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Abstract

Like Feinberg and Sherman (1985) and Phillips and Mason (1992) we test experimentally whether conglomerate firms, i.e., firms competing on multiple structurally unrelated markets, can effectively limit competition. Our more general analysis assumes differentiated rather than homogeneous products and distinguishes strategic substitutes as well as complements to test this forbearance hypothesis. Rather than only a partners design we also explore a random strangers design to disentangle effects of forbearance and repeated interaction. Surprisingly, conglomerate firms do not limit competition, they rather foster it. More in line with our expectations we find more cooperation in complement markets than in substitute markets and also more cooperation in a partners than in a strangers matching.

Keywords: Experiment, Forbearance, Competition
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1   Introduction

Typically, large firms do not only offer many products, but sell them in many distinct national and international markets. In contrast to modern large firms, firms around the centuries were conglomerates operating in unrelated markets and being confronted with conglomerate rivals in many unrelated markets. This observation of multimarket contact by conglomerate firms led economists to believe that multimarket contacts foster collusive behaviour in markets where rivals meet. Corwin D. Edwards was among the first who pointed to the potential of anti-competitive market outcomes:

> "There is an awareness that if competition against the large rival goes so far as to be seriously troublesome, the logic of the situation may call for conversion of the warfare into total war. Hence there is an incentive to live and let live, to cultivate a co-operative spirit, and to recognize priorities of interest in the hope of reciprocal recognition. Those attitudes support such policies as refraining from sale in a large company's home market below whatever price that company may have established there; refraining from entering into the production of a commodity which a large company has developed; not contesting the patent claims of a large company even when they are believed to be invalid; abstaining from an effort to win away the important customers of a large rival; and sometimes refusing to accept such customers even when they take the initiative." (Edwards, 1955, p. 335).

Although conglomerates are much less frequent in the age of globalisation, the concern that multimarket firms mutually forbear from competing even in related markets remain. Despite the potential for mutual forbearance among multiproduct firms, relatively little research has analysed the effects on competitive behaviour and market outcomes. Available evidence on the mutual forbearance hypothesis comes from experimental, theoretical, and empirical studies.

Our attempt to test the mutual forbearance hypothesis has been inspired by theoretical and experimental studies. Theoretical work by Bernheim and Whinston (1990) shows that asymmetries among multimarket firms and between market structures facilitate mutual forbearance. However, experimental studies lead to different results. Feinberg and Sherman (1985) conducted the first experimental study by assuming that two firms compete in two homogeneous markets, with zero cross-elasticity of linear demand across markets, and linear productions costs in both firms which are unrelated across

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markets. Their results provide some support for the mutual forbearance hypothesis. In contrast, Phillips and Mason (1992) found strong support of the propositions in Bernheim and Whinston (1990). However, the same authors showed the opposite in an experiment conducted later (Phillips and Mason, 2001).

These experimens were motivated by the empirical study by Heggestad and Rhoades (1978) who found that multimarket linkages among 187 major U.S. banking markets deterred competition. Successive empirical studies looked at the conditions under which multimarket contacts are weakened or strengthened, but consistently show that multimarket contacts lead to mutual forbearance. In particular, Evans and Kessides (1994) and Gimeno and Woo (1996, 1999) detected that collusive pricing is associated with multimarket contacts in the U.S. airline industry. Parker and Röller (1997) and Busse (2000) found collusive behaviour in the U.S. cellular telephone industry due to interdependency. Fernández and Marín (1998) showed effects of multimarket contracts on prices in the Spanish hotel industry and Jans and Rosenbaum (1997) in the U.S. cement industry.

Furthermore, firms with multimarket contacts have higher profits (Scott, 1982, 1991), higher survival rates (Baum and Korn, 1996, 1999), lower R&D expenditures, fewer product introductions (Vonortas, 2000; Young et al., 2000), lower sales growth (Greve, 2008), and lower service quality (Prince and Simon, 2009).

Our experimental study tries to complement the theoretical and empirical studies about mutual forbearance effects. In contrast to Feinberg and Sherman (1985) and in line with the theoretical work by Bernheim and Whinston (1990) we derive the market equilibria as point predictions and analyse statistically without any structural imposition how one can explain the experimental findings. In other words: Unlike Feinberg and Sherman (1985) we clearly distinguish between the rational choice prediction and our behavioral explanation of the empirical findings, e.g. by relying on the mutual forbearance hypothesis. Our benchmark analysis predicts no forbearance effects since the two markets are structurally unrelated what Feinberg and Sherman (1985) deny by rendering the markets behaviourally interdependent via conjectural variations across markets. Whereas they attribute forbearance effects to conjectural variations across markets, we will more openly explore how the behaviour of one firm in one or both markets will affect the other firm's behaviour.

Section 2 describes our more general market environment and section 3 the experimental design. Section 4 analyses the experimental data for the various treatments. Section 5 concludes and compares our findings with those of Feinberg and Sherman (1985) and others.

2   The market model

Like Feinberg and Sherman (1985) and Phillips and Mason (1992), we capture "conglomerates" by seller firms which are active on two markets and "competing conglomerates" by duopolistic competition. Given this framework we, however, generalise the analysis considerably by:

1. allowing for differentiated products which may be both, strategic substitutes and complements,

2. comparing three constellations of product types, namely

   - both products on both markets are substitutes (the only case considered by Feinberg and Sherman (1985) and Phillips and Mason (1992) who study sales competition on homogeneous markets),
   - both products on both markets are complements,
   - the two products on the one market are substitutes, those on the other market are complements,

3. varying the "shadow of the future" by comparing a design where players are rematched every four periods with one where they are rematched every twelve periods, and

4. performing control experiments with one conglomerate firm competing with

   - different conglomerate firms (Feinberg-and-Sherman's other treatment)
   - different non-conglomerate firms
   - only single firms, no conglomerates

on the two markets.

The reason for 1 and 2 is that one often obtains qualitatively different results for strategic complements than for strategic substitutes (see, for instance, Bester and Güth, 1998). The reason for 3 is that only by varying the interaction time (here from four to twelve), one can hope to disentangle what is due to one-sided or mutual forbearance and what to future dealings.[1]

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[1]Relying on a partners design only like Feinberg and Sherman (1985) or Phillips and Mason (1992) appears realistic but invites all sorts of confounding effects since repeated interaction allows for reputation formation, punishment etc.

Competing with two different conglomerates on one's two markets, the first case in 4, captures that conglomerates will usually be active on different markets. We will employ a circle design with each firm selling on a left- and a right-hand market where it competes with its left-, respectively right-hand neighbour firm. By investigating the case of a unique conglomerate, we hope to disentangle the effect of "going conglomerate", i.e., of whether one gains from becoming active on more than one market and how this depends on the "conglomeration" of one's competitors.

In order not to overburden our participants we keep the market model as simple as possible by relying on structural symmetry otherwise. For the X-market the inverse demand functions are

$$p_i = a - bx_i + cx_j \text{ with } a, b > 0 \text{ and } |c| < 2b$$

and for the Y-market

$$q_i = \alpha - \beta y_i + \gamma y_j \text{ with } \alpha, \beta > 0 \text{ and } |\gamma| < 2\beta$$

for both competing firms $i = 1, 2$ with $i \neq j$. Here x_i, x_j, y_i, y_j denote the sales amounts and p_i, p_j, q_i, q_j the prices or unit profits since we abstract from production costs. Thus for $i = 1, 2$ firm i's profit is given by

$$\Pi_i = p_i x_i + q_i y_i$$

Since the two markets are independent, except for possible forbearance effects, the equilibrium solutions are just the combinations of the two equilibria with

$$x_i^* = \frac{a}{2b - c} \text{ and } y_i^* = \frac{\alpha}{2\beta - \gamma} \text{ for } i = 1, 2.$$

Due to our parameter restrictions all equilibrium sales are positive. Furthermore, all equilibrium prices, i.e. unit profits, are positive. For $c > 0$, respectively $\gamma > 0$, the X-, respectively Y-products of both firms are strategic complements. To get a clue what cooperation, predicted by the forbearance hypothesis, requires, we have also derived the choices which maximise the sum of profits of both firms on each market:

$$x_i^+ = \frac{a}{2(b - c)} \text{ and } \gamma_i^+ = \frac{\alpha}{2(\beta - \gamma)} \text{ for } i = 1, 2$$

with the individual profits

$$\Pi_i^+ = \frac{a^2}{4(b-c)} + \frac{\alpha^2}{4(\beta-\gamma)} \text{ for } i = 1, 2.$$

The parameters used in the experiment are shown in table 1. Since profits

Table 1 Parameters used in the experiment

	a, α	b, β	c, γ	x^*	x^+	Π^*	Π^+
substitutes	64	2	-4	8	5	128	170
complements	24	2	1	8	12	128	144

Since participants choose only integer quantities in the experiment, $x^+ = 5$ for markets with substitutes, and not 5 1/3.

with cooperation are substantially higher, we expect that participants will try to maintain cooperation with their partner.

Hypothesis 1 *The majority of the subjects will sell more than the equilibrium quantity with complements and less with substitutes.*

According to the forbearance hypothesis, two firms which compete against each other on two unrelated markets will behave less aggressively than they would do if they were only active in one market. They fear that an aggressive strategy against their competitor in one market will not only translate into a competition in this market, but might also effect their sales in the other market, e.g. when their competitor takes revenge and responds with a quantity competition in the other market. This could lead to a loss that is bigger than the gain in the first market. Therefore, we suppose that we will find more cooperation in markets where conglomerate firms compete against each other.

Hypothesis 2 *We will find more cooperation in markets with conglomerate firms than in markets with single firms.*

In our partner design with twelve repeated rounds the players have more time to find out how their partner acts than in our random stranger design with only four rounds with the same partner. That way they are more likely to come to a cooperative solution. In addition, taking a choice which yields low profits for the partner can be punished for a longer time by the opponent in the partner matching. Knowing this, we suspect subjects to be more prudent of their choice and thus to cooperate more in the treatments with a partner matching.

Hypothesis 3 *We will find more cooperation in treatments with partner design (rematching every 12 periods) than in treatments where rematching occurs every 4 periods.*

As already mentioned above, we suspect that firms act less aggressively when they are active in two markets than when they are active in one market, because they fear revenge for their decisions. For the above mentioned reasons, this effect should be stronger in treatments where players face the same opponent in two markets simultaneously (homogenous conglomerates) than in treatments where players act in two markets, but with different opponents (heterogenous conglomerates), because in the latter they cannot be punished in the second market for their behavior in the first market. Thus, we expect more cooperation in treatments where players interact with the same player in both markets, namely in homogenous conglomerates.

Hypothesis 4 *Homogeneous conglomerates behave less aggressively than heterogeneous conglomerates.*

Competition can have qualitatively different effects when products are complements rather than substitutes (Bester and Güth, 1998). In complement markets the incentives are more aligned than in substitute markets what suggests hypothesis 5.

Hypothesis 5 *There will be more cooperation in complement markets than in substitute markets.*

3   Experimental design

The symmetry of both markets allows us to use just one payoff table per market (see the instructions for the treatments with the same two conglomerate firms and the partners matching in the appendix. The other instructions differ from these only where necessary). We have consistently avoided symmetry of parameters across markets by $(a, b, c) \neq (\alpha, \beta, \gamma)$, but have chosen parameter constellations with constant equilibrium profits across markets, i.e.,

$$p_i^* x_i^* = \left(\frac{a}{2b - c} \right)^2 b = \left(\frac{\alpha}{2\beta - \gamma} \right)^2 \beta = q_i^* y_i^* \text{ for i=1,2.}$$

Requiring that also cartel profits are the same under the x and the y market would imply

$$\alpha = a \cdot \sqrt{\frac{\gamma}{c}} \qquad \beta = b \cdot \frac{\gamma}{c},$$

Figure 1 Decision and feedback screen in the experiment

Period 2 — remaining time [sec]: 57

Market X — quantity of the other seller

quantity you are selling

	1	2	3	4	5	6	7	8	9	10	11	12
1	58	54	50	46	42	38	34	30	26	22	18	14
2	112	104	96	88	80	72	64	56	48	40	32	24
3	162	150	138	126	114	102	90	78	66	54	42	30
4	208	192	176	160	144	128	112	96	80	64	48	32
5	250	230	210	190	170	150	130	110	90	70	50	30
6	288	264	240	216	192	168	144	120	96	72	48	24
7	322	294	266	238	210	182	154	126	98	70	42	14
8	352	320	288	256	224	192	160	128	96	64	32	0
9	378	342	306	270	234	198	162	126	90	54	18	-18
10	400	360	320	280	240	200	160	120	80	40	0	-40
11	418	374	330	286	242	198	154	110	66	22	-22	-66
12	432	384	336	288	240	192	144	96	48	0	-48	-96

Market Y — quantity of the other seller

quantity you are selling

	4	5	6	7	8	9	10	11	12	13	14	15
4	80	84	88	92	96	100	104	108	112	116	120	124
5	90	95	100	105	110	115	120	125	130	135	140	145
6	96	102	108	114	120	126	132	138	144	150	156	162
7	98	105	112	119	126	133	140	147	154	161	168	175
8	96	104	112	120	128	136	144	152	160	168	176	184
9	90	99	108	117	126	135	144	153	162	171	180	189
10	80	90	100	110	120	130	140	150	160	170	180	190
11	66	77	88	99	110	121	132	143	154	165	176	187
12	48	60	72	84	96	108	120	132	144	156	168	180
13	26	39	52	65	78	91	104	117	130	143	156	169
14	0	14	28	42	56	70	84	98	112	126	140	154
15	-30	-15	0	15	30	45	60	75	90	105	120	135

OK

In the experiment participants click for each market on a row for their own sales quantity and on a column to indicate what they think their partner's choice will be. Chosen rows and columns are highlighted in red. The intersection of a highlighted row and column is marked with a circle. Feedback (regarding the other player's actual quantity and the own profit) is only given after both participants have entered their choices. Knowing the two quantities players can also look up the other player's profit in the table.

i.e. c must have the same sign as γ, meaning that both markets must feature either substitutes or complements. Since we want to include the situation where one market is for substitutes and one for complements we have to accept that cartel profits can not always be the same.

Asymmetric attractiveness of the two markets—will forbearance mainly pacify the better market in the sense of higher equilibrium profits?—could be an interesting topic of future research. Here it has been neglected to limit the anyhow unusually large number of treatments. Due to the asymmetric parameters across markets, participants may not be aware that markets are equally attractive from a rational choice perspective and may actually experience them as yielding different profits.

Forbearance, if it can be detected, e.g. by higher than equilibrium profits or by higher profits than in the control treatment with one-market firms, may be strong initially and lose importance later or vice versa. It therefore seems important to repeat the experiment often enough to render such dynamics observable. In the partners design the two firms, represented by two participants, stay together over twelve rounds. After that they are matched with a new partner with whom they play the next twelve rounds. The repetition is not previously announced. But when starting the repetition, participants are told that after the repetition the experiment ends. The details of the experimental setup are described in appendix A.

The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007) using the online recruitment system ORSEE (Greiner,

2004). It took place at the experimental laboratory of the School of Economics at the University of Jena between July 2008 and July 2009. All in all we collected 139 independent observations involving 574 participants.

An overview of the different treatments is provided in table 2. Our experiment was preceded by a language test to ensure that everyone was able to understand the instructions. After the instructions were read and questions were answered in private participants filled out a comprehension test to ensure that they understand the experiment. After the experiment was finished they completed a post-experimental questionnaire eliciting, among others, the sales strategy used.

In the experiment subjects do not have to calculate their payoff with the help of the demand function. They get—depending on the treatment which determines whether they are active on one or two markets—one or two tables, respectively, with which they can choose their sales amount (between 1 and 12 and between 4 and 15 in substitute and complement markets, respectively). They also have to predict what their partner (i.e. their rival on the respective market) is going to choose. A typical decision and feedback screen used in the experiment is shown in figure 1. Both players decide simultaneously. After each round both players receive feedback about both choices and their payoff in this round. Earnings are cumulated over all 24 rounds and paid in cash after the experiment using an exchange rate of 250 ECU/Euro if active in one market and an exchange rate of 500 ECU/Euro if active in two markets. The earning per person was between 7.8 Euros and 18.6 Euros with an average of 12.49 Euros. Sessions usually lasted about 90 minutes.

Our design differs from that of Feinberg and Sherman (1985) and Phillips and Mason (1992) who performed pen-and-paper classroom sessions. Although one can easily infer other's profits from the own feedback information after a round, unlike Feinberg and Sherman (1985) we did not provide this information to avoid demand effects like inspiring payoff comparisons or imitation learning and other regarding concerns. Furthermore, whereas Feinberg and Sherman (1985) explore their treatments within subjects we employed a between subjects design throughout.

4   Results

Participants played for 24 periods. Figure 2 shows frequencies of pairs of choices for all markets and for all markets with complements. The size (area) of the circles is proportional to the frequency. The equilibrium is denoted by N, the symmetric cooperative outcome is denoted by C, the asymmetric

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Table 2 Treatments

| treatment	type of conglomerate	matching structure	rematching every...rounds	market x	market y	independent observations	participants
1	no conglomerate	(a)	12	substitutes		8	32
2	no conglomerate	(a)	12	complements		8	32
3	no conglomerate	(a)	4	substitutes		11	44
4	no conglomerate	(a)	4	complements		8	32
5	homogeneous	(b)	12	substitutes	substitutes	12	48
6	homogeneous	(b)	12	substitutes	complements	12	48
7	homogeneous	(b)	12	complements	complements	11	44
8	homogeneous	(b)	4	substitutes	substitutes	12	48
9	homogeneous	(b)	4	substitutes	complements	12	48
10	homogeneous	(b)	4	complements	complements	12	48
11	heterogeneous	(c)	12	substitutes	complements	12	48
12	heterogeneous	(c)	4	substitutes	complements	12	48
13	asymmetric	(d)	12	substitutes	complements	9	54

The matching structure is described in detail in appendix A.

cooperative outcome in markets for substitutes is denoted by X. Figures 3 and 4 provide more details for the individual treatments. Each graph shows the difference between the relative frequency of choices in a treatment (for a given market type, either substitutes or complements) and the average of this market type (substititutes or complements). While the figures help us to better understand some of the effects, we will present mixed effects regressions to measure these effects in a more systematic way.

The average profit for each market per round was between -96 and 432 with an average of 129.6 ECU, slightly above the profit of the equilibrium level of 128. Figure 5 shows the development of average profits during the experiment. We see a clear end-game effect, i.e. a decrease in profits in the last round of every matching sequence. Figure 6 shows boxplots of profits for the different treatments and markets indicating that the variance of profits is much smaller in markets for complements. We also see that profits in conglomerates are more heterogeneous than in our baseline treatments.

The left part of figure 7 illustrates the distribution of quantities separately for substitutes and for complements. In line with hypothesis 1 most quantities (67.71%) are strictly larger than the equilibrium quantity of 8 for

Figure 2 Frequencies of pairs of choices

all markets for substitutes   **all markets for complements**
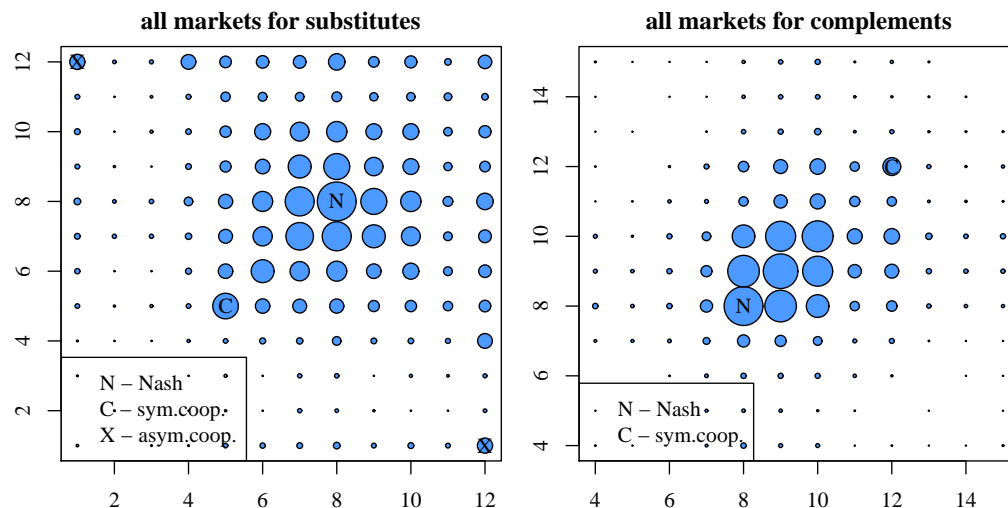
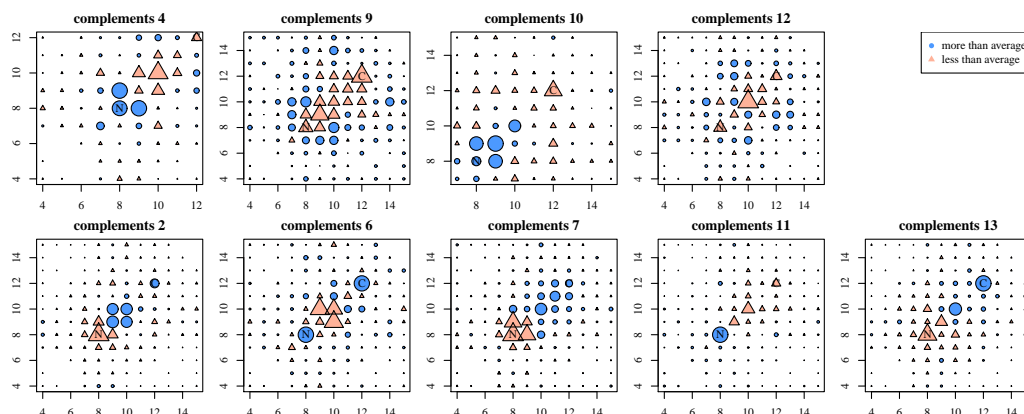The size (area) of the symbols is proportional frequencies of choices.

Figure 3 Frequencies of pairs of choices compared to average — substitutes
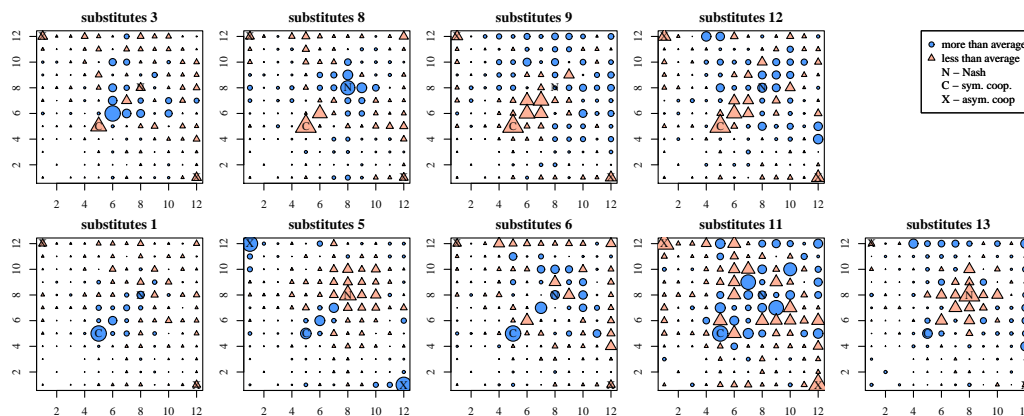
The size (area) of the symbols is proportional to the relative frequencies of choices in the treatment minus the relative frequency of choices in all treatments with markets for substitutes. Numbers of treatments correspond to table 2.

complements. This property is less pronounced for substitutes. According to hypothesis 1 we should find a smaller than equilibrium quantity for substitutes if players, indeed, cooperate also when products are substitutes. A much smaller proportion of players (43.3%) chooses quantities strictly smaller than the Nash equilibrium when products are substitutes. We will come back to this observation in the discussion of equations (5) and (7) below.

Figure 4 Frequencies of pairs of choices compared to average — complement

The size (area) of the symbols is proportional to the relative frequencies of choices in the treatment minus the relative frequency of choices in all treatments with markets for complements. Numbers of treatments correspond to table 2.

Figure 5 Profits over time
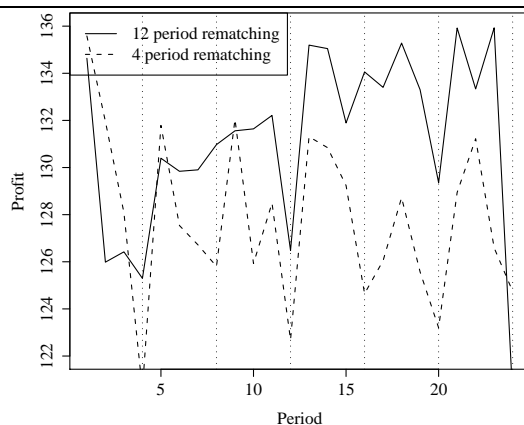
Result 1 *While most participants clearly choose more than equilibrium (co-operative) quantities with complements, a much smaller fraction chooses less than equilibrium (cooperative) quantities with substitutes.*

To confirm the above results with the help of an econometric model, we will define two variables:

Cooperation rate   We will say that subjects cooperate fully if they choose the symmetric cooperative solution. We should keep in mind that for substitutes joint profit is maximised when one player stays out of the market and the

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Figure 6 Profits in different treatments

Profits in markets for substitutes

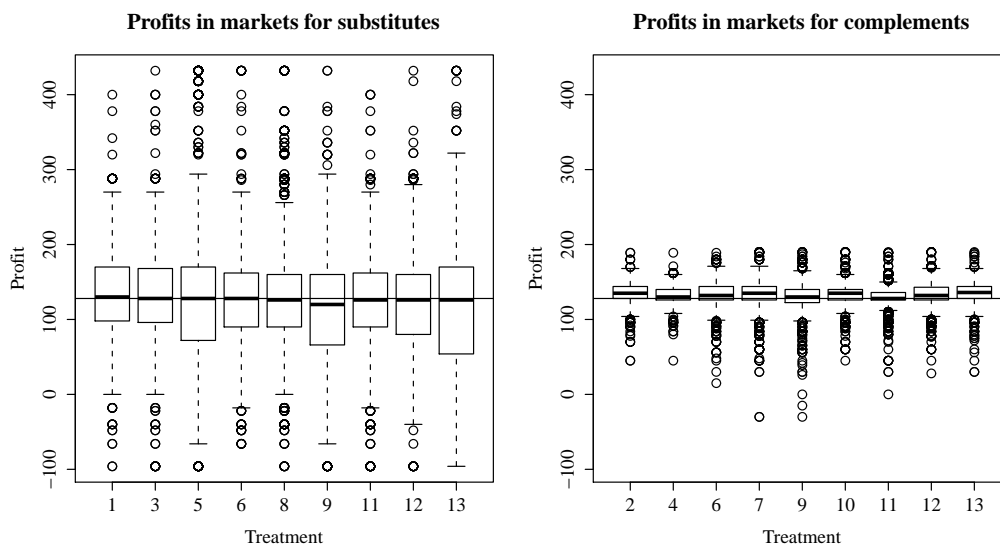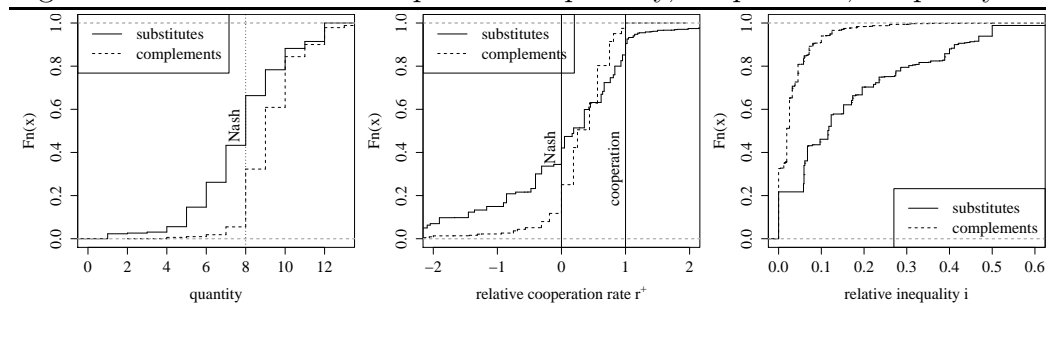**Profits in markets for complements**

Figure 7 Substitutes and complements: quantity, cooperation, inequality

other produces everything. To measure different degrees of cooperation we define a cooperation rate (henceforth denoted as r^+).

$$r^+ = \left(\frac{\Pi(x_i, x_j) + \Pi(x_j, x_i) - 2 \cdot \Pi^*}{2 \cdot (\Pi^+ - \Pi^*)} \right) \qquad (1)$$

$\Pi(x_i, x_j) + \Pi(x_j, x_i)$ is the joint profit of both players, Π^* the equilibrium profit of a single player, and Π^+ is the profit of a single player in the symmetric cooperative outcome.

By definition, $r^+ = 1$ in the symmetric cooperative outcome and $r^+ = 0$ in the Nash-equilibrium. In complement markets $r^+ > 0$ requires that a players chooses a quantity higher than the equilibrium quantity of 8, while

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Figure 8 Conglomerates and single firms: cooperation and inequality
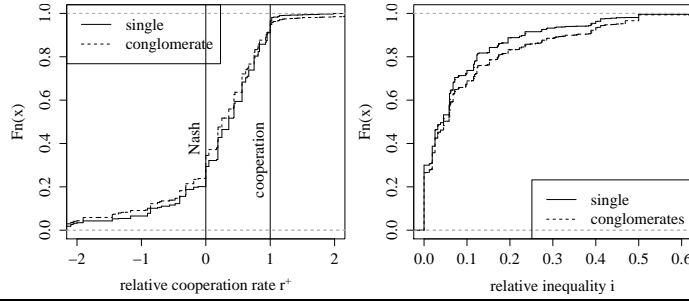
in substitute markets r^+ requires a quantity lower than 8. The middle part of Figure 7 shows the distribution of the relative cooperation rate r^+.

Result 2 *In the majority (i.e. 76.7%) of cases the relative cooperation rate is positive $(r^+ \geq 0)$.*

Inequality rate   Similarly, we define an inequality rate i:

$$i = \left| \frac{\Pi(x_i, x_j)}{\Pi(x_i, x_j) + \Pi(x_j, x_i)} - \frac{1}{2} \right| \tag{2}$$

We suspect that firms which compete against each other on two unrelated markets behave less aggressively when making their sales choices, because they fear the effects this might have for the profit on their other market. The partner they are playing with might take revenge on the other market and choose amounts of goods which lower the profits of the other firm dramatically.

To have a more formal look at hypotheses 2 to 5 we estimate two mixed effects model for relative cooperation r^+. We first define X as

$$X \equiv \beta_0 + \beta_{\text{partner}} \cdot d_{\text{partner}} + \beta_{\text{subs}} \cdot d_{\text{subs}} + \beta_{\text{homcon}} \cdot d_{\text{homcon}} + $$
$$\beta_{\text{hetcon}} \cdot d_{\text{hetcon}} + \beta_{\text{asymcon}} \cdot d_{\text{asymcon}} . \tag{3}$$

d_{partner} is a dummy that is 1 with partner matching (rematching every twelve periods) and zero otherwise, d_{subs} is a dummy that is 1 in substitute markets and zero otherwise, d_{homcon} is 1 in homogeneous conglomerates and zero otherwise, d_{hetcon} is 1 in heterogeneous conglomerates, and d_{asymcon} is 1 in asymmetric conglomerates. We also define Z as

$$Z \equiv \beta_0 + \beta_{\text{partner}} \cdot d_{\text{partner}} + \beta_{\text{subs}} \cdot d_{\text{subs}} + \beta_{\text{conglSubs}} \cdot d_{\text{conglSubs}} + $$
$$\beta_{\text{conglSubs}} \cdot d_{\text{conglSubs}} + \beta_{\text{conglSubsMix}} \cdot d_{\text{conglSubsMix}} + $$
$$\beta_{\text{conglSubsMix}} \cdot d_{\text{conglSubsMix}} + \beta_{\text{hetcon}} \cdot d_{\text{hetcon}} + \beta_{\text{asymcon}} \cdot d_{\text{asymcon}} . \tag{4}$$

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Table 3 Cooperation: estimation of equations (5) and (6)

	eq. (5)		eq. (6)	
(Intercept)	0.414***	$[0.314; 0.514]$	0.457***	$[0.354; 0.560]$
partner	0.083*	$[-0.006; 0.173]$	0.056	$[-0.031; 0.143]$
subs	-0.357^{***}	$[-0.392; -0.322]$	-0.496^{***}	$[-0.576; -0.416]$
homcon	-0.092^{*}	$[-0.199; 0.015]$		
hetcon	-0.249^{***}	$[-0.385; -0.112]$		
asymcon	-0.213^{*}	$[-0.409; -0.017]$		
conglSubs			0.134*	$[-0.001; 0.269]$
conglCompl			-0.107	$[-0.246; 0.032]$
conglSubsMix			-0.112^{*}	$[-0.228; 0.003]$
conglComplMix			-0.279^{***}	$[-0.397; -0.162]$
AIC	51953.742		51940.878	
N	19544		19544	

Stars denote the following significance levels: ***=.001, **=.01, *=.05. 95% confidence intervals are given in brackets.

$d_{\text{conglSubs}}$ is 1 for substitute conglomerates when both markets are substitutes, $d_{\text{conglSubs}}$ is 1 for complement conglomerates when both markets are complements, $d_{\text{conglSubsMix}}$ is 1 for substititute conglomerates when the other market is different (i.e. for complements), and $d_{\text{conglSubsMix}}$ is 1 for complement conglomerates when the other market is different. We also estimated specifications with time and interactions between time and conglomerate but found that time does not play a significant role here.

We now compare the following two specifications:

$$r_{it}^{+} = X + \epsilon_g + \epsilon_{it} \tag{5}$$
$$r_{it}^{+} = Z + \epsilon_g + \epsilon_{it} \tag{6}$$

where g is an index of the independent observation, i is an index for the individual participant and t indicates the period. In a similar way we also explain profits via

$$\Pi_{it} = X + \epsilon_g + \epsilon_{it} \tag{7}$$
$$\Pi_{it} = Z + \epsilon_g + \epsilon_{it} \tag{8}$$

To exclude end game behaviour we drop the last period of each interaction. Estimation results are shown in tables 3 and 4. In contrast to our expectations we do not find a positive but, for all three types of conglomerates, a strong negative effect in equations (5) and (7). When we look more closely at the type of the market in equations (6) and (8) we find a negative effect in

Table 4 Profit: estimation of equations (7) and (8)

	eq. (7)		eq. (8)	
(Intercept)	136.78***	$[132.69; 140.86]$	135.54***	$[131.19; 139.88]$
partner	3.25*	$[-0.19; 6.70]$	2.22	$[-1.04; 5.49]$
subs	-7.30***	$[-9.36; -5.23]$	-7.93***	$[-12.34; -3.53]$
homcon	-3.20	$[-7.43; 1.04]$		
hetcon	-8.04**	$[-13.33; -2.74]$		
asymcon	-9.00**	$[-16.47; -1.53]$		
conglSubs			4.54*	$[-0.77; 9.85]$
conglCompl			-2.58	$[-8.07; 2.91]$
conglSubsMix			-5.88**	$[-10.62; -1.13]$
conglComplMix			-5.43*	$[-10.31; -0.55]$
AIC	213900.47		213892.09	
N	19544		19544	

Stars denote the following significance levels: ***=.001, **=.01, *=.05. 95% confidence intervals are given in brackets.

three out of four cases. Only for a symmetric market with substitutes we find a significant increase in cooperation and an (although insignificant) increase in profits. For the other three cases, i.e. mixed conglomerates and symmetric conglomerates with markets for complements cooperation and profits are smaller in conglomerates than in non-conglomerates.

Result 3 *Conglomerate firms cooperate less than firms only active in one market.*

How to explain such surprising results will be discussed in the concluding section.

We do, however, find support for hypothesis 3. The coefficient β_{partner} is positive and significant in equation (5) and also positive and weakly significant in equation (7).

Result 4 *There is more cooperation in treatments with partner design (matching for twelve periods) than in treatments with more frequent rematching (every four periods).*

While we had to reject hypothesis 2, we find at least weak support for hypothesis 4. The coefficient β_{homcon} is positive, but only weakly significant in equation (5) and not significant in equation (7).

Result 5 *There is little, but only weakly significantly more cooperation in homogeneous conglomerates.*

Table 5 Determinants of the inequality: estimation results for equations (9) and (10)

	eq. (9)		eq. (10)	
(Intercept)	0.012	$[-0.006; 0.030]$	0.002	$[-0.017; 0.021]$
partner	-0.006	$[-0.023; 0.010]$	-0.000	$[-0.017; 0.017]$
subs	0.137^{***}	$[0.132; 0.142]$	0.168^{***}	$[0.156; 0.179]$
homcon	0.029^{**}	$[0.010; 0.049]$		
hetcon	0.025^{*}	$[-0.000; 0.050]$		
asymcon	0.048^{**}	$[0.012; 0.084]$		
conglSubs			0.007	$[-0.019; 0.033]$
conglCompl			0.031^{*}	$[0.005; 0.058]$
conglSubsMix			0.001	$[-0.021; 0.022]$
conglComplMix			0.039^{***}	$[0.017; 0.061]$
AIC	-24574.960		-24589.700	
N	19544		19544	

Stars denote the following significance levels: ***=.001, **=.01, *=.05. 95% confidence intervals are given in brackets.

The most significant and strongest effect we find is that of d_{subs} which supports hypothesis 5. This coefficient is highly significant in equation (5) and in equation (7).

Result 6 *There is more cooperation and higher profits in markets for complements than in markets for substitutes.*

Inequality   To assess inequality in the different treatments we estimate the following equation where we use the measure of inequality i_{it} as defined in equation (2). Again we compare two specifications:

$$i_{it} = \beta_0 + X + \epsilon_g + \epsilon_{it} \tag{9}$$
$$i_{it} = \beta_0 + Z + \epsilon_g + \epsilon_{it} \tag{10}$$

Results are shown in table 5. As we could already see in figure 2, asymmetric outcomes occur predominantly in substitute markets. In conglomerates inequality is slightly higher, but the effect is much smaller compared to the effect of substitutes.

5   Conclusions

To test the forbearance hypothesis, we performed a very systematic experimental analysis by allowing for differentiated products in the form of strategic

substitutes as well as complements, distinguishing infrequent and frequent rematching, and running several control treatments with different conglomerates or single product firms as well as with markets with no conglomerates at all.

Before summarising our own findings let us briefly view the major findings of the experimental investigations of forbearance effects by Feinberg and Sherman (1985) whose experimental setup has been described in section 3 and whose theoretical analysis is based on a conjectural variation approach. Feinberg and Sherman (1985) only consider homogeneous markets so that they can measure competitiveness by the sum of sales amounts. They observed no treatment effects (same rivals versus different conglomerate rivals on the two markets) regarding the total output on either market, but significant variance effects, namely a larger variance for the same than for different conglomerate rivals as well as for experienced than for inexperienced participants.

In our experiment participants mostly behave more cooperatively than the predicted equilibrium benchmark. As expected, we find more cooperation in complement than in substitute markets, more cooperation in infrequent rematching than in the frequent matching, and also—only weakly significantly—more cooperation in homogeneous than in heterogeneous conglomerates.

Surprisingly, conglomerate firms cooperate significantly less than single firms. Thus, at least in our experiment conglomerates do not have anticompetitive effects. Actually, conglomerates seem to enhance competition. A possible explanation of this astonishing result could be a multi-market analogue of leapfrogging, i.e., of strong competitive attempts by those lagging behind, for instance, in market or innovative success (for an experimental study of the latter, see, for instance, Cantner et al., 2009). If one firm is less successful on one market, this firm might be induced to "win" the other market. If anticipated by the competitor, both firms could be inspired to behave more competitively.

Of course, such behaviour can more easily evolve over time. In our experiment, it could unfold when one conglomerate is dominating one market—in the sense that market results would be disastrous when the other firm sells the same amount as the dominating firm. If on the other market both conglomerates sell similar amounts, the disadvantaged firm might try to dominate the other market. Thus, any strong disparity on one market can easily initiate a process of alternating attempts to dominate at least one market and of lower than equilibrium profits.

Our study shows that identifying anti-competitive effects by multimarket firms require complex explanatory variables because firms have become more

complex. The complexity of multimarket firms is, for instance, reflected in the internal organisation between the headquarter and their subsidiaries as well as between factor and product markets. Thus, in firms with weak internal coordination the headquarter cannot pose credible threats of retaliation to aggressive moves made by global multimarket firms against its subsidiaries. And, as Markman et al. (2009) have shown, forbearance in product markets may happen even at high costs to maintain forbearance in factor markets. Consequently, experiments, like ours, are able to test the mutual forbearance hypothesis from multimarket contact in a complex imperfectly observable context of a global market environment.

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A   Experimental Setup

We have relied on matching groups with four participants each in all treatments except for treatment 13 where conglomerate firms interact with single firms on the same markets. There we have matching groups of six.

Baseline treatment — no conglomerates: In our baseline treatment there are no conglomerates. The strategic interaction takes place only on a single market. If we write markets X and Y next to connections between the four members of a matching group, then matching in the baseline treatments follows one of these three structures:


[a]
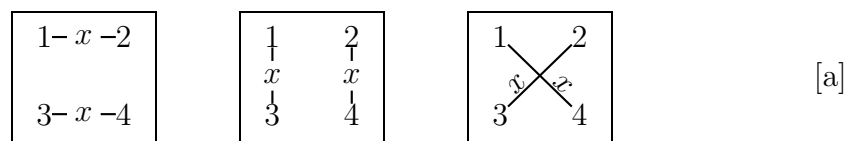
We study the case of no conglomerates both in a partners and in a strangers setting. In the partners setting we first play a game with one of these matchings for the first 12 rounds. Then another game is announced, again for 12 rounds, where we use another of the above matchings.

In the random matching setting we switch among the above matchings every four rounds. After 12 rounds another game is announced, again for 12 rounds, where again every four rounds the matching is changed.

Participants are not aware of the small size of the matching group. All what they know is that pairs are randomly formed in every four or in every twelve rounds. We start a new game after 12 rounds both in the partners and in the random matching treatment to avoid as far as possible any biases between the partners and the strangers design. We run the baseline treatment both with substitutes and with complements (treatments 1-4).

Homogeneous conglomerates: In the homogeneous conglomerate treatment (treatments 5-10), two firms simultaneously interact on two markets, using one of the following matchings:

[b]
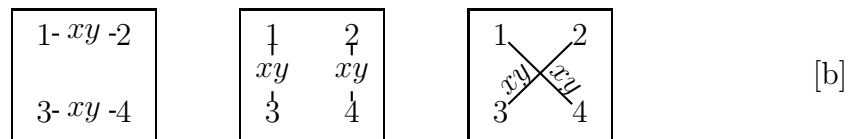
Heterogeneous conglomerates: When conglomerates are supposed to compete with two different conglomerates on both markets we use a circle matching as follows:

[c]
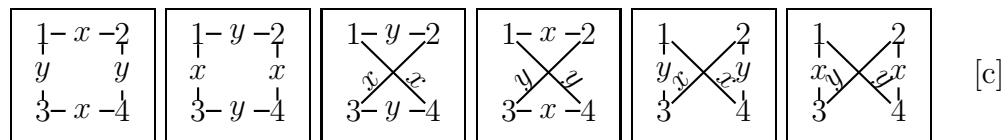
This setup is again studied in a partners design, where participants are first matched for 12 rounds, and then, following a different matching from [c], are rematched for another 12 rounds (treatment 11). In the random matching design we rematch every four rounds, with a restart after 12 rounds (treatment 12).

In the random strangers design the one missing of the other three participants was randomly changing between rounds. Furthermore, one could encounter the two partners on the X- or the Y-market in an irregular fashion.

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Asymmetric markets with conglomerates and single firms: When conglomerates are supposed to compete with non-conglomerates, each matching group of six participants contained two conglomerates and four "one market-firms", one for the X-market and one for the Y-market for each conglomerate firm. Here we only ran a partners design with two sessions containing 3 matching groups each, i.e. with 36 participants (treatment 13).

[d]
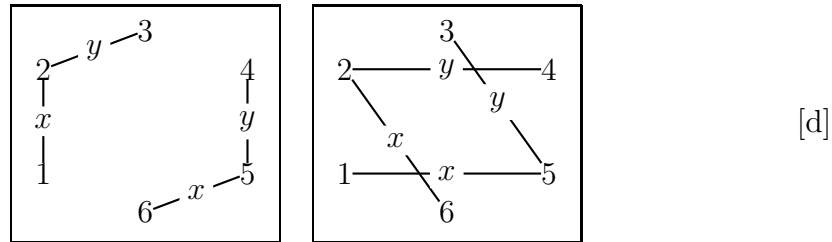
A (random) strangers design would have required larger matching groups what might have questioned the comparability of the results across treatments.

Substitutes and complements: Interaction on the above markets might depend on whether products are substitutes or complements. For the baseline treatment [a] without conglomerates (treatments 1-4) and the homogeneous conglomerates (treatments 5-10) we study all possible combinations. The case of heterogeneous conglomerates (treatments 11 and 12, [c]) and the case of conglomerates and single firms (treatment 13, [d]) is only studied in one setting each: products on the X-market are substitutes, products on the Y-market are complements (again, see table 2).

B   Experimental Instructions

Here we present the translation of the originally German instructions for treatment 6 (partner design, homogeneous conglomerates, substitute and complement markets). The instructions for the other treatments differ only where necessary.
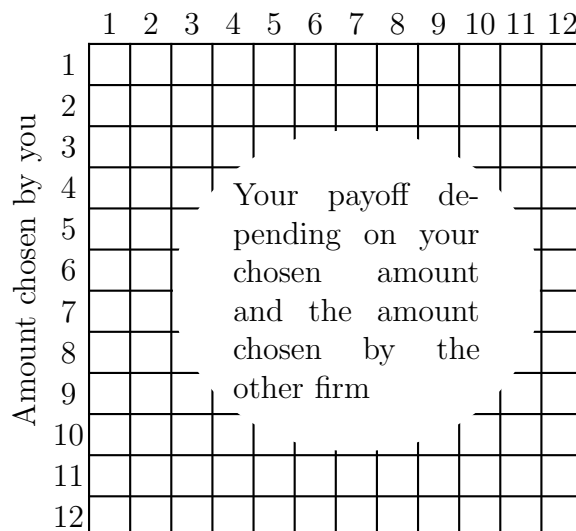
Welcome to this experiment and thank you for participating!

You can earn money in this experiment; the amount will depend on your own decisions and on the decisions of the other participants. *Therefore, it is very important that you read these instructions carefully.*

If you have any questions, please raise your hand. We will get to your seat and answer your questions. Please do not ask your questions out loudly. All participants of this experiment get the same instructions, whereas the
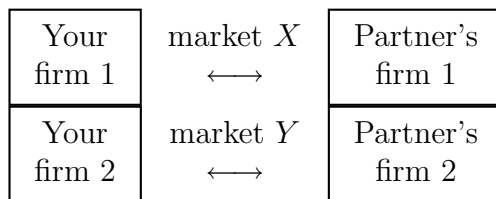
22

The amount you expect the other firm to choose

1 2 3 4 5 6 7 8 9 10 11 12

Amount chosen by you

Your payoff depending on your chosen amount and the amount chosen by the other firm

information that appears on the computer screen during the game is for the respective participant only. That is why you are *not allowed to look at the screens of the other participants or to talk to them during the experiment.* Non-compliance with these rules will result in your exclusion from the experiment. Please switch off your mobile phones now.

In the following experiment you will play together with one partner. You and your partner each represent two firms. These firms are active in the same markets, namely market X and market Y. Your task is to determine the sales volume of your firms in these markets. Your partner's task is to determine the sales volume of his/her firms in the same markets. Each of his/her firms will be confronted with one of your firms.

| Your firm 1 | market X $\longleftrightarrow$ | Partner's firm 1 |
| Your firm 2 | market Y $\longleftrightarrow$ | Partner's firm 2 |

You will play the following twelve rounds with the same partner.

During the experiment you will see charts on the screen. In these charts you can see how your decision and the decision of the other firm influence your profit and the profit of the other firm on the considered market.

The rows of the chart show your sales volume, it can be seen from the left margin. The sales volume of the other firm is shown in the columns.

The amount you expect the other firm to choose can be seen in the top row. The number in each cell of the chart shows how much you would earn in this round if you choose the amount indicated by the row of this cell and the other firm chooses the amount indicated by this column.

The profit of your partner's firm in this market can be determined with the same chart. If you want to know how much the other firm will earn, all you have to do is invert the lines and rows of the chart, i. e. in this case your sales volume can be seen in the columns and the sales volume of your partner is shown in the rows. The intersection cell shows the earnings of your partner's firm. This might help you in finding out which amount the other firm might choose. However, you cannot influence the sales volume taken by the other firm. Nevertheless, it is important for your own decision to have a precise assumption about how the other firm will act.

To help you with your considerations you can click the sales volume you expect the other firm to choose in the top row and the sales volume you want to choose yourself on the left margin. The corresponding row and column will be indicated in red. The profit you will earn in this market in this round if your partner indeed acts as you guess will be circled. You can try several combinations if you want to. Please confirm your final decision by clicking the OK button. The payoff of one market in a round depends on the sales amount chosen by you and the sales amount chosen by the other firm.

To help you to keep track you can find a table at your seat into which you can fill in your sales volume, your partner's sales volume, and your profit after each round.

The profits in the charts are given in ECU (experimental currency units). You will be informed about the exchange rate of ECU into Euro on your computer screen at the beginning of the experiment. This exchange rate is the same for all participants. At the end of the experiment you will be paid the sum of your profits from all rounds in Euro. This amount will be paid to you privately. No other participant will learn from us how much you have earned.

Once you have read the instructions carefully, please start answering the questions on the computer screen. There will be one question at once on the screen. These questions check your understanding of the experiment. Unfortunately, you will only be allowed to take part in the experiment if you understood the rules. If you make too many mistakes in the questionnaire you cannot participate. If you are not sure how to answer a question, you may read the instructions again, of course.