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Özgür Gürerk and Reinhard Selten

University of Erfurt, CEREB

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Abstract We explore the effects of the provision of an information-processing instrument – payoff tables – on behavior in experimental oligopolies. In one experimental setting, subjects have access to payoff tables whereas in the other setting they have not. It turns out that this minor variation in presentation has non-negligible effects on participants' behavior, particularly in the initial phase of the experiment. In the presence of payoff tables, subjects tend to be more cooperative. As a consequence, collusive behavior is more likely and quickly to occur.

Keywords Collusion · Cournot oligopoly · payoff tables · bounded rationality · framing · presentation effect

JEL Classification D03 L13 C72 C92

Ö. Gürerk
University of Erfurt, Laboratory for Experimental Economics
Tel.: +49-361-7374561
Fax: +49-361-7374529
E-mail: oezguer.guererk@uni-erfurt.de
Nordhäuser Str. 63, 99089 Erfurt

R. Selten
University of Bonn, *B*onn*E*con*L*ab
Tel.: +49-228-739192
Fax: +49-361-739193
E-mail: rselten@uni-bonn.de
Adenauerallee 24-42, 53113 Bonn

1 Introduction

Payoff tables[1] are widely used as an informational aid in experimental economics since its beginnings. Some of the pioneering studies on oligopolies adopt payoff tables (Fouraker and Siegel 1963; Sauermann and Selten 1967; Dolbear et al. 1968) as well as recent ones (e.g., Abbink and Brandts 2008, the majority of the studies reviewed in Huck et al. 2004). The influence of this device on subjects' behavior, however, has not yet been explored systematically. With this study, we try to fill this gap.

We conduct a series of Cournot market experiments with two presentational settings that differ slightly. In one setting named *TAB*, subjects are provided with payoff tables whereas they are not in the other setting (*noTAB*). Our main research interest concerns whether subjects in the two settings behave differently. In the context of an oligopoly, we may re-formulate our research question: Do competitors with an information processing aid tend to be more collusive than competitors without such an aid? To check whether the possible effects of payoff tables are robust with respect to market size, we conduct experiments with two, three, and four competitors.[2]

Previous studies show that slight differences in information presentation may indeed have effects on subject's behavior. Pruitt (1967), for instance, reports more cooperation in the prisoner's dilemma game if the payoff structure of the game is presented to subjects in the decomposed form. In a public goods experiment, Saijo and Nakamura (1995) provide subjects either with a "rough" table containing basic payoff information or a "detailed" table that is comparable to the payoff table we provide. They find, if the marginal capita per return is high (and resp. low), average contributions to the public goods are higher with detailed tables (resp. lower) than the investments with rough tables. Huck et al. (1999) find that markets tend to become less competitive if more information about demand and cost conditions are present, while more information about competitors' quantities and profits yields more competitive behavior. Bosch-Domènech and Vriend (2003) investigate imitation behavior in Cournot markets by varying the presentation of market information. They observe that the imitation frequency does not increase when the information retrieval gets more complex. In a gift-exchange experiment, Charness et al. (2004) find significant reductions in both wages and worker effort when subjects are provided with payoff tables compared to the baseline treatment without payoff tables. Requate and Waichman (2011) report no differences in behavior in Cournot duopoly experiments whether subjects are provided with payoff tables or use a payoff calculator. The studies of Charness et al. (2004)

[1] A payoff table is a matrix that depicts the payoff of player i for all possible combinations of i's and the opponent's actions. For example, in a Cournot market, the payoff table displays player i's payoff for all combinations of i's production choice and the competitors' total production.

[2] See Huck et al. (2004) for a general discussion of number effects in quantity setting oligopolies.

and especially, Requate and Waichman (2011) are closely related to ours.[3] In the last section of the paper, we will discuss and compare the findings of these studies to our results.

The payoff table we use in our study (see Appendix) reduces the complexity of the payoff structure by presenting all possible payoffs in a crystal clear way. This may help subjects to realize better what alternatives they have and what the consequences of these alternatives are. In particular, subjects may identify collusive quantities more easily. Hence, we conjecture that payoff tables should lead to more collusive behavior. On the other hand, one can think of an alternative conjecture: with payoff tables, subjects could also easily identify best-replies. This could drive the results more in the direction of Nash-equilibrium.

Our results show for all market sizes, average total quantities are lower when subjects are provided with payoff tables, i.e., in *TAB*, the markets are more collusive. In the initial phase of the experiment, the differences between both settings are most pronounced. Subjects provided with payoff tables choose more often collusive quantities. Over time, however, the differences between both settings get smaller.

The next section presents the model. Section 3 describes the experimental design and procedure. Section 4 is dedicated to the results. Section 5 concludes.

2 The model

Since we focus on the impact of payoff tables we use a very simple Cournot model. In a Cournot oligopoly, N symmetric firms compete in a market where a homogenous good is sold. By x_i we denote the single quantity produced by the firm i (production is limited to 60 units per period). The total market production, i.e., the sum of x_i is represented by X. To simplify the problem without changing its nature we set the cost of production to zero. Furthermore, we assume a linear market demand where the computer "buys" the total production. The resulting price is denoted with p and the inverse demand function then is $p = \max\{60 - X, 0\}$. The firms decide simultaneously on x_i. The profit of firm i is given by $\pi_i = (60 - X)x_i$ for $X \leq 60$ and $\pi_i = 0$ for $X > 60$.

For each market size, one can easily calculate the Cournot-equilibrium, which is the only pure Nash-equilibrium of the stage game yielding positive profits for each player. We refer to this equilibrium as the Cournot-Nash-equilibrium (henceforth CNE).[4] The CNE is the first theoretical benchmark to which we will compare the experimental results. The second benchmark to which we refer is collusion where all competitors act as if they were a single monopolist to maximize their joint profits. The third benchmark is the competitive outcome where firms maximize their profits given the market clearing

[3] The two main differences between the study of Requate and Waichman and ours are: first we investigate the effect of an informational aid (payoff table) to no aid at all. Second we investigate the possible effect not only for duopolies but for three different market sizes.

[4] The stage game also has other pure equilibria, e.g., $x_i = 60$ for $i = 1...n$.

price. Many experimental studies refer to these three benchmarks of quantity-setting oligopoly (see e.g., Offerman et al. 2002). Table 1 depicts the total quantities and prices in markets with two, three, and four competitors for the respective benchmarks.

Table 1 Total quantity and prices at benchmark outcomes

	Collusion		CNE		Competition	
Market size	X	p	X	p	X	p
$N = 2$	30	30	40	20	60	0
$N = 3$	30	30	45	15	60	0
$N = 4$	30	30	48	12	60	0

3 Experimental design

Our experimental design contains two informational settings (*noTAB*, *TAB*) and three market sizes, i.e., we have six experimental treatments. We conducted 10 independent observations per treatment; in total 180 students participated in ten experimental sessions. [5]After the participants had entered the laboratory, the instructor read aloud the instructions[6] to make sure that every participant heard the information at least once and to create common knowledge. The subjects' assignment to different markets was random but fixed for the duration of the experiment. Communication was not allowed. A market period consisted of a decision and a feedback phase. After the subjects made their quantity decisions, all competitors received feedback about all single quantities and profits in their market. The participants played 100 experimental periods that lasted two and half hours on average including the introduction. The average payoff was about 18 Euros. The experiments were programmed with the experimental programming toolbox RatImage (Abbink and Sadrieh 1995).

4 Results

4.1 Aggregate Behavior

On the aggregate level, there is a clear difference between both settings. Figure 1 depicts for each treatment average total quantities in blocks of ten periods.

[5] We had 2+2=4 sessions with 20 subjects each for the quadropoly treatments; 2+2=4 sessions with 15 subjects each for the triopolies; and 1+1=2 sessions with 20 subjects each for the duopoly treatments. Most of the participants were students who were recruited from economics, law, and social sciences departments.

[6] For an English translation of the instructions, see the Appendix. The original instructions in German are available upon request from the authors.

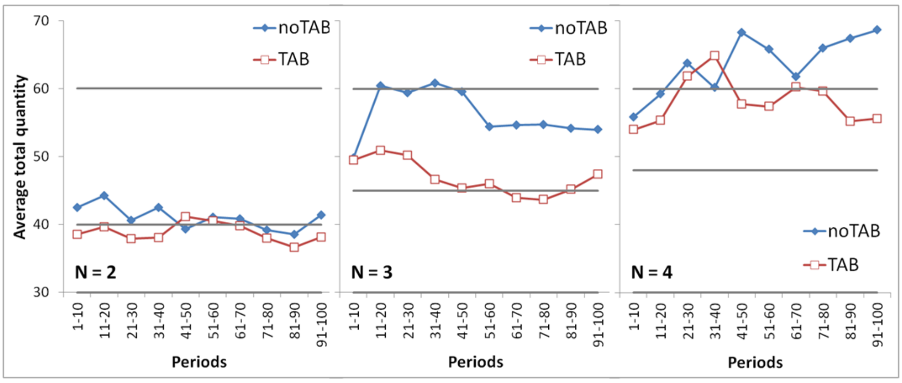

Fig. 1 Average numbers in different phases

For all market sizes and for almost all blocks, the average total quantity is lower in *TAB* than in *noTAB*.

The effect of payoff tables emerges early in the experiment. Averaged over the first five periods, in *TAB*-markets subjects choose significantly more often (U-Test, $p = 0.007$) single collusive quantities[7] (49% of all decisions) than subjects in *noTAB* (29% of all decisions).[8]

How do average quantities evolve during the experiment? In order to study this issue we compare data from periods 1-30 to the averages of periods 61-90.[9] In *noTAB*-duopolies, average quantities significantly decrease in later periods (Wilcoxon matched pairs test, $p = 0.059$). In *TAB*-duopolies, there is no significant decrease since subjects here – in contrast to their counterparts in *noTAB* – choose low production levels already in the initial phase of the experiment. For $N = 3$ and $N = 4$, in *TAB*, over time, we observe a trend to more collusive quantities when subjects are provided with payoff tables. The average total quantity in the later periods is lower ($N = 3 : p = 0.093$, $N = 4 : p = 0.114$) than in the early periods 1-30.[10] In contrast, in these markets in *noTAB* setting, there is no decrease of quantities.

A closer look on the three figures reveals a non-monotonicity of the effect of payoff tables, i.e., for $N = 3$ the differences between *TAB* and *noTAB* are more pronounced than the differences for $N = 2$ and $N = 4$. In duopolies,

[7] Single collusive quantities are closer to the symmetric collusive benchmark than to other benchmarks. For example, in duopolies, the symmetric collusive benchmark quantity is 15 while the single quantity in CNE is 20. Hence, all single quantities closer to 15 than to 20 are counted as collusive single quantities.

[8] The reported non-parametric statistical tests use the session averages of independent observations and report two-sided p-values.

[9] We do not consider the last 10 periods to exclude possible end game effects.

[10] Compared to other studies (e.g., reported in Huck et al., 2004) the average quantity in *TAB*-quadropolies could be considered as somewhat high. However, if we exclude one strong outlier market with 142.3(!) units, the average market quantity in periods 61-90 is only 53.5 (and not 58.2). Without that extreme outlier, the decrease in quantity in the last 30 periods, in *TAB*-quadropolies gets even highly significant ($p = 0.015$)

the impact of payoff table is immediate, in the first ten periods, subjects with payoff table produce -10.3% less than subjects without payoff table (N=3: -0.6%, N=4: -3.5%). Over the course of the experiment, however, this difference declines, since duopolists in *noTAB* also learn to collude successfully. In triopolies, payoff tables seem to be most effective by helping subjects to cooperate. On average, in subjects *TAB* produce -20.1% less than their counterparts in *noTAB*. For $N = 4$, the payoff table is apparently not so effective in decreasing contributions although the average difference between both treatments is higher than for $N = 2$ (-9.8% for $N = 4$, -5.7% for $N = 2$). Moreover, play in $N = 4$ is often dominated by punishment actions directing the averages in both treatments to a similar level. These observations are in line with the finding of Huck et al. (2004) that collusion is rare for markets with $N = 4$ or higher.

Table 2 depicts a classification of markets based on average quantities in periods 61-90. It shows that over all market sizes, there are more collusive markets in *TAB* (11 markets, 37% of all markets) than in *noTAB* (8 markets, 27%). [11] We define a market as collusive (abbrev. COL) if this market's average total quantity is closer to the collusive benchmark than to other two benchmarks introduced in Section 2; i.e., a duopoly market is classified as collusive if this market's average total quantity is below 35 while the same market is classified as a "CNE-market" (CNE) if this market's average total quantity lies between 35 and 50. [12]

Table 2 Classification of markets according their average quantities in periods 61-90

	noTAB			*TAB*		
Market size	COL	CNE	COM	COL	CNE	COM
$N = 2$	5	2	3	5	3	2
$N = 3$	2	3	5	4	3	3
$N = 4$	1	5	4	2	2	6
Total	8	10	12	11	8	11

In total, in *noTAB*, there are 10 markets with average total quantities around the CNE (8 in *TAB*). In *noTAB*, we classify 12 markets as competitive while there are 11 COM markets in *TAB*.

The above classification reveals that many markets succeed to collude. Interestingly, oligopolies in *TAB* establish collusion in significantly earlier periods than markets in *noTAB*. Figure 2 shows the evolution of collusive markets for each treatment in blocks of ten periods. As can be seen from the figures, in the beginning phase (periods 1-20), for all market sizes, in *TAB* there are more collusive markets then in *noTAB*. Aggregated over all market sizes, the

[11] Previous studies use similar classifications, see e.g., Fouraker and Siegel (1963) or Huck et al. (2004).

[12] Applying the same logic we label duopoly markets with average quantities above 50 as competitive (COM).

difference between both settings is highly significant (U-Test, $p = 0.022$). The markets in *noTAB*, however, catch up during the experiment with the markets in *TAB*. Similar to the evolution of average quantities, for $N = 3$, the differences between both settings remain stable while they diminish for $N = 2$ and $N = 4$.

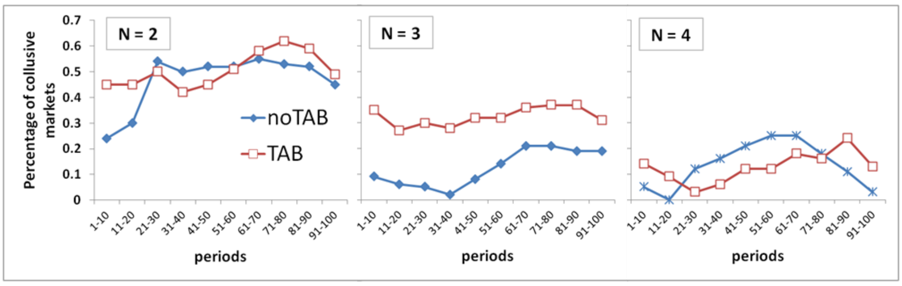

Fig. 2 Relative frequency of collusive markets

4.2 Individual Behavior

How do payoff tables influence the individual behavior? Since in our experiment subjects receive detailed feedback about each of the competitors' quantities and profits, they were able to apply a variety of decision rules. We focus on rules to which it is often referred in previous studies on quantity setting markets: Best-reply, collusive response, and imitation. In our game, each competitor is able to unilaterally force the market price to zero by choosing $x_i = 60$. This choice can be interpreted as a punishment act since in this case the player who chooses 60 as well as all other competitors obtain zero profits for sure. For this reason, we consider punishment as a fourth decision rule. In the following, we define the four rules more precisely. Then we look whether and how often subjects did choose these rules in the experiment.

Best-Reply (BR): A player i playing a (myopic) best-reply assumes that the sum of competitors' quantities will be the same in period t as in period $t-1$ and sets her actual quantity in period t according to the best-reply function $x_i^t = 30 - (X_{-i}^{t-1}/2)$ with X_{-i}^{t-1} being the sum of other competitors' last period quantities.

Collusive Response (CR): A player i who applies a collusive response wants to maximize the joint profits in the market. Thus she chooses x_i according to the formula: $x_i^t = 30 - X_{-i}^{t-1}$, i.e., the total quantity including player i's quantity equals the monopoly quantity.

Imitate the successful (IM): An imitator i sets the own quantity to $x_i^t = x_j^{t-1}$, where i being the imitator and j the most successful competitor in the previous period, with total quantity $X^{t-1} < 60$ and $x_j^{t-1} > x_i^{t-1}$.[13]

Punishment (PUN): A punisher i chooses $x_i = 60$ to set the market price to zero.

Which of the rules described above do subjects follow? Are subjects in *TAB* more inclined to apply BR than subjects in *noTAB* since the payoff table presents them the best-replies in a clear way? Do subjects with payoff tables choose more often CR which were easily identifiable? On the other hand, because of the clarity, one could expect less IM-behavior with payoff tables. Punishment could be observed more often in *noTAB*, e.g. as a signaling/disciplining device, if quantities in *noTAB* are indeed higher (less cooperative) than in *TAB* where probably there is less need for punishment.

In this study, we are interested in the differences between both information settings and not in learning behavior. Hence, we focus on exact applications of the above mentioned rules. Table 3 depicts the absolute and the relative frequencies of exact applications of the decision rules we observed in our experiments. Relative frequencies refer to the cases in which a decision rule was *applicable* which means that a player indeed was able to choose a particular rule. The percentage of applicable cases are also depicted in Table 3.[14]

BR was applicable in 87.6% of the cases in *noTAB* and in 92.4% cases in *TAB*. In both settings, however, only less than 10% of the decisions are actually BR. This is surprising since subjects had all necessary information to calculate the BR. In *TAB*, subjects could even read the best-reply directly from the payoff table. Despite this, subjects in *TAB* (8.2%) do not choose significantly more often BR than subjects in *noTAB* (7.1%).

In *noTAB*, CR was applicable in 47.1% of all cases (in *TAB*: 50.8%). Of these cases, 28.6% were actually CR (in *TAB*: 37.4%). Hence, in both settings, CR is the most frequent observed decision rule, in relative as well as in absolute terms. Subjects in *TAB* choose more often CR than subjects in *noTAB*. The difference between both settings is highest for $N = 3$. In both settings, the amount of CR declines with N.

In *noTAB*, imitation was applicable in 36.9% of all possible cases (37.8% in *TAB*). However, subjects applied imitation only in 10.1% of the these cases (10.9% in *TAB*). In duopolies imitation is more frequent (20.0% in *noTAB*, 16.3% in *TAB*) whereas it is rare in quadropolies (8.3% in *noTAB*, 7.8% in *TAB*). The discrepancy between the imitation numbers in duopolies and in quadropolies could be due to the ambiguity of the intention of imitational

[13] We exclude cases where the total quantity in the market was 60 or higher since in these case the profits of all competitors were zero, i.e., all competitors were equally successful (or equally unsuccesful). We also exclude cases where the player i him/herself was (one of) the most successful competitor(s) in period $t-1$. In such cases, for player i there is no successful competitor to copy in period t.

[14] Not all the rules were applicable in each period. For example, CR is only applicable if the total quantity in a market is less than or equal to 30. If the total quantity is greater than 30, there is no reasonable CR.

Table 3 Observed decisions in percent

		noTAB					*TAB*				
		BR	IM	CR	PUN	Total	BR	IM	CR	PUN	Total
$N = 2$	relative	3.4	20.0	37.8	1.0		8.0	16.3	39.3	1.6	
	app. cases	99.0	24.2	93.4	99.0		98.4	24.9	93.3	99.0	
	absolute	3.4	4.8	35.3	1.0	44.5	7.9	4.1	36.7	1.6	50.2
$N = 3$	relative	9.8	8.6	21.6	5.3		6.7	13.2	40.2	2.3	
	app. cases	89.3	41.5	37.5	99.0		95.4	36.1	55.7	99.0	
	absolute	8.8	3.6	8.1	5.2	25.7	6.4	4.8	22.4	2.3	35.8
$N = 4$	relative	7.0	8.3	21.1	7.1		9.6	7.8	29.3	4.7	
	app. cases	80.5	39.7	30.9	99.0		87.2	45.6	27.7	99.0	
	absolute	5.6	3.3	6.5	7.0	22.5	8.4	3.6	8.1	4.7	24.7
Total	relative	7.1	10.1	28.6	5.2		8.2	10.9	37.4	3.2	
	app. cases	87.6	36.9	47.1	99.0		92.4	37.8	50.8	99.0	
	absolute	6.2	3.7	13.5	5.1	28.6	7.6	4.1	19.0	3.2	33.9

decisions. First, subjects may imitate the most succesful competitor if they do not know what else to do. Sometimes, however, imitation may also occur in order to send a "message" to others. For example, some subjects choose the symmetric collusive quantity and that of the (most succesful) competitor with the highest quantity alternately to signal that the competitor with the highest quantity also should choose the collusive quantity. It is clear, that this kind of "signaling" is observed more often if the addressee of the signal can identify that he or she is the addressee - as in the case of a duopoly.

PUN was applicable with the exception of the first period, i.e., in 99.0% of possible cases. In *noTAB*, subjects punish in 5.2% of these cases while in TAB this percentage decreases to 3.2%. In both settings, the use of punishment increases with N (Jonckheere-Terpstra-Test, $p = 0.052$ for *noTAB*; $p = 0.032$ for *TAB*). This reflects the increasing difficulties to collude when the market size grows.[15]

Huck et al. (1999) and Offerman et al. (2002) investigate different learning theories in a Cournot quadropoly and triopoly setting respectively, in different treatments with different feedback mechanisms. Huck et al. (1999) find overall, imitation seems the better explanation for the adjustment of quantities. The number of perfect hits of imitation behavior, however, is relatively low throughout the treatments. In particular, in FULL, the only comparable treatment to our design, 7.9% of the decisions are actually imitate the best, 0.6% imitate the average, and 1.4% are BR. Huck et al. (1999) do not count CR. In Offerman et al. (2002) $Qq\pi$ is the comparable treatment to our settings. In this treatment, collusion is found roughly as frequent as the competitive (Walrasian) outcome. Additionally, the more complicated demand and cost functions could be a reason that in the latter study one observes more imita-

[15] A multinomial logistic regression analysis which we report in the Appendix brings out similar results with respect to individual choice behavior of the considered decision rules.

tion than in our extremely simple setting where cognitive costs of finding the collusive response may be lower, especially in *TAB*.

5 Conclusion

In this study, we systemically investigate the effect of payoff tables on subjects' behavior in Cournot markets with two, three, and four competitors. The only variation between our two informational settings is the provision of a payoff table - all other things remaining equal. Hence, any differences between the both settings of our study can be unambiguously traced back to the presence (or the absence) of payoff tables. Overall results show that subjects provided with payoff tables choose more often collusive quantities. Moreover, subjects with payoff tables manage to collude earlier than subjects without payoff tables. Towards the end of the experiment, however, the differences between both settings get smaller. Thus, the length of the experiment seems to be an important determinant: in experiments with a small number of periods, payoff tables are more likely to make significant differences. For all market sizes, the number of collusive markets are higher with payoff tables.

Both ours and the study of Charness et al. (2004) show that payoff tables have an effect on behavior. In contrast to Charness et al. (2004), however, we find that payoff tables seem to make behavior more cooperative. Charness et al. (2004) observe significant reductions of average wages and effort levels in a gift-exchange game when subjects are provided with payoff tables. One major difference between our setting and the study of Charness et al. (2004) is that they investigate an asymmetric game while our setting has a symmetric structure. In a symmetric game, the payoff table possibly makes subjects more clear that there are gains from cooperation if all competitors would choose similar quantities. In contrast, in an asymmetric environment as in the gift-exchange game, the payoff table may let subjects focus on the inequality of the situation leading to less gift-exchange than observed normally without payoff tables. One explanation provided by Charness et al. is that payoff tables possibly made subjects more clear that in a gift-exchange experiment firms' marginal benefits from worker's effort decrease when effort increases. Subjects realizing this "inefficiency of gifts" at higher wages may provide less effort, i.e., they may cooperate less than subjects without payoff tables.

The study by Requate and Waichman (2011) and ours complement each other well in understanding the effect of informational aids in Cournot experiments. While they show that there is no significant differences in behavior whether subjects use payoff tables or a payoff calculator, we show that the use of an informational aid at all can make (significant) differences. Requate and Waichman (2011) investigate only duopolies. Our results with respect to duopolies are roughly in line with their findings: in the long-run, the duopolies in *noTAB* are similarly collusive as duopolies in *TAB*. We find, however, significant differences between our settings for triopolies. The question remains open whether for $N > 2$ there would be (significant) differences between settings with payoff tables and settings with a payoff calculator.

In the theoretical literature, we find many results on the presence and absence of information but very little on the significance of information processing instruments. This study clearly shows that information-processing aids have non-negligible effects. Our results show that payoff tables indeed have an impact on subjects behavior even in a very simple setting. Hence, they might have even stronger effects in more complicated environments which possibly demand subjects' cognitive abilities even more. Thus, from a methodological point of view, the provision of subjects with payoff tables may be useful and recommended, especially in complex experimental studies.

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6 Appendix

6.1 Additional Analysis

A comparison of the constant terms reveals that the decision rule CR is chosen more frequently than the all other decision rules and the remaining category

Table 4 Multinomial logistic regression

Decision rule		Coefficient	Rob. Std. Error	z	p
Other		(base outcome)			
Best-reply (BR)	n	-0.101	0.130	-0.78	0.435
	treat	0.271	0.228	1.19	0.234
	cons	-2.228	0.481	-4.62	0.000
Imitation (IM)	n	-0.364	0.097	-3.72	0.000
	treat	0.179	0.150	1.19	0.233
	cons	-1.836	0.306	-6.00	0.000
Collusive response (CR)	n	-1.702	0.353	-4.83	0.000
	treat	0.528	0.601	0.88	0.380
	cons	2.871	1.017	2.82	0.005
Punishment (P)	n	0.451	0.314	1.44	0.150
	treat	-0.430	0.520	-0.83	0.409
	cons	-4.237	1.043	-4.06	0.000

Std. Err. adjusted for 60 clusters (markets). Number of obs = 18000. Pseudo $R^2 = 0.0955$, Wald chi2(8) = 40.55, log pseudolikelihood = -15207.035.

"others". All decision rules but CR are chosen less frequently than the remaining category as the negative signs of the constant terms and the significant p-values show. For any decision rule, there are no significant differences between treatments, i.e., the respective rules are chosen in similar percentages in both treatments. If we look at number effects, we see that the probability to choose CR and IM decreases with N whereas the probability to choose BR or P does not change significantly when N incraeses.

6.2 Translation of the Instructions to the Experiment

The Structure of the Experiment. The experiment consists of 100 periods. You will be randomly assigned to different groups. There are 2 to 4 participants in each group. The composition of each group does not change throughout the experiment. The members of a group are competitors on a market for a specific good. At the beginning of the experiment you will be informed, how many competitors you have.

The Structure of a Period. You determine your supply x, by choosing a number out of $\{0..60\}$. There are no costs, i.e., the good is produced and supplied without costs. Depending on your supply and the supply of your competitors, the total supply X on this market is determined as follows: $X = \sum_i x_i$, where x_i denotes the single supply of the supplier i on the market. The price p depends on the total supply X as follows:

$$p = \begin{cases} 60 - X & \text{if } X \leq 60 \\ 0 & \text{if } X > 60 \end{cases}$$

Your profit G is calculated as follows: $G = p \cdot x$. Your earnings depend on your final profit.

Feedback at the end of each Period. At the end of each round, each participant is informed about his profit G and the supplies and profits of his competitors. The profits of your competitors are determined in the same way as your own profit. Depending on the profit, every participant is paid a certain amount in the fictitious currency “Thaler”. The screen shows the profit of the last period and the cumulated profit (sum of all profits obtained so far).

End of the Experiment and Total Payoffs. From the beginning, the exchange rate is displayed on the computer screen. At the end of the experiment your cumulated profit will be multiplied with the exchange rate. After the experiment you will be paid this amount.

Additional instructions for the setting “TAB”. You will be provided with a payoff table. The lines on this table correspond to your possible supplies out of $\{0..60\}$. The columns correspond to the competitors' supplies (i.e., sum of the supplies of your competitors). In the respective fields of the table, you will find your corresponding profit.

6.3 The Payoff Table

Sum of the quantity of other competitors

Own quantity	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	3
2	116	114	112	110	108	106	104	102	100	98	96	94	92	90	88	86	84	82	80	78	76	74	72	70	68	66	6
3	171	168	165	162	159	156	153	150	147	144	141	138	135	132	129	126	123	120	117	114	111	108	105	102	99	96	9
4	224	220	216	212	208	204	200	196	192	188	184	180	176	172	168	164	160	156	152	148	144	140	136	132	128	124	12
5	275	270	265	260	255	250	245	240	235	230	225	220	215	210	205	200	195	190	185	180	175	170	165	160	155	150	14
6	324	318	312	306	300	294	288	282	276	270	264	258	252	246	240	234	228	222	216	210	204	198	192	186	180	174	16
7	371	364	357	350	343	336	329	322	315	308	301	294	287	280	273	266	259	252	245	238	231	224	217	210	203	196	18
8	416	408	400	392	384	376	368	360	352	344	336	328	320	312	304	296	288	280	272	264	256	248	240	232	224	216	20
9	459	450	441	432	423	414	405	396	387	378	369	360	351	342	333	324	315	306	297	288	279	270	261	252	243	234	22
10	500	490	480	470	460	450	440	430	420	410	400	390	380	370	360	350	340	330	320	310	300	290	280	270	260	250	24
11	539	528	517	506	495	484	473	462	451	440	429	418	407	396	385	374	363	352	341	330	319	308	297	286	275	264	25
12	576	564	552	540	528	516	504	492	480	468	456	444	432	420	408	396	384	372	360	348	336	324	312	300	288	276	26
13	611	598	585	572	559	546	533	520	507	494	481	468	455	442	429	416	403	390	377	364	351	338	325	312	299	286	27
14	644	630	616	602	588	574	560	546	532	518	504	490	476	462	448	434	420	406	392	378	364	350	336	322	308	294	28
15	675	660	645	630	615	600	585	570	555	540	525	510	495	480	465	450	435	420	405	390	375	360	345	330	315	300	28
16	704	688	672	656	640	624	608	592	576	560	544	528	512	496	480	464	448	432	416	400	384	368	352	336	320	304	28
17	731	714	697	680	663	646	629	612	595	578	561	544	527	510	493	476	459	442	425	408	391	374	357	340	323	306	28
18	756	738	720	702	684	666	648	630	612	594	576	558	540	522	504	486	468	450	432	414	396	378	360	342	324	306	28
19	779	760	741	722	703	684	665	646	627	608	589	570	551	532	513	494	475	456	437	418	399	380	361	342	323	304	28
20	800	780	760	740	720	700	680	660	640	620	600	580	560	540	520	500	480	460	440	420	400	380	360	340	320	300	28
21	819	798	777	756	735	714	693	672	651	630	609	588	567	546	525	504	483	462	441	420	399	378	357	336	315	294	27
22	836	814	792	770	748	726	704	682	660	638	616	594	572	550	528	506	484	462	440	418	396	374	352	330	308	286	26
23	851	828	805	782	759	736	713	690	667	644	621	598	575	552	529	506	483	460	437	414	391	368	345	322	299	276	25
24	864	840	816	792	768	744	720	696	672	648	624	600	576	552	528	504	480	456	432	408	384	360	336	312	288	264	24
25	875	850	825	800	775	750	725	700	675	650	625	600	575	550	525	500	475	450	425	400	375	350	325	300	275	250	22
26	884	858	832	806	780	754	728	702	676	650	624	598	572	546	520	494	468	442	416	390	364	338	312	286	260	234	20
27	891	864	837	810	783	756	729	702	675	648	621	594	567	540	513	486	459	432	405	378	351	324	297	270	243	216	18
28	896	868	840	812	784	756	728	700	672	644	616	588	560	532	504	476	448	420	392	364	336	308	280	252	224	196	16
29	899	870	841	812	783	754	725	696	667	638	609	580	551	522	493	464	435	406	377	348	319	290	261	232	203	174	14
30	900	870	840	810	780	750	720	690	660	630	600	570	540	510	480	450	420	390	360	330	300	270	240	210	180	150	12
31	899	868	837	806	775	744	713	682	651	620	589	558	527	496	465	434	403	372	341	310	279	248	217	186	155	124	9
32	896	864	832	800	768	736	704	672	640	608	576	544	512	480	448	416	384	352	320	288	256	224	192	160	128	96	6
33	891	858	825	792	759	726	693	660	627	594	561	528	495	462	429	396	363	330	297	264	231	198	165	132	99	66	3
34	884	850	816	782	748	714	680	646	612	578	544	510	476	442	408	374	340	306	272	238	204	170	136	102	68	34	
35	875	840	805	770	735	700	665	630	595	560	525	490	455	420	385	350	315	280	245	210	175	140	105	70	35	0	
36	864	828	792	756	720	684	648	612	576	540	504	468	432	396	360	324	288	252	216	180	144	108	72	36	0	0	
37	851	814	777	740	703	666	629	592	555	518	481	444	407	370	333	296	259	222	185	148	111	74	37	0	0	0	
38	836	798	760	722	684	646	608	570	532	494	456	418	380	342	304	266	228	190	152	114	76	38	0	0	0	0	
39	819	780	741	702	663	624	585	546	507	468	429	390	351	312	273	234	195	156	117	78	39	0	0	0	0	0	
40	800	760	720	680	640	600	560	520	480	440	400	360	320	280	240	200	160	120	80	40	0	0	0	0	0	0	
41	779	738	697	656	615	574	533	492	451	410	369	328	287	246	205	164	123	82	41	0	0	0	0	0	0	0	
42	756	714	672	630	588	546	504	462	420	378	336	294	252	210	168	126	84	42	0	0	0	0	0	0	0	0	
43	731	688	645	602	559	516	473	430	387	344	301	258	215	172	129	86	43	0	0	0	0	0	0	0	0	0	
44	704	660	616	572	528	484	440	396	352	308	264	220	176	132	88	44	0	0	0	0	0	0	0	0	0	0	
45	675	630	585	540	495	450	405	360	315	270	225	180	135	90	45	0	0	0	0	0	0	0	0	0	0	0	
46	644	598	552	506	460	414	368	322	276	230	184	138	92	46	0	0	0	0	0	0	0	0	0	0	0	0	
47	611	564	517	470	423	376	329	282	235	188	141	94	47	0	0	0	0	0	0	0	0	0	0	0	0	0	
48	576	528	480	432	384	336	288	240	192	144	96	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
49	539	490	441	392	343	294	245	196	147	98	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
50	500	450	400	350	300	250	200	150	100	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
51	459	408	357	306	255	204	153	102	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
52	416	364	312	260	208	156	104	52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
53	371	318	265	212	159	106	53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
54	324	270	216	162	108	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
55	275	220	165	110	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
56	224	168	112	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
57	171	114	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
58	116	58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
59	59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Fig. 3 Excerpt from the Payoff Table