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What if women earned more than their spouses? An experimental investigation of work-division in couples

François Cochard[1] · **Hélène Couprie**[2] · **Astrid Hopfensitz**[3]

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Abstract Female specialization on household work and male specialization on labor-market work is a widely observed phenomenon across time and countries. This absence of gender neutrality with respect to work-division is known as the "work-division puzzle". Gender differences regarding characteristics (preferences, productivity) and context (wage rates, social norms) are generally recognized as competing explanations for this fact. We experimentally control for context and productivity to investigate preferences for work-division by true co-habiting couples, in a newly developed specialization task. Efficiency in this task comes at the cost of inequality, giving higher earnings to the "advantaged" player. We compare behavior when men (or women) are in the advantaged position, which corresponds to the traditional (or power) couple case where he (or she) earns more. Women and men contribute equally to the household public good in all conditions. This result allows us to rule out some of the standard explanations of the work-division puzzle.

Keywords Experiment on couples · Time allocation · Work-division

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✉ Astrid Hopfensitz
astrid.hopfensitz@tse-fr.eu

François Cochard
fcochard@univ-fcomte.fr

Hélène Couprie
helene.couprie@gmail.com

[1] CRESE EA3190, Université Bourgogne Franche-Comté, 25000 Besançon, France

[2] Université de Cergy-Pontoise (THEMA), 33 Bd du Port, 95011 Cergy-Pontoise, France

[3] Toulouse School of Economics, University of Toulouse Capitole, 21 Allee de Brienne, 31000 Toulouse, France

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1 Introduction

Labor specialization by men and women is widely observed across time and cultures (Blau and Kahn 2007). When living in a couple women, especially mothers, tend to withdraw from the labor market and focus on household work, whereas men tend to increase their hours of labor market work (e.g., Alger and Cox 2013). Even in couples where the wife earns more than her husband, we usually still observe equal or even more investment by women in household public goods (Brines 1994; Rizavi and Sofer 2010; Sevilla-Sanz et al. 2010). This absence of gender neutrality with respect to work-division is known as the "work-division puzzle". Two factors could cause this phenomenon. Either net benefits extracted from domestic work relative to labor market work differ between men and women.[1] Given this ratio of net benefits, specialization would therefore be a sign of efficient resource allocation by the household. Or intrinsic gender norms lead women to contribute to the household public good (e.g., Greig and Bohnet 2009). In this case policies aimed at increasing female labor market participation might not be effective as long as they cannot overcome these norms.

Theoretical household models give a framework that details how available time can be transformed into individual net benefits in couples. The main mechanism for this is the household production concept (Becker 1981; Gronau 1977; Sofer 1985). Similar to a public good, household services are produced using family members' effort. However, while public good dilemmas usually assume that the contribution of every member increases efficiency, this is not necessarily the case for household domestic goods. Productivity differences across household members might be causing the observed unequal work allocation in couples (e.g., Becker 1981). Productivity at housework compared to labor market wages might be greater for women than for men. If women have a comparative advantage at home whereas their partners have a comparative advantage on the labor market, the efficient couples would choose a strongly gendered work-division. In such a case, efficient allocation of resources in the household causes gender specialization. When interested in work-division in families we therefore have to investigate how spouses interact in situations requiring task specialization.

Investigating the causes of gender specialization in families is naturally constrained by the availability of information on relative domestic productivity levels. While productivity on the labor market can be easily approximated by observed wage rates, domestic productivity is difficult to measure. One of the rare exceptions is domestic production in agricultural economies. In addition even in cases where productivity is measurable, this does not imply that the affected household members are actually aware of these differences. The additional impact of social pressure through neighbors, colleagues or family members, is even harder

[1] Benefits can be material but might also be related to status or emotions. Benefits also have to be adjusted for either material or non-material costs.

to control. Social pressure might indeed constitute a significant cost associated with deviations from gender norms. We therefore propose an experimental investigation into spouses' behavior in an environment where a household public good can be produced and relative advantages are such that efficiency requires specialization. Our 'specialization game' will allow us to investigate the counterfactual where women earn more from non-public good investment than men, which corresponds to the work-division puzzle. We can further eliminate the impact of social pressure by allowing for choices in an anonymous environment. Tasks requiring specialization, as we propose it, have not yet been experimentally studied. Since our specialization game is structured such that efficiency comes at the cost of inequality, a strong concern for efficiency is required by the disadvantaged player to make contributions to the public good. Family economics assumes such a strong efficiency interest among spouses.[2]

The empirical evidence confirms that women contribute more to household public goods (for example childcare) than men (see Hoddinott and Haddad 1995; Thomas 1990, for developing countries; and Lundberg et al. 1997, for the U.K.). Also women are often considered to be more caring, friendly and oriented towards cooperation than men (Balliet et al. 2011). Results from experimental social dilemma games among strangers sometimes supports this view and sometimes contradicts it. The reason seems to lie in a higher sensitivity to social context by women (Ledyard 1995; Eckel and Grossman 2008; Croson and Gneezy 2009; Balliet et al. 2011). An important empirical question is, to which degree existing gender differences in social situations are shaped by society (through institutions, norms and social pressure) and to which degree they are internalized. The psychological costs of social pressure by being observed and judged, can have important consequences for behavior (e.g., Hoffman et al. 1994; Masclet et al. 2003). At the same time cognitive dissonance, due to not being able to comply with an internalized norm, can hurt the self-image and equally influence behaviors (e.g., Bénabou and Tirole 2006; Murnighan et al. 2001). The origin of gender differences concerning altruism and cooperation has also been related to sociocultural or evolutionary arguments (Balliet et al. 2011; Alger and Cox 2013). The general conclusion is that generalizable gender differences for behavior in social dilemmas are unlikely to exist and that an understanding of gender differences requires a separate analysis for different types of interactions and situations. Family interactions are both from an evolutionary and sociocultural perspective crucial for men and women. Controlled experiments on family interactions suggest so far that men care more for efficiency, whereas women tend to care more for equality (Beblo and Beninger forthcoming; Kamas and Preston 2012). Since in many experimental paradigms efficiency and equality are correlated, distinguishing these two motives requires a specific approach.

We study spouses' behavior in a novel specialization task and compare behavior to a situation involving a standard voluntary contribution mechanism (e.g., Isaac

[2] The existence of efficiency concerns among unrelated individuals has been suggested by Engelmann and Strobel (2004) and Engelmann and Strobel (2006) and been discussed in Bolton and Ockenfels (2000) and Fehr et al. (2006).

and Walker 1988). In both cases investment in the private good contributes to an increase in own payoff whereas investment in the public good leads to the production of a good equally distributed among spouses. The specialization task creates an asymmetric situation in which returns from the private good are higher for one of the spouses compared to his/her partner.[3] The participant that will in the following be called "the advantaged player" will generate larger returns from private investment than from public good investment. If gender differences concerning public good contribution are internalized, we expect behavior in the experiment to reflect this and women to invest more in the public good, regardless of private returns. If gender differences do not concern public good contributions in general, but are rather related to efficiency and equality concerns, our design allows us to disentangle these. If, however, real-world gender differences are mainly caused by external factors (differences in payoffs or social pressure), we expect that men and women will react in the same way to being in either the advantaged or disadvantaged position.[4]

Previous experimental studies on couples' behavior in social dilemmas have rejected the idea that maximal efficiency is achieved (Cochard et al. 2016; Iversen et al. 2011; Ashraf 2009; Mani 2011). Nevertheless relatively high efficiency levels are observed and a significant proportion of couples maximizes efficiency. However, by definition, social dilemmas are structured such that contribution to the public good implies maximization of efficiency. Our specialization game presents a situation where for the "advantaged" spouse, private investment is maximizing own payoffs but also efficient for the household. Thus our design eliminates the dilemma nature for the advantaged spouse if he aims at own-payoff-maximization and efficiency. However, if spouses care at the same time for efficiency and for equality of earnings from the game, this creates a new sort of dilemma. The advantaged player has to trade off maximizing household income or equalizing private payoffs for both partners. As previously discussed, spouses have been observed to show a concern for equality of earnings and might thus face this type of dilemma.

Our results show that couples react to inequalities concerning private returns in the expected way: namely the advantaged spouse (i.e., the one with higher private returns) reduces his/her investment in the public good and increases his investment in the private good. We further observe that the inequality concerning private returns causes symmetric behavior dependent on whether either the man or the woman has a higher private return. Our results thus support in a lab setting the theoretical assumption that labor specialization by spouses is mainly driven by differences in net benefits from labor market activity, and are not a result of gender-specific preferences concerning public good contributions. We further observe a tendency for higher efficiency among men and for more equality among women.

[3] Specialization in couples has also been studied by Goerges (2015), however, for a task where spouses jointly decide whether to specialize or not and who of the two partners should take the role of the 'advantaged' player.

[4] In other domains (Gneezy et al. 2009) it has been shown that gender differences can be inverted given different institutions. Specifically it was observed that the generally believed greater competitiveness of men disappears in a matriarchic culture.

We test the robustness of our results by comparing behavior in an abstract task where contributions are defined by the allocation of points and a time allocation task, where contributions depend on actual time invested. Time allocation might provide a more intuitive context to the dilemma (e.g., Loomes 1999) and thus increases the external validity of our results. Our results concerning gender differences are not affected by this framing, however, we observe overall higher efficiency levels under the time allocation framing.

2 Task and predictions

To study the impact of comparative advantages for men or women we will introduce a "specialization task". In this two-player game, efficiency is reached when only one of the two players (the "disadvantaged" player) contributes his entire endowment to a public good. Since public good production is equally distributed on both players, efficiency leads to inequality in earnings. As a baseline we will use a standard two-person public good game that we will describe first.

2.1 Baseline: the symmetric public good game

In the baseline symmetric public good game spouses receive an initial endowment of 20 units and are asked to decide concerning its allocation on either a private or public account. Each unit invested in the public account returns 1.2 as much as one unit invested in the private account. Returns from the public account are equally split across the two spouses. Earnings of a player investing c_s (i.e., contribution by self) in the public good where the partner contributes c_p to the public good are calculated as follows[5]:

$$y_s = 10\,(20 - c_s) + 6\,(c_s + c_p) \tag{1}$$

As usual in these kinds of dilemmas, efficiency would be reached if players chose to cooperate, namely contributing all their endowment to the public good ($c_s = 20$; $c_p = 20$). The Nash-equilibrium predicts mutual defection for two selfish individuals ($c_s = 0$; $c_p = 0$) in a one-shot interaction and this corresponds to the lowest earnings for both players. Since even strangers present other-regarding preferences in these types of games, we expect this phenomenon to be even stronger for couples.[6] In Cochard et al. (2016) spouses played a discrete prisoners' dilemma once

[5] We present here the actual point earnings also used in the experiment. To avoid calculations with fractions, each unit invested in the private account returns 10 experimental units, and each unit invested in the public good returns 6 experimental units to each of the two spouses.

[6] In a preceding article, we discuss how model predictions are affected when participants in the experiment are true couples. Efficiency is reached more easily because of two phenomena: a strong aversion to payoff inequality within the couple and the presence of a micro-norm of sharing which contaminates the way individual payoffs are transformed into individual welfare. Because couples have interactions outside of the laboratory (essentially consumption sharing habits) the control of individual payoffs remains imperfect and this generates a complexity in the analysis that we chose not to integrate in this article. The interested reader can refer to Cochard et al. (2016) and consider that an income-pooling micro-norm would generate a preference for efficiency during the experiment.

Table 1 Predictions dependent on preferences

	Selfishness $max\ y_s$	Altruism $max\ y_p$	Efficiency seeking $max\ (y_s + y_p)$	Inequality aversion $min\|y_s - y_p\|$
Baseline task				
	$c_s = 0$	$c_s = 20$	$c_s = 20$	$c_s = \mathcal{B}c_p$
Specialization task				
If advantaged:	$c_s = 0$	$c_s = 20$	$c_s = 0$	$c_s = 60/13 + (10/13)\mathcal{B}c_p$
If disadvantaged:	$c_s = 0$	$c_s = 20$	$c_s = 20$	$c_s = \begin{cases} -6 + (13/10)\mathcal{B}c_p & \text{if } \mathcal{B}c_p > 60/13 \\ 0 & \text{if } \mathcal{B}c_p \leq 60/13 \end{cases}$

y_s denotes the pay-off for self, y_p partner's pay-off and $\mathcal{B}c_p$ the belief concerning spouse's contribution

with their partner and once with a stranger of the opposite sex. The maximization of joint earnings (implying that both spouses cooperate) occurred more frequently in couples than when strangers play together. In the case of our symmetric game, predictions of individual behavior dependent on three extreme cases of social preferences are summarized in Table 1. An own-payoff maximizing agent (pure selfishness) would contribute nothing to the public good ($c_s = 0$). A player who aims at maximizing spouse's payoff (extreme altruism) would do the opposite ($c_s = 20$). Finally, a purely inequality averse agent would always act as he believes his/her partner to do in order to minimize the difference in earnings. Denoting self-beliefs about the partner's contribution: $\mathcal{B}c_p$, he simply contributes: $c_s = \mathcal{B}c_p$.

2.2 Specialization game

The specialization game reflects the puzzle that occurs when a couple makes a work-division choice. For one player, the "advantaged" one, the choice of not investing in the public good is efficient, the individual interest and the couples interest are thus aligned. This could be viewed as the choice of specializing in labor market work instead of contributing to household production when having a higher labor market wage rate.[7] On the contrary, the "disadvantaged" player will have to make a choice that leads to a dilemma between his/her self-interest and the couple's interest. This corresponds to the choice of specialization in household work for the partner who has lower labor market earnings. In this case efficiency and equality are in conflict. The efficient solution in the specialization game is also the most unequal one.

Concretely, as in the baseline game, each individual is endowed with 20 units that have to be allocated between a private and a public account. Earnings from the public account are the same as in the case discussed above. However, earnings from the private account are not the same for both partners. Specifically one of the two

[7] In real life, such specialization could also be due to lower household productivity or to social pressure inflicting additional costs.

players is advantaged and earns from his private account 1.3 times more than the other player. Denoting c_s (*resp.* c_p), the contribution by self (*resp.* partner) to the public account, individual earnings in the case where self is advantaged are computed as follows:

$$\begin{cases} y_s^{advantaged} &= 13(20 - c_s) + 6(c_s + c_p) \\ y_p^{disadvantaged} &= 10(20 - c_p) + 6(c_s + c_p) \end{cases} \tag{2}$$

Predictions according to different kinds of social preferences are presented in Table 1.

In the asymmetric case, an advantaged player that aims at maximizing the joint earnings of the couple (i.e., pure efficiency seeking) should invest all of his units in his private account ($c_s = 0$). A disadvantaged partner that aims at maximizing joint earnings of the couple should still invest all units in the public account ($c_s = 20$). In contrast, an own-payoff-maximizing agent will never contribute to the public good ($c_s = 0$). A player who aims at maximizing his spouse's payoff would fully contribute ($c_s = 20$).

A pure inequality averse agent will act in a way to minimize the difference in earnings (i.e., $min|y_s - y_p|$), thus acting in function of his/her beliefs of the partner's action, denoted $\mathcal{B}c_p$. The advantaged spouse will in this case choose:

$$c_s = \frac{60}{13} + \frac{10}{13}\mathcal{B}c_p \tag{3}$$

Thus an advantaged individual who is intra-household income inequality adverse contributes despite this solution being not efficient. A purely inequality adverse, disadvantaged spouse will choose:

$$c_s = \begin{cases} -6 + \frac{13}{10}\mathcal{B}c_p & if\ \mathcal{B}c_p > \frac{60}{13} \\ 0 & if\ \mathcal{B}c_p \leq \frac{60}{13} \end{cases} \tag{4}$$

In other words: such a player will not contribute to the public good if he believes his partner's contribution will be too small (i.e., lower than 5).

We can imagine linear combinations of any combination of these four extreme strategies (selfish, altruist, efficiency seeker and inequality averse). In this case we might want to differentiate between preferences that give relative stronger weight to self (i.e., y_s) of the form:

$$\hat{U}_s = \alpha y_s + \beta(y_s + y_p) - (1 - \alpha - \beta)|y_s - y_p| \tag{5}$$

and preferences that give relatively stronger weight to the other (i.e., y_p) of the form:

$$\tilde{U}_s = \gamma y_p + \delta(y_s + y_p) - (1 - \gamma - \delta)|y_s - y_p| \tag{6}$$

with $0 \leq \alpha, \beta, \gamma, \delta \leq 1$, where α and γ indicate the weight of own (Eq. 5) and partner's (Eq. 6) earnings, respectively. And where β and δ indicate the additional weight of joint earnings.

Table 2 Overview of between-subject treatments

	Control	Spouses
M advantaged and F disadvantaged	30 pairs	32 couples
	60 participants	64 participants
F advantaged and M disadvantaged	25 pairs	32 couples
	50 participants	64 participants
	55 pairs	64 couples
	110 participants	128 participants

Other sessions were carried out but due to software problems results are not reported here

While it is difficult to distinguish between preference for equality and efficiency in general social dilemma games, our specialization task allows us to do so. Fig. 4a illustrates strategies given an individual's beliefs about his partner's behavior for a player in either an advantaged or disadvantaged position. The shaded area in the left panel indicates belief-choice combinations that are consistent with a function of the form $\hat{U}_s$ (i.e., some selfish concern). The shaded area in the right panel indicates combinations consistent with a function of type $\tilde{U}_s$ (i.e., some altruism concern). To investigate the type of preferences in couples we also elicit beliefs among spouses about their partners' actions.

To investigate the symmetry and robustness of our results concerning the behavior of spouses we will consider a $2 \times 2 \times 2 \times 3$ design. Two of these treatment variations are on a between-subject level and will be described first. The others are on an in-subject level and will be discussed afterwards.[8]

On a between-subject level we will compare treatments where either the man or the woman is advantaged. This will allow us to compare a situation where men have a comparative advantage with the counterfactual where women have the comparative advantage concerning the private good. We further study both spouses (Spouses) and unrelated individuals (Control) that are randomly matched with a partner of the opposite sex to form a pair. For all treatments and numbers of observations see Table 2.

In an in-subject design we further compare the baseline game with the specialization game described above. We observe three different framings of these games to control for their abstraction level. In two of them spouses decide how to allocate 5 min of time between two abstract work tasks (A and B), one leading to production of the private and the other of the public good. In treatment *No Leisure* these were the only two options available. In treatment *Leisure* a leisure option was available and thus work required some effort. We finally compare these to an abstract treatment (*Abstract*), where spouses are asked to invest tokens in either a project A or B.

[8] A further control for spouses concerned whether earnings where private or known to the partner. Results from these sessions (another 22 couples) will not be discussed in this paper.

3 Experimental protocol

The experiment was conducted in June 2010 and September 2016 in the laboratory of experimental economics at the Toulouse School of Economics. An overall of 238 participants took part in the study. Of these 128 were recruited as co-habiting, heterosexual couples (i.e., 64 couples). Another 110 unrelated participants were recruited for control sessions. The experiment was computerized and the interface was programmed in Visual Basic. Participating couples were recruited by newspaper reports about the ongoing study, flyers and information provided on a website. The recruitment information for spouses specified that heterosexual couples, more than 20 years old were invited to participate in a study of economic decisions by couples. Couples were required to live together for at least one year (but did not need to be married) and invited to sign up jointly for one two-hour session. Control participants were recruited through the standard participant database of the laboratory; they were not required to have a partner or to be married.

For spouses mean age by men and women was 37 and 35 years, respectively. Partners had been living together for an average of 10 years, 60% of our participating couples were married or under civil union and 41% had at least one child living in their household. Summary statistics can be found in Table 3. Participants in the control sessions were younger and mostly students.

In total 27 sessions (11 control; 16 spouses) were conducted with at least 3 and at most 6 couples present. Great care was taken to explain each part of the instructions as simple as possible and screens were presented in a graphically intuitive way (see Appendix A and B).

Upon arrival participants were invited to a reception room that provided some refreshments and journals. When all participants had arrived, we announced that the study was about to begin and that participants should not communicate in the lab. Control participants were informed that the study required an even number of men and women to participate. Cubicles were designated for men or women respectively. This ensured that partners could not communicate or observe each other during the study. Control participants were informed that they had been randomly matched with a partner of the opposite sex to form a couple. They were not informed who this partner was. Instructions were then the same as in the treatments with spouses.

The study consisted of four experimental parts and a questionnaire part. The timeline of the different parts of the study is described in Table 4. Instructions to the different parts of the experiment were always read aloud. Participants were actively

Table 3 Socio-demographic variables of spouses (64 couples)

	Mean	(std dev)
Married (dummy)	0.45	0.49
Civil contract (dummy)	0.16	0.36
Age—*men*	36.86	11.88
Age—*women*	35.30	12.16
Years as couple	10.02	11.85
Children living in household (dummy)	0.41	0.49

Table 4 Timeline of experimental sessions

Welcome and general instructions	
Part 1: Abstract	
Situation 1: Baseline	(i) action, (ii) beliefs
Situation 2: Specialization task	(i) action, (ii) beliefs
Familiarization with time allocation task	
Part 2: Leisure	
Situation 1: Baseline	(i) action, (ii) beliefs
Situation 2: Specialization task	(i) action, (ii) beliefs
Part 3: No Leisure	
Situation 1: Baseline	(i) action, (ii) beliefs
Situation 2: Specialization task	(i) action, (ii) beliefs
Part 4: Individual decision task[a]	
(i) actions, (ii) beliefs partner, (iii) beliefs population	
Part 5: Chat phase in couple	
Socio-demographic questionnaire	
Payout (private or public) and good bye	

[a] Part 4 and 5 are not used in this paper. Results from part 4 are discussed as the 'French' sample in Beblo et al. (2015)

encouraged to ask questions if something was not clear to them. After instructions were read, a short summary of the instructions was displayed on screen and participants had to answer a short control question to test their understanding. When participants had finished reading the summary, and correctly answered the control question, they were invited to enter their decision on screen.

Initial instructions informed participants that they were about to participate in a study on decision making in which they have to make a number of decisions. It was explained that the study would consist of a number of separate parts, each part consisting of one or more decisions to be taken. Earnings from the experiment were calculated in an experimental currency: Francs Toulousains.[9] It was stressed that decisions were individual, private and anonymous with respect to the experimenters, to other participants and their partner.

About half of the participants were further in a treatment favoring men (M), the other were in a treatment favoring women (F). In the initial instructions it was made clear that the "advantaged" participants would throughout the experiment have higher earning possibilities.

The experiment consisted of three parts. In each of the three parts couples were presented with the decision problems described above concerning investment in either a public or private account. In the first part (treatment *Abstract*) investment was represented in an abstract way using points that could be allocated to either account, denoted A and B to participants. All participants had 20 points at their disposal. In parts two (*Leisure*) and three (*No Leisure*) investment was represented in a more concrete way using a time period of 5 min (20 intervals of 15 s) during which participants worked on a task associated with either account. The difference

[9] The exchange rate to Euros was in the sessions for spouses: 20 FT = 1 euro. It was adjusted for the student subject pool to 40 FT = 1 euro to represent standard experimental earnings from participation.

between the two parts consisted in the fact that in part two (*Leisure*) a leisure task was available.[10] This leisure task consisted in the option to surf the Internet. Inactivity in the effort tasks was considered as leisure and led automatically to a web-browser allowing for Internet access.

The order of the three parts was always the same. The part including leisure was presented before the part without leisure to make participants as unsuspicious as possible about the presence of the leisure option. Specifically we wanted to ensure that participants felt that this environment was natural and that they would not feel inhibited to use the opportunity for leisure. In part three no leisure option was available, and therefore decisions only concerned the allocation of 5 min of time between the two options without imposing effort.

In each part the baseline and specialization task were presented. Investment in the private account led to private earnings of the individual, investment in the public account led to the production of a public good that was equally redistributed among the partners. Earnings from the public account were the same in both tasks only earnings from the private account varied for the advantaged player.[11] The advantaged player was in all three parts either the man or the woman in the couple.

Final earnings were determined by one randomly selected game out of each part plus earnings from belief elicitation questions.[12] Participants were not informed which games were chosen and could therefore not deduce from earnings the actions of their partner. Each player was privately informed about his/her earnings and received a private cash envelope.

[10] Concretely, in parts two (Leisure) and three (No Leisure), both tasks were identical and, denoted as A and B. They both consisted of copying phone numbers from a list but corresponded to either a public or a private investment with different pay-offs for the individual and the couple. Payment for both tasks was by time spent on the task and not by quantity or quality of the work done. By doing so we exclude productivity differences due to different ability levels. Participants were paid by interval of 15 s, for a total endowment of 5 min (i.e., 20×15 s $= 300$ s). Participants could switch back and forth between tasks and payment was calculated by the total amount of time spend on either task. The task was rather easy and participants had a 3 minutes time interval to familiarize themselves with the task and the computer interface that allowed switching between the different options. In part three (*No Leisure*) payment was not dependent on effort (having actually worked and typed numbers) but solely on the time the participant chose to spend on the computer interface corresponding to either task. The whole time endowment was therefore allocated between the public or private account. In part two (*Leisure*) this was not necessarily the case: specifically inactivity was considered as leisure and therefore not counted in either account. While working, participants could see in real-time how much time they had left and how much time they had already spent on the two tasks.

[11] In the baseline game each point/time interval invested in the private account earned 10 experimental currency units, and each point/time interval invested in the public account returned 6 experimental currency units to each partner. In the specialization game one of the two partners earned for each point/time interval invested in the private account 13 experimental currency units (i.e., the 'advantaged' player) while the other received only 10 experimental currency units.

[12] Before final payout participants entered a chat phase (Part 5, see Table 4). This phase allows us to observe possible transfers between partners after finishing the experiment. Specifically partners were given the option to decide to allocate part of their earnings to a common envelope if desired. Results are not discussed in this paper.

4 Results

4.1 Choices

We first focus on the sustainability of task specialization during the experiment (see Fig. 1 and Table 5). Average contributions among spouses to the public good in the baseline public good situation are across framings 16.2 (5.0)[13] [in the control group: 8.9 (6.3)]. As expected, contributions are not different for advantaged or disadvantaged players (Mann–Whitney[14] by advantage, separately for men and women,[15] each framing, and spouses and control).[16] In the specialization game spouses with low returns from the private good invest about 16.0 (5.1) of their available resources in the public good [control: 5.5 (6.1)]. By contrast spouses that have higher returns from their private good invest only 4.4 (5.5) of their resources in the public good [control: 3.2 (3.8)]. This difference is highly significant for spouses ($p < 0.000$ for both men and women and each framing), which can be easily observed from the difference in distributions (Fig. 2). In the control group, differences between advantaged and disadvantaged players are much less pronounced. We observe a small difference for women (respect. 2.1 (2.6) vs. 5.6 (6.0) across framings, $p < 0.05$ in Abstract and No leisure, $p = 0.200$ in Leisure); for men, contributions are not statistically significantly different for advantaged versus disadvantaged players (respect. 4.1 (4.4) vs. 5.5 (6.5) across framings). Indeed for control participants the distribution of individual contributions is very similar for advantaged and disadvantaged players across framings (see Fig. 2).

Efficiency in the specialization task requires that the advantaged player does not contribute, while the disadvantaged player contributes. Spouses reach in the baseline and the specialization task, a mean efficiency level[17] of about 80% (see Table 6). There are no significant differences in efficiency between framings (all framings, baseline versus specialization task, Wilcoxon matched-pairs signed-ranks test on couple efficiency rates, n.s.). Efficiency levels are also not different for advantaged versus disadvantaged players (Mann–Whitney by advantage, separately for men and women, each framing, n.s.). In the control treatment efficiency levels are significantly lower than in the spouses treatment ($p = 0.000$), except in the specialization task with advantaged players. Indeed advantaged control participants

[13] Standard deviations are in parentheses.

[14] Unless otherwise stated, tests are two-sided.

[15] It is not possible to treat all data (n = 128) as independent observations as each spouse's decision is clearly not independent from his/her partner's decision. Thus, we carry out tests on each sex separately (n = 64 observations for each).

[16] The overall high contributions in the baseline could be also due to other characteristics that make participating spouses different from standard subject pools: notably their age, income or education level.

[17] Efficiency for disadvantaged players is computed as their investment in the public account (i.e., their contribution) divided by 20. For advantaged players, efficiency equals their investment in the *private* account divided by 20. In the Abstract and No leisure treatments, investment in the private account equals 20 minus investment in the public account; in the Leisure treatment this is not necessarily the case as subjects may have used the leisure option. The couple's efficiency rate is simply the mean efficiency rate of the spouses.

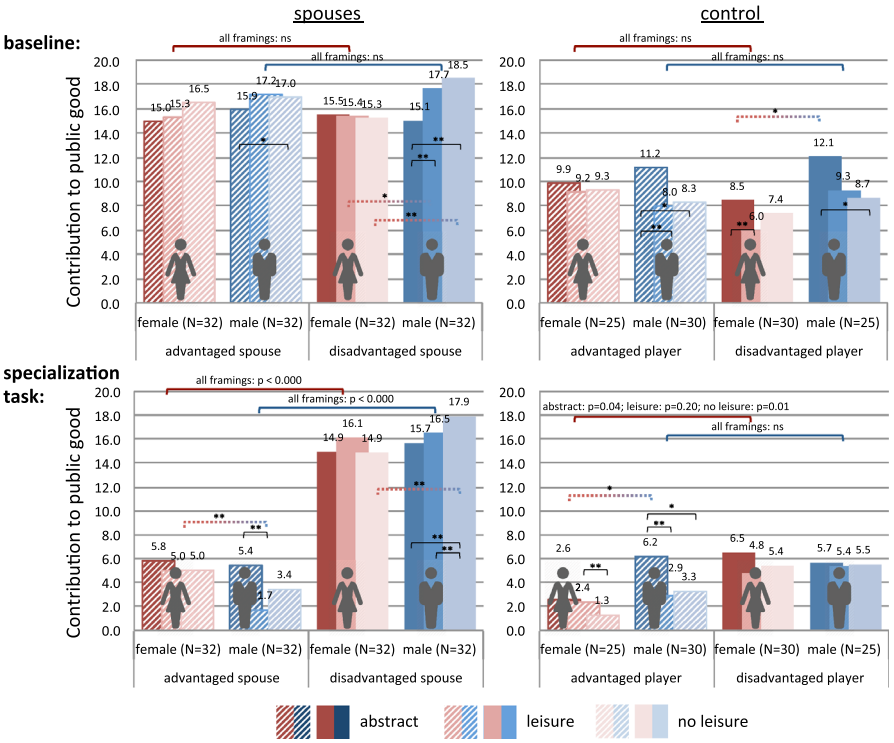

Fig. 1 Contributions to public good by gender in baseline and specialization task. Note that in baseline no player was advantaged but that nevertheless one of the two players knew that he would be advantaged throughout the experiment. *Stars* indicate p values from Wilcoxon signed-rank test on differences in framing (*<0.1; **<0.05); p values above 0.1 are marked as ns (for the detailed values see Tables 5 and 6)

in the specialization game, are extremely efficient (i.e., contribute nothing to the public good), which results in a higher level of efficiency in the specialization task than in the baseline (84.0 vs. 46.4%, $p = 0.000$).

On a couple level more than 70% of spouses have a mean efficiency level equal or above 70% (each framing and both games, see Fig. 3). Control couples only reach in about a quarter of the cases an efficiency level above 70%. Our first result is therefore the following:

Result 1 *Spouses react to the asymmetry in returns from the private good in the specialization task. Advantaged spouses reduce their investment in the public good and disadvantaged spouses invest as much as in the baseline task. As a result efficiency is at the same level in the baseline and the specialization task. Control participants reach significantly lower efficiency levels. In the specialization task, advantaged and disadvantaged control participants decrease their investment into the public good.*

As a result, compared to control participants, spouses reach relatively high efficiency levels in the specialization task. This result is in line with our previous

Table 5 Average investment levels (out of 20 units) in public good across all treatments

	Advantaged player						Disadvantaged player						Spouses		Control	
	Spouses (n = 64)		Control (n = 55)		*Mann–Whitney p: Spouses versus Control*		Spouses (n = 64)		Control (n = 55)		*Mann–Whitney p: Spouses versus Control*		*Mann–Whitney p: advantaged versus disadvantaged player*			
	F: N = 32	M: N = 32	F: N = 25	M: N = 30	*F*	*M*	F: N = 32	M: N = 32	F: N = 30	M: N = 25	*F*	*M*	*F*	*M*	*F*	*M*
Baseline																
Abstract	15.0	15.9	9.9	11.2	*0.01*	*0.00*	15.5	15.1	8.5	12.1	*0.00*	0.17	0.91	0.43	0.58	0.65
Leisure	15.3	17.2	9.2	8.0	*0.00*	*0.00*	15.4	17.7	6.0	9.3	*0.00*	*0.00*	0.95	0.32	0.19	0.72
No Leisure	16.5	17.0	9.3	8.3	*0.00*	*0.00*	15.3	18.5	7.4	8.7	*0.00*	*0.00*	0.82	0.72	0.68	0.97
All	15.6	16.7	9.5	9.1	*0.00*	*0.00*	15.4	17.1	7.3	10.0	*0.00*	*0.00*	0.91	0.43	0.25	0.65
Specialization task																
Abstract	5.8	5.4	2.6	6.2	0.02	0.45	14.9	15.7	6.5	5.7	*0.00*	*0.00*	0.00	0.00	0.04	0.66
Leisure No	5.0	1.7	2.4	2.9	0.54	0.09	16.1	16.5	4.8	5.4	*0.00*	*0.00*	0.00	0.00	0.20	0.39
Leisure	5.0	3.4	1.3	3.3	0.10	0.50	14.9	17.9	5.4	5.5	*0.00*	*0.00*	*0.00*	*0.00*	*0.01*	0.34
All	5.3	3.5	2.1	4.1	0.04	0.37	15.3	16.7	5.6	5.5	*0.00*	*0.00*	*0.00*	*0.00*	*0.03*	0.70

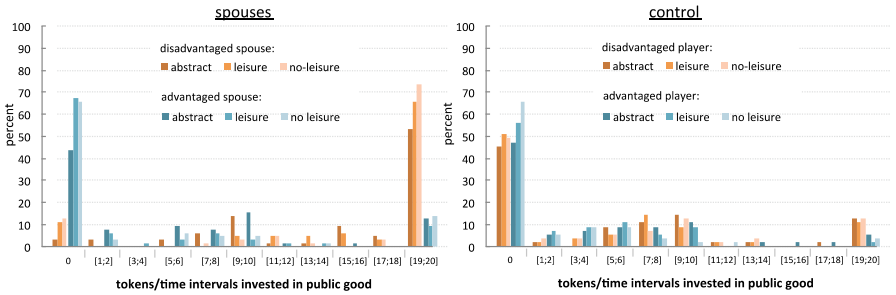

Fig. 2 Histogram of investment by advantaged and disadvantaged players in specialization task

Table 6 The effect of investment framing on the efficiency of decisions

	Advantaged player			Disadvantaged player			Spouses	Control
	Spouses (n = 64) [%]	Control (n = 55) [%]	*Mann–Whitney p: Spouses versus Control*	Spouses (n = 64) [%]	Control (n = 55) [%]	*Mann–Whitney p: Spouses versus Control*	*Mann–Whitney p: advantaged versus disadvantaged player*[a]	
Baseline								
Abstract	77.3	52.9	*0.00*	76.5	50.6	*0.00*	0.42	0.75
Leisure	81.2	42.6	*0.00*	82.7	37.6	*0.00*	0.64	0.49
No Leisure	83.8	43.8	*0.00*	84.4	39.9	*0.00*	0.85	0.72
All	80.7	46.4	*0.00*	81.2	42.7	*0.00*	0.79	0.51
Specialization task								
Abstract	71.9	77.4	0.46	76.6	30.7	*0.00*	0.53	*0.00*
Leisure	81.1	86.5	0.88	81.4	25.3	*0.00*	0.90	*0.00*
No Leisure	78.9	88.2	0.54	82.1	27.3	*0.00*	0.42	*0.00*
All	77.3	84.0	0.34	80.1	27.7	*0.00*	0.49	*0.00*

[a] Test results are the same when tests are done seperately for men and for women

work on French spouses playing a prisoners' dilemma, where 72.5% of spouses cooperated (Cochard et al. 2016). This is also similar to the results from a dictator-game style distribution task administered at the end of the session (part 4, reported in Beblo et al. 2015). In this abstract task an average efficiency level of around 75% was observed. Furthermore, our earlier results showed that spouses react symmetrically to inequality in the abstract distribution task. Specifically men and women acted the same and treated situations where they were themselves in either the advantaged or disadvantaged position similarly.

Having observed the specialization by spouses but not by control participants, we can now compare the situation where men are advantaged with the counterfactual where women are advantaged. For this we will compare behavior by men and

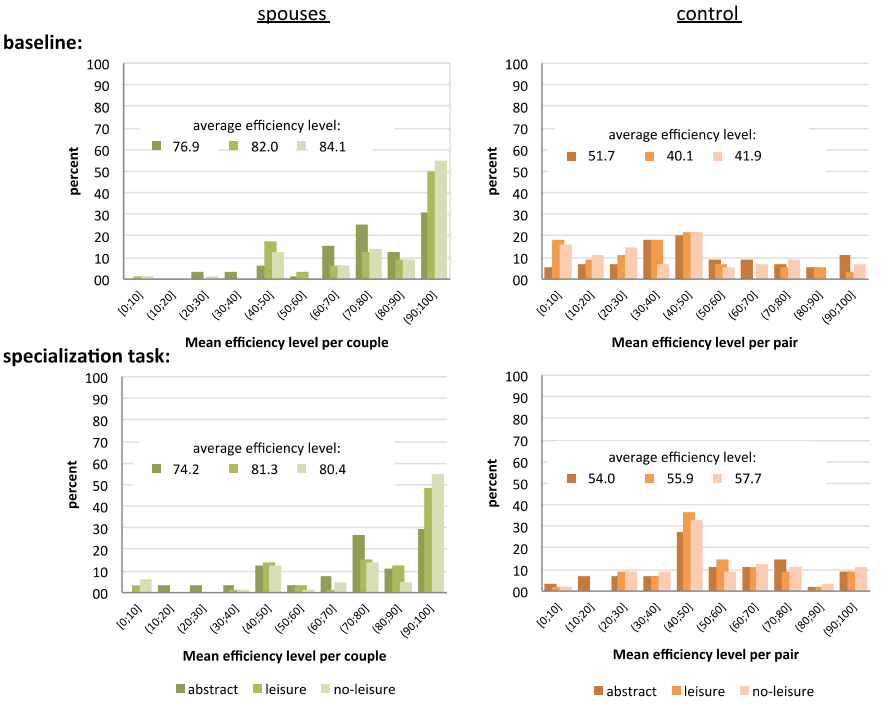

Fig. 3 Distribution of mean efficiency reached by couples in baseline and specialization task. Efficiency for disadvantaged players is computed as their investment in the public account (i.e., their contribution) divided by 20. For advantaged players, efficiency equals their investment in the private account divided by 20. In the Abstract and No leisure treatments, investment in the private account equals 20 minus investment in the public account; in the Leisure treatment this is not necessarily the case as subjects may have used the leisure option. The couple's efficiency rate is simply the mean efficiency rate of the spouses

women that are in the same role (either advantaged or disadvantaged). We first compare average public good contributions across frames. For spouses we observe no significant difference across gender [for either role (advantaged, disadvantaged) and either game (baseline, specialization)]. Thus we observe no consistent gender difference in behavior for spouses. If we analyze each frame separately (see Fig. 1) we observe significance for disadvantaged spouses in the baseline game both in the leisure (men: 17.7 (5.7); women: 15.4 (7.0); $p = 0.097$) and no leisure (men: 18.5 (4.3); women: 15.3 (7.5); $p = 0.038$) frames, and in the specialization game for advantaged spouses in the leisure frame (men: 1.7 (4.2); women: 5.0 (7.6); $p = 0.046$) and for disadvantaged spouses in the no leisure frame (men: 17.9 (5.9); women: 14.9 (7.5); $p = 0.049$). Therefore there are some differences between men and women, with a slight tendency for men to be more efficient but it should be noticed that in all cases these differences are of relatively small magnitude. Control participants show no significant gender differences if we compare average contributions across frames in the baseline. In the specialization task male advantaged players contribute marginally significantly more than female

advantaged players (men: 4.1 (4.4); women: 2.1 (2.6); $p = 0.070$) but disadvantaged players show no significant difference. Our second result is therefore:

Result 2 *Overall, men and women react in the same way to being in either the advantaged or disadvantaged position, both for spouses and control participants. Across frames we observe no gender differences concerning investment in the public good.*

Thus contrary to theories that ascribe specialization to internalized norms, we observe no evidence of women investing more in the public good than men. For spouses both men and women contribute around 80% of their resources to the public good when in the disadvantaged position, and around 20% when in the advantaged position. Our results therefore support in an abstract laboratory setting the theoretical assumption that labor specialization by spouses is driven by differences in net benefits from labor market activity. The observed gender differences should thus be ascribed to differences in these net benefits and not to gender-specific differences.

Overall our results are robust across the different frames. Notably across roles and games, average contributions are not different in frames Leisure and no Leisure.[18] For spouses and control participants, average use of leisure is about 1% of the time endowment (3.2 s), which explains the lack of a difference.[19]

The abstract frame led to slightly different reactions, however, both of our results hold for it too. Specifically in a number of instances the Abstract frame shows for spouses significantly lower efficiency rates compared to either the Leisure or no Leisure frame. However, due to the fact that this frame was always presented before the others, we cannot rule out that learning was causing this effect. From the histograms of investment choices (Fig. 2) we see that the Abstract frame leads to more choices of focal numbers (5, 10 and 15). In the control group the effect is rather inverted, leading in the baseline to higher efficiency rates in the abstract frame (see Fig. 1).

We further might wonder whether certain couple characteristics influence our main results. Possible variables for this could be the fact of having children or the relative bargaining power of spouses. We therefore verify results 1 and 2, comparing spouses with and without children. Both results also hold in this case. We also asked participants about their own salary and how much they believed their partner to earn. We can thus also compare participants that believe their partner to earn more with those that believe their partner earns less. Again both our results hold for either type of participant.

[18] Specifically when doing all pairwise comparisons in 14 out of 16 cases we observe no significant difference, and we observe a small difference in two cases (specialization game for disadvantaged men (Leisure: 16.5 (6.9); No Leisure: 17.9 (5.9); $p = 0.025$) for spouses, and advantaged women (Leisure: 2.4 (3.3); No Leisure: 1.3 (2.2); $p = 0.009$) in the control).

[19] Across treatments men and women typed approximately eight ten-digit phone numbers per minute (i.e., about 80 keystrokes per minute). This suggests that subjects felt as much compelled to provide an effort in treatment No Leisure than in treatment Leisure, although no sanction actually existed in the former.

4.2 Preferences

Choices lead in the specialization task as well as in the baseline, to efficiency levels of around 80%. We might, however, wonder whether this can be ascribed to preferences for efficiency or to preferences for equality given optimistic beliefs about the partner. Given that our results are qualitatively not altered by the framing of investment, we will in the following concentrate on results from the no leisure treatment to investigate the relationship between beliefs and actions. The following results also hold when results from either of the other treatments are used.

A large proportion of participants (almost 70%) act in a fully efficiency maximizing way. About 20% of participants (i.e., 33 individuals) split their investment between the two investment options. We will use beliefs to investigate if these choices can be interpreted as stemming from inequality aversion. Beliefs are plotted against own actions for advantaged and disadvantaged players in Fig. 4b. The top panels show results from the baseline task. Indeed we see that a large proportion of observations falls close to the 45° line for both spouses and control participants. In this task, about 62% of spouses contributed 20 and declared that they believed that their partner contributed 20. This proportion was much lower for

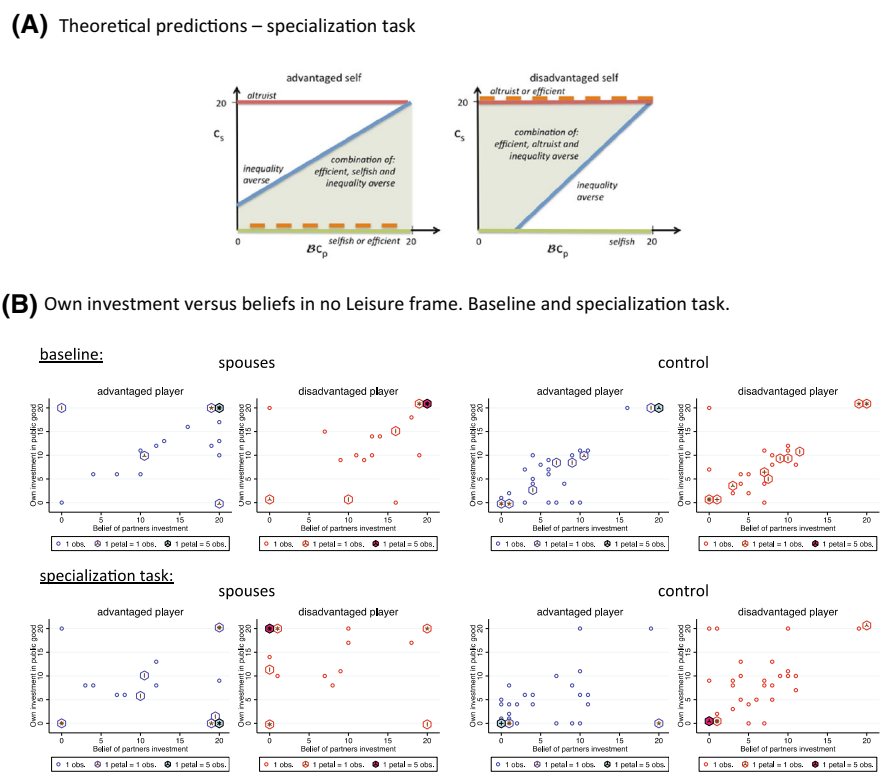

Fig. 4 Actions versus beliefs concerning spouses' actions (**A**) predictions (**B**) density distribution plots (Sunflower plots) of stated beliefs and own choices in the no Leisure frame

control participants (advantaged: 24%, disadvantaged: 11%). However, since the baseline game is symmetric, this might be an indication of concerns for efficiency, for equality or alternatively be the result of a social projection bias (e.g., Glaeser et al. 2000; Sapienza et al. 2013). The projection bias is the belief that people close to us will act like us. The specialization task requires a bit more cognitive effort by the participant to understand the incentive situation of their partner. Our results (Fig. 4b, bottom panel) confirm that participants do not simply project their own actions on their beliefs about their partner. Among spouses a large proportion of advantaged participants (30 out of 64) and disadvantaged participants (35 out of 64) reports beliefs that in combination with their own choice led to maximal efficiency and that are largely asymmetric in actions. Among control participants only 6 (out of 110) participants report beliefs that in combination with their own choice imply maximal efficiency.

The density distribution plots in Fig. 4b also allow us a comparison with the characterization of preferences (Fig. 4a). We notice that for spouses in the specialization game the large majority of observations for advantaged players, 82.8%, fall in the area compatible with functions of type $\hat{U}_s$ (combination of motives with some selfish concern). While the large proportion of observation for disadvantaged players, 85.9%, falls in the area that is consistent with a function of type $\tilde{U}_s$ (combination of motives with some altruistic concern). Since the role of advantaged player was randomly allocated and equally distributed over the two sexes, it seems unrealistic to assume that advantaged players are more selfish while disadvantaged players more altruistic. The more likely interpretation is that for both types of players a mix of efficiency and equality concerns influence behavior. This is in line with earlier results that observe a trade-of between efficiency and equality in couples.

5 Discussion and conclusion

This paper presents experimental results concerning work-division choices made by true couples. We observe behavior in a specialization task and compare choices to a baseline public good task. The specialization task is meant to simulate the dilemma between family and work life experienced by many couples. In addition, it allows us to study the counterfactual where men are in a disadvantaged position concerning their private earnings which occurs in some non-traditional "power couples" (Bloemen and Stancanelli 2015). The efficient outcome is such that one member will increase his private earnings from choosing the efficient option (i.e., specializes into labor market work), whereas the other sacrifices private earnings in order to invest in the household public good (i.e., specializes into household work). We test the robustness of our results given different framings of the investment task (time allocation or abstract investment).

Couples react in the expected way in the specialization task. Their behavior is largely compatible with the predictions. Efficiency levels are in the baseline and in the specialization task at about 80%. In particular, advantaged players reduce their

contribution to the public good and disadvantaged players maintain their contributions largely unchanged. The baseline versus specialization task comparison did not show a change in efficiency despite the increase of inequality at the household level in the specialization task. This striking result is compatible with the existence of an intrinsic coordination mechanism among couples unrelated to inequality in earnings. An income-pooling micro-norm could play such a role (see Beblo and Beninger forthcoming; Cochard et al. 2016).

We observe no significant gender differences. Men and women react almost the same to being in either the advantaged or disadvantaged position in the specialization task. Hence, our results support in an abstract laboratory setting the theoretical assumption that labor specialization by spouses is driven by differences in net benefits from labor market activity. Contrary to real life, the work-division puzzle does not appear in the experiment. The fact that many real-life tasks involve very different skills and different cultural norms are at play might further be influential for spouses behavior outside of the laboratory. Both the value that men and women attribute to the specific service produced at home (e.g., education of a child) and social pressure with respect to gender norms of who should do these tasks, might influence the relative costs and benefits in addition to salaries. The division of real-life tasks is also often not as explicit as the division of a sum of money, but spontaneous (e.g., who gets up from the table to calm a crying baby). Some evidence that spontaneous decisions might differ from deliberate allocation choices, can be drawn from our comparison of an abstract frame with the time allocation frames. Indeed efficiency by spouses is higher in the time allocation frames, potentially because they pay less attention to the exact values and thus react in a more spontaneous fashion.

Most notably, our experiment shows, that women *do not* have a higher intrinsic preference for investing in an abstract public good for a household.

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