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## **Satisficing in strategic environments: a theoretical approach and experimental evidence**

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Satisficing in strategic environments:  
a theoretical approach and experimental evidence

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**Abstract**

The satisficing approach is generalized and applied to finite  $n$ -person games. Based on direct elicitation of aspirations, we formally define the concept of satisficing, which does not exclude (prior-free) optimality but includes it as a border case. We also review some experiments on strategic games illustrating and partly supporting our theoretical approach.

*JEL classification:* C72; C92; D01

*Keywords:* Strategic interaction; Satisficing behavior; Bounded rationality

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## 1. Introduction

Satisficing is the core idea of bounded rationality (Simon, 1955). Unlike rationality theory, it does not presuppose well-behaved preferences and uniquely specified beliefs, but rather assumes some adequate mental model capturing the crucial structure of the decision environment. The basic idea of the satisficing approach is that people form aspirations, search for alternatives satisficing them, and adapt their aspirations in the light of experience. This framework for boundedly rational decision making conforms more to actual human behavior than the classical rational theory because it respects people's cognitive limitations by relying on ideas that are intuitively understandable.

Although the satisficing approach offers a natural "language" to explain the behavior of individuals and firms (Cyert and March, 1963), it cannot easily be used to predict decision-making. Similar to the rational choice approach, where one cannot predict anything without presupposing specific preferences, it is impossible to predict satisficing choices when not knowing the aspirations. Rather than following the tradition of revealed preference analysis and trying to infer aspirations from behavior, we rely on directly elicited payoff aspirations. Knowing people's aspirations, we can then formally define the conditions that must be fulfilled in order for a choice to be satisficing.

While in the portfolio choice experiments (reviewed by Güth, 2007), and in the saving study by Güth, Levati and Ploner (2007) aspirations apply to different states of nature, in strategic interaction satisficing depends on what one expects about the competitors' behavior. The basic idea of our satisficing approach is that each player forms a *conjecture* about the others' behavior. The conjecture of a particular player is potentially a set containing all the competitors' strategy constellations that the player considers as possible. We do not require the player to attach probabilities to the various elements in the conjecture. Therefore, the conjecture is non-probabilistic or *prior-free*. We will show how our notion of satisficing allows for prior-free optimality, i.e., for a

concept of optimality which is more basic than that required by expected utility maximization as it does not involve any prior.

The paper proceeds as follows. Section 2 introduces the concept of satisficing in normal form games. Section 3 describes experimental designs to test the satisficing hypothesis and optimality. Section 4 reviews some preliminary experimental findings, and Section 5 concludes.

## 2. Satisficing in normal form games

A normal form game with a finite set  $I$  of  $n \in \mathbb{N}$  ( $n \geq 2$ ) players specifies, for each player  $i \in I$ , a finite set of strategies  $S_i$  available to  $i$ , from which she can choose one strategy  $s_i \in S_i$ , and a payoff function  $u_i(\mathbf{s})$  assigning payoff levels to  $i$  for all possible strategy profiles  $\mathbf{s} \in \prod_{i \in I} S_i$ .

While traditional game theory supposes that all players are rational and that rationality is common knowledge, our satisficing approach avoids these rationality requirements and assumes that each of the  $n$  players forms an idiosyncratic set-valued conjecture about the others' behavior. For each player  $i$ , let  $C_i$  be the set of the others' strategy constellations that  $i$  considers as possible, i.e.,  $\emptyset \neq C_i \subseteq S_{-i} = \prod_{j \in I \setminus \{i\}} S_j$ , and let  $c_i$  denote an element of this set. We do not require player  $i$  to attach probabilities to the various elements in her conjecture. If  $c_i \in C_i$ , this simply means that player  $i$  does not want to exclude the event  $c_i = \mathbf{s}_{-i} = (s_1, \dots, s_{i-1}, s_{i+1}, \dots, s_n)$  without necessarily being able to specify how likely the event is.

We further suppose that each player  $i$  forms a payoff aspiration for each element  $c_i$  in  $C_i$ . If  $A_i(c_i)$  is  $i$ 's aspiration when she expects  $c_i$  from her competitors,<sup>1</sup> then a given strategy  $s_i \in S_i$  is *satisficing* if

$$(1) \quad u_i(s_i, c_i) \geq A_i(c_i) \quad \text{for all } c_i \in C_i.$$

For a given aspiration profile  $\mathbf{A}_i = \{A_i(c_i)\}_{c_i \in C_i}$ , whose cardinality  $|\mathbf{A}_i|$  is

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<sup>1</sup>We do not prevent  $i$  to form the same aspiration for different  $c_i$  in  $C_i$ .

defined by  $|C_i|$  (i.e., by the number of player  $i$ 's conjectures), denote the *set of satisficing strategies* by

$$S_i(\mathbf{A}_i) = \{s_i \in S_i : u_i(s_i, c_i) \geq A_i(c_i) \text{ for all } c_i \in C_i\}.$$

In general,  $S_i(\mathbf{A}_i)$  can be (i) empty, meaning that the aspiration profile  $\mathbf{A}_i$  is too ambitious (i.e., there exists at least one conjecture  $c_i \in C_i$  such that  $u_i(s_i, c_i) < A_i(c_i)$  for all  $s_i \in S_i$ ), (ii) rather large, so that many strategies  $s_i \in S_i$  are satisficing,<sup>2</sup> or (iii) contain only strategies  $s_i^* \in S_i$  that yield the same payoff  $u_i(s_i^*, c_i)$  for all  $c_i \in C_i$ , and whose optimality we discuss next.

Defining optimality in our context entails specifying what characterizes an *optimal* aspiration profile. Let  $\mathbf{A}_i^*$  be one of player  $i$ 's optimal aspiration profiles. Then the following two conditions must hold:

- (i)  $S_i(\mathbf{A}_i^*) \neq \emptyset$ , i.e.,  $\mathbf{A}_i^*$  must allow for satisficing, and
- (ii)  $S_i(\mathbf{A}_i^+) = \emptyset$  for any aspiration profile such that  $A_i^+(c_i) > A_i^*(c_i)$  for at least one  $c_i \in C_i$  and  $A_i^+(c_i) \geq A_i^*(c_i)$  for all  $c_i \in C_i$ , i.e., it must be impossible to satisfice a more ambitious aspiration profile.

If  $S_i(\mathbf{A}_i^+)$  is non-empty and contains strategies  $s_i^+$  that for all conjectures  $c_i \in C_i$  allow player  $i$  to achieve no lower aspirations than those allowed by the strategies  $s_i^*$  in  $S_i(\mathbf{A}_i^*)$ , and for at least one  $c_i$  allow her to achieve higher aspirations, then  $i$  might increase her aspirations for some constellation of conjectures without having to reduce any other aspiration. Thus, for any optimal  $\mathbf{A}_i^*$ , the set  $S_i(\mathbf{A}_i^*)$  must contain only strategies  $s_i^*$  for which it is impossible to find another strategy  $s_i^+$  such that  $u_i(s_i^+, c_i) > u_i(s_i^*, c_i)$  for at least one  $c_i \in C_i$ , and  $u_i(s_i^+, c_i) \geq u_i(s_i^*, c_i)$  for all  $c_i \in C_i$ .

In non-degenerate games where no two strategy profiles yield the same payoff for any of the  $n$  players, the set  $S_i(\mathbf{A}_i^*)$  contains just one strategy  $s_i^*$  so that  $u_i(s_i^*, c_i) = A_i^*(c_i)$  for all  $c_i \in C_i$ . In general, for each set-valued conjecture  $C_i \subseteq S_{-i}$ , there exists a large set of optimal aspiration profiles  $\mathbf{A}_i^*$  and optimal

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<sup>2</sup>This, depending on the strategy, may allow for aspiration adaptation.

strategies  $s_i^* \in S_i(\mathbf{A}_i^*)$ . Moreover, this multiplicity is enlarged by the richness of possible idiosyncratic conjectures that player  $i$  may entertain.

We conclude this section by linking our concept of prior-free optimality to the familiar equilibrium concept in game theory. Similar to the rationality assumption in game theory, assume that each of the  $n$  players forms optimal aspiration profiles  $\mathbf{A}_i^*$  and chooses optimal strategies  $s_i^* \in S_i(\mathbf{A}_i^*)$ . Since equilibria of strategic games can be characterized by optimality and rational expectations, optimal strategies  $s_i^*$  in our satisficing approach qualify as an equilibrium if, for all  $i \in I$ ,  $C_i$  contains only the actual strategy profile of the other  $n - 1$  players, i.e.,  $C_i \equiv \{\mathbf{s}_{-i}^*\} = \{(s_1^*, \dots, s_{i-1}^*, s_{i+1}^*, \dots, s_n^*)\}$ . This means, in fact, that all players entertain rational expectations about the others' behavior.

### 3. Experimental protocols to explore satisficing

In games as described in Section 2 (where we have abstracted from chance moves), an obvious protocol to explore satisficing is to ask each participant  $i$  not only to choose a strategy  $s_i \in S_i$ , but also to specify a set  $C_i$  of the others' strategy constellations  $\mathbf{s}_{-i}$  that she considers as possible, and to form an aspiration profile  $\mathbf{A}_i = \{A_i(c_i)\}_{c_i \in C_i}$  whose richness is bounded from above by the cardinality of  $C_i$ , denoted by  $|C_i|$ .

Eliciting aspirations but rewarding participants for their payoff function  $u_i(s_i, \mathbf{s}_{-i})$ , renders  $\mathbf{A}_i$  mere “cheap-talk”. Although we do not necessarily disqualify this procedure, we find it more appropriate to incentivize aspiration choices and will discuss some ways of paying for aspirations in the next section.

Checking if a given strategy  $s_i \in S_i$  is satisficing means checking if  $s_i \in S_i(\mathbf{A}_i)$ . One may be interested in observing how participants react when informed of whether their strategy is satisficing or not. The provided feedback may consist either in simply telling participants that their strategy is not satisficing or in informing them about the specific  $c_i \in C_i$  violating  $u_i(s_i, c_i) \geq A_i(c_i)$  for the strategy  $s_i$  under consideration.

Protocols may also vary depending on how free participants are in predicting their opponents' behavior. If the space of strategy profiles  $S = \prod_{i=1}^n S_i$  contains only few elements and the number  $n$  of players is rather small, one may enforce  $C_i = S_{-i}$ , i.e., participants cannot exclude any possible constellation of others' behavior. However, in games where  $S$  or  $n$  is large, bounded rationality requires  $C_i$  to contain only a few elements. In this case, the experimenter may either impose an upper bound for  $|C_i|$  or allow subjects to freely decide how many constellations of others' behavior they do not want to exclude.

Before describing some experimental studies on satisficing conducted so far, let us briefly indicate how we can capture the situation in which the payoff function  $u_i(\cdot)$  depends not only on the strategy profile  $\mathbf{s}$  but also on chance moves  $z \in Z$ , where  $Z$  is finite. In line with our non-probabilistic approach to strategic interaction, rather than assuming cardinal utilities in the sense of  $U_i(\mathbf{s}) = \sum_{z \in Z} p(z)u_i(\mathbf{s}, z)$ , with  $p(z)$  denoting the probability of  $z$ , we simply impose a set-valued conjecture about both the others' behavior and the chance moves. Thus, each idiosyncratic conjecture must now specify not only a constellation  $\mathbf{s}_{-i}$  of the others' behavior but also a chance result  $z \in Z$ . By this means, we can extend our notion of satisficing and prior-free optimality to strategic games in normal form involving chance moves, whose probabilities may or may not be known.

## 4. Experimental evidence

### 4.1. Study 1: testing the absorbability of satisficing in strategic settings

The first experiment (Berninghaus, Güth, Levati and Qiu, 2006) was designed to investigate the absorbability of satisficing in a context with strategic uncertainty.<sup>3</sup> It relied on a multi-period homogeneous duopoly market with

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<sup>3</sup>The absorption problem goes back to Oskar Morgenstern and has been recently discussed by Güth and Kliemt (2004). The absorbability of the satisficing approach for investment decision problems without strategic interaction has been experimentally investigated by Güth, Levati and Ploner (2008a).



stochastic demand  $D_k$ . Specifically,  $D_k$  could take a value of 12, 24, or 48 for  $k = 1, 2$ , and 3, respectively, where the three states were equally likely. Denoting the amount supplied by seller  $i$  ( $i = a, b$ ) in state  $k$  ( $k = 1, 2, 3$ ) by  $x_{i,k}$  and the price in state  $k$  by  $p_k$ , the stochastic inverse demand function in  $k$  can be written as  $p_k = \max\{D_k - x_{a,k} - x_{b,k}, 0\}$ , yielding profits  $\pi_{i,k} = p_k x_{i,k}$  for each seller  $i$ . In this market, the symmetric equilibrium, given in general form by  $x_{i,k}^* = D_k/3$  for  $i = a, b$ , requires the duopolists to sell 4 in the worst state 1, 8 in the intermediate state 2, and 16 in the best state 3.

This first study on satisficing in market interaction elicited *point* (rather than set-valued) *conjectures* about the amount sold by the other seller in the three states of demand. In particular, in every period and each duopoly market, besides choosing her own sales profile  $\mathbf{x}_i = (x_{i,1}, x_{i,2}, x_{i,3})$ , each seller  $i$  had to predict the *most probable* sales profile  $\mathbf{c}_i = (c_{i,1}, c_{i,2}, c_{i,3})$  of her competitor and form her own aspirations profile  $\mathbf{A}_i = (A_{i,1}, A_{i,2}, A_{i,3})$ . Quantities had to be integer numbers between 0 and 20. In this context,  $i$ 's strategy profile  $\mathbf{x}_i$  is satisficing if

$$(2) \quad (D_k - x_{i,k} - c_{i,k})x_{i,k} \geq A_{i,k} \quad \text{in each state } k = 1, 2, 3.$$

A total of four experimental sessions were run, each consisting of two subsequent phases with 12 periods each. Thirty-two students participated in each session in the random matching mode (or strangers design). To collect more than one independent observation per session, subjects were rematched within matching groups of 8 players, guaranteeing 4 independent observations per session and 16 independent observations in total.

The first experimental phase aimed at familiarizing participants with the concept of satisficing (so as to induce its absorption) as well as at investigating what is mostly revised by individuals (point conjectures, aspirations, or sales behavior) when requirement (2) does not hold. More specifically, in the first 12 periods, participants were forced, via a so-called “decision aid”, to make

satisficing choices. After each seller participant had specified  $\mathbf{x}_i$ ,  $\mathbf{c}_i$  and  $\mathbf{A}_i$ , it was checked by the software whether requirement (2) held. Each participant was then informed of whether or not her stated profit aspirations could be achieved in each state of nature. If this was not possible for some state, the participant *had to* go back and revise one or more components of her decisions. Revisions were also allowed in case of compliance with (2), though.

In the second phase, aimed at testing the absorption of satisficing, seller participants were still informed of whether or not their sales strategy was satisficing, but they were free to choose their sales quantity.

To incentivize conjectures as well as aspiration choices, participants were paid either according to their stated (point) conjectures or according to their aspirations, with both possibilities being equally likely. When payments were based on conjectures, the payoff of seller participant  $i$  ( $i = a, b$ ) in the selected state  $k$  ( $k = 1, 2, 3$ ) was given by  $W_{i,k} = 100 - |x_{i,k} - c_{i,k}|$ . When payments depended on aspirations, participant  $i$  earned her aspiration  $A_{i,k}$  for the selected state  $k$  if the actual profits  $\pi_{i,k}$  sufficed to satisfy  $A_{i,k}$ . Otherwise, she earned the highest aspiration  $A_{i,l}$  ( $l = 1, 2, 3; l \neq k$ ) complying with  $\pi_{i,k} \geq A_{i,l}$ . Paying the highest achieved aspiration matches the implication of aspirations in the satisficing approach: one is satisfied if aspirations are met (realized profits are greater than aspirations), while one is unsatisfied if aspirations are not met (realized profits are smaller than aspirations).

Table 1 provides descriptive statistics on crucial variables like profits, choices, conjectures and aspirations, separately for the two phases.

[Table 1 about here](#)

In both phases, mean sales choices in states 1 and 2 are not significantly different from the game-theoretical predictions, while in the best state 3 participants tend to undersell as compared to the benchmark solution. Conjectures about the competitor's sales amount are, in general, not accurate, but systematically below actual choices. Furthermore, for all three states of nature, mean

aspirations are lower in phase 1 than in phase 2, implying that participants tend to become “more demanding” in the second 12 periods.

Figure 1 displays the time path of average aspirations and average profits attainable given the chosen and the conjectured quantity (i.e.,  $[D_k - x_{i,k} - c_{i,k}]x_{i,k}$ ), separately for each state and each phase. Phase 2’s sample includes only satisficing choices. For each state of nature, whatever the phase, average aspirations lie constantly below average attainable profits. Thus, subjects aspire to profits that are significantly smaller than those they might aim for, given their conjectures about the opponent’s behavior. Moreover, while in phase 1 the gap between attainable profits and aspirations shrinks significantly over time for all three states, in phase 2 it stays rather constant.

Figure 1 about here

In the first phase, out of all the 4608 individual observations (32 subjects  $\times$  3 states  $\times$  12 periods  $\times$  4 sessions), 3564 comply immediately with requirement (2), meaning that the three profiles of interest,  $\mathbf{x}_i$ ,  $\mathbf{c}_i$ , and  $\mathbf{A}_i$ , are satisficing at first attempt for the same individual. Most of these immediately satisficing profiles are confirmed, but a small number (3.76%) is revised, with most of the revisions (72%) concerning own aspirations, some (16%) point conjectures, and just a few (11%) own sales choices. The observation that participants adapt mostly their aspiration levels when satisficing is not fulfilled also applies to the remaining 1044 observations, which are not immediately satisficing and, thus, must be revised. In the second phase, out of the 1368 observations that were informed to be not satisficing, 150 decide to revise some aspects of their decision. Also in phase 2, aspirations are revised more often (62% of the times) than one’s own and conjectured sales.

Figure 2 about here

Figure 2 reveals a high tendency to deliberately maintain satisficing in the second phase. In each single period, the frequency of satisficing is above 60%,

and satisficing choices are more frequent in the best state 3 than in the other two states. Thus, most participants comply with satisficing requirement (2) without being forced to do so, thereby suggesting that in market interaction the satisficing concept is absorbable.

*4.2. Study 2: eliciting a set-valued conjecture about the others' behavior and testing for prior-free optimality*

To investigate whether agents comply with prior-free optimality, Güth, Levati and Ploner (2008b) avoided multiple states of nature, but allowed for multiple conjectures concerning the others' behavior. They considered a multi-period heterogeneous triopoly market with price competition. Let  $p_i$  be firm  $i$ 's own price ( $i = 1, 2, 3$ ) and let  $\bar{p}_{-i}$  denote the average price of the other two firms in the market. Quantity sold by individual firm  $i$  ( $x_i$ ) depends negatively on  $p_i$  and positively on  $\bar{p}_{-i}$  as follows:  $x_i(\mathbf{p}) = 40 - 2p_i - (p_i - \bar{p}_{-i})$ . Given this demand function, the noncooperative symmetric equilibrium benchmark, assuming mutually best responses, is  $p_i^* = 8$ , implying profits  $\pi_i(\mathbf{p}^*) = 192$ .

In every period, each seller participant  $i$  ( $i = 1, 2, 3$ ) had to choose a unique price  $p_i$  from 0 to 12 (using up to two decimals), specify a set-valued conjecture  $C_i$  about the possible average price of her two current competitors, and form a profit-aspiration  $A_i(c_i)$  for each conjectured price  $c_i \in C_i$ . The cardinality of  $C_i$  could be at the most six, so that each participant  $i$ 's aspiration profile could contain a maximum of six elements per period. In this case, satisficing requirement (1), as defined in Section 2, translates into

$$(3) \quad \pi_i(p_i, c_i) \geq A_i(c_i) \quad \text{for all } c_i \in C_i,$$

where  $\pi_i(p_i, c_i)$  are the profits  $i$  can attain given  $p_i$  and  $c_i$ .

Moreover, as participants were not required to specify a probability distribution over the set of conjectured prices, this setting allows for testing prior-free optimality. In particular, participants' choices are said to be prior-free optimal if they satisfy two testable conditions. The first condition is that the chosen

price must be *rationalizable* in the sense that it must be a best response to some price belonging to the convex combination of the minimum and maximum elements in the seller's conjecture. Price choices that cannot be rationalized by any probability distribution over  $C_i$  are referred to as *type 1-deviation from prior-free optimality*. The second condition is that each specified aspiration must fully exhaust the profit potential allowed by the corresponding conjectured price and the chosen price, i.e.,  $\pi_i(p_i, c_i) = A_i(c_i)$  must hold for all  $c_i$  in  $C_i$ . Aspiration profiles  $\mathbf{A}_i$  such that  $\sum_{c_i \in C_i} [\pi_i(p_i, c_i) - A_i(c_i)] > 0$  represent a so-called *type 2-deviation from prior-free optimality*.

Eighty-one students participated in three separated sessions, each consisting of 9 periods. New groups were randomly formed in each repetition (strangers design), with rematching within matching groups of 9 players so as to guarantee a total of 9 independent observations. In every period, each subject could rely on a software aided satisficing routine (the “decision aid”) informing her of whether or not her price was satisficing. Irrespective of abidance by requirement (3), a participant could confirm her sales price or revise some aspects of her decisions. A maximum of 5 revisions per period was warranted.

To incentivize all three tasks, in each period subjects could be paid according to realized profits, conjectures, or aspiration choices, with all three possibilities being equally likely. When payments were based on conjectured prices, the payoff of a seller participant was given by  $W_i = 180 - 10 \times |\bar{p}_{-i} - \tilde{c}_i|$ , with  $\tilde{c}_i$  being  $i$ 's closest conjecture to the actual  $\bar{p}_{-i}$ . When payments were based on aspirations, a participant earned her highest achieved aspiration, i.e., the highest  $A_i(c_i)$  complying with  $\pi_i(p_i, \bar{p}_{-i}) \geq A_i(c_i)$ . If all the aspirations stated by the subject exceeded her actual profits, her earnings were nil.

The boxplots in Figure 3 provide descriptive statistics on the distributions of stated prices and average conjectured prices (i.e.,  $\frac{\sum_{c_i \in C_i} c_i}{|C_i|}$ ) over all periods. In both graphs, the  $\times$  dots denote the means, and the horizontal lines indicate the theoretical equilibrium benchmarks.

Figure 3 about here

Although price choices converge to a value close to the noncooperative equilibrium benchmark (the mean price in the last period is 7.6), they are always lower. Play was, therefore, mostly out of equilibrium with seller participants being more competitive than predicted by equilibrium theory. Average conjectured prices increase over time too, but they are different from the equilibrium benchmark in all periods.

Table 2 presents some descriptive statistics about the participants' satisficing behavior in each of the 9 experimental periods. The share of participants who immediately choose a satisficing price (i.e., who achieve all their aspirations at first attempt) increases over time. The share of those finally satisficing is above 96% in each period and is rather stable. Over all periods, the percentage of subjects undertaking at least one revision is quite low. Comparing rows iv. and v. reveals that the likelihood of revising depends on whether one chooses a satisficing price at first attempt or not. In particular, the propensity to revise is higher when aspirations cannot be immediately achieved. Finally, row vi. shows that, on average, those who revise engage in one revision (out of 5) in each period.

Table 2 about here

That people have difficulties in complying with prior-free optimality is shown in Table 3, which presents (i) the percentage of subjects who set a price that cannot be rationalized by any probability distribution over  $C_i$  (type 1-deviation from prior-free optimality), (ii) the percentage of subjects who choose a rationalizable price, but specify too moderate aspiration profiles (type 2-deviation from prior-free optimality), (iii) the percentage of subjects who meet both conditions for prior-free optimality, and (iv) for the satisficing subjects exhibiting a type 2- (but not a type 1-) deviation, the average unexhausted profit potential relative to the attainable profits, defined as  $\frac{\sum_{c_i \in C_i} [\pi_i(p_i, c_i) - A_i(c_i)] / \pi_i(p_i, c_i)}{|C_i|}$ .

[Table 3 about here](#)

Most seller participants fall within the type 1-deviation category in each of the 9 periods, even though the percentage of non rationalizable prices significantly decreases over time. The percentage of type 2-deviations done by those who state a rationalizable price ranges from 22.22% in period 1 to 33.33% in period 9. At the outset of the experiment, only 3.70% of the participants meet the two conditions for prior-free optimality, and this percentage increases to 11.11% in period 9. Finally, the average relative unexhausted profit potential of those who choose a rationalizable price is significantly different from zero in all periods, and it is rather stable over time. Thus, most participants fail to report a rationalizable price, and the decline in type 1-deviations does not lead to an increase in prior-free optimal choices because type 2-deviations become more frequent over time.

## 5. Conclusions

When applied to strategic games, satisficing depends on what one expects about the competitors' behavior. Therefore, to define satisficing in finite  $n$ -person games, we require player  $i$  to specify a set-valued conjecture about the others' strategy constellations, and to form a payoff aspiration for each element in her conjecture. Player  $i$  is then said to follow a satisficing mode of behavior if the strategy she chooses is satisficing in the sense that, for each element in her conjecture, the resulting payoff is not lower than the corresponding aspiration.

We adopt a non-probabilistic approach to strategic interaction, i.e., we do not require a player to attach probabilities to the various elements in her conjecture. This allows us to test optimality in a more basic sense than that required by expected utility maximization. More specifically, a feasible aspiration profile is said to be prior-free optimal if it is impossible to find another feasible aspiration profile that, for at least one conjecture, allows for a payoff improvement.

With the help of data from two oligopoly experiments it has been explored

(i) whether seller participants specify a satisficing strategy, (ii) what is mostly revised by participants (conjectures, aspirations, or sales choices) when their strategy is not satisficing, (iii) whether participants go on with satisficing after becoming aware of it, and (iv) whether they comply with prior-free optimality.

So far the results are partly encouraging. The overwhelming majority of subjects adapts profit-aspirations until they can be met. Most participants voluntarily maintain satisficing after having been familiarized with the concept, thereby revealing some absorbability of the satisficing approach. The percentage of seller participants who satisfice at the end of each period is always very high. However, many satisficing participants specify a too moderate aspiration profile: they forego some of the profits they could aspire to given their chosen price and their conjectured prices. While in the first experiment (Berninghaus et al., 2006), this may be due to “safe” play by the participants, who wanted to guarantee themselves a positive outcome in case of payment based on aspirations, we are rather confident that this argument lacks relevance in the second study (Güth et al., 2008b). In order to improve their chance of earning money, participants in this second experiment could report several conjectures and aspirations without having to forego profits resulting from their conjectured prices. The claim that, in this setting, participants did not play “safe” is supported by the observation that the increase in the number of conjectured prices is associated with a decrease in the dispersion of conjectures and aspirations. Finally, many participants have great difficulties to generate prior-free optimal choices: overall, only 9.19% of the seller participants meet the conditions for prior-free optimality in experiment 2.

To conclude, our primary goals here were to generalize the concept of satisficing to strategic environments and to document some relevant experimental evidence on satisficing in market interaction. Understanding the reasons why satisficing individuals fail to meet prior-free optimality requirements may be an interesting future line of research.



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**Table 1**

Experimental study 1: Descriptive statistics on profits, choices, conjectures and aspiration levels, separately for phase 1 and phase 2

<i>Phase</i>	<i>Variable</i>	Mean	Median	Std. Dev.
1 (period 1–12)	<i>Profit</i>	9.87	9.63	0.95
	$x_{i,1}$	4.06	3.87	0.42
	$x_{i,2}$	8.29	8.14	0.68
	$x_{i,3}$	15.11	15.49	1.08
	$c_{i,1}$	3.67	3.68	0.28
	$c_{i,2}$	7.57	7.55	0.61
	$c_{i,3}$	14.08	14.21	1.14
	$A_{i,1}$	13.94	13.63	1.54
	$A_{i,2}$	55.37	55.77	5.39
	$A_{i,3}$	221.79	220.16	16.09
2 (period 13–24)	<i>Profit</i>	9.80	9.61	1.14
	$x_{i,1}$	4.25	4.10	0.68
	$x_{i,2}$	8.47	8.25	0.91
	$x_{i,3}$	15.74	15.86	1.15
	$c_{i,1}$	3.86	3.86	0.38
	$c_{i,2}$	7.84	7.93	0.83
	$c_{i,3}$	14.53	14.84	1.34
	$A_{i,1}$	21.38	20.51	5.77
	$A_{i,2}$	70.60	67.72	12.13
	$A_{i,3}$	239.87	239.80	28.82

**Table 2**

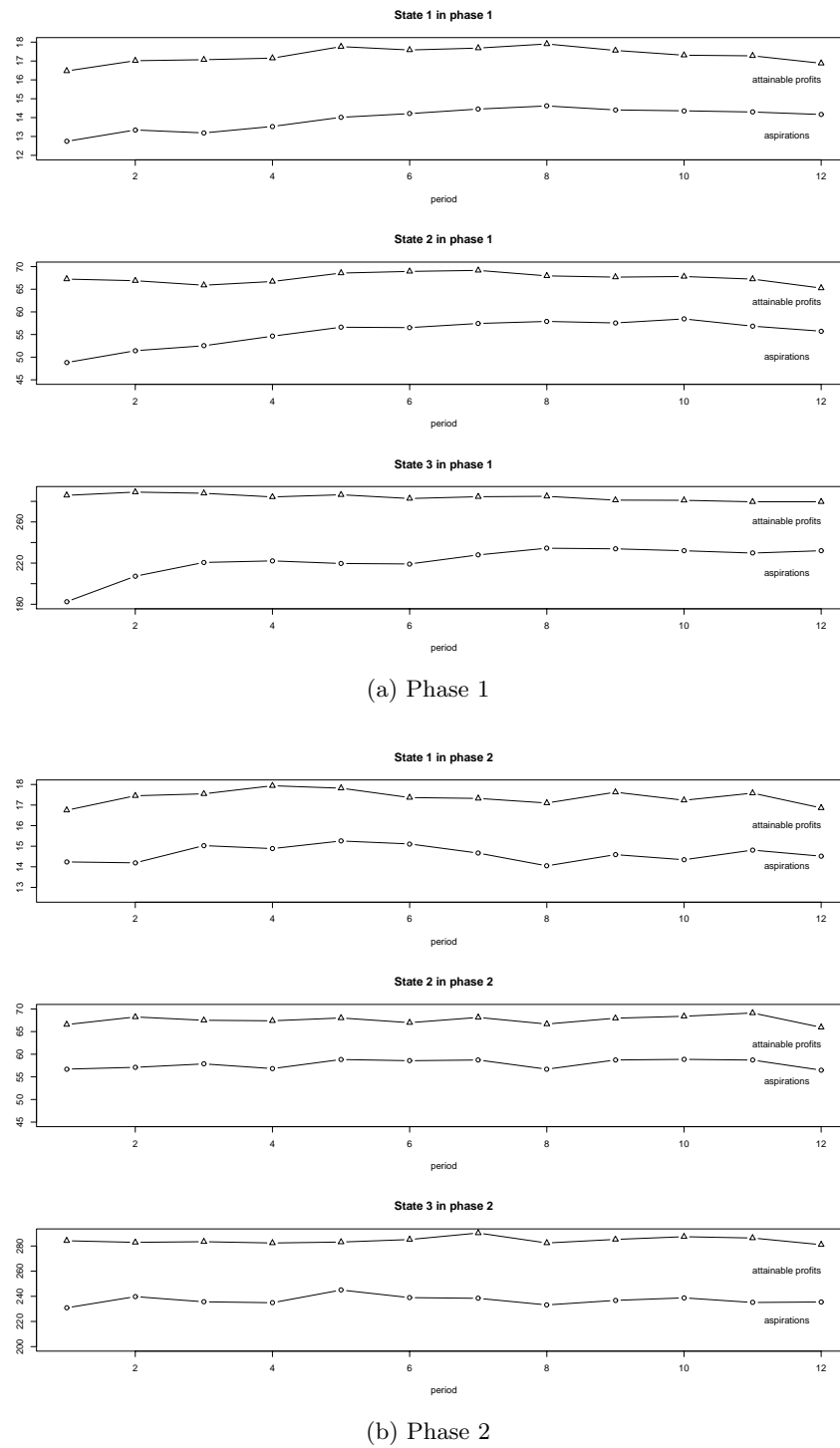
Experimental study 2: Revisions and satisficing behavior

	Period								
	1	2	3	4	5	6	7	8	9
Subjects satisficing at first attempt (%)									
i.	83.95	90.12	93.83	87.65	93.83	93.83	95.06	96.30	97.53
Subjects finally satisficing (%)									
ii.	98.77	96.30	98.77	97.53	98.77	97.53	96.30	97.53	97.53
Subjects revising (%)									
iii.	28.40	24.69	16.05	14.82	11.11	14.82	6.17	4.94	3.70
Subjects revising among those not satisficing at first attempt (%)									
iv.	92.31	100.00	100.00	90.00	100.00	80.00	50.00	66.67	0.00
Subjects revising among those satisficing at first attempt (%)									
v.	16.18	16.44	10.53	4.23	5.26	10.53	3.90	2.56	3.80
Average number of revisions									
vi.	1.22	1.25	1.39	1.25	1.44	1.08	1.60	1.25	1.00

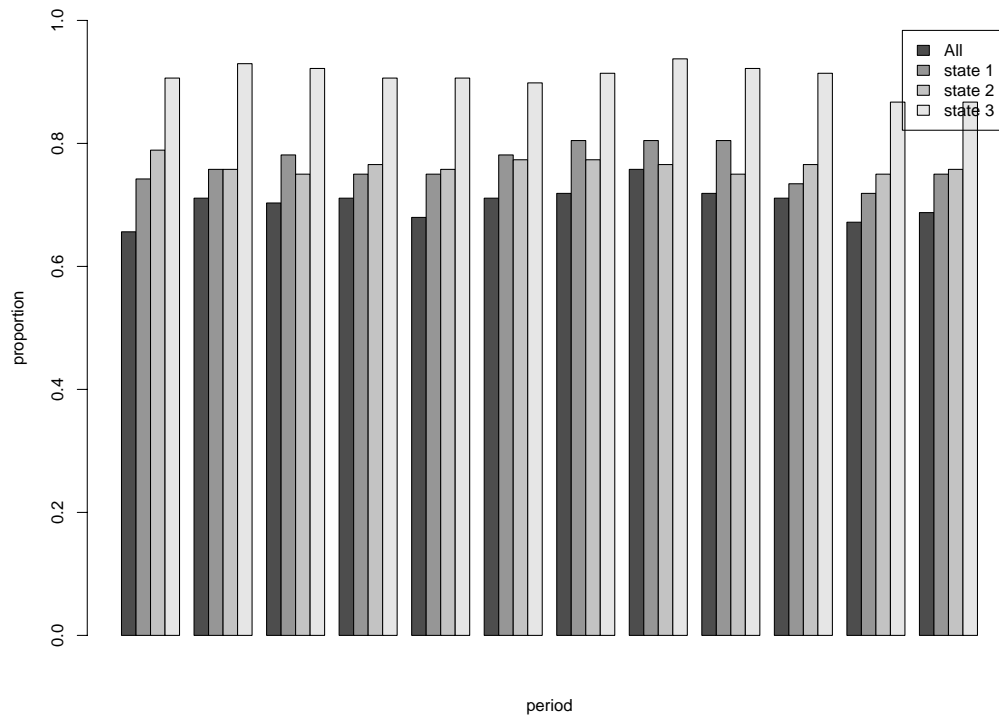
**Table 3**

Experimental study 2: Deviations from and compliance with prior-free optimality

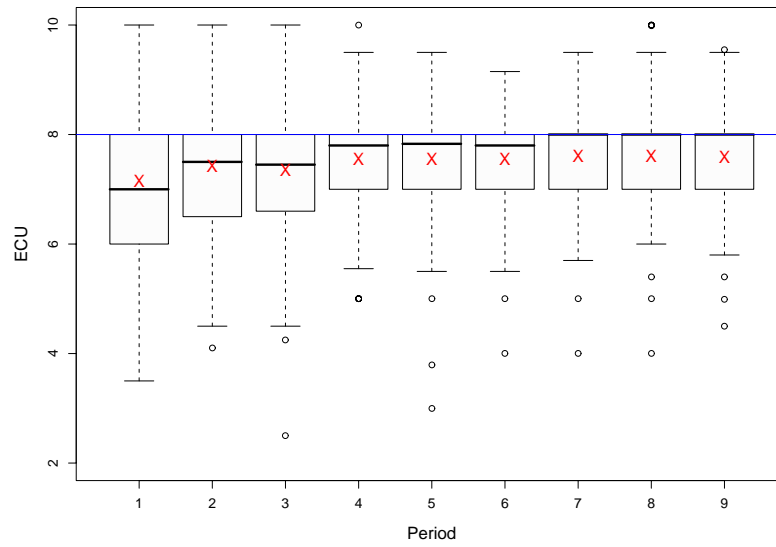
	Period								
	1	2	3	4	5	6	7	8	9
Type 1-deviation (% Subj)									
i.	72.84	62.96	69.14	64.20	61.73	61.73	56.79	56.79	53.09
Type 2-deviation (% Subj)									
ii.	22.22	27.16	23.46	25.93	25.93	23.46	27.16	28.40	33.33
Prior-free optimality (% Subj)									
iii.	3.70	6.17	6.17	7.41	11.11	12.35	12.35	12.35	11.11
Average unexhausted profit potential in type 2-deviations									
iv.	5.50	4.70	3.60	4.30	5.60	5.70	4.50	4.30	4.00



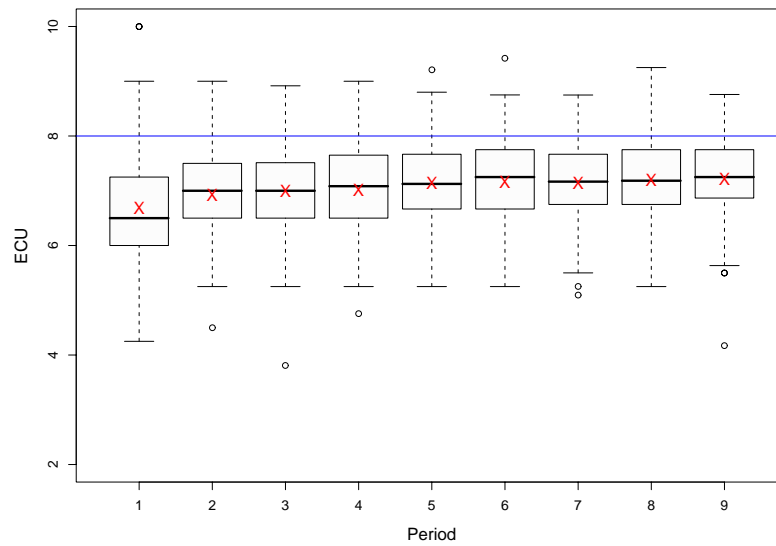
**Fig. 1.** Experimental study 1: Average aspirations and average attainable profits in each state of nature, separately for phase 1 and phase 2.



**Fig. 2.** Experimental study 1: Frequency of observations complying with satisficing for all states and separately for each state in every period of phase 2.



(a) Stated prices



(b) Average conjectured prices

**Fig. 3.** Experimental study 2: Distribution of stated prices and average conjectured prices.