Sound the charge! – A currency attack game with limited communication*

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Abstract

The article presents the results of an experiment implementing a currency attack game modeled as a *global game:* Subjects receive only private, noisy signals on the state of the economy (which is a parameter of the payoff function). In addition to previous experiments, candidates were able to exchange recommendations before making a decision. It can be shown that recommendations—although used strategically—improve both coordination and overall predictability, while predictability is diluted for intermediate states of the economy.

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1. Introduction

As coordination games exhibit several Nash-equilibria it is hard to predict which one will actually be chosen; self-fulfilling prophecies may occur. However, if the payoff function depends on a variable that is not common knowledge a unique solution can be obtained if the players get private, noisy signals concerning this variable's unknown value. Such games are referred to as *global games* (Carlsson & van Damme, 1993, p. 989).

An important economic example for coordination games are so-called *speculative attacks:* Speculators bet against a currency peg; their success depends on the total number of speculators who sell the currency. It depends on the structure of the model if self-fulfilling prophecies occur. Obstfeld (1996) presents a model in which exchange-rate crises can be caused by several self-reinforcing mechanisms. However, from a political point of view, the possible emergence of self-fulfilling prophecies is highly undesirable for it implicates that currency crises are unforeseeable.

Morris/Shin (1998) show that if the speculative attack game is modeled as a global game it is possible to obtain a unique theoretical threshold (for the state of the economy) such that all players who get signals above that threshold attack (i. e. short-sell the currency), while all players who get signals below don't attack.[1] Given this insight the recommendation for central banks would be *not to release* information concerning the state of the economy but to reduce the market participants' knowledge to private noisy signals in order to avoid self-fulfilling prophecies. There is, however, little experimental evidence for the theoretical prediction: Performing experiments with both information conditions, Heinemann/Nagel/Ockenfels (2004) were not able to find any name-worthy differences between public and private information concerning the predictability of results. One reason might be that public information does not create so-called *higher-order beliefs*, i. e. public information does not become public knowledge (Heinemann et al., 2004, p. 1584): Although all participants are informed about the economy's state they might fail to reason that this knowledge is now available to everybody and that all participants know about that fact. However, this result may also be driven by the experimental design: Participants were not allowed to communicate. It cannot be precluded, however, that in reality communication indeed may be an important factor to boost common expectations and therefore to induce self-fulfilling prophecies.

This article presents the results of an experiment similar to the one performed by Heinemann et al. (2004). However, in an additional treatment participants were able to give a *recommendation* to the other subjects before making their actual decisions. It can be shown that overall predict-

[1]It depends on the structure of the model, however, whether players attack for higher or lower signals given a certain threshold. In the model presented by Morris/Shin (1998) players only attack for *lower* signals.

ability improves slightly, while coordination improves considerably. For intermediate values of the unknown variable predictability is diluted by recommendations: There is limited evidence for self-fulfilling prophecies to occur even in private information condition.

The currency attack model and its parameters will be presented in the next section. Section three describes the implementation of the experiment; the main findings are presented in section four, while section five concludes.

2. Model and experimental specifications

The phrase "speculative attack" refers to a situation in which market participants short-sell a currency in order to force the central bank to abandon a currency peg. If they succeed they collect the difference between the official exchange rate and the shadow rate, while facing opportunity costs T. This difference—denoted by Y—is the bigger, the worse the state of the economy is. The number of attackers that are needed in order to force the central bank to devaluate also depends on the state of the economy. If the state of the economy is rather bad—and hence Y is high—the central bank has to devaluate the currency anyway and it is rational for all traders to attack. However, if Y is very low the potential benefit from attacking would not cover the transaction costs and thus it is rational for all investors not to attack. If Y is somewhere in between, success depends on the number of attacking agents: At least $\lceil a(Y) \rceil$ out of n agents need to attack, where $\lceil \cdot \rceil$ denotes the ceiling function. In private information condition investors don't know the exact value of Y but get private signals that are uniformly distributed on $[Y - \epsilon, Y + \epsilon]$ (Heinemann et al., 2004, pp. 1585–1586). Below, T is interpreted as payoff from not attacking (referred to as choosing action A); attacking is referred to as choosing action B. Parameters are specified as follows:

- $Y \sim \mathcal{U}(10, 90)$
- $x_i \sim \mathcal{U}(Y - 10, Y + 10)$
- $T = 40$
- $n = 8$
- $a(Y) = 10 - \frac{Y}{8}$

Figure 1 shows the number of players that at least need to choose action B in order to be successful given the parameters specified above.

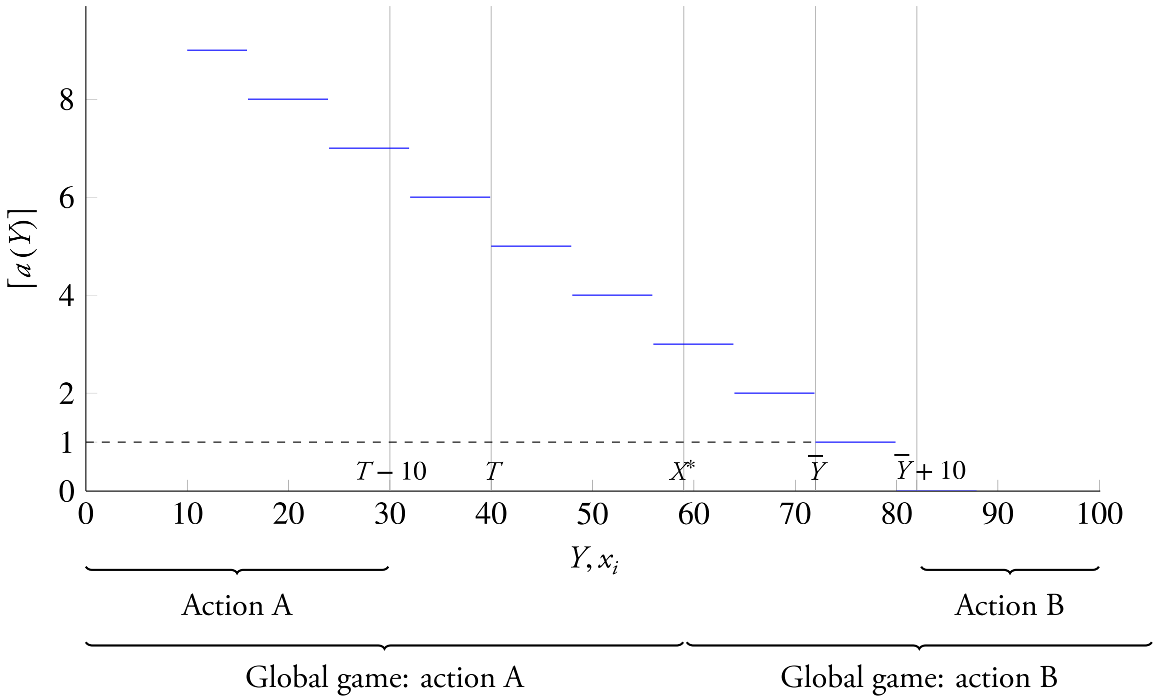

Figure 1: *Number of players $\lceil a(Y) \rceil$ that at least need to choose action B in order to be successful.*

As $x_i \sim \mathcal{U}(Y - 10, Y + 10)$ players who receive private signals $x_i \leq 30$ know for sure that $Y \leq 40$. I. e, even if action B should be successful its payoff Y would be less than the secure payoff T. Hence, if $x_i \leq 30$ action A should be chosen anyway. If $Y = \overline{Y} := a^{-1}(1)$ action B is successful if at least one player chooses B. If $x_i \geq \overline{Y} + 10 = 82$ player i knows for sure that $Y \geq \overline{Y}$ and, hence, that action B will be successful in any case. Choosing B is then a strictly dominant strategy. Choice of A for $x_i \leq 30$ and choice of B for $x_i \geq 82$ will be referred to as usage of undominated thresholds in section 4.

In case of public information there exist two Nash-equilibria for $T < Y < \overline{Y}$: Either all players attack or no one attacks. If players only receive private signals, however, it is possible to derive a so-called global game threshold X^* such that expected utility from an attack at $x_i = X^*$ equates the secure alternative T. Then all players who receive signals greater than X^* will attack. Given Y, the probability that a *single* player receives a signal of at least X^* is given by

$$P(x_i \geq X^*) = 1 - F(X^*) = \frac{Y - X^* + \epsilon}{2\epsilon}$$

Given the probability of success in *one* trial, p, the probability of getting k successes in n trials is given by the binomial distribution $\text{Bin}(k, n, p)$. The probability that at least $\lceil a(Y) \rceil$ out of n

players receive signals $\geq X^*$ is then given by

$$P(\text{number of attackers} \geq \lceil a(Y) \rceil - 1) = 1 - \text{Bin}\left(\lceil a(Y) \rceil - 2, n-1, \frac{Y - X^* + \epsilon}{2\epsilon}\right)$$

where Bin(·) denotes the cumulative distribution function of the binomial distribution. Expected utility from an attack, given a signal X^*, is then given by the LHS of equation (1).

$$EU(X^*) = \frac{1}{2\epsilon} \int_{X^*-\epsilon}^{X^*+\epsilon} Y\left[1 - \text{Bin}\left(\lceil a(Y) \rceil - 2, n-1, \frac{Y - X^* + \epsilon}{2\epsilon}\right)\right] \, dY \overset{!}{=} T \qquad (1)$$

Applying the parameters stated above the global game equilibrium is given by $X^* \approx 59.05$. All players who receive private signals $x_i < 59.05$ should choose action A, while players who receive private signals $x_i > 59.05$ should choose action B.

The experimental setup allows candidates to give a recommendation to the other players after having received their private signals. As these recommendations are somehow "cheap talk", there is no explicit theoretical prediction what strategy to recommend conditional on x_i. There are three hypotheses concerning the effect of recommendations.

Hypothesis 1 *Recommendations improve coordination within a group.* For example, given a group's threshold is 45,[2] if player i receives a signal $x_i = 50$, while $Y = 40$, a majority of A-recommendations could prevent him from making the "wrong" decision.

Hypothesis 2 *Recommendations deteriorate the predictability of results.* Without recommendations, for example, given a group's threshold is 50 and $Y = 50$, 49 % of the candidates might get signals below 50 and don't attack, while 51 % get signals above and attack—or vice versa, depending on chance. However, if 49 % give recommendations for A and 51 % recommend B, it seems reasonable to assume that in the next step 100 % will choose B—or vice versa. So without recommendations there are either 51 % B-decisions or 49 % B-decisions, depending on chance—there is no big difference. In contrast, with recommendations there are either 100 % B-decisions or 0 % B-decisions, depending on chance—the true outcome is then not at all predictable.

Hypothesis 3 *Recommendations are used strategically.* Players could benefit from recommending B because a majority of B-recommendations could motivate other candidates to actually choose B even if their signals are below their personal threshold. In some situations, given values of Y close

[2]Experimental results show that the groups' mean threshold is close to 45; see section 4.

to the group's mean threshold, voting excessively for B could help to beat the hurdle function $a(Y)$ afterwards. Hence, there might be a strategic incentive to recommend B if one's own signal is close to or even below the personal threshold.

3. Experimental design

The experiment was programmed and conducted with the software z-Tree (Fischbacher, 2007). Candidates could only see their own screen; they were not allowed allowed to talk. At the beginning of the experiments candidates were shown some general instructions on their screens. These instructions were read out, as well.[3] Afterwards, they had to answer some questions that were of importance for Lechner's (2013) experiment that was conducted in the second half of the sessions.[4] Subjects were then shown instructions for the global game-experiment. After everyone had read the instructions through the first of ten rounds started.

In *baseline* sessions subjects had to choose between action A—generating a secure payoff of 40—and action B—generating a payoff of Y if at least $\lceil 10 - \frac{Y}{8} \rceil$ out of the 8 group members choose B (zero, else).[5] Candidates were not informed about the true value of Y. Instead they received private hint-numbers x_i. Subjects knew that Y and x_i were independently and uniformly distributed on $[10, 90]$ and $[Y - 10, Y + 10]$, respectively.[6]

In *treatment* sessions subjects were able to provide the other players within their group with a recommendation whether to choose action A or B. Before they were to meet their actual decisions, all subjects were shown the total number of votes for A and B within their respective group.

In both *baseline* and *treatment* sessions candidates were informed about the unknown number Y, the number of players who decided for B and their own payoff at the end of every round.

As soon as all ten rounds were completed the second experiment started. At the end of the sessions subjects were asked to complete a questionnaire concerning their degree programme, age and gender, among other questions that were of relevance for the second experiment.

Candidates' attention was called to the experiments by posters and promotion at the beginning of lectures. Most candidates were acquired at the beginning of the sessions spontaneously. As an allowance participants were offered sweets and pastries. In addition, candidates were offered to

[3] All instructions, questionnaires and decision screens of the experiment can be found in the appendix.

[4] The experiment conducted by Lechner (2013) was aimed at unveiling the relationship between religiosity and behaviour in a trust game. As it concerned social preferences whereas the currency-attack game focused solely on coordination, it can be assumed that subjects' behaviour was not affected alternately.

[5] In order to avoid behavioural biases words like "speculative" or "attack" were not used.

[6] Values for Y and x_i for all ten rounds and all 8 players were randomly drawn ex ante. The same values were used for all sessions in order to ensure comparability, given the low number of sessions.

leave their e-mail addresses in order to get the results of the experiments, which about half of them did. They were not paid off with real money, however.

A total of twelve sessions were carried out in a computer room at the University of Passau, six of them on 10th and 12th of december 2012, respectively. The total number of participants is 140. 74 of them studied at the faculty of philosophy, 40 studied at the faculty of economics, 18 were students at the faculty of law, 6 studied at the faculty of computer science and mathematics and 2 candidates claimed not to study at any of the named faculties. Table 1 gives an overview over date, starting time and type of the sessions.[7]

			Number of candidates	
Session ID	Date	Starting time	Treatment	Baseline
T1	10.12.	09.00	8	–
T2	10.12.	11.00	12	–
T3	10.12.	12.00	12	–
B1	10.12.	13.00	–	12
B2	10.12.	15.00	–	12
B3	10.12.	17.00	–	12
T4	12.12.	11.00	12	–
T5	12.12.	12.00	12	–
B4	12.12.	13.00	–	12
T6	12.12.	15.00	12	–
B5	12.12.	16.00	–	12
T7	12.12.	17.00	12	–
Total number of candidates			80	60

Table 1: *Date, starting time and type of the sessions.*

[7]In order to get data of 12 subjects although the group size is fixed to 8 the following procedure was carried out: Subjects 1–8 played regularly in group one. The decisions and recommendations of subjects 5–8 were copied to group two. Hence, group two consisted of the copied decisions and recommendations of subjects 5–8 plus the "real" subjects 9–12 who thus virtually played in a group of 8 as well. For analysis purposes the 12 subjects were considered as one group.

Subjects 9–12 of session T1 could not participate due to technical problems. The data of subjects 13–16 of session B2 cannot not be used for analysis due to a software bug that might have biased their decisions.

4. Results

4.1. Undominated strategies

Subjects use undominated strategies if they choose A for $x_i \leq 30$ and B for $x_i \geq 82$ (see section 2). On average, 97.8 % of all strategies are undominated. 98.8 % of all strategies played in treatment sessions are undominated whereas 96.5 % of all strategies played in baseline sessions are undominated. Although both numbers appear to be very high, the count of dominated strategies used in baseline sessions is about 100 % higher than in treatment sessions—not even accounting for the fact that the number of treatment observations is 800 whereas the number of baseline observations is only 600. Obviously, recommendations serve as a corrective to the usage of dominated strategies.

4.2. Estimation of thresholds

Following Heinemann et al. (2004, p. 1589), I assume that subjects use thresholds to meet their decisions, for this is a very intuitive concept on how to match different signals x_i to actions A or B. Logistic regressions are used to estimate the distribution of thresholds, with the signal x_i being the independent variable.

The logit model is given by

$$\log\left[\frac{P(B)}{1-P(B)}\right] = \beta_0 + \beta_1 x\,. \tag{2}$$

After rearranging equation (2) the probability for a choice of B is given by

$$\text{Prob}\,(B) = \frac{\exp\,(\beta_0 + \beta_1 x)}{1 + \exp\,(\beta_0 + \beta_1 x)}$$

(Liao, 1994, p. 12). Remodeling gives the cumulative distribution function of the logistic distribution

$$\text{Prob}\,(B) = \frac{1}{1 + \exp\left(a - bx\right)} \tag{3}$$

where $a = -\beta_0$ and $b = \beta_1$. It can be interpreted in two ways: Either as estimated probability for a choice of B given a signal x or as estimated distribution of individual thresholds. $\mu = a/b$ is the mean of the distribution. It will be interpreted as the mean threshold within a group. The standard deviation is given by $\sigma = \pi/(b\sqrt{3})$. It shows how much individual thresholds vary within a group and is therefore interpreted as a measure of coordination (Heinemann et al., 2004, p. 1590).

Logistic regressions were performed for all sessions. Table 2 gives an overview over the mean of estimated thresholds and mean of estimated standard deviations within the sessions as well as the standard deviation of estimated thresholds across the sessions.[8] The results are explained in the sections below.

	BD	TD	TR	TR_{1-5}	TR_{6-10}
Mean estimated μ	47.36	44.67	40.83	42.94	38.71
Mean estimated σ	18.35	10.57	19.71	13.76	23.24
Standard deviation of estimated μ across sessions	5.78	4.30	4.61	4.99	5.58
Number of sessions	5	7	7	7	7
Global game threshold X^*	59.05	59.05			

Table 2: *Overview of mean estimated μ and σ and standard deviation of estimated μ. BD $\triangleq$ baseline decision, TD $\triangleq$ treatment decision, TR $\triangleq$ treatment recommendation, TR_{1-5} $\triangleq$ treatment recommendation, rounds 1–5 and TR_{6-10} $\triangleq$ treatment recommendation, rounds 6–10.*

4.3. Threshold level

Mean estimated thresholds for both baseline and treatment decisions are clearly below the global game threshold. A one-sided Mann-Whitney U test indicates that μ_{BD} is below the global game equilibrium at a 5 % significance level (p=0.0313). This result is in line with Heinemann et al. (2004, p. 1591) who find that estimated thresholds are below the global game solution for high values of T.[9] The mean estimated threshold of treatment sessions μ_{TD} is below the global game threshold at a 1 % significance level (p=0.007).

However, there is no statistically significant difference between mean estimated thresholds of baseline and treatment sessions. Hence, (limited) communication in form of recommendation does not increase the probability of action B. This is interpreted in the way that communication of traders with private information on the state of the economy does not account for more currency attacks to take place.

[8] Results of all logistic regressions can be found in appendix B.

[9] However, it cannot be precluded that the effect may also (at least partially) be due to the fact that subjects were not paid off in real money, which may have caused them to be less risk avers.

4.4. Coordination

Figure 2 shows the mean estimated distributions of individual thresholds for treatment and baseline sessions or, alternatively, the individual probability for choosing/ recommending B given x.

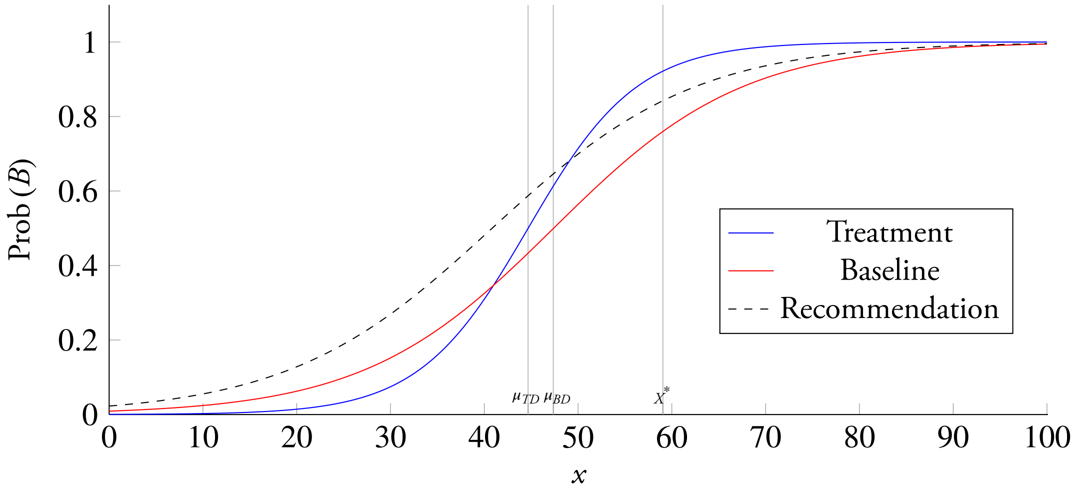

FIGURE 2: *Estimated distributions of individual thresholds (or probabilities for choice of B/ recommendation for B given x) for treatment and baseline.*

The estimated standard deviation of baseline sessions (red) is clearly greater than the estimated standard deviation of treatment sessions (blue). I. e., in treatment sessions subjects are more successful in agreeing on a common switching point. This difference is statistically significant at a 5 % level (p=0.0368), giving support for hypothesis 1: recommendations improve subjects' coordination. The interpretation is that traders who communicate are more likely to be successful in attacking a currency peg. It seems important to note that Heinemann et al. (2004, p. 1593) found coordination to be better in case of public information which might be seen as an argument for central banks not to release relevant information publicly. This experiment shows, however, that (limited) communication—which I assume to take place among traders in reality as well—can improve coordination also. Limiting information to private signals thus might not help to deteriorate traders' coordination, for the effect may be outweighted by communication.

4.5. Predictability

Table 2 also shows the standard deviation of estimated thresholds across the sessions, which is interpreted as predictability of results (Heinemann et al., 2004, p. 1593). In conflict with hypothesis 2, predictability is better for treatment sessions. However, the deteriorating effect of recommendations suggested in hypothesis 2 is expected to occur only for values of Y that are close to the mean threshold of a group. It may be suspected that the coordinating effect of recommendations leads to better predictability regarding the whole range of Y, while the presumed predictability-diluting effect may only be visible if the analysis is restricted to "critical" Y-values. Table 3 shows the results of logistic regressions considering only observations for $40 \leq Y \leq 60$.

	BD	TD
Mean estimated μ	45.53	44.46
Mean estimated σ	12.19	8.60
Standard deviation of estimated μ across sessions	3.45	5.99
Number of sessions	5	7
Global game threshold X^*	59.05	59.05

Table 3: *Overview of mean estimated μ and σ and standard deviation of estimated μ. BD $\triangleq$ baseline decision and TD $\triangleq$ treatment decision.*

Indeed, standard deviation of the estimated thresholds across the treatment sessions increases by 74 % compared to baseline sessions. Hence, there is limited support for hypothesis 2: Recommendations dilute predictability only if the unknown variable Y is close to the group's threshold, while overall predictability improves.

The interpretation of this result is that communication among traders might cause unforeseen currency attacks to take place especially if the economy is in some "intermediate" state whereas communication improves predictability if the economy is in either a very bad or a very good shape.

4.6. Strategic usage of recommendations

The mean estimated threshold for giving a recommendation for B is about 8.5 % lower that the mean estimated threshold for an actual decision for B (see table 2 and figure 2, dashed line). This effect is statistically significant at a 10 % level (p=0.0641), giving support to hypothesis 3. Apparently, subjects are more likely to give a recommendation for B (which is non-hazardous) than to actually decide for B (which can lead to monetary losses).

In order to test whether the subjects' behaviour evolves over time logistic regressions were performed for rounds 1–5 and rounds 6–10, separately. Figure 3 illustrates the results.

Regarding rounds 1 to 5 (blue line) there is a rather concrete switching point when to give a recommendation and this switching point is rather high. Considering rounds 6 to 10 (red line),

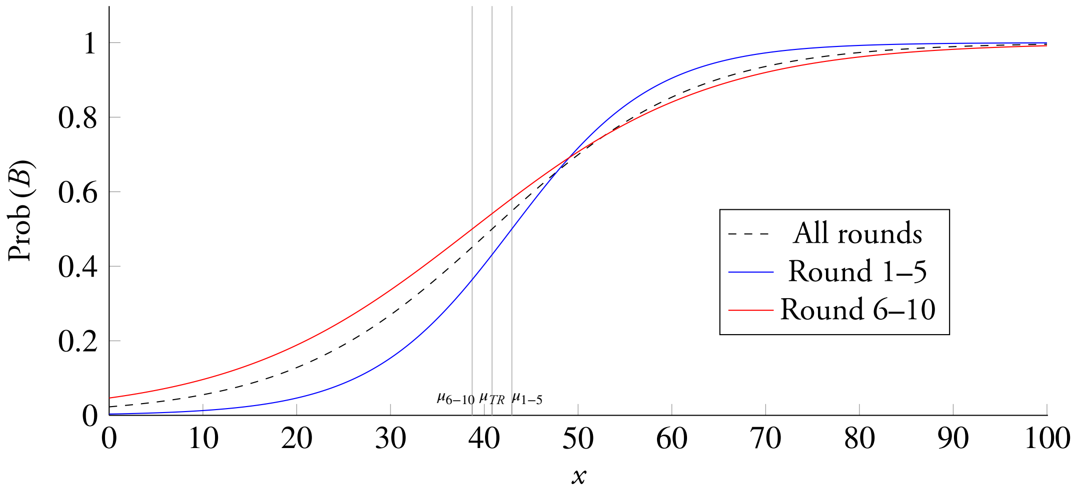

FIGURE 3: *Estimated individual thresholds for recommendation for B (or probabilities for making a recommendation for B given x).*

however, it is hard to constitute a concrete threshold; standard deviation is relatively high and the distribution's mean is lower. A one-sided Mann-Whitney U test indicates that indeed $\mu_{6-10} < \mu_{1-5}$ at a 10 % significance-level (p=0.0825). There is no statistical support for the presumption that $\sigma_{6-10} > \sigma_{1-5}$, however. A reason for the decrease of the recommendation-threshold over time may be that subjects learn how to use recommendations strategically. As some candidates don't learn (or may have some intrinsic motivation to keep honest), while others start to recommend excessively, the standard deviation of estimated thresholds increases—although this effect is not statistically significant.

It is interesting to note, however, that—although misused strategically—recommendations nevertheless did improve coordination. It may be suspected, though, that playing the game over more than 10 periods would deteriorate the coordinating effect of recommendations.

5. Conclusions

Currency attack games are important economic examples of coordination games. As there are several Nash-equilibria, the actual outcome of such games may be driven by self fulfilling prophecies. Several refinement theories offer general solutions—one of them is the theory of global games which requires that certain parameters of the payoff function are not publicly known.

Heinemann et al. (2004) conducted experiments with a parameter of the payoff function being either public or private information, respectively. They show that under public information condition—unlike the theoretical prediction—self fulfilling prophecies don't appear. However, their results may be due to the fact that they didn't incorporate a communication facility in their experimental design.

This article presents the results of a similar experiment with private information in which subjects additionally were to give a recommendation to other players before choosing an option. It can be shown that the possibility to give recommendations improves coordination within the groups, the level of thresholds is however unchanged. This is interpreted as follows: If traders engage in communication the occurrence of a currency attack does not become more likely. However, if a currency attack actually takes place it is more likely to be successful.

Unlike expected beforehand, the possibility to give recommendations does not deteriorate the predictability of results. In the contrary, predictability gets even higher. However, analysis shows that the expected effect is indeed existent: Considering only "critical" values of Y that are close to the group's mean threshold, recommendations dilute predictability. The effect is though not strong enough to outweight the predictability improvement that is due to better coordination in low and high states of the economy. These results indicate that communication among traders might cause currency attacks to be rather unforeseeable if the economy is in some "intermediate" state.

Finally, it can be stated that recommendations are used strategically: subjects are more likely to recommend B than to actually choose this option. This can be due to the fact that recommending B may be helpful to beat the hurdle function in some cases whereas it can never lead to monetary losses. One might think of traders trying to talk each other into short-selling a currency, while actually acting much more conservatively when it matters.

It seems somewhat remarkable that although recommendations were used strategically they nevertheless helped to improve coordination considerably.

A. Instructions, questionnaires and decision screens

A.1. General instructions

Herzliche willkommen zum Experiment und vielen Dank für Ihre Teilnahme.

Ich werde Ihnen kurz einige allgemeine Erläuterungen zum Experiment vorlesen. Erst nachdem Sie diese gehört haben, klicken Sie bitte auf „Experiment starten“.

Die Teilnehmer an dem Experiment befinden sich alle hier im Raum. Alle nehmen am selben Experiment teil. Mit dem Experiment wollen wir Erkenntnisse über menschliches Verhalten gewinnen.

Das Experiment dauert ca. 30 Minuten. Eine Auszahlung der erspielten Gewinne ist leider nicht möglich. Bitte verhalten Sie sich dennoch so, als würden die Gewinne ausbezahlt werden.

Sie spielen anonym und können sich nicht untereinander absprechen. Die von Ihnen getroffenen Entscheidungen sowie die von Ihnen angegebenen Daten können Ihnen nicht zugeordnet werden.

Während des Experiments müssen Sie teilweise auf die anderen Teilnehmer warten. Dies kann auch mal einige Minuten in Anspruch nehmen. Bitte bleiben Sie während dieser Zeit geduldig sitzen. Nutzen Sie die Zeit, um sich ihr Verhalten während des Experimentes zu überlegen.

Alle Anweisungen und Erklärungen finden Sie auf den folgenden Bildschirmseiten. Bitte lesen Sie alle Informationen gründlich durch, bevor Sie einen Bildschirm per Mausklick verlassen.

Sie können einmal verlassene Bildschirme nicht erneut aufrufen.

Bleiben Sie bitte während des Experiments ruhig an Ihrem Arbeitsplatz sitzen. Bitte sprechen Sie von jetzt an nicht mehr miteinander.

Sollten Sie Fragen haben, heben Sie bitte Ihre Hand. Wir kommen dann zu Ihnen.

Klicken Sie jetzt auf „Experiment starten“.

A.2. Questionnarie I

Bitte lesen Sie die folgenden Sätze konzentriert durch und geben Sie anschließend an, ob Sie der jeweiligen Aussage zustimmen oder nicht zustimmen. Klicken Sie bitte anschließend auf „weiter“!

- Nichts ist trauriger als eine Frau, die sich aus anderen Gründen auszieht als für die Liebe.
- Man soll selber keine Rache nehme, sondern Gott das Gericht überlassen.
- Autoverkäufer verkaufen Autos, Versicherungsvertreter Versicherungen. Und Volksvertreter?
- Gott ist die Liebe

A.3. Instructions for the currency attack game

Allgemeine Informationen

Sie sind einer von acht Teilnehmern, die in einer Gruppe miteinander interagieren. Die Regeln sind für alle Teilnehmer gleich. Das Experiment besteht aus 10 unabhängigen Runden; in jeder Runde müssen Sie eine Entscheidung treffen (A oder B). Ihre Gruppe bleibt über die 10 Runden konstant.

Auf den folgenden Seiten wird der Entscheidungsbildschirm anhand eines Beispiels erklärt. Die Erläuterungen dazu werden durch *orange* Schrift gekennzeichnet.

A.4. Instruction-, example- and decision screens

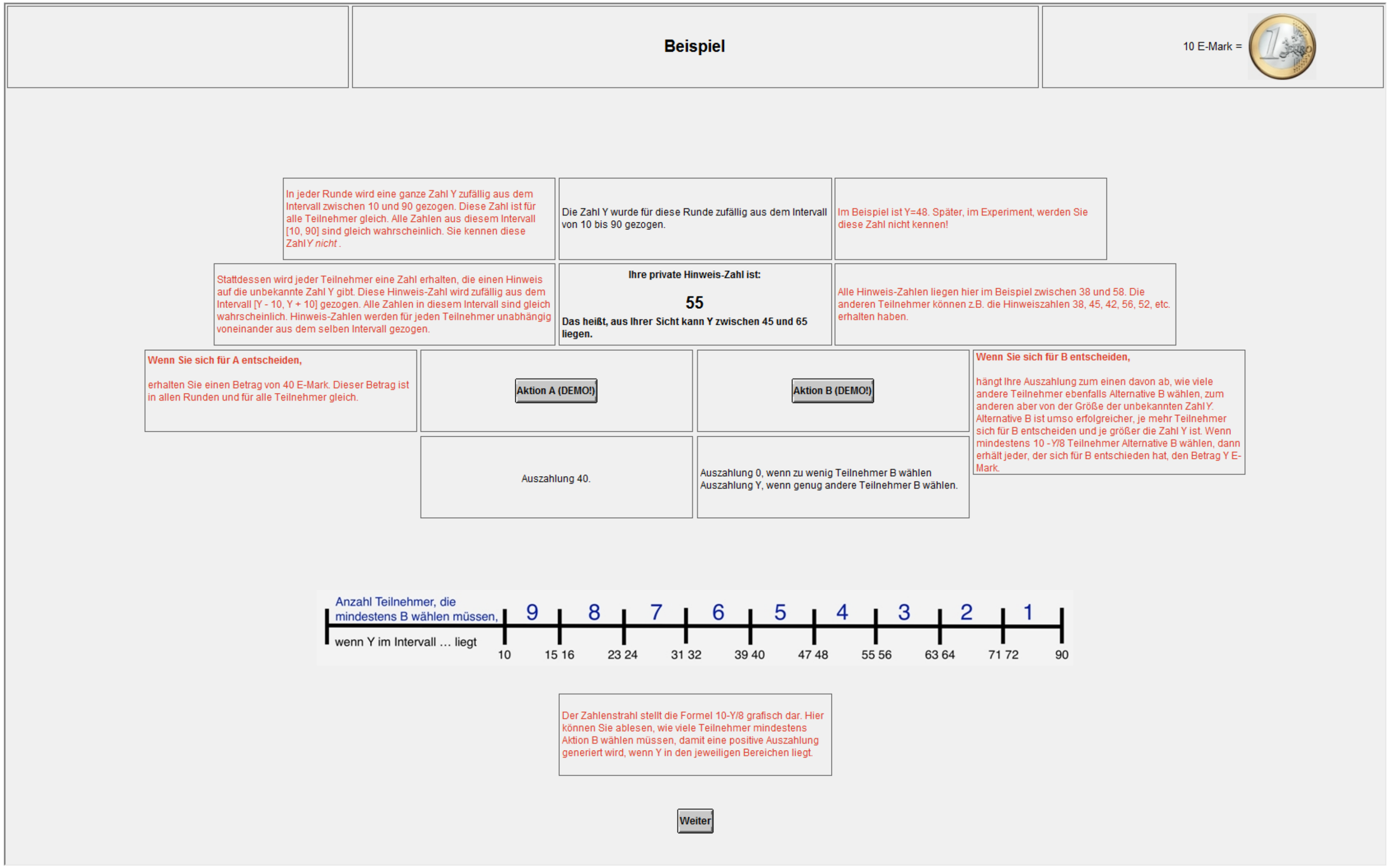

FIGURE 4: *Instruction screen.*

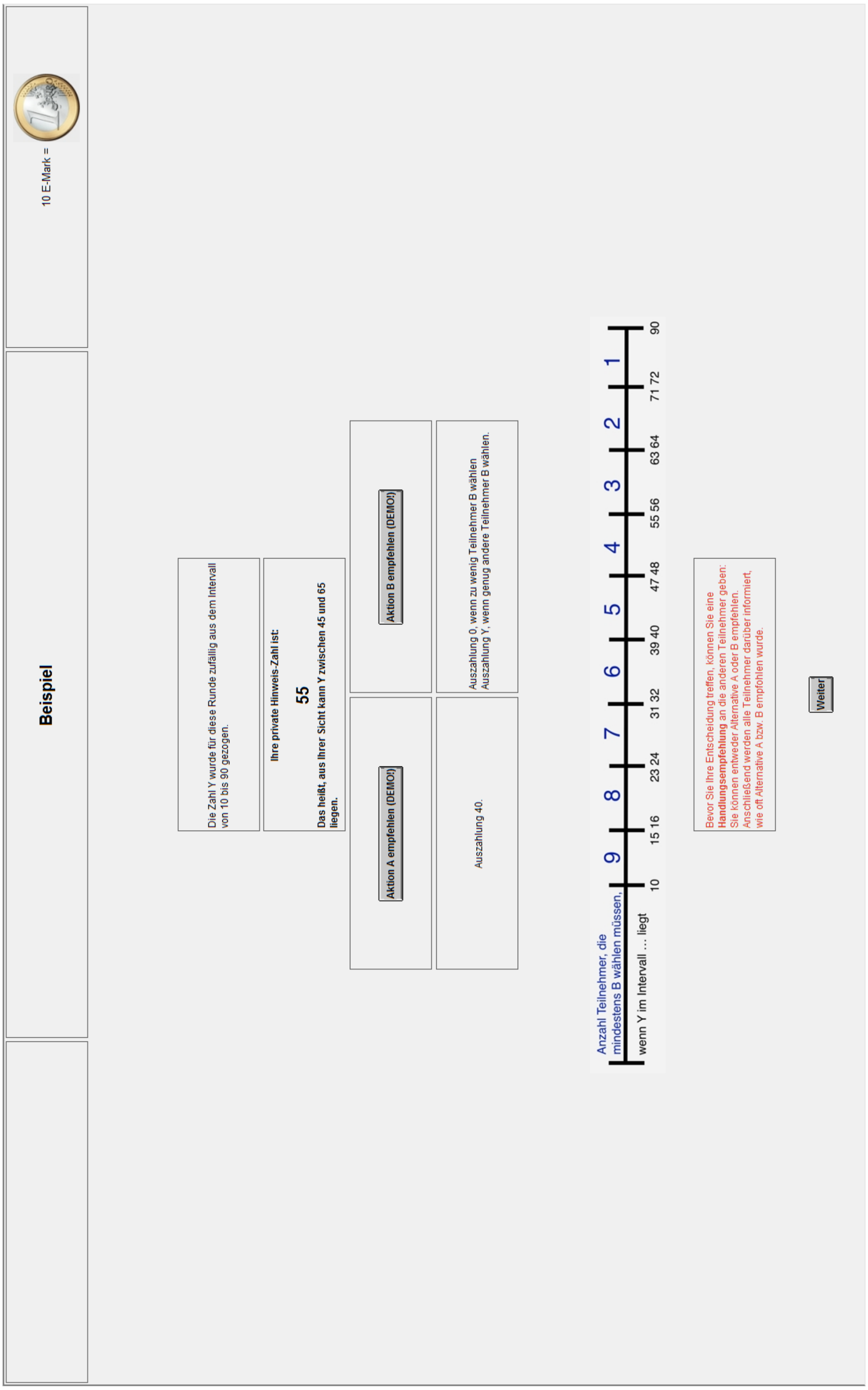

FIGURE 5: *Example screen 1 (recommendation).*

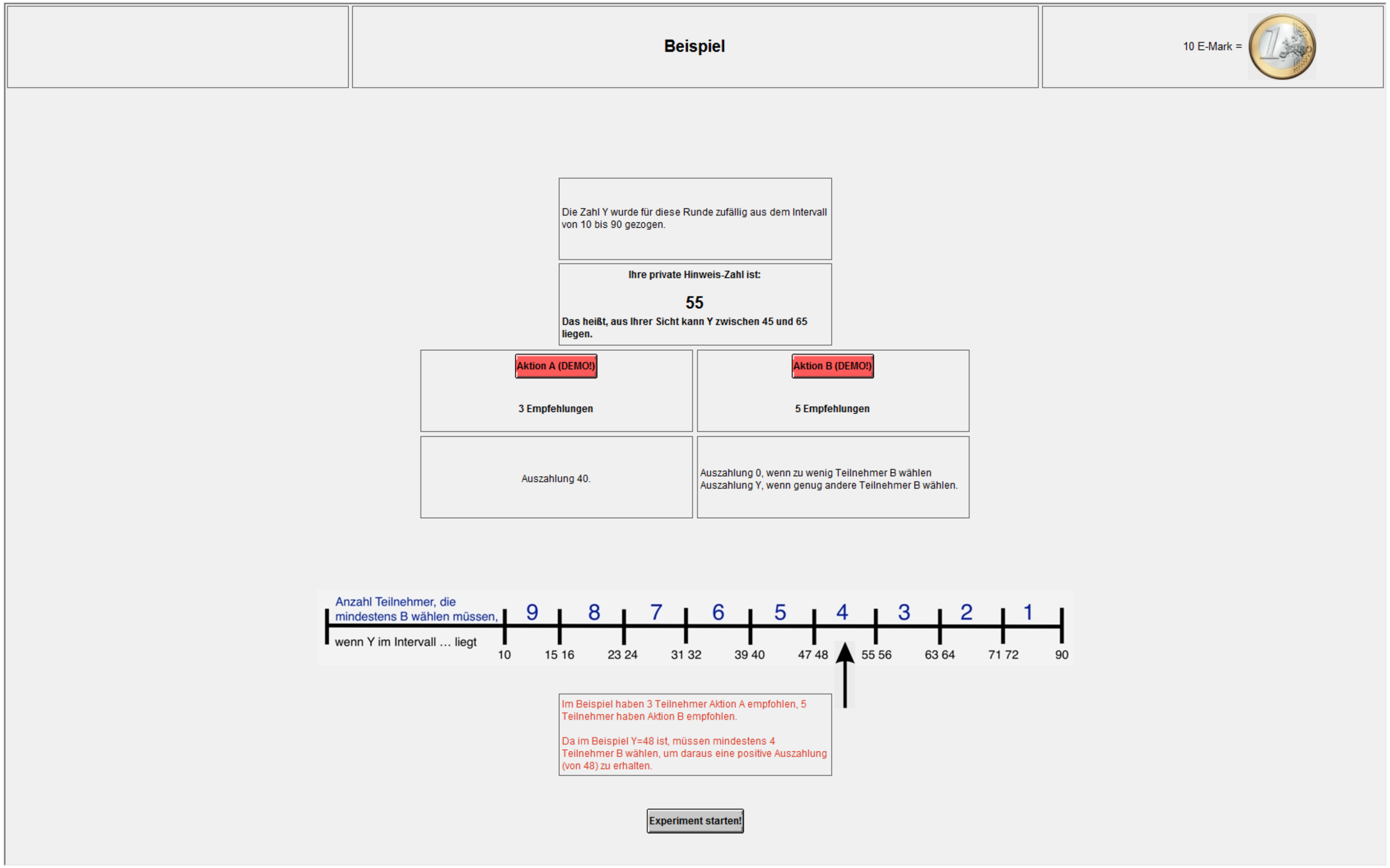

FIGURE 6: *Example screen 2 (actual decision).*

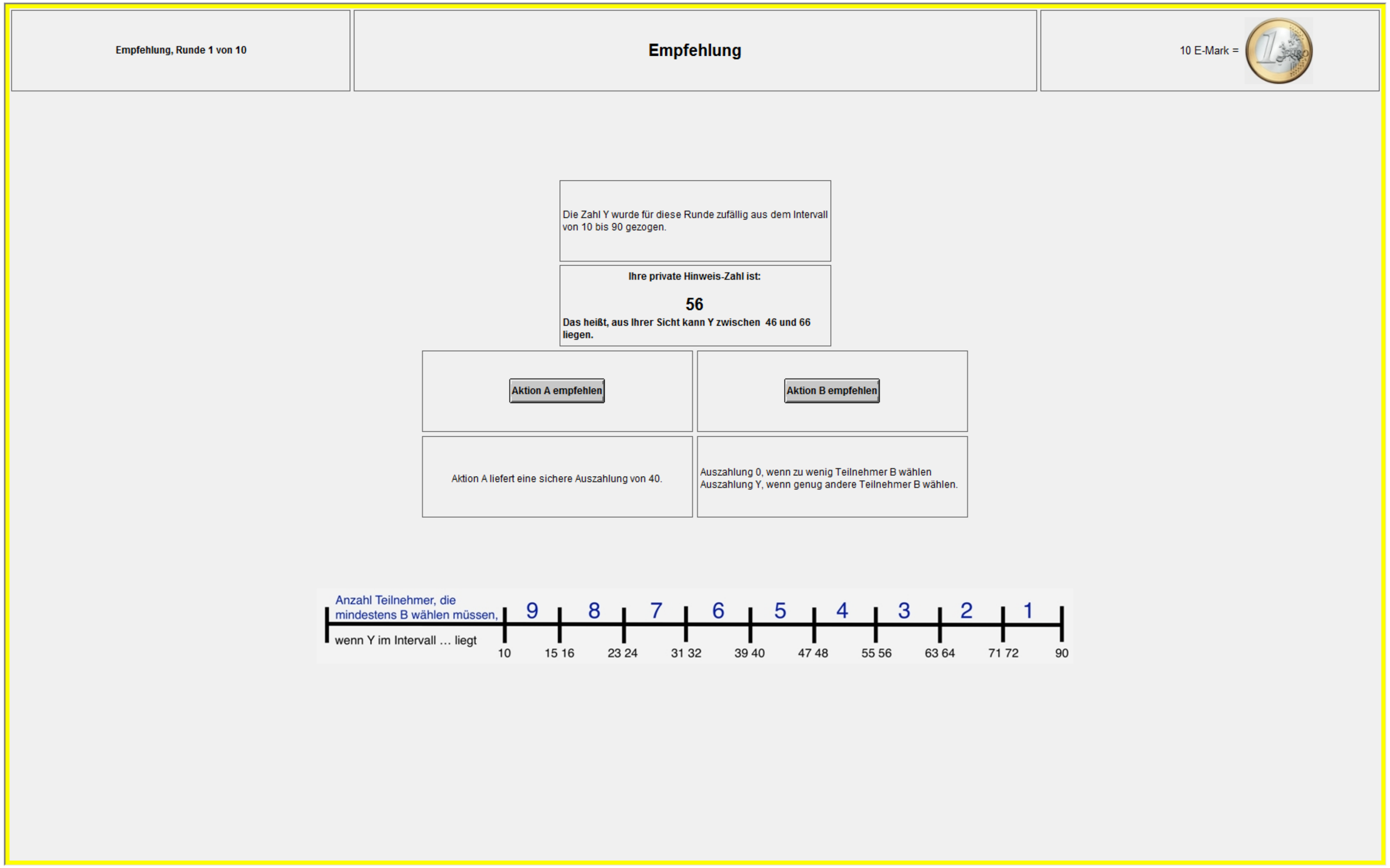

Figure 7: *Decision screen 1 (recommendation).*

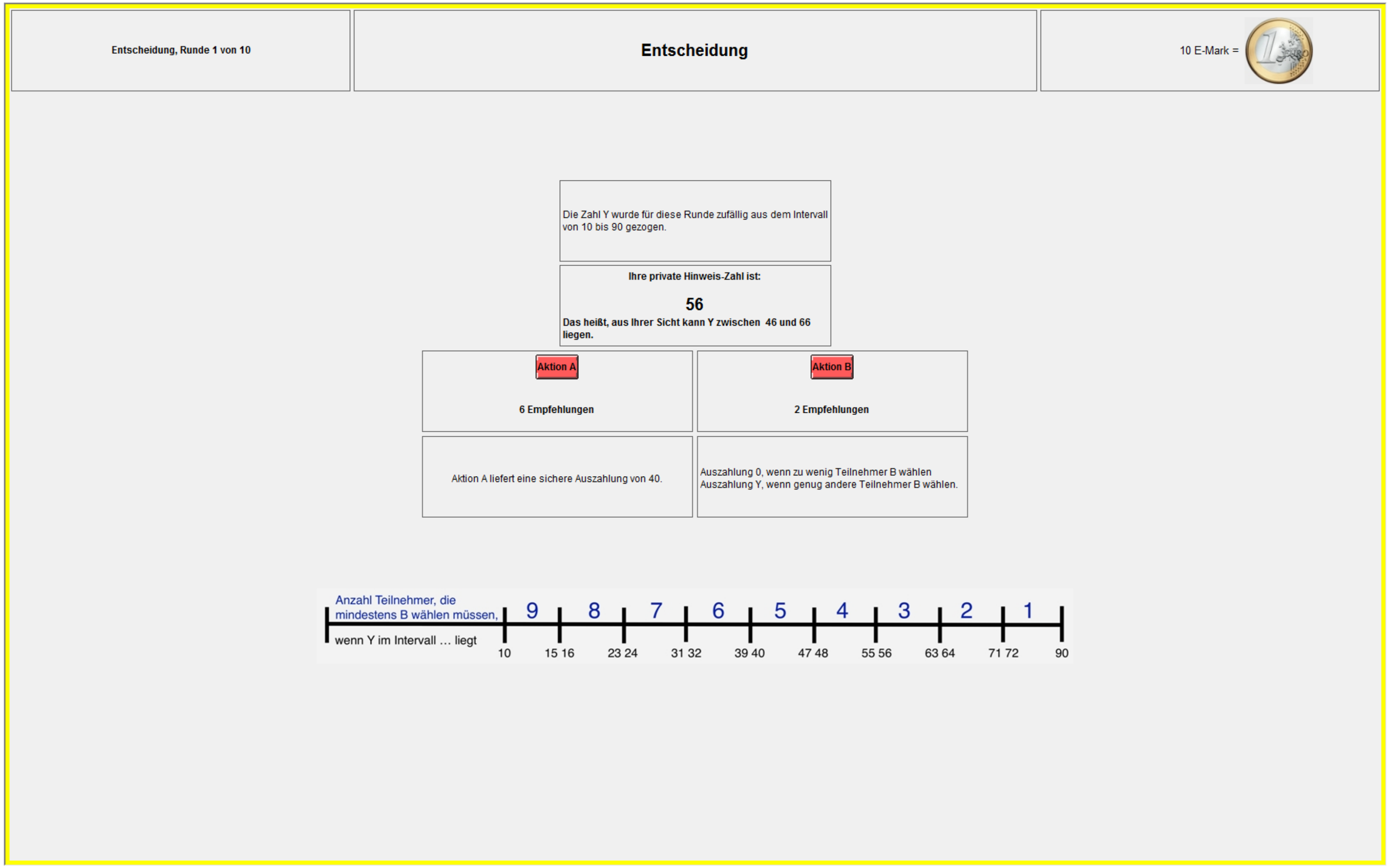

FIGURE 8: *Decision screen 2 (actual decision).*

A.5. Questionnaire II

Bitte beantworten Sie zum Abschluss des Experiments folgende Fragen auf den nächsten zwei Seiten und drücken Sie anschließend auf „absenden“.

Die von Ihnen gemachten Angaben werden vollständig anonym erfasst und ausgewertet!

- Glauben Sie an Gott?
- Gehören Sie einer Religion oder Konfession an?
- Abgesehen von Hochzeiten, Beerdigungen und Taufen, wie häufig besuchen Sie Gottesdienste?
- Abgesehen von Hochzeiten, Beerdigungen und Taufen, wie häufig beten Sie?
- Abgesehen von Hochzeiten, Beerdigungen und Taufen wie häufig lesen Sie in der Bibel (im Koren, in der Thora, etc.)?
- Glauben Sie, dass der Teufel existiert?
- Haben Sie Kenntnisse in Spieltheorie? Wenn ja, um welche Art von Spiel hat es sich bei dem zuvor gespielten Spiel gehandelt?
  - Ja, es handelt sich um ein Ultimatumspiel.
  - Ja, es handelt sich um ein Vertrauensspiel.
  - Ja, es handelt sich um ein Diktatorspiel.
  - Nein, ich habe keine Kenntnisse in Spieltheorie.
- In welcher Fakultät studieren Sie bzw. arbeiten Sie?
- Sind Sie männlich oder weiblich?
- Wie jung sind Sie?

B. Results of the logistic regressions

Session ID	Regressand	Estimated parameters a	b	Estimated μ a/b	Estimated σ $\frac{\pi}{b\sqrt{3}}$
T1	*B*	4.78	0.11	43.14	16.38
T1	*Empf*	2.54	0.07	37.98	27.07
T2	*B*	6.27	0.17	36.96	10.69
T2	*Empf*	3.38	0.09	36.87	19.76
T3	*B*	9.66	0.20	47.50	8.92
T3	*Empf*	3.66	0.09	40.87	20.25
B1	*B*	3.45	0.07	52.32	27.53
B2	*B*	10.30	0.23	44.80	7.89
B3	*B*	4.56	0.11	39.71	15.79
T4	*B*	15.25	0.34	44.37	5.28
T4	*Empf*	6.81	0.17	40.75	10.85
T5	*B*	17.21	0.36	48.46	5.11
T5	*Empf*	9.93	0.23	43.07	7.87
B4	*B*	4.13	0.09	46.10	20.26
T6	*B*	7.33	0.15	49.51	12.25
T6	*Empf*	5.76	0.12	49.77	15.68
B5	*B*	4.82	0.11	45.07	16.95
T7	*B*	5.05	0.12	42.81	15.37
T7	*Empf*	1.82	0.05	36.53	36.50

TABLE 4: *Results of the logistic regressions.*

Session ID	Regressand	Estimated parameters a	b	Estimated μ a/b	Estimated σ $\frac{\pi}{b\sqrt{3}}$
T1	B	7.52	0.18	42.06	10.15
T2	B	3.65	0.11	32.42	16.12
T3	B	15.35	0.31	49.51	5.85
B1	B	5.08	0.10	50.43	18.01
B2	B	10.63	0.23	45.60	7.78
B3	B	5.53	0.14	40.78	13.39
T4	B	13.26	0.31	43.32	5.92
T5	B	15.70	0.33	48.18	5.57
B4	B	5.68	0.13	44.72	14.28
T6	B	10.14	0.21	48.60	8.70
B5	B	4.82	0.11	45.07	16.95
T7	B	10.84	0.23	47.10	7.88

TABLE 5: *Results of the logistic regressions using observations for* $40 \leq Y \leq 60$.

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