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## Please, marry me!: An experimental study of risking a joint venture

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Please, marry me!  
– An experimental study of risking a joint  
venture –\*

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**Abstract**

Empirical studies in family economics usually rely on questionnaires, statistical or panel data. Here we try to study experimentally some crucial aspects of engaging in a marriage. First the female partner can end the relationship or suggest one of the two forms of joint venture. Whereas a full engagement relies on more specialization, but makes her more exploitable by the male partner, a low engagement is less productive, but also fairer. More specifically, the random profit of a joint venture is allocated by ultimatum bargaining in case of a full engagement whereas demands are determined simultaneously in case of a low engagement. Partners interact anonymously. In the repetition the two partners in a matching group of four participants are exchanged. Our treatment variables are her and his outside option value representing gender specific investments in human capital.

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## 1. Introduction

Marriage is frequently researched by different disciplines using different empirical methods ranging from questionnaires, e.g. studying mate preferences (see Buss, 1995), to studies based on statistical yearbooks, or panel data (see Becker et al., 1977). Statistical data sets often do not contain information on which theoretical models of marriage formation and married life rely. On the other hand questionnaire data are often less reliable. This is frequently observed for polls, e.g. when comparing estimates of democratic voting results, based on polls, with actual election results (see Brüggelambert and Crueger, 1999, for a recent comparison).

Both disadvantages can be avoided by experimental studies. By an appropriate design the experimental observations can provide just the type of data, needed for testing theoretical hypotheses. Furthermore, by granting substantial payoffs, one can try to avoid unreasonable answers. This, however, comes at a price. It is hard, maybe even impossible, for such an experiment to capture all crucial aspects of a human marriage, especially the romantic ones. We do not even try to capture such latter aspects. Instead we have concentrated on the major economic aspect of married life, namely its character as a joint venture, based on productivity increases due to labor division.

In our experiment pairs consisting of a female partner ( $X$ ) and a male partner ( $Y$ ) are already formed. We ran two experimental series. In Berlin both parts ( $X$  and  $Y$ ) are played by (fe)male participants. In Bergen it was commonly known that all  $X$ -, respectively  $Y$ -participants are females, respectively males. What partners must decide is whether the relationship will be continued, and if so, at which level of engagement or labor division, e.g. in the form that she specializes in taking care of the family. In our view,  $X$  has a shorter reproductive period. Because of this our model assumes that  $X$  takes the initiative in deciding whether to terminate the relationship with  $Y$  or to offer a low or full engagement. If  $Y$  accepts one of the latter proposals, either a  $L(ow)$  or a  $F(ull)$ -joint venture is agreed upon.

Both types of joint venture can result in a high ( $\overline{P}$ ) or a low ( $\underline{P}$ ) profit  $P$ . The higher profitability of a full engagement is reflected by the higher probability of the large profit  $\overline{P}$ . This higher productivity has, however, its price which she ( $X$ ) must pay. Whereas bargaining is fair in the sense of a fair bargaining game (Nash, 1953) in case of a low engagement, it is ultimatum bargaining (experimentally studied first by Güth et al., 1982) with  $Y$  as the proposer and  $X$  as the responder in case of a full engagement (that orthodox labor division results in an unfavorable bargaining position for the female partner is pointed out and analyzed by Ott, 1992). What we capture here can be interpreted as different forms of marriage contracts with different rules in case of a divorce (see Allen, 1998, for an empirical analysis of such rules).

To allow for learning the experiment was repeated once. In the repetition the participant kept her ( $X$ ) or his ( $Y$ ) role, but confronted a new partner. Actually four participants (two  $X$  and two  $Y$ ) formed a matching group in which partners were exchanged in the repetition. Our only treatment variables are the outside option values  $O_X$  and  $O_Y$ , i.e. what  $X$ , respectively  $Y$  earn in case of no engagement. By varying these we try to capture gender specific attitudes to invest in human capital.

Section 2 describes the basic model. The details of the experimental procedure are represented in section 3. In sections 5 we analyze the data by evaluating the support for the various hypotheses, stated in section 4. Our concluding remarks (section 6) summarize our findings.

## 2. The basic model

To describe the experimental situation we rely on the following notation:

- $O_X, O_Y (> 0)$  her ( $X$ ), respectively his ( $Y$ ) outside option value;
- $P$  joint profit resulting from  $X$  and  $Y$ 's joint venture where  $P = \overline{P}$  and  $P = \underline{P}$  ( $\overline{P} > \underline{P} > 0$ ) are the two possible realizations of  $P$ ;

- $N$ (o joint venture);
- $L$ (ow engagement type of joint venture);
- $F$ (ull engagement type of joint venture);
- $d_i$  what party  $i = X, Y$  demands of  $P$  for itself where  $0 \leq d_i \leq P$ ;
- $w = \text{Prob}\{P = \bar{P} \text{ in case of } F\}$ ,  
 $\omega = \text{Prob}\{P = \bar{P} \text{ in case of } L\}$  where  $1 > w > \omega > 0$ ;

The sequential decision process can be described as follows:

- (i)  $X$  chooses between  $N$ (o),  $L$ (ow), or  $F$ (ull) engagement type of joint venture; after  $N$  (no engagement) the game ends with the outside option vector  $(O_X, O_Y)$ , whereas it continues otherwise.
- (ii)  $Y$  learns whether  $L$  or  $F$  is suggested by  $X$ ; he can accept ( $\mathcal{L}$ , respectively  $\mathcal{F}$ ) or reject ( $\bar{\mathcal{L}}$ , respectively  $\bar{\mathcal{F}}$ ) the respective proposal; if he rejects (after  $\bar{\mathcal{L}}$  or  $\bar{\mathcal{F}}$ ) the game ends with the payoff vector  $(O_X, O_Y)$ , whereas it continues otherwise.
- (iii) Chance selects  $P = \bar{P}$  (the high profit) with probability  $w$  in case of a full engagement ( $F$  and  $\mathcal{F}$ ), respectively with probability  $\omega < w$  in case of a low engagement ( $L$  and  $\mathcal{L}$ ), or  $P = \underline{P}$  (the low profit) with the complimentary probability; both,  $X$  and  $Y$ , are informed about the realization of  $P$ .
- (iv) If a low joint venture has been formed (after  $L$  and  $\mathcal{L}$ ) both,  $X$  and  $Y$ , independently choose their demands  $d_i$ ; if  $d_X + d_Y > P$ , the game ends with the payoff vector  $(P/4, P/4)$ ; otherwise the payoff vector is

$$(d_X + \frac{P - d_X - d_Y}{2}, d_Y + \frac{P - d_X - d_Y}{2}).$$

If a full joint venture has been formed (after  $F$  and  $\mathcal{F}$ ) first  $Y$  proposes  $d_Y$ ; knowing  $d_Y$   $X$  then accepts this proposal or not. In case of a rejection both earn  $P/4$  whereas the payoff is  $P - d_Y$  for  $X$  and  $d_Y$  for  $Y$  when  $X$  accepts.

Due to  $w > \omega$  a full engagement  $F$  is more profitable than a low engagement  $L$  which relies on less labor division and specialization. But the full engagement puts  $X$  at a major disadvantage when bargaining on stage (iv) how to split  $P$ . Whereas in case of  $L$  and  $\mathcal{L}$  bargaining is fair in the sense of a symmetric bargaining game (Nash, 1953), after  $F$  and  $\mathcal{F}$  the extremely asymmetric rules of ultimatum bargaining (see Güth, 1976, and Güth et al., 1982, for an early experimental study) are applied.

Conflict or divorce is assumed to result in a major loss, namely of half of  $P$ . An obvious generalization is to allow for all conflict losses  $\delta P$  with  $0 < \delta \leq 1$ , i.e. both partners  $X$  and  $Y$  together earn only  $(1 - \delta)P$  in case of a divorce. More important than the special value  $\delta = 1/2$  is the symmetry of conflict payoffs. It is often claimed that the female partner usually receives a smaller share of  $(1 - \delta)P$  than her male partner. This claim may be true for financial assets, but when including emotional goods as children the asymmetry often is reversed. To explore such an asymmetry of conflict payoffs and how it affects the reward allocation could be a promising line of future research.

Why did we not rely on biased conflict payoffs already in the study at hand? One justification is that legal divorcement settlements in the recent past tend to avoid unfair allocations, e.g. by compensating female partners for their career disadvantage. The decisive reason has been, however, to explore in isolation the effects of asymmetric outside option values and of asymmetric bargaining in case of more efficient labor division. Asymmetric conflict payoffs could be explored by always relying on the symmetric bargaining rules of the  $L$ -joint venture and by assuming that more efficient labor division increases the conflict loss  $\delta P$ , e.g. in the sense of  $1 \geq \delta_F > \delta_L > 0$ , and/or the discrepancy between the shares which  $X$  and  $Y$  receive of  $(1 - \delta)P$ .

Clearly, a couple, i.e. the pair of  $X$  and  $Y$ , should decide for a full engagement  $F$  if they can trust each other. When both partners are, however, opportunistic and only interested in their own monetary earnings, the results might change dramatically. To illustrate this in more detail we derive the opportunistically

rational solution behavior by elaborating the consequences first of the proposal  $L$  and then of the proposal  $F$  by  $X$  on stage (i).

**The bargaining game after  $L$  and  $\mathcal{L}$**  has many strict equilibria  $(d_X, d_Y)$ , namely all vectors satisfying

$$d_X > P/4, d_Y > P/4, \text{ and } d_X + d_Y = P.$$

By requiring symmetry (see Nash, 1953) the strict equilibrium

$$(d_X^*, d_Y^*) = (P/2, P/2)$$

is selected as the unique solution on which our further analysis relies. Anticipating this solution acceptance  $\mathcal{L}$  of  $L$  yields  $P_\omega/2$  for  $Y$  where

$$P_\omega = \omega \bar{P} + (1 - \omega) \underline{P}.$$

Thus  $Y$  will choose  $\mathcal{L}$  if  $P_\omega/2 \geq O_Y$ , otherwise he would prefer  $\bar{\mathcal{L}}$ .

**The bargaining game after  $F$  and  $\mathcal{F}$**  has two stages: On the second stage  $X$  will accept  $Y$ 's demand  $d_Y$  if  $P - d_Y \geq P/4$ , otherwise she would reject  $d_Y$ . Thus  $Y$ 's optimal demand on the first stage is  $d_Y^* = \frac{3}{4}P$  which would be accepted. Thus  $\mathcal{F}$  yields  $\frac{3}{4}P_w$  for  $Y$  where

$$P_w = w \bar{P} + (1 - w) \underline{P}.$$

Consequently,  $Y$  will choose  $\mathcal{F}$  if  $\frac{3}{4}P_w \geq O_Y$ , otherwise he would prefer  $\bar{\mathcal{F}}$

**On the initial stage (i)**  $X$  will choose

- $L$  if  $P_\omega/2 > O_X$ ,  $P_\omega/2 > P_w/4$ , and  $P_\omega/2 > O_Y$ ;
- $F$  if  $P_w/4 > O_X$ ,  $P_w/4 > P_\omega/2$ , and  $\frac{3}{4}P_w > O_Y$ ;
- $N$  otherwise.

In the experiment situations where one of the two parties would be indifferent according to the above results are avoided. For  $X$  it is assumed that she prefers  $N$  whenever she expects her proposal  $L$  or  $F$  to be rejected by  $Y$ . Although perfectness considerations (Selten, 1975) could suggest the contrary, we prefer to allow here for a secondary concern, namely that  $X$  wants to avoid the embarrassment of having her proposal almost surely rejected. We will be especially interested in situations where a full engagement  $F$ , which is preferable when  $X$  can trust  $Y$ , is avoided by opportunistically rational partners.

### 3. The experimental protocol

The experimental sessions were performed as computerized experiments. After seating participants at isolated terminals any communication was strictly forbidden. The experiment then proceeded as follows: Participants receive the instructions which they read carefully; they are allowed to ask privately for clarifications concerning the rules. Before starting the experiment, participants fill out a pre-experimental control questionnaire; the experimenters ask for complete answers. On the computer screen each participant is told whether he is the  $X$ - or the  $Y$ -partner and informed about both outside option values ( $O_X$  and  $O_Y$ ).  $X$  is asked for her plans concerning the bargaining stage. Similarly,  $Y$  is asked for his plans concerning stages (ii) and (iv) of the decision process.  $X$  is asked to choose between  $N$ ,  $L$ , or  $F$ . After learning whether  $N$ ,  $L$ , or  $F$  has been suggested  $Y$  decides between  $\mathcal{L}$  or  $\overline{\mathcal{L}}$  in case of  $L$ , respectively between  $\mathcal{F}$  or  $\overline{\mathcal{F}}$  in case of  $F$ . After  $N$ ,  $\overline{\mathcal{L}}$ , or  $\overline{\mathcal{F}}$  the game ends.

If a joint venture ( $L$  and  $\mathcal{L}$  or  $F$  and  $\mathcal{F}$ ) has been formed, the size of  $P$  is randomly selected by a computerized chance move. Both partners learn whether  $P = \overline{P}$  or  $P = \underline{P}$  has been chosen. After  $L$  and  $\mathcal{L}$  they choose simultaneously their demands. After  $F$  and  $\mathcal{F}$  first  $Y$  has to choose  $d_Y$ . Then  $X$  is informed about  $Y$ 's demand  $d_Y$  and accepts or rejects the amount which  $Y$  is offering her. On the next screen both partners indicate on a bipolar discrete scale how much they like their partner. After informing both partners how much they have earned, the game ends.



Only then it is announced that the game will be repeated once with each participant keeping his/her role ( $X$  or  $Y$ ), but with a new partner. Actually by the code numbers 4 participants, say  $X.i$ ,  $X.j$ ,  $Y.i$ , and  $Y.j$ , form a matching group in the sense that first the pairs are  $(X.i, Y.i)$  and  $(X.j, Y.j)$  and then  $(X.i, Y.j)$  and  $(X.j, Y.i)$ . After the repetition participants fill out a post-experimental questionnaire.

The only treatment variables are the outside options  $O_X$  and  $O_Y$ , i.e. the monetary payoffs without a joint venture. Otherwise the parameters are

$$\bar{P} = 45, \underline{P} = 25, w = 75\%, \omega = 25\%$$

yielding  $P_w = 40$  and  $P_\omega = 30$ . Our  $2 \times 2$ -factorial design is based on

$$O_X \in \{3, 13\} \text{ and } O_Y \in \{8, 18\}.$$

In our view, situation I (Table 3.1) with  $O_X = 3$  and  $O_Y = 8$  resembles rural societies where both outside options are low (due to low investments in human capital). Situation II with  $O_X = 13$  and  $O_Y = 8$  and situation III with  $O_X = 3$  and  $O_Y = 18$  allow to analyse the impact of increased investments in female, respectively male education. Both such investments are high ( $O_X = 13$ ,  $O_Y = 18$ ), but not necessarily equal in modern societies (situation IV). Whereas situation II relies on the same absolute difference  $|O_X - O_Y| = 5$  as I and IV, this asymmetry is more extreme in situation III.

	$O_Y = 8$	$O_Y = 18$
$O_X = 3$	I (rural society): $L, \mathcal{L}$	III $\left( \begin{array}{c} \text{much better} \\ \text{male education} \end{array} \right)$ : $F, \mathcal{F}$
$O_X = 13$	II $\left( \begin{array}{c} \text{moderately better} \\ \text{female education} \end{array} \right)$ : $L, \mathcal{L}$	IV (modern society): $N$

Table 3.1: The  $2 \times 2$ -factorial design and the initial decisions by opportunistically rational partners.

In Table 3.1 the  $2 \times 2$ -factorial design is illustrated together with the initial decisions by opportunistically rational partners as derived in the previous section, i.e. when  $X$  cannot trust in  $Y$ 's fairness. Since  $P_w/2 = 15 > P_w/4 = 10$ ,  $X$  strictly

prefers an  $L$ -engagement, which is always more profitable than her outside option  $O_X$ , over an  $F$ -engagement. In case of  $O_Y = 18$  her proposal  $L$  would, however, be rejected by  $Y$ . Thus  $X$  offers  $F$  in case of  $O_X = 3$  and  $O_Y = 18$  yielding her  $P_w/4 = 10$ . In case of  $O_X = 13$  and  $O_Y = 18$  she chooses  $N$ , i.e. she shies away from a joint venture with  $Y$ .

The monetary unit was German Mark (DM) in Berlin and Norwegian Kroner in Bergen. The earnings ranged from DM 16,25 to DM 61,00 with an average earning of DM 35,47, respectively from NOK 71,30 to NOK 310,00 with an average of NOK 187,37. The conversion rate for DM into NOK was 1 DM = 5 NOK. In total an experimental session lasted about one hour. We always relied on instructions and decision screens in English, see Appendix A.

Altogether we have 144 observations of the couples (96 in Berlin and 48 in Bergen). One matching group consists of 4 participants - 2  $X$  and 2  $Y$  - providing 4 plays, 2 in the first and 2 in the second round. In each treatment (see Table 3.1) we have 6 matching groups. In Berlin we implemented all four  $(O_X, O_Y)$ -treatments, whereas in Bergen we ran only treatment II and IV. For summary statistics, see Appendix B.

## 4. Hypotheses

A full engagement with a high degree of labor division and specialization is always profitable in expected terms when partners can trust each other to share the rewards evenly:  $P_w/2 = 20$  would even suffice to satisfy  $Y$  in case of  $O_Y = 18$ . In case of opportunism the full engagement  $F$  can, however, only be expected in situation III when, furthermore, the rewards would be shared unevenly with  $X$  receiving only 1/4 of the available pie  $P$ . We expected experimental behavior to be partly relying on trust, i.e. to lie in between these extremes.

**(A.1)** Even in situations I, II, and IV some  $X$  will suggest  $F$ , i.e. trust in  $Y$ 's fairness.

(A.2) If  $F$  is accepted, many partners  $Y$  will demand less than  $3/4$  of  $P$ , where this tendency should be stronger for  $O_X = 13$  than for  $O_X = 3$ .

In usual ultimatum games the optimal demand by  $Y$  is  $d_Y^* = P$  since the conflict payoffs are zero, i.e. all of  $P$  and not only  $P/2$  is lost. Already there one typically observes  $d_Y$  in the range  $P/2 \leq d_Y \leq \frac{2}{3}P$  (see Güth et al., 1982, and Roth, 1995, for a recent survey). The fact that here the responder  $X$ 's conflict payoff is  $P/4$  instead of 0 should further discourage too "greedy demands".

One can describe hypothesis (A.1) as  $X$ 's trust in  $Y$ 's reciprocity and hypothesis (A.2) as reciprocal behavior. Of course, when  $O_X$  is small, the proposal  $F$  is less risky than when  $O_X$  is large. It thus should trigger less reciprocity.

In view of earlier ultimatum experiments we further expected:

(B.1) After  $F$  and  $\mathcal{F}$  "unfair demands"  $d_Y > P/2$  are often rejected where this tendency should be stronger for  $O_X = 13$  than for  $O_X = 3$ .

(B.2) In the repetition the average demand  $d_Y$  after  $F$  and  $\mathcal{F}$  increases.

Part (B.1) is supported by the profound evidence for rejecting unfair offers in ultimatum bargaining; part (B.2) is also suggested by experimental results, e.g. of Binmore et al. (1985).

Although the bargaining procedure after  $L$  and  $\mathcal{L}$  is fair due to its symmetry, this bargaining game implies a difficult coordination task since all vectors  $(d_X, d_Y)$  with  $d_X > P/4$ , and  $d_Y > P/4$ , and  $d_X + d_Y = P$  are strict equilibria. Clearly, the normative principle of symmetry invariance (Nash, 1953) implying the solution  $d_X^* = P/2 = d_Y^*$  is highly appealing and prominent. But behaviorally the symmetry of the bargaining game after  $L$  and  $\mathcal{L}$  is rather questionable since one never has  $O_X = O_Y$ . Only when "sunk costs do not matter", partners will forget what they have given up individually for the sake of their joint venture. But "sunk costs often matter" what suggests

(C.1) After  $L$  and  $\mathcal{L}$  the partner  $i$  demands more the higher the own outside option ( $O_i$ ) and the lower the partner's outside option ( $O_j$ ) is.

Hypothesis (C.1) states that the partner with the better outside option will feel entitled to ask for more of what is available whereas the partner with the inferior outside option might want to compensate the other for the larger sacrifice.

Our rather complex experimental situation allows for other more or less specific hypotheses, e.g. how behavior depends on past results. A few of them will be mentioned when presenting the experimental data and their analysis.

## 5. Behavioral regularities

We start our analysis by investigating the support for the various hypotheses, stated in the previous section. Table 5.1 displays the relative share of the different types of realized joint ventures, i.e. non-cooperation, a low, respectively a full joint venture and how often X-participants have suggested them as depending on treatments. Since the tendency to strive for a full joint venture is universally strong, hypothesis A.1 is clearly confirmed. One can state

**Regularity 1:** Participants strive for efficiency by avoiding non-cooperation ( $N$ ) and by suggesting ( $F$ ) and accepting ( $\mathcal{F}$ ) the full joint venture. Altogether 81.25% of X-participants choose  $F$  resulting in 77.08% of full joint ventures.

Striving for efficiency seems to be equally strong for all treatments. To analyze how treatments effect the decisions on joint venture type, we estimate both the probability for realizing the efficient joint venture outcome by a probit model and the choice between no, low or full joint ventures by a multinomial logit model<sup>1</sup>.

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<sup>1</sup>An alternative approach is to estimate  $X$ 's proposal and  $Y$ 's conditional acceptance or rejection by a system of equations. However, since there are only 6 (6) rejections of  $X$ 's proposal  $L(F)$ , this approach is not feasible.

In both estimations we control for participants' understanding of the experiment by their total score in the pre-experimental questionnaire. Learning is captured for by a dummy variable for the second round. Finally, to control for the effect of common knowledge about gender, as granted in Bergen, but not in Berlin, we use a dummy variable for the experiment in Bergen. The results are reported in Tables 5.2 and 5.3<sup>2</sup>.

Although striving for the efficient joint venture is universally strong, the results of Tables 5.2 and 5.3 reveal a tendency for couples to "move" toward their respective rational joint venture, as claimed in hypothesis A.1. According to the probit model the strive for efficiency is strongest for treatment III where the efficient joint venture is chosen by opportunistically rational partners ( $F$  and  $\mathcal{F}$ ). As we can see from Table 5.2 treatment I reduces the probability by 26.6 percent points (significant at .078 level) compared to treatment III. The two other treatments have the expected sign, but are insignificant. Furthermore the results from the multinomial logit model confirm partly this tendency. First, the hypothesis of no effect of treatments on the choice between low and full joint venture are rejected at a significance level of  $z = .109$  ( $\chi^2(3) = 6.05$ ). Second, all treatments - compared to treatment III - increase the probability of choosing low versus full joint venture, where treatment I is significant ( $z = .040$ ). In the choice between no and full joint venture the treatment effects have the expected sign, but are insignificant.

**Regularity 2:** There is a tendency for treatments to "push" the couples towards their normative (benchmark) joint venture.

Many  $X$ -participants propose  $F$  although they can be exploited by their  $Y$ -partner. Higher demands  $d_Y$  in a full than in a low joint venture can be viewed as an attempt of  $Y$  to exploit his bargaining position. To analyze this further we

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<sup>2</sup>The results of the probit model are based on independent error terms. Clearly, it is reasonable to assume independence between matching groups. However, within a matching group there may be correlation due to switching partners in the second round. To control for this we estimate a random effect model with autocorrelation in  $X$  partners and another random effect model with autocorrelation in  $Y$  partners. Results of both models are similar to the reported result, and hence we do not report them.

regress  $Y$ 's demand and  $X$ 's reaction in case of full joint venture and both  $X$ 's and  $Y$ 's demand in case of low joint venture<sup>3</sup>. The results are reported in Tables 5.4 and 5.5. The OLS estimator for the pooled low and full joint venture data shows that  $Y$  demands 3.167 DM more in the full than in the low joint venture (significant at the level .066). The predicted *marginal* effect on  $Y$ 's demand resulting from a (marginal) increase in the pie are with .487 higher for the full joint venture than with .355 for the low joint venture (not statistically different on the 10 percent level).

In a low joint venture the partners face equal bargaining positions. This is supported by the nonsignificant effect of the dummy variable  $X$ -role on their demand (see Table 5.5). Nevertheless they have a rather low success rate 53% overall (100% in Bergen and 36% in Berlin).

**Regularity 3:** There is a significant tendency that in a full joint venture  $Y$  demands more for himself than he would have done in a low joint venture.

In a low joint venture there is no significant difference between the  $X$  and  $Y$  demands.

After agreeing in a joint venture outside options are lost. However, as argued in the previous section, the outside options still may influence how the pie is split. The estimation results for the full joint venture (Table 5.4) reveal a tendency for  $Y$  to demand less for himself in all treatments other than treatment III where his initial position is best. The effect of treatment II ( $O_X > O_Y$ ) is significant ( $z = .029$ ) what supports the second part of hypothesis A.2, namely that  $Y$ 's demand increases with decreasing  $O_X$ . It is remarkable that the  $X$ 's acceptance rate is rather high (80%, 75%, and 81.5%) for treatments I, III and IV compared to

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<sup>3</sup>Regressions on conditional decisions may lead to biased estimates since the couples have selected themselves into a joint venture type. To correct for this we also estimated the probability for  $Y$  to be in full joint venture (respective low joint venture) and  $Y$ 's demand for  $F\&\mathcal{F}$  ( $Y$ 's demand and  $X$ 's demand for  $L\&\mathcal{L}$ ) by a two step (Heckman, 1979) procedure. In all these three models the selection estimates are non-significant, and therefore we only report the OLS estimators of the conditional demands and the MLE estimator of a probit model for  $X$ 's acceptance.

treatment II (68%), the only situation where  $X$  has an outside option advantage. This tendency also shows up in the negative sign of the coefficient for treatment II (Table 5.4). As stated in hypothesis B.1,  $X$ 's predicted probability to reject  $Y$ 's offer increases where  $Y$ 's demand increases.

Furthermore, all "fair" demands ( $d_Y \leq P/2$ ) are accepted. In case of a low joint venture participants reduce significantly their own demand when their partner's outside option increases, as claimed in hypothesis C.1.

Although the instructions employ the neutral economic term "joint venture", our main intention has been to capture basic aspects of marriage with  $X$  as the female and  $Y$  as the male person. Whereas in Berlin-sessions gender has been controlled, but without forcing female (male) participants to play the role of  $X$  ( $Y$ ), this was not only enforced in the Bergen-sessions, but also commonly known. However, common knowledge (or cultural difference) exerts no significant effect.

A remarkable result is that male and female choose different joint venture types (see Table 5.2). A female  $X$  tends to propose less often the full joint venture. She has a 19.7% lower probability of reaching a full joint venture compared to a male with the same background characteristics (significance level  $z = .015$ ). If  $Y$  is female, the probability for  $\mathcal{F}$  is 33.3% lower than for a  $Y$ -male. In other words females tend to reject more often an  $F$ -offer than males. Female  $Y$ -partners tend to accept more often the low joint venture than male  $Y$ -partners (significant at  $z = .040$ , see Table 5.3). Furthermore, female  $X$ -partners propose more often low joint venture than males (significant at  $z = .022$ )<sup>4</sup>. Possible explanations for gender effects could be gender specific risk attitudes or inequality aversion.

**Regularity 4:** Both,  $X$ - and  $Y$ - females have a significant lower probability of realizing a full joint venture than  $X$ -, respectively  $Y$ -males.

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<sup>4</sup>We find the same significant gender effects by regressing only the Berlin data. Since the roles are gender specific in Bergen we cannot test the gender differences between Bergen and Berlin.

As expected better understanding - measured by a high score in the pre-experimental control questionnaire - reduces significantly the probability for realizing the more efficient joint venture and tends to shift choice behavior towards joint venture types as predicted by opportunistically rational behavior. High scores for  $X$ - and  $Y$ -participants reduce the probability for  $F$  and  $\mathcal{F}$  by 2.2% (significant at .034), respectively 2.0% (significant at .076, see Table 5.2). Contrary to our hypothesis B.2, learning, measured by period, seems to have no effect of  $Y$ 's demand behavior in a full joint venture. However, it influences significantly their demand in the case of a low engagement (see Table 5.5).

## 6. Conclusions

Our experimental study tries to capture one of the major economic aspect of married life, namely its character as a joint venture, based on productivity increases due to labor division which can vary with the marriage contract. We distinguish between full and low engagement beside continuing single life. Whereas a full engagement relies on more specialization, but makes "her" more exploitable by "him", a low engagement is less productive, but offering equal chances. Our treatment variables are her ( $O_X$ ) and his outside option ( $O_Y$ ) representing different attitudes to invest in human capital (rural societies - both outside options low; (fe)male biased societies where one outside option is increased; modern societies with both outside options high, but still male-biased).

On the average the participants head for efficiency by choosing the full joint venture.  $X$ -partners mostly suggest full engagement (81.25%), i.e. reveal an enormous trust in  $Y$ 's fairness.  $Y$ -partners exploit their advantage and demand more than in the case of a low joint venture. The experimental data also reveal a weak treatment effect in the choice of a joint venture type as suggested by our benchmark solution.

When explaining the experimental scenario we have already indicated further variations of the basic situation, e.g. by varying the conflict losses and by introducing



different conflict payoffs. Actually we plan to explore this experimentally, but in set up where outside options are substituted by predetermined shares of  $P = \overline{P}$  and  $P = \underline{P}$  where the probability of  $P = \overline{P}$  is even lower for single life than in case of a low joint venture (Güth et al., 1999).

Of course, it would be very important to compare our qualitative findings with the empirical facts about chosen marriage contracts and divorce settlements. Given our very stylised scenario this seems rather difficult. More realistic models might simplify the task, but at the price of possibly overburdening participants with complex situations which they hardly will understand. This also explain why we plan to investigate assymmetric payoffs in a simpler scenario where outside options are similarly determined as partnership payoffs.

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# Tables

**Table 5.1:** The percentage of realized and proposed joint venture types (in brackets)

	Treatment								All	
	I (3, 8)		II (13, 8)		III (3, 18)		IV (13, 18)			
$N$ (No)	4.2	(0.0)	4.2	(4.2)	12.5	(0.0)	16.7	(0.0)	9.7	(1.4)
$L$ (Low)	25.0	(25.0)	16.7	(16.7)	8.3	(12.5)	6.3	(12.5)	13.2	(17.4)
$F$ (Full)	70.8	(75.0)	79.2	(79.2)	79.2	(87.5)	77.1	(83.3)	77.1	(81.3)
$n$	24		48		24		48		144	

**Table 5.2:** Determinants of the efficient joint venture (*F*) for all treatments.  
MLE estimator of the probit model

	Coefficient	Std. err	$P >  z $	Marginal effect (%)
Treatment I	-.819	.465	.078	-26.6
Treatment II	-.278	.452	.538	-7.8
Treatment IV	-.339	.453	.454	-9.6
X-female	-.848	.348	.015	-19.7
Y-female	-1.078	.346	.002	-33.3
Bergen	-.332	.416	.424	-9.4
X-score	-.083	.039	.034	-2.2
Y-score	-.073	.041	.076	-2.0
Period	.305	.254	.230	8.2
Constant	3.628	.873	.000	
$N = 144$				
Observed frequency: .771;    Log Likelihood = -65.35;				
Predicted probability: .812;    Pseudo $R^2 = .1568$ ;				

Note: The marginal effects are calculated at the mean values of the explanatory variables. Marginal effect for dummy variables is for discrete change from 0 to 1.  $P > |z|$  are the test of the underlying coefficient being different from 0. For example  $P < .05$  (.10) means that estimates are significantly different from zero on a 5% (10%) level.

**Table 5.3:** Multinomial logit for realization of joint venture types

Joint venture type	Coefficient	Std. Err.	$P >  z $
No			
Treatment I	-.064	1.346	.962
Treatment II	-1.037	1.233	.400
Treatment IV	.412	1.054	.696
X-female	.706	.948	.457
Y-female	2.745	1.176	.020
Bergen	1.994	1.490	.181
X-score	.169	.115	.140
Y-score	.206	.110	.061
Period	.188	.621	.762
Constant	-8.386	2.439	.001
Low			
Treatment I	2.055	1.002	.040
Treatment II	1.188	.988	.229
Treatment IV	.277	1.085	.798
X-female	1.769	.770	.022
Y-female	1.469	.718	.040
Bergen	.018	.870	.983
X-score	.138	.084	.101
Y-score	.072	.086	.407
Period	-1.054	.587	.073
Constant	-6.233	1.878	.001
$N = 144$			
Log Likelihood = -80.43;			
Pseudo $R^2 = .1957$ ; $\chi^2(18) = 39.15$ ;			

**Table 5.4:** Determinants of  $Y$ 's conditional demand and  $X$ 's acceptance og  $Y$ 's offer in case of a full joint venture (Significance levels: \*(10%) \*\*(5%))

	Y's demand				X's acceptance	
	Full Joint Venture		Both (Full and low)		Full Joint Venture	
	Coef.	Std. Err.	Coef.	Std. Err.	Coef.	Std. Err.
Treatment I	-.970	1.599	-.969	1.401	-.076	.738
Treatment II	-3.382**	1.526	-3.718**	1.371	-.675	.669
Treatment IV	-1.277	1.459	-1.725	1.322	.138	.637
$Y/X$ -female	2.055*	1.210	1.075	1.056	-1.204**	.541
$Y/X$ -score	-.048	.144	-.097	.126	-.077	.076
Period	.156	.909	.008	.815	.267	.405
Bergen	.763	1.212	.467	1.092	-.307	.568
Pie (ECU)	.487**	.087	.481**	.076	.155**	.047
$Y$ 's demand (F-JV)	-	-	-	-	-.233**	.061
F-Joint Venture	-	-	3.167*	1.710	-	-
Constant	5.455	4.571	3.749	3.209	1.925	1.718
	$N = 111$		$N = 130$		$N = 111$	
	Adj. $R^2 = .360$		Adj. $R^2 = .564$		Pseudo $R^2 = .413$	
	OLS Estimator		OLS Estimator		MLE Probit Estimator	

**Table 5.5:** Determinants of own demand in case of low joint venture

	Coefficient	Std. Err.	$P >  t $
Own outside option	.028	.093	.766
Partner outside option	-.338	.093	.001
Gender	-1.257	.987	.213
Bergen	.161	1.340	.905
Score	-.058	.133	.668
Pie $P$	.294	.109	.012
Period	-2.173	1.102	.058
$X$ -role	.911	1.005	.372
Constant	10.574	3.499	.005
$N = 38$			
Adj. $R^2 = .4340$			

# Appendix A:

## Instructions

In the experiment two partners, named  $X$  and  $Y$ , can engage in a joint venture.

On the computer you will be told whether you are the  $X$ - or the  $Y$ -partner and your outside option.

These are the instructions for both partners  $X$  and  $Y$ . Any decision you make is anonymous and cannot be related to you personally neither by your partner nor by the experimenter. Both will never learn your identity.

The initiative rests upon  $X$  who first chooses either

- $N$  - meaning **no** joint venture
- or  $L$  - **low** joint venture
- or  $F$  - **full** joint venture

In case of  $N$  the experiment ends with  $X$  earning her outside option value  $0_X$  and  $Y$  earning his outside option value  $0_Y$  respectively.

In case of  $L$  or  $F$  now  $Y$  has to decide whether he accepts ( $\mathcal{L}$  in case of  $L$  and  $\mathcal{F}$  in case of  $F$ ) or rejects ( $\overline{\mathcal{L}}$  in case of  $L$  and  $\overline{\mathcal{F}}$  in case of  $F$ ) the respective offer by  $X$ .

In case of  $\overline{\mathcal{L}}$  or  $\overline{\mathcal{F}}$  the experiment ends with  $X$  earning  $0_X$  and  $Y$  earning  $0_Y$ . By  $\mathcal{L}$  the two partners  $X$  and  $Y$  have agreed upon an  $L$ -joint venture, by  $\mathcal{F}$  they have agreed upon an  $F$ - joint venture.

Both types of joint venture can yield a high profit  $\overline{P}$  = ECU 45 or only a low profit  $\underline{P}$  = ECU 25. Here ECU stands for **E**xperimental **C**urrency **U**nit, which is DM 1 for 1 ECU. Due to the higher degree of specialization the probability of  $\overline{P}$  = ECU 45 is, however, larger for an  $F$ -joint venture than for an  $L$ -joint venture.

More specifically, the probability of  $\bar{P}$  = ECU 45 is 75 % for an  $F$ -joint venture and only 25 % for an  $L$ -joint venture. Thus the likelihood of  $\underline{P}$  = ECU 25 is 25 % for an  $F$ -joint venture and 75 % for an  $L$ -joint venture.

After forming a joint venture the computer determines by chance whether your joint venture, if it is formed, yields the high profit of  $\bar{P}$  or only the low profit of  $\underline{P}$ . Both partners are told whether  $P = \bar{P}$  or  $P = \underline{P}$  has been randomly chosen. How this joint profit of  $P = \bar{P}$  or  $P = \underline{P}$  is then distributed among  $X$  and  $Y$  depends on the type of the joint venture. An  $F$ -joint venture requires sequential decisions whereas an  $L$ -joint venture allows for simultaneous decisions.

**In case of an  $F$ -joint venture** first  $Y$  determines his demand  $d_Y$  with  $0 \leq d_Y \leq P$ , i.e. how much of  $P$  he demands for himself. Then  $X$ , knowing  $P$  and  $d_Y$  and thus the amount  $P - d_Y$  which  $Y$  is offering her, can accept or reject the offer. If  $X$  rejects the offer  $P - d_Y$ , the game ends with  $X$  and  $Y$  earning  $P/4$  each. Thus  $X$  and  $Y$  lose  $P/2$  since they could not agree on how to share  $P$ . If, however,  $X$  accepts the offer  $P - d_Y$ , the game ends with  $X$  earning  $P - d_Y$  and  $Y$  earning  $d_Y$ , i.e. by fully sharing  $P$ .

**In case of an  $L$ -joint venture** both,  $X$  and  $Y$ , determine their respective demand  $d_X$  with  $0 \leq d_X \leq P$  and  $d_Y$  with  $0 \leq d_Y \leq P$  simultaneously.

If  $d_X + d_Y > P$ , the game ends with  $X$  and  $Y$  earning  $P/4$  each. Thus  $X$  and  $Y$  lose  $P/2$  since they could not agree on how to share  $P$ . If, however,  $d_X + d_Y \leq P$ , the game ends with

$$X \text{ earning } d_X + \frac{P - d_X - d_Y}{2}$$

and

$$Y \text{ earning } d_Y + \frac{P - d_X - d_Y}{2},$$

i.e. by fully sharing  $P$ .

For an easy overview the following table summarizes the rules. In the first column we list all the possible outcomes (no joint venture, an  $L$ - or  $F$ -joint venture); the

second, respectively third column specifies what  $X$ , respectively  $Y$  earn in case of  $P = \bar{P}$ , respectively  $P = \underline{P}$  :

behavior	what $X$ , respectively $Y$ earns for	
	$P = \bar{P} = \text{ECU } 45$	$P = \underline{P} = \text{ECU } 25$
no joint venture, i.e. $X$ chooses $N$ or $Y$ reacts by $\bar{\mathcal{L}}$ to $L$ or by $\bar{\mathcal{F}}$ to $F$	$0_X$ , respectively $0_Y$	
$L$ -joint venture, i.e. $X$ chooses $L$ to which $Y$ reacts by $\mathcal{L}$ so that $P = \bar{P}$ results with probability of 25 %	$\bar{P}/4$ if $d_X + d_Y > \bar{P}$ ; $d_X + \frac{\bar{P}-d_X-d_Y}{2}$ , respectively $d_Y + \frac{\bar{P}-d_Y-d_X}{2}$ otherwise	$\underline{P}/4$ if $d_X + d_Y > \underline{P}$ ; $d_X + \frac{\underline{P}-d_X-d_Y}{2}$ , respectively $d_Y + \frac{\underline{P}-d_Y-d_X}{2}$ otherwise
$F$ -joint venture, i.e. $X$ chooses $F$ to which $Y$ reacts by $\mathcal{F}$ so that $P = \bar{P}$ results with probability of 75 %	$\bar{P}/4$ if $X$ rejects; $\bar{P} - d_Y$ , respectively $d_Y$ otherwise	$\underline{P}/4$ if $X$ rejects; $\underline{P} - d_Y$ , respectively $d_Y$ otherwise



# Decision screens

The outside options of X and Y are  $O_X = \text{ECU } 5$  and  $O_Y = \text{ECU } 15$ .

1.) Assume  $d_Y$  is equal to ECU 20. If an **F (full)-joint venture** is formed and

1a.) X **accepts**  $P - d_Y$

in case of  $P = \text{ECU } 45$  X earns ECU

and Y earns ECU

whereas in case of  $P = \text{ECU } 25$  X earns ECU

and Y earns ECU

1b.) X **rejects**  $P - d_Y$

in case of  $P = \text{ECU } 45$  X earns ECU

and Y earns ECU

whereas in case of  $P = \text{ECU } 25$  X earns ECU

and Y earns ECU

## Control Questionnaire: Part I

The outside options of X and Y are  $O_X = \text{ECU } 5$  and  $O_Y = \text{ECU } 15$ .

2.) If an **L (low)-joint venture** is formed and  $d_X = \text{ECU } 20 = d_Y$  is chosen by X and Y,

in case of  $P = \text{ECU } 45$  X earns ECU

and Y earns ECU

whereas in case of  $P = \text{ECU } 25$  X earns ECU

and Y earns ECU

3.) If **no** joint venture is formed,

X earns ECU

and Y earns ECU

## Control Questionnaire: Part II

You are the **X-partner** , i.e. you decide between N (no), L (low), or F (full)-joint venture.

Your outside option is:  **$O_X = \text{ECU } 3$** .

The outside option of your Y-partner is:  **$O_Y = \text{ECU } 8$** .

Before deciding we kindly ask you to answer a few questions concerning your intentions.

The answers are non-binding, i.e. you can later decide differently.

1. How much would you ask for yourself in case of an L-joint venture ?

In case of  $P = \text{ECU } 45$  I would ask for  $d_X = \text{ECU}$

and in case of  $P = \text{ECU } 25$  for  $d_X = \text{ECU}$

2. How much would you require for accepting an offer  $P-d_Y$  in case of an F-joint venture?

I would accept the offer  $P-d_Y$

in case of  $P = \text{ECU } 45$  if it is not smaller than ECU

and in case of  $P = \text{ECU } 25$  if it is not smaller than ECU

**OK**

## X-1 Decision Form

You are the **Y-partner** .

Your outside option is:  **$O_Y = \text{ECU } 8$** .

The outside option of your X-partner is:  **$O_X = \text{ECU } 3$** .

Before you learn whether X has chosen N (no), L (low), or F (full)-joint venture we kindly ask you to answer a few questions concerning your intentions.

The answers are non-binding, i.e. you can later decide differently.

1. How much would you ask for yourself in case of an L-joint venture ?

In case of  $P = \text{ECU } 45$  I would ask for  $d_Y = \text{ECU}$

and in case of  $P = \text{ECU } 25$  for  $d_Y = \text{ECU}$

2. How much would you ask for yourself in case of an F-joint venture ?

In case of  $P = \text{ECU } 45$  I would ask for  $d_Y = \text{ECU}$

and in case of  $P = \text{ECU } 25$  for  $d_Y = \text{ECU}$

3. If X offers L-joint venture, I plan to react by ☐ accepting ☐ rejecting

If X offers F-joint venture, I plan to react by ☐ accepting ☐ rejecting

**OK**

## Y-1 Decision Form

# APPENDIX B

## Summary Statistics:

	All			Treatment I O <sub>X</sub> =3, O <sub>Y</sub> =8			Treatment II O <sub>X</sub> =13, O <sub>Y</sub> =8			Treatment III O <sub>X</sub> =3, O <sub>Y</sub> =18			Treatment IV O <sub>X</sub> =13, O <sub>Y</sub> =18		
	Mean	St.err		Mean	St.err		Mean	St.err		Mean	St.err		Mean	St.err	
X's proposal of joint venture (shares):															
No	0.012	0.117	0.000			-	0.042	0.202	0.000	0.000	-	0.000			-
Low	0.174	0.380	0.250			0.442	0.167	0.377	0.125	0.125	0.338	0.167	0.377	0.377	0.377
Full	0.812	0.392	0.750			0.442	0.792	0.410	0.875	0.875	0.338	0.833	0.377	0.377	0.377
Realized joint ventures (shares):															
No	0.097	0.297	0.042			0.204	0.042	0.201	0.125	0.125	0.338	0.167	0.377	0.377	0.377
Low	0.132	0.339	0.250			0.442	0.167	0.377	0.083	0.083	0.282	0.062	0.245	0.245	0.245
Full	0.771	0.423	0.708			0.464	0.792	0.410	0.792	0.792	0.415	0.771	0.424	0.424	0.424
Pie if Low or Full (ECU)															
Y's demand if Full (ECU)	40.54	8.36	39.78			8.98	37.17	9.87	43.09	43.09	6.01	43.50	5.33	5.33	5.33
X's acceptance if F *	25.00	5.93	26.40			5.58	21.57	5.69	27.76	27.76	6.57	26.48	4.39	4.39	4.39
Y's demand if Low(ECU)	0.84	0.37	0.88			0.33	0.82	0.39	0.79	0.79	0.42	0.86	0.35	0.35	0.35
X's demand if Low(ECU)	13.76	3.75	15.50			4.80	12.69	3.19	16.50	16.50	2.12	11.33	1.15	1.15	1.15
X's demand if Low(ECU)	13.15	2.84	13.75			3.57	13.78	2.87	10.75	10.75	0.35	11.83	0.76	0.76	0.76
X earnings (ECU)	16.06	5.95	15.34			6.75	15.87	6.20	14.87	14.87	7.17	17.28	4.41	4.41	4.41
Y earnings (ECU)	19.67	7.37	18.77			8.75	17.46	7.11	20.67	20.67	7.84	21.85	6.02	6.02	6.02
X female*															
Y female*	0.681	0.469	0.417			0.482	0.792	0.410	0.750	0.750	0.442	0.667	0.476	0.476	0.476
X scores (# correct answers)	0.306	0.462	0.333			0.504	0.208	0.410	0.500	0.500	0.510	0.292	0.459	0.459	0.459
Y scores (# correct answers)	9.19	3.60	8.92			4.07	9.42	4.08	9.17	9.17	3.38	9.12	2.99	2.99	2.99
Bergen*	10.60	3.40	11.08			3.42	9.83	3.61	11.50	11.50	2.55	10.67	3.47	3.47	3.47
Numbers															
	0.333						0.500					0.500			
	144					24					24				48

\* Dummy variables equal to 1 if statement is true