects were randomly grouped in triads to divide 12 points, which corresponded to 36 euros. A silhouette indicating the gender of each member of the committee was displayed. At any moment during the bargaining process, subjects could: (1) make a proposal on how to divide the twelve points, (2) provisionally support (or not) an existing proposal, or (3) withdraw the proposal after having made one. Agreements were reached when at least two members of the triad agreed on a split for a ten-second *ratification period*. This design closely follows the unstructured bargaining protocol of Tremewan and Vanberg (2016, 2020).

Importantly, each second that goes by during the game, the value of the fund decreases

by 24 cents.[6] Thus, if 150 seconds went by without agreement, all players earned 0. Subjects experienced the described bargaining protocol over 12 periods. The experiment was computerized using zTree software (Fischbacher, 2007). Screenshots, experimental instructions, and details of the bargaining interface can be found in the Online Appendix.

2.2 Treatments and Session Details

We conducted four treatments (between-subjects): *All female* (FFF), *Female majority* (FFM), *Male majority* (MMF), and *All male* (MMM). This means that the gender composition of the triads was fixed in each treatment even though the triads were randomly re-matched in each of the 12 periods. Gender was never mentioned in the instructions or invitation email.

Following the same protocol as Geraldes (2020), we recruited equal number of subjects of each gender to participate in each session, so that upon arriving to the laboratory, subjects would see a gender balanced group. During each session, we conducted two treatments concurrently but subjects only participated in one of them. Six sessions were for the treatments FFF and MMM, and the other six sessions were for FFM and MMF. [7]

Prior to the start of the session, a demographic survey was conducted which asked for gender among several other questions. In our sample, it was always the case that the reported gender matched what the experimenters determined when assigning subjects to computer terminals.

A total of 282 subjects participated in our experiment. They were undergraduate students from Maastricht University, mostly from the School of Business and Economics. Only one period was randomly selected for payment in order to equally incentivize each period (Azrieli et al., 2018). A show-up fee of 5 euros was offered and earnings averaged 16.50 euros. Sessions lasted about 60 minutes. Our design and hypotheses were pre-registered.[8]

3 Previous Literature and Hypotheses

There is a large and growing body of experimental literature studying majoritarian bargaining games. One of the most widely studied models in the laboratory is the legislative

[6] The total fund continues to fall each second during the ratification period.

[7] In the sessions involving the two mixed-gender treatments, 1/3 of the men were paired with 2/3 of the women for FFM and the complement group assigned to treatment MMF. This particular recruiting and treatment allocation procedure was done in order to avoid as much as possible revealing the objective of the experiment.

[8] Pre-registration available at https://aspredicted.org/rh24f.pdf.

bargaining game by Baron and Ferejohn (1989). In this game, players are randomly selected to propose a distribution of a unit of wealth, followed by a voting stage in which a majority must approve. In case of rejection, the process repeats itself and discounting occurs.[9]

Another approach to study multilateral majoritarian bargaining in the laboratory, which we pursue in the present study, is to allow for free-form protocols where time is continuous and any player may propose a division of the pie at any point (and withdraw it).[10] Two recent studies (Tremewan and Vanberg, 2016, 2020) show that bargaining outcomes (i.e., agreed splits) are quite similar in structured and unstructured bargaining protocols despite the differences in the procedures.

Without pretending to suggest that one approach is *better* than the other, we consider the unstructured bargaining protocol more appropriate for our investigation because it captures better the realm of the motivating real-world settings that we have set forth. Importantly, the fundamental purpose of this study is to assess men's and women's bargaining behavior, not to test the accuracy of game theoretical predictions. Finally, the present work also opens the question of whether our findings translate to structured bargaining protocols, which we believe presents an interesting venue for further exploration.

We summarize the evidence from Baron and Ferejohn and unstructured bargaining experiments in Table 1. While it is clear that MWCs are modal representing around 60 percent of all accepted proposals in Baron and Ferejohn (1989) experiments (periods 6-10), the proportion of grand coalitions (GCs) is far from negligible. A similar pattern arises in free-form experiments. Also, a noticeable pattern is that MWCs become more popular as subjects gain experience in bargaining. Thus, as a validation check to ensure that our subject sample is consistent with previous studies, we pose the following hypothesis for our experiment:

Hypothesis 0. *MWCs are the modal allocation of the surplus. The prevalence of MWCs increases with experience regardless of the gender composition of the bargaining group.*

Hypothesis 0 is silent on three important aspects. First, is there a gender difference in the likelihood of proposing an MWC or GC?[11] Second, conditional on an MWC being

[9]For experiments with cheap talk see Agranov and Tergiman (2014); Baranski and Kagel (2015). For veto treatments see Kagel et al. (2010). For one-round games with exogenous continuation values see Diermeier and Gailmard (2006). For treatments with varying voting weights see Diermeier and Morton (2005); Fréchette et al. (2005).

[10]The unstructured bargaining approach has a long history in bilateral bargaining, see Roth (1987); Roth et al. (1981); Roth and Murnighan (1982).

[11]Note that we define a GC as an allocation in which three members receive a positive share regardless of whether the number of players supporting the coalition is two or three. Arguably, for a coalition to include three players, we would need their consent. Nonetheless, the standard nomenclature in the literature is to

Table 1: Coalition Size in 3-Players Majoritarian Bargaining Experiments[1]

	Coalition Size			
	Minimum Winning		Grand	
	Periods 1-5	Periods 6-10	Periods 1-5	Periods 6-10
Baron and Ferejohn Protocol				
Diermeier and Morton (2005)	0.60	0.60	0.40	0.40
Fréchette et al. (2005)	0.58	0.66	0.42	0.34
Kagel et al. (2010)	0.44	0.60	0.55	0.40
Baranski and Kagel (2015)	0.70	0.71	0.30	0.29
Bradfield and Kagel (2015)	0.45	0.52	0.55	0.47
Laroze et al. (2020)[2]	0.52		0.48	
Free-form Bargaining				
Murnighan and Roth (1980)[2,3]	0.94		0.06	
Tremewan and Vanberg (2016)[4]	0.37	0.62	0.52	0.46
Tremewan and Vanberg (2020)	0.56	0.85	0.44	0.15

[1] Data are from treatments in which verbal communication is not allowed, information on gender or other demographics is not provided, decision makers act individually (not in teams), and subjects are randomly rematched after each period. Discounting varies by study. Accepted proposals only. Data obtained from Baranski and Morton (2020).

[2] We did not have the raw data, hence we pool all periods of play as reported in the paper.

[3] Experiments had only male participants and were not computerized.

[4] In this experiment, payoffs accrue to subjects in a given period for every second they are in agreement. We report the percentage of time for which each allocation was in place.

proposed, is there a preference in the gender of the invited partner? Third, conditional on an MWC being proposed, how will the pie be split within the coalition?

With the exception of Laroze et al. (2020), we are unaware of any other multilateral bargaining experiment in which the gender of group members is displayed intentionally or the gender composition of the committee is varied exogenously. There are several important differences between the studies. First, our study is exclusively focused on assessing the effect of displaying gender information on the bargaining process whereas in Laroze et al. information about gender, race, and political orientation is publicly displayed simultaneously. Second, we exogenously set the gender composition of the group and keep it fixed within a session (which is essential to have subjects exposed to only one treatment), while in Laroze et al. group gender composition is randomly formed and varies within periods of play and sessions. Third, we study an unstructured bargaining process, whereas in Laroze et al. subjects play a Baron and Ferejohn protocol that preestablishes the order of moves. The authors find no effect of race or gender on proposer power or coalition partner choice, but report that the offered shares decrease as ideological distance increases. We should note, though, that in their setting subjects simultaneously observe the gender, race, and political ideology of other bargainers. Thus, as the authors acknowledge, the lack of a gender effect could be due to the higher importance of social desirability in their setting.

Given that we lack data about the effect of gender on multilateral bargaining games, we will draw on insights from meta-analyses of the experimental literature on simple bilateral bargaining settings, namely, the dictator game to set forth hypothesis on gender differences. Moreover, as we are not aware of a meta-analysis of gender differences in ultimatum games, we base our hypothesis regarding gender differences also on the studies by Eckel and Grossman (2001), Solnick (2001), and McGee and Constantinides (2013), along with the survey evidence in Eckel et al. (2008).

The results for dictator games meta-analyses and for ultimatum games with gender pairing are summarized in Tables A1 and A2 of the Appendix. Collectively, these studies indicate that women share more than men, and importantly, Rand et al. (2016) show that the altruistic effect of time pressure is stronger on women. The latter result is particularly pertinent for our setting since the fear of exclusion from a coalition may create an urgency to reach an agreement. While this urgency is faced by both men and women, according to Rand et al. (2016) this effect moves women closer to equal sharing than men because they

report two-way splits as MWCs even if three people support the coalition, and 3-way splits as grand coalitions (or surplus coalitions) even if only a simple majority approves. Throughout the paper, we abide by the standard nomenclature.

will act intuitively.

Furthermore, evidence from dictator games with two recipients in Fehr et al. (2006) shows that women are 10 percent more likely than men to choose the most egalitarian outcome among a set of three alternatives. Note that in their study, the alternatives differ in efficiency as well, which is not the case in our game. Thus, we do not have competing motives or trade-offs between fairness and efficiency.

Hypothesis 1. *The proportion of GC agreements is increasing in the number of women in the bargaining group.*

We now proceed to hypothesize with respect to the gender composition of the coalitions. A natural conjecture is that if subjects in an anonymous bargaining game randomize over whom they invite to their coalition, gender information can alter the probability with which men and women will invite each other. What is not clear is which direction to expect: will there be same-gender favoritism in coalition formation? Or will members of the gender majority in the group seek coalitions with the minority player? Again, given the paucity of previous studies assessing the effect of gender composition on coalition formation[12], we draw on insights from related games.

The meta-analysis on discrimination in experiments by Lane (2016) shows evidence of a significant *outgroup bias* for gender identity: both men and women discriminate positively toward the opposite gender. According to their estimates, the probability of discriminating in favor of the opposite gender is almost 33 percent with an effect size of close to 50 percent. The results in Eckel and Grossman (2001) for male responders' acceptance behavior in ultimatum bargaining games are in line with this pattern: men are more likely to accept an offer (controlling for the share) when offered by a female. However, females are more likely to accept offers from other females. The latter result is not supported in the study by Solnick (2001), where female pairs account for the largest rejection rates of all pairings. Considering this mixed evidence, we hypothesize no gender differences will arise in the mixed-gender coalitions emerging in treatments FFM and MMF.

Hypothesis 2. *Conditional on an MWC being agreed upon, mixed-gender coalitions are equally likely to be formed in heterogeneous groups (i.e., FFM and MMF) regardless of which gender is the majority.*

[12]Unfortunately Laroze et al. (2020) do not report the probability of inclusion into MWCs by proposer and voter gender.

Conditional on a mixed-gender coalition, how will payoffs be divided? Considering the previous results that women are more generous than men, and the findings by Eckel and Grossman (2001); Solnick (2001) that women are offered typically smaller shares of the pie than men, we believe that women will obtain smaller shares in mixed-gender coalitions. However, note that a women being offered a small share by a man in a mixed-gender coalition in treatment FFM has the option to partner with another women in order to raise her share. Thus, we believe that payoff asymmetry in favor of males will be more prominent in mixed-gender coalitions when men are the majority (MMF).

Hypothesis 3. *Women receive a smaller share than men in mixed-gender coalitions when men are the group majority, but not when women are the group majority.*

We now discuss our hypothesis on efficiency, which in our setting can be measured by the time needed to reach an agreement. Recall that payoffs decrease each second that goes by, thus groups that are quicker to agree will enjoy higher aggregate payoffs. In light of the finding that women are more generous, we should expect faster agreements in FFF compared to MMM. However, offers are only part of the story given that proposals can be rejected. The evidence on rejections from ultimatum games is mixed. Eckel and Grossman (2001) find that, when paired with the same gender, females are less likely to reject an offer than males (3.1% vs 18.8%). The latter result is in line with McGee and Constantinides (2013) who find a smaller differences (14.7% vs. 18.2%). However, Solnick (2001) finds the opposite pattern (23.1% vs. 4.5%). Overall, the evidence seems to suggest that women are more agreeable and generous then men (Eckel et al., 2008).[13] We therefore hypothesize that:

Hypothesis 4. *Groups with only women reach agreements faster than groups with only men.*

Thus far, we have hypothesized about bargaining *outcomes* but not about the bargaining *process*. Because we implement a free-form protocol of negotiations, our analysis is essentially exploratory. Nonetheless, we hypothesize about one specific variable of interest: the opening offer. Will men and women differ in their willingness to move first? Note that in structured bargaining protocols, such as Baron and Ferejohn, ultimatum, and dictator games, the proposer role is exogenously assigned. Thus, to our knowledge, we are the first to experimentally assess the propensity to move first in a multilateral bargaining setting.

[13] Hernandez-Arenaz and Iriberri (2020) report that men take longer to reach agreements in an alternating offer bargaining game when there are asymmetries between players, but not in a perfectly symmetric case where the equal split prevails.

Exley et al. (2020) study a wage setting game between an employer and an employee that have worked (i.e., real effort task) to generate a contribution that determines joint profits to be divided via bargaining. In their main treatment, employees can choose to enter a wage negotiation game. Their results show that women are significantly less likely than men to enter negotiations (66% vs. 74%).

Evidence from other domains is also illuminating on this matter. For example, Coffman (2014) finds that, controlling for ability, women are less likely than men to contribute their ideas (e.g., answer to a quiz). Vast experimental evidence following Niederle and Vesterlund (2007) shows that men are more likely to sort into competitive environments than women. In a group decision domain, Ertac and Gurdal (2012) show that women and men differ substantially in the willingness to make a decision on behalf of their group: 55% of women compared to 86% of men volunteer to make a group decision. Men are also more likely than women to give advice on how to play a game strategically (Cooper and Kagel, 2016).[14]

If we assume that the forces driving the willingness to enter into a negotiation, contribute an idea, offering advice on strategic play, or sort into competition, affect bargaining postures, then we should expect women to take a more passive stance in our setting. Moreover, the competitive nature of the bargaining setting may foster even larger differences in willingness to propose if the environment is perceived as male-typed. Our last hypothesis is therefore:

Hypothesis 5. *In mixed-gender groups (i.e., FFM and MMF), men are more likely than women to make the opening proposal.*

4 Results

In Table 2, we summarize the structure of the data. In total, we observed 288 bargaining games in the FFF and MMM treatments, and 276 bargaining games in the FFM and MMF treatments.

In Subsection 4.1, we test our hypotheses regarding bargaining outcomes. To this end, we follow the same order of our stated hypotheses. In Subsection 4.2, we conduct an exploratory analysis on individual bargaining strategies.

[14] For experimental work on leadership and gender, see Reuben and Timko (2018) and Reuben et al. (2012).

Table 2: Description of Data Set

Treatment	Subjects	Periods	Agreements[1]	Matching groups	Subjects per matching group
FFF	72	12	288	6	12
FFM	69	12	276	6	9, 12 [2]
MMF	69	12	276	6	9, 12 [2]
MMM	72	12	288	6	12

[1] An agreement refers to a bargaining outcome (there are no disagreements in our sample). It is the number of periods times the number of subjects divided by 3.

[2] In one of our sessions, not enough subjects showed up. Hence, there is one matching group with 9 subjects.

4.1 Bargaining Outcomes

First, we note that there are no disagreements in our sample, and therefore we observe a monetary division for every game played.

4.1.1 Final Agreements: Types of Coalitions

We start by analyzing the type of allocations that triads agreed upon. In Table 3, we report the proportion of MWCs and GCs for each treatment. Clearly, the MWCs are modal representing approximately 80 percent of all agreements. In Figure 1, we see that the proportion of GCs is decreasing (and thus MWCs is increasing) with experience in all treatments.[15]

In short, Hypothesis 0 is supported.

Result 0. *In line with Hypothesis 0, we find that: (1) 79.9 percent of all agreements are MWCs and 19.9 are GCs*[16]*, (2) The prevalence of MWCs increases with experience, regardless of the gender composition of the bargaining group.*

Table 3 shows a clear pattern: As the number of females increases in the triad, so does the proportion of GCs. To probe the statistical significance of these observations, we conduct a probit regression (clustering at the matching group level) of the probability of GC on the number of females. The marginal effects are reported in Table 4. We also accounted for a period trend (and its interaction with the number of females) in a second model (column 4).

[15] A linear probability model corroborates this result. In an unreported regression, we regressed a dichotomous variable for whether an agreement is a GC on treatment dummies, a period trend, and its interaction with each treatment, and we did not find any significant difference in the rate of GC decay by treatment.

[16] There are 2 instances in which one member obtains the entire surplus. We omit these two instances throughout our analysis since they represent only 0.18% of all bargaining games.

Table 3: Proportion of Minimum Winning and Grand Coalitions by Treatment

	FFF	FFM	MMF	MMM
Minimum Winning Coalitions				
All	0.740	0.739	0.844	0.872
Equal splits (50% each)	0.535	0.551	0.594	0.635
Grand Coalitions				
All	0.260	0.257	0.152	0.128
Equal splits (33.3% each)	0.149	0.178	0.109	0.090
Gender Composition of MWCs				
mixed gender	n.a.	0.67	0.58	n.a.
same gender	n.a.	0.33	0.42	n.a.

Table 4: Marginal Effects of Probit Models for Grand Coalition Agreement

	All Periods	Periods 1-6	Period 7-12	All Periods
Number of Females	0.050***	0.060**	0.040*	0.050***
	(0.019)	(0.027)	(0.021)	(0.019)
Period				-0.029***
				(0.005)
N	1128	564	564	1128

Standard errors clustered at the matching group level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

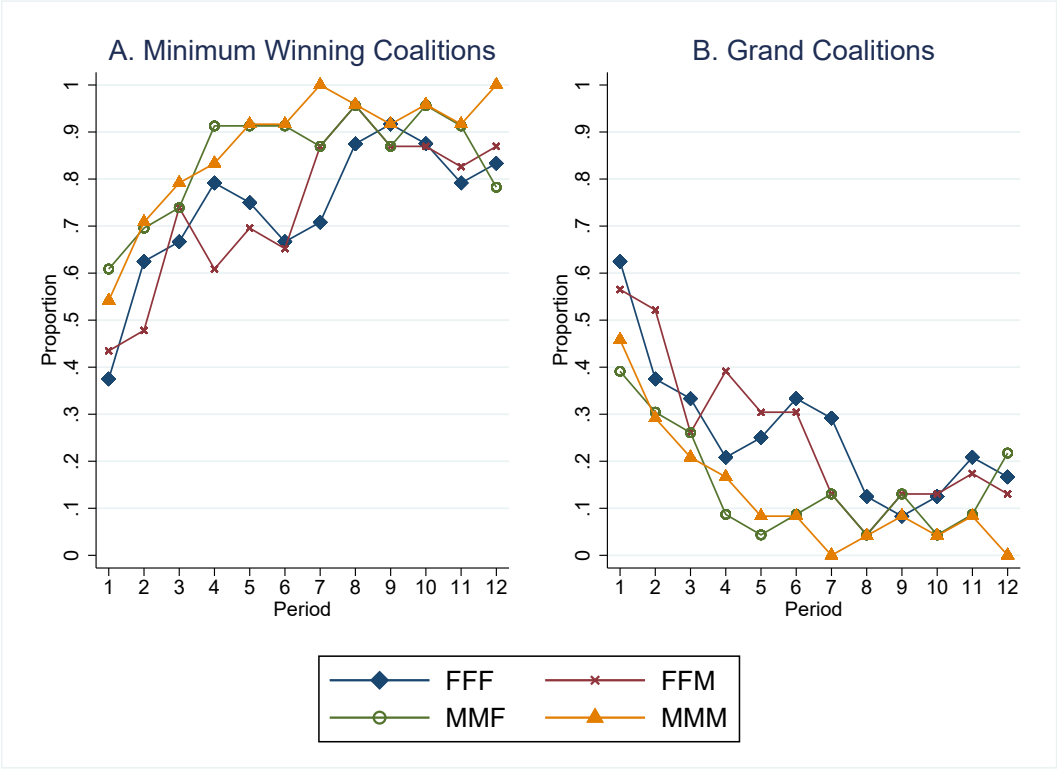

Figure 1: Minimum Winning and Grand Coalitions over Periods of Play, by Treatment

Supporting Hypothesis 1, our regression shows that each additional female in a triad represents a 5 percentage point increase in the probability of observing a GC.[17] In line with these findings, the euclidean distance between agreed splits and the equal split is smaller in female majority groups compared to male majority groups (0.34 vs. 0.38, p=0.8).

An important observation is that unanimous approval is more common in FFF and FFM than in MMM and MMF. While willingness to approve is evidently correlated with the amount of the surplus that a subject receives, it further evidences that the female representation in committees increases the number of agreements which are viewed as acceptable by the entire group. See Section C.2 of the Online Appendix for supporting tables.

Result 1. *The proportion of GCs is increasing in the number of females in the bargaining group.*

How often do mixed-gender coalitions emerge in FFM and MMF? Note that perfect randomization over partner choice implies that female-male coalitions arise with 2/3 probability in FFM and MMF. Pooling over all games, we find that 67% of the time MWCs are mixed-gender in FFM—which is consistent with equiprobable partner choice—but only 58% in MMF (see bottom of Table 3). The probit regression analysis in Table 5 with treatment dummies reveals that this difference is not statistically significant (p=0.166). Notably, however, in the first half of the experiment, mixed-gender coalitions represent 77% and 57% of MWCs in FFM and MMF, respectively, and this 20 percentage point difference is significant (p=0.047). Note that it is the large proportion of mixed-gender MWCs in FFM driving this result, as the proportion of such allocations remains similar in the second half for MMF.

Overall, we cannot support Hypothesis 2.[18]

Result 2. *Mixed-gender coalitions are more common in female majority groups than in male majority groups in the first half of the experiment, but there is no difference in the second half.*

Turning to our next hypothesis, we now investigate whether there are gender differences in the split of the surplus within mixed-gender coalitions (see Table 6). First, we note that approximately 73% of all agreements in mixed-gender MWCs are equal split. Women take

[17] For robustness, we conducted the same regression, but instead of considering the number of women as a continuous variable, we had individual treatment dummies and we also conducted a regression with a dichotomous variable for female majority versus male majority. The direction of our results are largely confirmed, although not all treatment differences reach significance at conventional levels. See Section C.1 of the Online Appendix.

[18] In Subsection 4.2, we conduct an exploratory analysis of the possible causes of lower formation of mixed-gender coalitions in MMF. Specifically, we look at first proposals broken down by gender and the behaviors of men and women that are left out of a MWC.

Table 5: Marginal Effects of Probit Models for Mixed-Gender MWCs

	(1) All Periods	(2) Periods 1-6	(3) Period 7-12	(4) All Periods
MMF	-0.087	-0.198**	-0.010	-0.093
	(0.063)	(0.100)	(0.060)	(0.065)
Period				-0.014*
				(0.007)
N	437	193	244	437

Standard errors clustered at the matching group level. FFM is the baseline.
* p<0.1, ** p<0.05, *** p<0.01

Table 6: Shares in Mixed-Gender Coalitions, by Treatment and Gender

	FFM	MMF
Mixed-Gender MWCs		
Women	48.96	50.43
Men	51.04	49.57
Grand Coalitions		
Women	33.63	28.97
Men	32.74	35.52

49% of the pie in FFM and 50.4% in MMF. The regression analysis presented in Table 7 shows that being in the majority or in the minority does not affect women's shares within a MWC. If anything, what we find is a slight gender minority advantage. Computing the mean share difference between minority and majority members (pooling FFM and MMF) we obtain 0.18, but it is not significantly different from 0 (p=0.324).[19]

Despite not having a hypothesis regarding the shares of men and women in GCs, we consider it important to look at these agreements as well. The data looks strikingly different when we focus on GCs. In these agreements, gender minorities obtain, on average, 3 percentage points less of the pie (p=0.066). In FFM, men receive 32.7 percent of the pie while women receive 33.6. A wider gap arises in MMF, where women receive 29 percent and men 35.5 percent.

Table 7: Linear Regression for Female Share in Mixed-Gender Coalitions

	(1) All Periods	(2) Periods 1-6	(3) Period 7-12	(4) All Periods
Male Majority (MMF)	0.177	-0.001	0.333	-0.098
	(0.169)	(0.191)	(0.208)	(0.262)
Period				-0.010
				(0.025)
MMF × Period				0.041
				(0.036)
N	271	127	144	271
R^2	0.01	0.00	0.02	0.01

Standard errors clustered at the matching group level. FFM is the baseline.

* p<0.1, ** p<0.05, *** p<0.01

In a nutshell, we reject Hypothesis 3.

Result 3. *(1) Men and women in mixed-gender coalitions receive the same share regardless of the gender majority of the bargaining group. (2) Interestingly, we also find that there is a gender minority disadvantage in grand coalitions.*

[19]The p-value was obtained from a linear regression of the share difference on a constant, with standard errors clustered at the matching group level.

4.1.2 Final Agreements: Efficiency

We now analyze the efficiency of the agreements by assessing how quickly they are reached because this will allow us account for the money *lost* and, thus, determine aggregate payoffs. A summary of these results is presented in Table 8. Final agreements are reached the slowest in FFF (16.9 seconds) and fastest in MMM (15.3 seconds), the difference being significant at the 10% level. [20] The efficiency loss in monetary terms is 30 percent higher in FFF (6.30 EUR) compared to MMM (4.88 EUR). In other words, we reject Hypothesis 4.

Table 8: Agreement Delay and Efficiency

	FFF	FFM	MMF	MMM
Average Time to Agreement[1](sec)	16.85	15.74	16.60	15.31
Money Lost[2](EUR)	4.04	3.78	3.98	3.67
Agreement reached in the:				
First attempt (%)	58.3	71.4	62.7	59.4
Second attempt (%)	18.8	12.7	12.7	19.4
Third attempt and beyond (%)	22.9	15.9	24.6	21.2

[1] This is the time at which the agreement was ratified. By subtracting 10 seconds, one obtains the time at which the preliminary agreement was reached.

Result 4. *All-male triads are faster in reaching agreements than all-female triads, which leads to enhanced efficiency in all-male treatments.*

Can differences in bargaining duration be attributed to the nature of the agreements? One natural conjecture is that MWCs are agreed upon faster than GCs. However, we find no differences in time to agreement between triads that approved a GC and those that approved an MWC ($p>0.7$).

To better understand the bargaining delays in our setting, we take now into account that a temporal delay can be due to inactivity, slow responses, or multiple provisional agreements being broken prior to the final one. We find virtually no difference between FFF and MMM regarding agreements reached in the first attempt (58.3 percent and 59.4 percent of the first provisional agreements bind, respectively). The same holds regarding agreements reached in the second or third attempts and beyond (see bottom part of Table 8). In other

[20] See Section C.3 of the Online Appendix for the detailed econometric analysis. All p-values reported are obtained from OLS regressions with standard errors clustered at the matching group level.

words, bargaining behavior is not *tougher* in the FFF treatment compared to the MMM treatment. This indicates that the explanation for the efficiency premium in MMM over FFF is that males are quicker to make opening offers, which reduces the overall time of reaching agreements.

4.1.3 Are There Gender Differences in Earnings?

Although we do not have a hypothesis regarding (possible) gender differences in earnings, we are certainly interested in assessing whether any exist.

From Result 3 in Subsection 4.1.1, we know that there is no gender difference in the received share in mixed-gender coalitions for both the FFM and MMF treatments. However, this is only part of the story since in the analysis above we only considered mixed-gender coalitions. Therefore, we should also tackle the following question: Do women take a smaller share than men pooling over *all* agreements in mixed-gender treatments? In a *fair* division of the pie, a single player would take 1/3 of the resources (in expectation) regardless of gender and gender composition. Regression analysis indicates that men receive more than 1/3 of the surplus in MMF and FFM but it is not significant at conventional levels.[21]

This overall pattern in received shares affects earnings. Differences in shares translate into men earning approximately 22% more than women in MMF (11.34 EUR vs. 9.32 EUR, $p = 0.006$, Mann-Whitney test), whereas the gender gap observed in FFM is only 2% (10.89 EUR vs 10.66 EUR, $p = 0.146$, Mann-Whitney test). Altogether, the results thus far indicate that the considerable gender gap in earnings in MMF relative to FFM is driven by the disproportionately higher formation of same-gender MWCs in MMF, as well as women's lower share in GCs in MMF.

Another noteworthy result in Table 9 relates to the contrast of earnings between the FFF and MMM treatments—Men earn significantly more than women (10.77 EUR vs. 10.64 EUR, $p = 0.045$, Mann-Whitney test), which is clearly driven by the longer time that women take to reach final agreements.

We summarize in our next result:

Result 5. *Men earn more than women in FFM and MMF, with the gap being wider when females are the minority. Men also earn more than women in MMM compared to FFF, which is explained by men being faster in reaching agreements.*

[21] Testing for whether a male's share is greater than 1/3, the p-values are 0.14 and 0.22 in FFM and MMF, respectively (see regression in Section C.4 of the Online Appendix).

Table 9: Earnings

	FFF	FFM	MMF	MMM
Earnings	10.64	10.74	10.67	10.77
Women		10.66	9.32	
Men		10.89	11.34	

4.1.4 Who Proposes First?

We now test our final hypothesis on opening offers, which we conjectured are mostly done by men. Note that in mixed-gender treatments, the majority gender should make the opening offer 2/3 of the time if each gender had equal likelihood of proposing first.

In Table 10, we show that men are indeed more likely than women to make the opening offer. When men are the majority, one of them moves first 79 percent of the time. When men are the minority, they move first 45 percent of the time. Both of these proportions are greater than what would arise if both men and women proposed first with equal likelihood (see test in Table 10). Thus, the data support Hypothesis 5.

Table 10: Proportion of First Offers by Males in Mixed-Gender Treatments

	FFM	MMF
(1) Observed	0.45	0.79
(2) If Random	0.33	0.67
p-value for test[1] (1)=(2)	0.059	0.003

[1] Test based on a linear regression with standard errors clustered at matching group level.

Do first movers enjoy a payoff advantage? Figure 2 shows the mean share of the fund in the approved allocation received by subjects that proposed first, for each gender. The figure also displays the share corresponding to an equal split at 1/3 (dashed line). In both mixed-gender treatments, male first movers enjoy a payoff advantage. The gap is of 10 percentage points in MMF (28.4 vs 38.2, p=0.013) and smaller in FFM (34.4% vs. 36.5%, p=0.191). Note that women propose MWCs more often than men when they are the minority, hence the large gap in first-mover advantage in MMF is not due to women proposing more inclusive splits (see Figure A1).

Comparing MMM and FFF, we also see a gender gap in first-proposer advantage (32.7% of the pie for women and 35.7% for men (p=0.080), but this is driven by the fact that women in FFF are more likely to propose GCs than men in MMM.

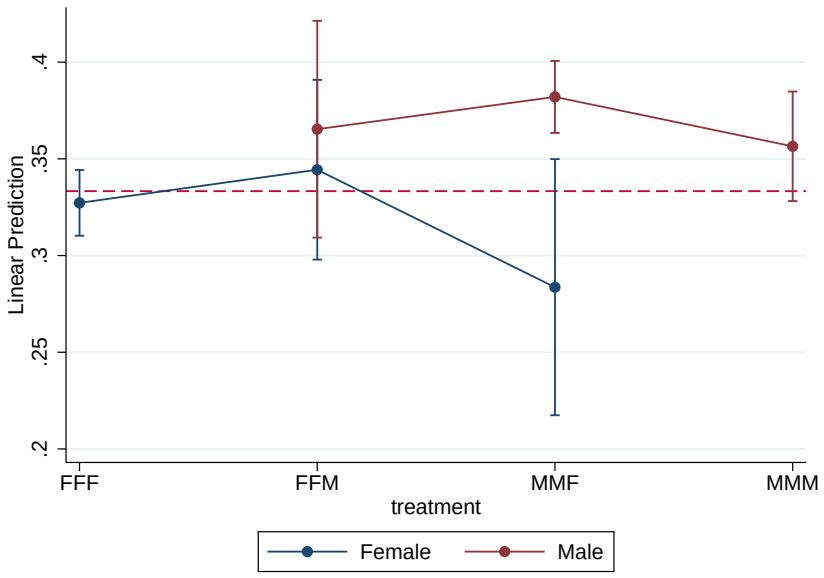

Figure 2: Share of the Fund for First Proposers in Approved Allocations

Result 6. *Men are more likely than women to make the first offer regardless of whether they are in majority or minority. Men that propose first enjoy a larger share of the pie than women.*

4.2 Exploratory Analysis—Formation of Mixed-Gender Coalitions in FFM and MMF

Why are mixed-gender coalitions more prevalent in FFM than in MMF? In this section, we conduct an exploratory analysis to better understand the differences in the formation of mixed-gender coalitions between FFM and MMF. Our motivation to take a closer look at the data is the lower earnings of women in MMF as reported in Subsection 4.1.3. Thus, we are primarily interested in uncovering why women are left out of MWCs more often than men in MMF. The insights we gather in this exploratory analysis will be summarized in a series of hypotheses, which we will test in the *Follow-up* experiment. As such, we do not conduct statistical tests to accommodate for the valid critique of multiple hypothesis testing.

We focus on three initial events of the bargaining games: (1) the first offer, (2) the first provisional agreement, and (3) the first counter-offer during the first ratification period.[22]

[22]We focus our analysis on these events of the bargaining process because they are straightforward to observe and quantify, and the number of comparable observations available as the game goes on decreases rapidly (most games end after the first agreement and, as time elapses, the ever-decreasing number of games is divided among an exponentially increasing number of possible histories). Also, in around 80% of the games,

The latter element is fundamental for assessing how provisional agreements may break down. We also limit our attention to MWCs, which are more straightforward to analyze[23] and, very importantly, represent the large majority of agreements in our data.

4.2.1 Why are Women Excluded from MWCs More Often Than Men in MMF?

We consider three main reasons why a woman may be more likely to be excluded in implemented MWCs when matched with two men. The most obvious is that men have a preference to make proposals to other men. Our data from the *Main* experiment does not support this explanation: when a male first-mover proposes a MWC, only 44% of the proposals are made to the other man, so any existing bias is *in favor* of women.

Another possible reason is that women are more likely to propose GCs, which are seen as less attractive by men. Although first proposals by women are 12% more likely to be GCs across all treatments, we see in Figure A1 that women in MMF are marginally $less$ likely to propose GCs. Interestingly, while men's proposals for GCs is consistent across treatments, women seem to conform to the male behavior when in the minority.

A third possibility is that the difference is caused by men being faster at making the opening offer. Indeed, men offer first in 79% of the MMF games, which is more than the 2/3 suggested by chance. While this behavior contributes to the widening of the gender gap as reported previously, it is certainly not decisive because 66% of first MWC provisional agreements in MMF are mixed-gender.

4.2.2 First Provisional Agreements and Counter-Offers

Bargaining dynamics may differ by gender, which can affect final agreements. How does the bargaining process evolve such that women become excluded? In Table 11, we report whether initial MWCs are implemented, and, if not, the type of agreement that follows. In Table 12, we break down the types of clicks (i.e., offers) immediately following initial MWCs. Regarding the first counter proposals following an initial mixed-gender provisional MWC in MMF, 45% of those made by excluded men are MWCs proposals to females, compared to 31% to the other male. Again, as with the first offers, women are favored. Thus, we can confidently rule out deliberate discrimination as an explanation for more (than expected if random) women being left out. There is, however, evidence that women are not as good as men at breaking coalitions: excluded women are more likely not to click at all (11% vs. 5%)

it is the first or second provisional agreement that is implemented (see Table 8).

[23] In a GC, it is not clear who a proposal has been made to.

and more likely to propose GCs (21% vs. 14%), which are less popular, as we have shown in Section 4.1.

Table 11: Fate of First (Temporary) MWC Agreements

Treatment	**FFM**		**MMF**	
(Gender Composition of MWC)	**(MF)**	**(FF)**	**(MF)**	**(MM)**
Same coalition partners				
Implemented as is	94 (69%)	48 (75%)	92 (60%)	57 (72%)
Renegotiated	3 (2%)	2 (3%)	12 (8%)	6 (8%)
New coalition partners				
New MF	16 (12%)	14 (22%)	18 (12%)	15 (19%)
New FF	17 (13%)	n.a.	n.a.	n.a.
New MM	n.a.	n.a.	27 (18%)	n.a.
GC	6 (4%)	0 (0%)	4 (3%)	1 (1%)
Num. Obs.	136	64	153	79

Table 12: Counteroffer after First (Temporary) MWC Agreement Formed

Treatment	**FFM**		**MMF**	
(Gender Composition of MWC)	**(MF)**	**(FF)**	**(MF)**	**(MM)**
Counteroffer made by:				
Men in provisional agreement	11 (8%)	n.a.	18 (12%)	14 (18%)
Women in provisional agreement	12 (9%)	10 (16%)	10 (7%)	n.a.
Excluded member	102 (75%)	47 (73%)	117 (76%)	56 (71%)
No counteroffer made	11 (8%)	7 (11%)	8 (5%)	9 (11%)
Num. Obs.	136	64	153	79
Counteroffers by Excluded Member				
Propose a GC	31 (30%)	6 (13%)	16 (14%)	12 (21%)
Propose a MWC to F	37 (36%)	36 (77%)	53 (45%)	n.a.
Propose a MWC to M	22 (22%)	n.a.	36 (31%)	39 (70%)
Other	12 (12%)	5 (11%)	12 (10%)	5 (9%)
Num. Obs.	102	47	117	56

Furthermore, in MMF, men leave a mixed-gender MWC more frequently than women. First of all, 12% of the first clicks of a coalition member during a provisional agreement are made by the man breaking the agreement compared to 7% for females. This behavior can also be observed in Table 11: when a new MWC forms with the excluded male, in 27 out of 45 cases it is the man from the initial agreement who leaves.

Thus, given our exploratory analysis, we derive the following new hypotheses for the treatment MMF:

Hypothesis 6. *1. Men proposing MWCs randomize over their coalition partner.*

2. Females left out of a MWC are less likely to make counteroffers than left out men.

3. Men are more likely than women to leave a preliminary agreement.

5 *Follow-up* Experiment: An Investigation of the Gender Gap in Earnings in Mixed-Gender Coalitions

In order to probe the robustness of the gender gap in earnings, as well as to test the significance of the exploratory analysis of mixed-gender coalition dynamics (section 4.2), we conducted 8 additional sessions of the mixed-gender treatments (FFM and MMF). While hypothesis 6 concerns MMF only, we conducted both MMF and FFM treatments because otherwise it would be impossible to keep the recruitment protocol constant (i.e., to preserve an equal number of males and females present in the laboratory).[24]. Our hypotheses, sample size, and the definition of the outcomes variables were pre-registered.[25]

The *follow-up* experiment was conducted during June 2021 at LINEEX, which is the Laboratory for Research in Behavioural Experimental Economics (University of Valencia). A total of 240 subjects took part in the experiments and all the procedures were identical to those of the *Main* experiment.

5.1 Results

First and foremost, we replicate our main finding: men earn more than women in both treatments. On average, the share a man receives is 5.4 percentage points higher (p=0.001, pooling both treatments). While we find the gender gap in MMF to be 1.8 percentage points higher than in FFM, the difference is not significant (p=0.464). Also, there is no statistically significant difference between the *Main* and the *Follow-up* experiments (p=0.475).

Men are more likely to be part of an MWC in both mixed-gender treatments. Mixed-gender coalitions occur 59 percent of the time in MMF, which is less than predicted by a

[24]We also conducted two additional sessions for FFF and MMM in order to verify that our samples were not distinct in those treatments, which we corroborate. In particular, MMM reaches agreements in 14.3 seconds and FFF in 19.5, which leads to a replication of a gender gap in earnings.

[25]See pre-registration at https://aspredicted.org/ZTY$_3$6Y.

Table 13: Bargaining Outcomes in Mixed-Gender Treatments (*Follow-up* Experiment)

	FFM	MMF
Minimum Winning Coalitions		
All	0.792	0.740
Equal splits	0.573	0.482
Gender Composition of MWCs		
Mixed gender	0.770	0.590
Same gender	0.230	0.410
Mean Share of Pie		
Women	0.312	0.304
Men	0.375	0.348
Mean Earnings (in Euros)		
Women	9.88	9.61
Men	11.95	11.02
Agreement reached in		
First attempt (%)	56.25	59.11
Second attempt (%)	21.09	15.36
Third attempts and beyond (%)	22.66	25.52

random coalition formation process (p=0.036). In FFM these represent 77 percent which is higher than predicted by chance (p=0.018).

We corroborate in the *Follow-up* experiment that men are more likely to propose first. In FFM, men propose first 48% of the time, which is significantly higher than 1/3 (p=0.004). In MMF, women propose first 22% of the time, which is significantly lower than 1/3 (p=0.013). As we shall see, this is the main behavioral pattern of the bargaining process in mixed-gender triads that we observe in both the *Main* and *Follow-up* experiments. A gender gap also arises in the first-mover advantage (see Figure A2).

When focusing on the first proposal on the floor conditional on the offer being a MWC, we cannot reject that women in FFM randomize over whom to invite in the coalitions (p=0.500). Conversely, men in MMF display discriminatory behavior: they offer a positive share to the other man with 57 percent chance, significantly higher than predicted by a coin toss (p=0.004). Thus, we reject part 1 of Hypothesis 6 and identify another channel through which women are disadvantaged in male majority groups, which did not arise in the *Main* experiment.

We now investigate whether women in MMF are are less likely to *fight back* when left out of an MWC compared to left-out men, as we had documented in the *Main* experiment.

With reference to Table 15, we do not find such behavior in the *Follow-up* experiment: in 4% of preliminary MWCs the excluded men does not make a counteroffer while this only happens 2% the time when the female is the excluded member. Thus, we cannot attribute the gender gap that we find in the *Follow-up* experiment to women displaying a more passive bargaining posture when excluded, and as such, cannot support Hypothesis 7.2.

Are men more likely than women to leave a mixed-gender MWC in MMF as we hypothesized? Table 14 shows that out of the 59 cases where a new MWC is formed, 28 times it was the men who left the provisional mixed-gender MWC to join a male-male MWC and 31 times it was the female who left the provisional mixed-gender MWC for a new male partner. Further evidence is provided in Table 15 which shows that men make counteroffers 9% of the time, and women do so 11%. While these difference are not statistically significant, their direction is contrary to our stated hypothesis.

Table 14: Fate of First (Temporary) MWC Agreements, by Treatment (*Follow-up* Experiment)

	FFM		**MMF**	
(Gender Composition of MWC)	**(MF)**	**(FF)**	**(MF)**	**(MM)**
Same coalition partners				
Implemented as is	148 (68%)	35 (48%)	103 (54%)	72 (72%)
Renegotiated	4 (2%)	3 (4%)	11 (6%)	6 (6%)
New coalition partners				
New MF	25 (11%)	31 (42%)	31 (16%)	21 (21%)
New FF	33 (15%)	n.a.	n.a.	n.a.
New MM	n.a.	n.a.	28 (15%)	n.a.
GC	9 (4%)	4 (5%)	18 (9%)	1 (1%)
Num. Obs.	219	73	191	100

Result 7. *In male majority groups, we identify the following bargaining dynamics which can explain the gender gap in earnings:*

1. *Men are more likely to make the opening offer than women (Main and Follow-up experiments).*

2. *Excluded women are less aggressive in trying to break all-male coalitions and men are faster at making proposals (Main experiment).*

3. *Men are more willing to break a mixed-gender coalition (Main experiment).*

Table 15: Counteroffer after First (Temporary) MWC Agreement Formed, by Treatment (*Follow-up* Experiment)

Treatment	**FFM**		**MMF**	
(Gender Composition of MWC)	**(MF)**	**(FF)**	**(MF)**	**(MM)**
Counteroffer made by:				
Men in provisional agreement	12 (5%)	n.a.	16 (9%)	18 (18%)
Women in provisional agreement	17 (8%)	20 (28%)	21 (11%)	n.a.
Excluded member	179 (82%)	52 (72%)	146 (80%)	80 (82%)
No Offer is made	11 (5%)	1 (1%)	8 (4%)	2 (2%)
Num. Obs.	219	73	191	100
Counteroffers by Excluded Member				
Propose a GC	59 (33%)	9 (17%)	40 (27%)	20 (25%)
Propose an MWC to F	55 (56%)	33 (63%)	54 (37%)	n.a.
Propose an MWC to M	44 (44%)	n.a.	37 (25%)	49 (61%)
Other	21 (12%)	10 (17%)	15 (10%)	11 (14%)
Num. Obs.	179	52	146	80

4. *Men are more likely to choose a man as their coalition partner than a woman (Follow-up experiment).*

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6 Discussion and Concluding Remarks

Collectively, the results from our experiments demonstrate that the gender composition of a bargaining committee affects the agreements reached and the bargaining process that leads to them. First and foremost, we document the existence of a gender gap in earnings: men earn more than women, both in mixed-gender and same-gender bargaining triads. The gap in earnings in the same-gender treatments stems from the fact that women take longer to reach agreement compared to men. Given the shrinking pie feature of our experiment, higher delay translates into lower earnings in the all-female triads.

In mixed-gender treatments, the gender gap in earnings arises regardless of whether women are a minority or a majority. We identify three mechanisms contributing to the gender gap in earnings in mixed-gender triads. First, men are more likely to make the opening offer, which enhances their odds of being part of a winning coalition. Importantly, only men enjoy a first-mover advantage. Since this finding is robust to both samples of our study, we argue that this element is a key determinant in driving the gender gap in

earnings.

Second, gender differences in the bargaining process also play a role in explaining differentials in earnings. In the *Main* experiment, we find that excluded women in male-majority triads are less proactive and successful in breaking male-male coalitions compared to left-out men, which skews men's chances of reaching an agreement with each other in which a woman is excluded. Furthermore, in male-majority triads, men leave mixed-gender coalitions to partner with the other male in the triad more often than females break away.

Third, we find evidence for direct or intentional discrimination in the *Follow-up* experiment. In the second sample we study, we find that men tend to partner with each other in male-majority triads, whereas women do not display such behavior when they are in majority. Male-male MWCs generally end in agreement (close to 70 percent of the time) in male-majority triads. In contrast, the female-female coalitions are rather unstable in the *Follow-up* experiment; they are dissolved 48 percent of the time and result in mixed-gender coalitions.

Moreover, our results show that female representation causally and positively affects the proportion of GCs splits, which is evidence that women act more pro-socially than men in a majoritarian bargaining setting. As such, unanimous agreements occur more frequently in female majority triads (FFF and FFM) relative to male majority triads (MMF and MMM). If equality in resource distribution is a goal societies pursue, our results indicate that goal will be more likely achieved when committees are predominantly female.

We do not find evidence supporting our hypothesis that all-female triads reach agreements faster. If anything, time to agreement is longest in FFF. And, when looking at how many interim coalitions precede the final agreement, no differences emerge between treatments. It is possible that the symmetric nature of our setting is the reason for the lack of variation in bargaining duration, especially since equal splits (both in GCs and MWCs) are quite focal. Experimentally altering information about others' payoffs (Roth and Murnighan, 1982), entitlements (Baranski, 2016), or bargaining power (Diermeier and Morton, 2005) may make it harder to reach agreements because these can lead to conflicts over what is an *acceptable* split. The latter variations are areas of research where further experimentation can lead to important insights regarding men's and women's bargaining behavior.

In the Introduction, we briefly mentioned several previous findings that highlighted how the gender composition of a group affects outcomes in other domains (see Footnote 2). Specifically, Bourreau-Dubois et al. (2020) investigate child support decisions by French judges. A

three-person panel negotiates how much child support to award under a majority rule and without a predefined structure to the negotiation process. All-women judge panels award the highest level of child support, but there is no monotonic relationship between the number of females in the group and the monetary support and all-male panels grant lower support, but not significantly. Moreover, using a business management game, Apesteguia et al. (2012) report that groups of three women are more likely to make investments in corporate social responsibility programs that have positive consequences over others.

Besides the issue of non-random allocation into groups, the two previous settings have one aspect in common that differentiates them from our study: the resulting decisions have consequences over third parties. We argue, however, that generosity toward others will display the same increasing pattern in the number of women in the committee. Evidence from the meta-analysis on dictator games by Bilén et al. (2020) shows starker gender differences in generosity toward charities, with women transferring 10 percentage points more than men. Further experimental work is needed to understand how exogenous variation in the gender composition of a committee affects outcomes when decisions are being made that have consequences for third parties.

A word of caution is in order. In both experiments, participants overwhelmingly report to not have noticed the gender silhouettes.[26] Assuming their responses are largely truthful, this implies that the gender differences we find in the mixed-gender treatments would also emerge if we conducted the experiment with the same gender composition without showing gender-revealing silhouettes. Under this treatment variation, any gender gap in earnings that may arise could be attributed to gender differences in *bargaining dynamics* only. However, we are cautious about interpreting the answers subjects gave about not noticing the gender of their partners. Because we also find evidence for discrimination in explaining the gender gap in earnings, this indicated that the use of silhouettes to prime gender was not necessarily unsuccessful. That is, despite participants' (negative) answer to the manipulation check, we cannot rule out that: (1) they did not notice consciously, but the effect is subconsciously operating, and (2) they noticed the silhouettes but lied about it to avoid being labeled as sexist or discriminatory.

In closing, the evidence from two decades of laboratory experiments on the popular Baron and Ferejohn (1989) game of structured bargaining, a cornerstone model in political economy, has shown that MWCs are modal but that GCs are non-negligible, representing close to

[26] In a debriefing question, we find that 72% and 68% of the participants reported that they did not notice the silhouettes in the *Main* and *Follow-up* experiments.

1/3 of agreements for three-player games (Baranski and Morton, 2020). To our knowledge, none of the Baron and Ferejohn (1989) experiments report the proportion of MWCs and GCs proposals by gender and none has explicitly controlled for gender balanced recruitment at the session level. Hence, we conjecture that variation in the proportion of MWCs observed in Baron and Ferejohn experiments can be due to variations in gender composition of the sessions' participants. Thus, overlooking this important element in majoritarian bargaining experiments may affect results. Given the similarity in payoff divisions observed in structured and unstructured games (see summary in Table 1), we conjecture that our results will transfer to settings like Baron and Ferejohn (1989) experiments, albeit with smaller gender gap in shares. This is because a structured process would naturally assign equal probability to propose for each subject, which is an advantage men pursue over women in our experiment. In our ongoing research agenda, we are currently investigating how different institutional changes may help close the gender gap in earnings, which can have important implications for political and business settings.

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A Supporting Tables and Figures

Table A1: Meta-Analyses Results on Gender Differences in Dictator Games

Study	Finding Summary	Significance	Sample
Engel (2011)	Women transfer 5.8 more percentage points of the total pie than men.	p<0.1	12 studies
Bilén et al. (2020)	Women transfer 4.2 percentage points more of the total pie than men.	p<0.001	53 studies (15,042 obs.)[1]
Rand et al. (2016)	The effect of increasing reliance on intuition by experimentally reducing response time on transfers is 5.5 percentage points larger in women than men.	p<0.001	22 studies (4,366 obs.)

[1] This study uses raw data, while the others use effect sizes.

Table A2: Results from Ultimatum Game Studies with Gender Pairings

	Share Offered (%)			**Rejection Rate (%)**		
	EG (2001)	S (2001)	MC (2013)	EG (2001)	S (2001)	MC (2013)
Female	38.5	46.8	46.6	10.5	13.5	15.9
F to F	37.8	43.1	47.2	3.1	23.1	14.7
F to M	39.8	51.3	45.9	9.4	6.3	15.6
Male	36.5	46.7	45.8	14.1	4.2	16.8
M to M	36.6	47.3	45.8	18.8	4.5	18.2
M to F	36.6	44.3	45.8	17.2	0.0	17.2

[1] EG is for Eckel and Grossman (2001). S is for Solnick (2001). MC is for McGee and Constantinides (2013).
Sources: Table 2 in EG (2001) and MC (2013). Data for MC and EG is for all 8 periods. S is a one-shot game.

Table A3: Linear Regression of Time to Agreement

Dep Var.	Time to Agreement	Time to Agreement	Mean Time to Agreement
All Male	-1.677	-1.677	-1.677
	(-1.91)	(-1.91)	(-1.82)
period trend	-0.0972		
	(-1.04)		
Constant	7.632***	7.000***	7***
	(8.43)	(8.82)	(10.76)
N	576	576	12
R^2	0.013	0.011	0.249
Clustering	Matching Group	Matching Group	No

Standard errors reported in parentheses below coefficient values. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

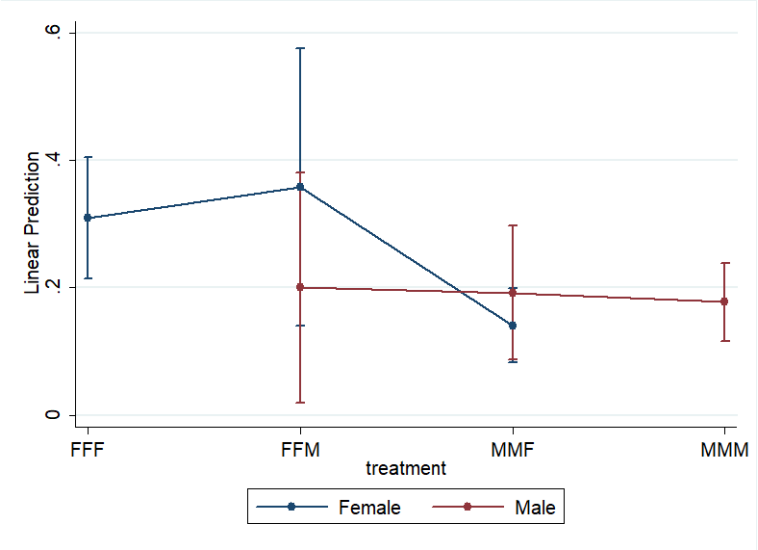


Figure A1: Proportion of First Offers Proposing Grand Coalitions

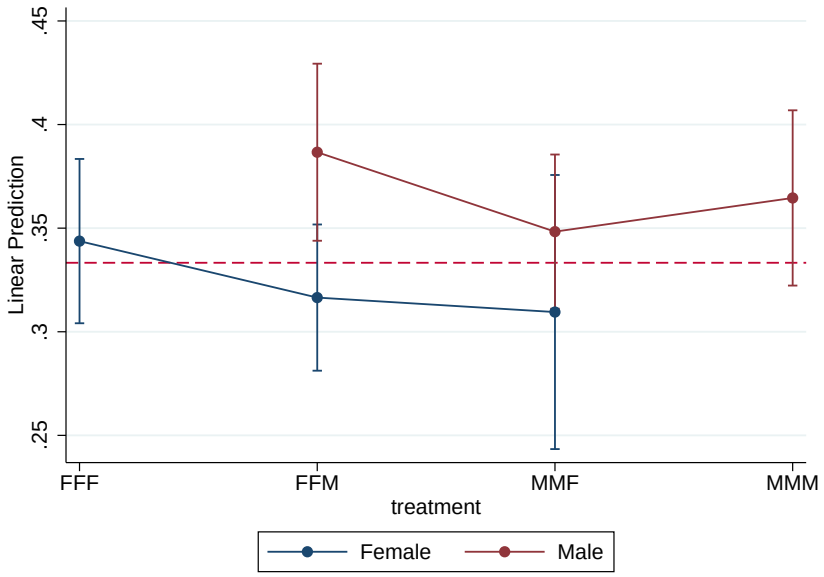


Figure A2: Share of the Fund for First Proposers in Approved Allocations, Follow-up Experiment

Online Appendix for "An Experiment on Gender Representation in Majoritarian Bargaining"

Andrzej Baranski, Diogo Geraldes, Ada Kovaliukaite, and James Tremewan

Contents

A Description of the Bargaining interface

The bargaining setting is represented in the form of a two-dimensional simplex consisting of a finite number of circles, each representing a possible division of the twelve points. A possible division includes a specification of three non-negative numbers of points corresponding to each agent in one point increments such that the three numbers sum to twelve. To learn the specific division associated with a given circle, a subject only needs to hover over that circle with the mouse. To propose a particular circle, a subject has to click on that circle, and the proposal is immediately visible to the three subjects in the triad because the outline of the selected circle is colored with the same color associated to the proposing subject. To provisionally support an existing proposal, a subject has to click on an outlined circle, and this intention is immediately visible to the three subjects in the triad because the outline of the selected circle gets also "inner-lined" with the color associated with the supporting subject. Importantly, when a provisional agreement starts (i.e., when at least two subjects click on the same circle): i. A red dot instantaneously appears in the center of the circle; ii. The points that each subject gets in case an agreement is reached—which are shown in the vertex of each subject—turn red; iii. A ten-seconds countdown pops up at the top of the simplex to indicate the remaining seconds until actual agreement.

For the sake of clarity, we describe a possible bargaining dynamic taking Figure 1 as a reference. In the experiment, each subject saw the simplex from the perspective of the "You" vertex, which was always located at the bottom vertex of the simplex and associated with the green color. The simplex top-left vertex and top-right vertex subjects were always associated with the orange and blue colors, respectively. Thus, Figure 1 indicates that more than two seconds ago, the green subject proposed the division: [5 (points for green subject), 4 (points for orange subject), 3 (points for blue subject)] and exactly two seconds ago the orange subject provisionally accepted the proposal. Subsequently, there are two possible scenarios. If the green and orange subjects do not click anywhere else in the subsequent eight

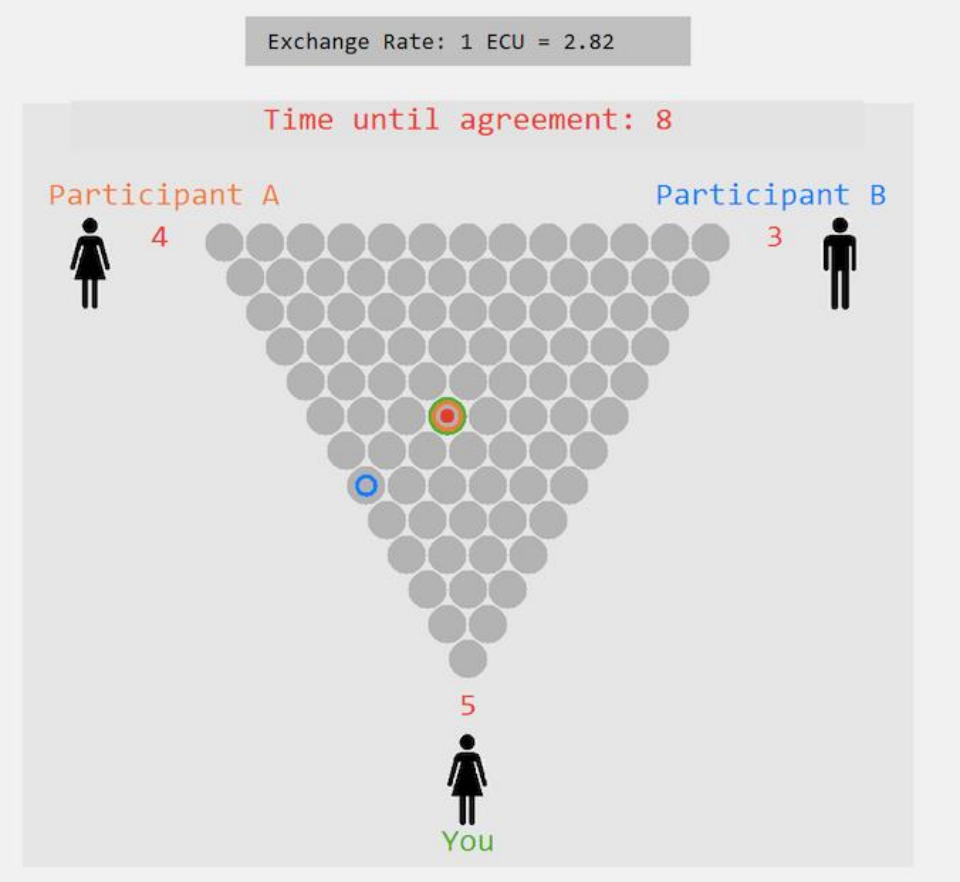


Figure 1: Bargaining Interface

seconds, an agreement is reached regardless of the clicking behavior of the blue subject. In other words, the bargaining process ends. However, if before the subsequent eight seconds elapse, the green subject or the orange subject (or both) click outside the simplex, or click on an alternative division of the twelve points, the provisional agreement on the division [5,4,3] is broken, and the bargaining process continues. Finally, in Figure 1, we also see the (continuously decreasing) exchange rate of points to Euros, which we permanently displayed at the top of the screen during the bargaining process.[1]

[1]Evidently, the Euro value of the points when an agreement is reached is determined by the exchange rate at the end of the ratification period. This means that the *de facto* Euro value of the points for provisionally accepted agreements that start within the last nine seconds of the 150 seconds bargaining time limit is zero. The latter possible bargaining scenario never happened in our experiment.

B Experimental Instructions and Protocol

On the next pages, we reproduce the experimental instructions.

MAIN PART OF THE EXPERIMENT

ON-SCREEN INSTRUCTIONS:

In this part of the experiment, participants will interact in groups of three. The interaction will be repeated twelve times. In what follows, we will call each repetition of the interaction a "round".

During each round, the three members of a group will have the opportunity to distribute **12 POINTS** amongst themselves.

The points you receive will determine how much money you earn at the end of the experiment (exactly how will be explained later, but the more points you receive, the more money you can expect to earn).

In order to help you understand exactly how the interactions work, we will now demonstrate the functioning of the program on your screen.

There will be a short tutorial. In the tutorial, you will be shown the screen that will be used during the real rounds. How to understand this screen and use it to interact with the other participants in your group is explained to you in the printed instructions you have been given.

During this tutorial **no money will be awarded**. The purpose of this tutorial is only to help you understand how the program works. You will be informed before the real interactions begin. Please follow the printed instructions carefully. It is important to understand how the program works!

PLEASE CLICK "Begin Tutorial" IF YOU ARE READY TO BEGIN THE TUTORIAL.
Follow the printed instructions to complete the tutorial.

TUTORIAL STAGE 1

Read the instructions below and complete ALL the listed exercises.
Note: you will not be able to finish the tutorial if you do not complete ALL the listed exercises.

DO NOT click "Move to stage 2" until you are specifically asked to do so.

UNDERSTANDING THE TRIANGLE

- The participants in your group must decide how to divide **12 points** amongst yourselves.
- On your screen, you will see small circles arranged in the form of a large triangle. Each circle represents a different way of allocating the points amongst you and the other two participants you are interacting with in a given round.
- The corners of the triangle are labeled **"**You", "Participant A", and "Participant B".
- The circles in the corners of the triangle correspond to allocations in which the indicated corner participant receives all available points, while the others receive no points.
- **The closer a circle is to a given corner, the more points the corresponding allocation assigns to that participant.**
- If you move your mouse over a circle, the corresponding points to be allocated to each participant **are displayed in the appropriate corners of the triangle**.

- **EXERCISES*:***

    - **Move your mouse around** the triangle until you understand how the circles are arranged.
    - **Click on a circle** to select it. Notice that the selected circle is marked in green.
    - **Click outside the triangle**. The green circle should disappear. During the real interactions, when you click on a circle, this will be shown on the screens of the two other participants you are interacting with, and it will disappear from their screens if you click outside the triangle. If two or more participants select the same circle continuously for 10 seconds, the points are allocated accordingly in that round.

MAKING AGREEMENTS

- During the real interactions, any of the three participants (including you) may click on any circle at any time.
- When you click on a circle, the other two participants in your group will see this circle marked on their screen.

- When another participant in your group clicks on a circle on their screen, it will be marked on your screen in the color corresponding to that participant: orange for "Participant A", blue for "Participant B".
- Clicking on an unmarked circle is like suggesting that division.
- Clicking on a circle marked by another participant is like provisionally accepting the division they have suggested. **The offer will only be really accepted and determine the number of points earned in that round if neither you nor the other participant clicks elsewhere in the following 10 seconds.**
- When another participant clicks on a circle you have marked, they have provisionally accepted the division you have suggested. Again, your offer will only be really accepted and determine the number of points earned in that round if neither you nor the other participant clicks elsewhere in the following 10 seconds.
- When there is a provisional agreement in place, a **red circle** will appear in the appropriate circle.
- When there is a provisional agreement in place**,** a clock will start counting down **"Time until agreement" from 10 seconds** to let you know when it will be really accepted if neither participant clicks elsewhere. You can see this shown in red on the picture at the end of these instructions.
- For the division to be implemented **at least two of the three group members must arrive at an agreement.**

THE VALUE OF POINTS, TIME LITMITS and ROUND EARNINGS

- **At the start of each round, each point will be worth €3**. Thus, at the start of each round, you have $€3 \times 12\ points = €36$ to divide within your group.
- The value of the points will decrease throughout the round. In particular**, a point will be worth €0.02 (2 cents) less in each second**. For example, after 20 seconds pass since the beginning of a round, each point will be worth $€3 - 20\ \text{seconds} \times €0.02 = €2.6$.
- The exchange rate of points to euros at a given point in time will be shown at the top left side of the screen. You can see this in the picture at the end of these instructions.
- **The round will end, when an agreement is reached (that is, when at least two participants continuously agree on the allocation of points for 10 seconds) or when the exchange rate reaches €0 per point.** If there is no agreement after the exchange rate has reached €0 per point, the round will end, and no one will receive any points.
- **If the agreement is finalized, your earnings for a particular round will be determined by the number of points allocated to you in that round and the exchange rate at the time when the agreement is confirmed:**

$$\textit{Your earnings for a round} = \textit{number of points allocated to you in the circle under agreement} \times \textit{exchange rate at the time when the agreement is confirmed}$$

DO NOT CLICK "Move to stage 2" JUST YET!

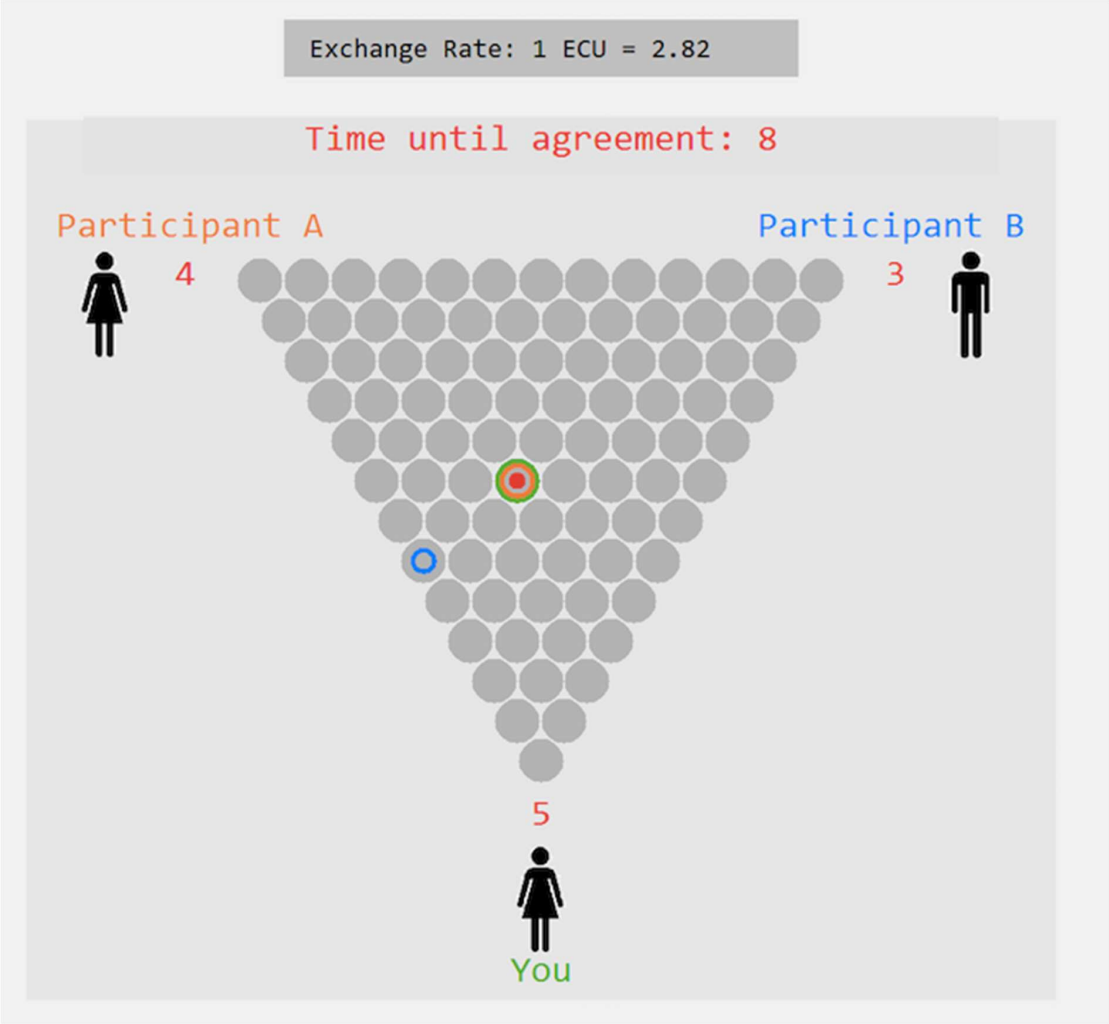
- When you click "Move to stage 2" two things will happen:
    - Two circles, one blue and one orange, will appear on *random circles* in the triangle. These are what it looks like when the participants you are interacting with click on their triangle, but the locations of these circles have been chosen by the computer at random. You will not be interacting with real participants for now.
    - The clock will start and the exchange rate of points to euros will start to decrease. Don't worry! The points received in this tutorial will not affect how much money you earn in this experiment. Also, you can repeat this part of the tutorial as many times as you like.
- There will be only two differences between Stage 2 of the tutorial and the real interactions:
    - In the tutorial rounds the points you receive will not affect how much money you earn.
    - In the real interactions the blue and orange circles may move as the participants you are interacting with click on different circles on their triangles.

TUTORIAL STAGE 2

CLICK ON "Move to stage 2" and complete the following exercises.

- ***Exercises:***
    - Watch the top line of the screen and see how the exchange rate of points to euros decreases.
    - Click the blue circle and see how the "Time until agreement" starts counting down until zero, when the round will "end" and the number of points you receive is determined. **Then click "Play another tutorial round" and repeat with the orange circle and click "Play another tutorial round" again.**
    - Now try clicking on the blue circle then clicking on an empty circle or outside the triangle before the 10 seconds are up. See how the "Time until agreement" starts counting down and then disappears when you click elsewhere.
    - Now try clicking on the blue circle then clicking on the orange circle before the 10 seconds are up. See how the "Time until agreement" starts counting down and then starts again at 10 seconds when you click on the second circle.
    - You can now experiment with the tutorial screen as much as you like.

When you have understood how the interactions work, click on "Finish tutorial" button. When all participants have finished the tutorial, the real interactions will begin.


Exchange Rate: 1 ECU = 2.82
Time until agreement: 8
Participant A
Participant B
4
3
5
You

ON-SCREEN INSTRUCTIONS:

You have finished the tutorial.
You will now interact 12 times with **real participants**.

The participants with whom you will interact will be randomly determined at the beginning of each round.

The other participants in your group will always be referred to on your screen as "Participant A" and "Participant B".

At the end of the experiment, **one** of these rounds will be randomly selected and you will be paid according to your earnings in that round, and that round only.

You may now ask questions about the instructions on this page and way the program works.

If you have a question, please raise your hand and ask it **quietly** when an experimenter comes.

If you have no questions, please click "Continue" and wait for the **real rounds** to begin.

C Additional Results

C.1 Probability of Grand Coalition Agreement Marginal Effects

Table A1: Probability of Grand Coalition Agreement Marginal Effects

	(1) Model with Trt. Dummies	(2) Model with Gender Majority
MMF	0.024	
	(0.052)	
FFM	0.129*	
	(0.074)	
FFF	0.132**	
	(0.057)	
Period	-0.030***	-0.029***
	(0.005)	(0.005)
Females are Majority[1]		0.119**
		(0.051)
N	1128	1128

Standard errors clustered at the study level in parentheses. In Model (1), MMM is the baseline. In Model (2), males in majority (i.e., MMM + MMF) is the baseline. * p<0.1, ** p<0.05, *** p<0.01

[1] This is a dummy variable that takes the value 1 for treatments FFM and FFF.

C.2 Unanimity Support

Table A2: Proportion of Unanimous Agreements by Treatment

	FFF	FFM	MMF	MMM
All	0.288	0.301	0.199	0.184
Minimum Winning Coalitions	0.006	0.017	0.019	0.022
Grand Coalitions	0.640	0.732	0.762	0.568

Table A3: Linear Probability model for Unanimous Approval

	(1) All	(2) MWC	(3) GC
FFM	0.013	0.012	0.092
	(0.077)	(0.009)	(0.083)
MMF	-0.089	0.013	0.122*
	(0.054)	(0.011)	(0.061)
MMM	-0.104**	0.017	-0.072
	(0.049)	(0.011)	(0.073)
Constant	0.288***	0.006	0.640***
	(0.044)	(0.005)	(0.028)
Observations	1,128	793	225
R^2	0.015	0.002	0.022

[1] Robust standard errors in parentheses. FFF is the baseline. *** p<0.01, ** p<0.05, * p<0.1.

[2] FFM different from MMM in column 1 ($p = 0.0958$). MMF different from MMM in column 3.

C.3 Linear Regression for Time to Final Agreement

Table A4: Linear Regression for Time to Final Agreement

	(1) All Periods	(2) Periods 1-6	(3) Period 7-12	(4) All Periods
Constant	16.85***	17.15***	16.55***	17.85***
	(0.795)	(0.869)	(0.834)	(1.009)
FFM	-1.112	-1.131	-1.092	-0.379
	(1.383)	(1.359)	(1.549)	(1.746)
MMF	-0.253	-0.341	-0.165	-0.492
	(1.056)	(1.177)	(1.124)	(1.390)
MMM	-1.542*	-1.785*	-1.299	-2.328
	(0.875)	(1.040)	(1.049)	(1.376)
Period				-0.153
				(0.125)
FFM x Period				-0.113
				(0.147)
MMF x Period				0.0368
				(0.156)
MMM x Period				0.121
				(0.182)
Observations	1,128	564	564	1,128
R^2	0.006	0.008	0.004	0.010

Standard errors in parentheses clustered at the matching group level. FFF is the baseline. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C.4 Tobit for Share of the Surplus in Mixed-Gender Treatments

Table A5: Tobit for Share of the Surplus in Mixed-Gender Treatments

Male	0.010	(0.033)
Male Majority (MMF)	-0.061**	(0.031)
Male × MMF	0.077	(0.053)
_cons	0.291***	(0.014)
N	1656	
F-statistic	1.83	

Standard errors clustered at the matching group level in parentheses. Women in FFM is the baseline. * p<0.1, ** p<0.05, *** p<0.01

A Wald test for Male+MMF+Male × MMF+ Cons =1/3 yields a p-value of 0.22. Thus, we reject that a male subject receives on average more than 1/3 of the surplus in MMF.

A Wald test for Male + Cons=1/3 yields a p-value of 0.14. Thus, we reject that a male subject receives on average more than 1/3 of the surplus in FFM.