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Does Competition Aggravate Moral Hazard? A Multi-Principal-Agent Experiment

Olga A. Rud
Department of Economics, Bates College
Jean Paul Rabanal
Department of Economics, Bates College
jrabanal@bates.edu
John Horowitz
Department of Economics, Ball State University

January 2, 2017

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Keywords: Delegated portfolio management, conflict of interests, rating services, market design, deception, laboratory experiment

JEL codes: D03, D40, D82, G02, G23, G24, C90

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*Department of Economics, Bates College.

†Corresponding Author. *Email:* jrabanal@bates.edu *Address:* 2 Andrews Road, Lewiston, Maine 04240 *Tel:* 1-207-786-6099.

‡Economics Department, Ball State University.

1 Introduction

In 2016, Wells Fargo Bank, one of the largest financial services companies in the United States, faced public outrage because its employees opened over two million unauthorized accounts. Some of the former employees said that they opened these unauthorized accounts to reach monthly sales quotas and that management tacitly approved the deceptive practices. Instances of deceptive behavior in financial services has been documented in Egan et al. (2016), who determine that one in eight financial advisors have a misconduct on their record, and in Cohen et al. (2014), who use an experimental approach to show that banking cultural norms deter honesty.

This suggests that there is latent deceptive behavior that exists in financial markets. According to Akerlof and Shiller (2015), competitive markets may actually contribute to dishonest behavior by tying profit, to a certain extent, to deception. Thus, the norms in the financial/banking sector can be shaped by the tough competition in the sector or, in other words, by the market structure.

In this paper, we formally test the hypothesis whether market structure has an impact on deceptive behavior using a controlled laboratory environment. We design a Multi-Principal-Agent game and find that competition among financial advisers undermines truth-telling when clients fully trust their recommendations. We also conclude that our findings are robust to a 300 percent increase in fees for the monopolist Agent.

Our design assumes that financial advisers (Agents) manage portfolios on behalf of the clients (Principals) for which they receive a fee (Asset Under Management fee or AUM). Agents can recommend that the Principals either Continue or Stop the investment project, which can be either high value (assets) or low value (assets). Though the Principals would prefer to invest only in high value projects, they cannot accurately observe whether the project is high value or low value until the end of the game. Agents, on the other hand, can perfectly observe the project type before issuing a recommendation.

The Principals in our game are gullible. They are robots that completely trust Agent recommendations.[1] While this assumption may appear extreme, it is standard in other theoretical work that we discuss and, more importantly, it permits us to focus solely on Agent motivation and behavior across two market structures: monopoly and competition. For example, a Principal's ultimate choice of Agent in a competitive environment might be based on prior performance (see for example the Trust game experiment by Huck et al. 2012) and which would make reputation concerns non-negligible. The assumption of a gullible Principal allows us to isolate the effect of competitive markets and abstain from incorporating other concerns (such as reputation) when we compare different market

[1]Burton-Chellew et al. (2016) find no difference in behavior between humans and robots in a Public Goods, using a strategy method.

structures.

The monopoly structure in our experiment is fairly simple. Each Agent randomly meets a Principal. The Agent only collects revenue if the recommendation is to invest in the project. In the competitive structure, each Agent may advise up to three Principals, depending on the actions of other Agents. The game in the competitive structure proceeds as follows: each Agent is matched with a Principal, and if the Agent in the initial assignment recommends to stop, then the Principal is reassigned to another Agent whose recommendation is to invest. Note that the possible revenue in the competitive environment is three times higher than in the monopoly market. For this reason, we design another monopoly market in which the fee is 300 percent higher than in the baseline monopoly market. Thus, the monetary incentives for Agents are aligned in both competitive and high-fee monopoly structures.

We find that misconduct in the competitive structure is 29 percentage points higher than in the baseline monopoly structure. Our result is robust to the increase of fee adopted in the high-fee monopoly market. We also cannot reject the hypothesis that the likelihood of misconduct is the same in our two monopoly structures at a five percent significance level.

Our experimental design captures key elements of theoretical models studying the behavior of money managers, certifiers or rating agencies. Dasgupta and Piacentino (2015) analyze how equity blockholders affect corporate governance. In their model, blockholders are money managers who receive AUM fees and are able to observe the actions of the management in the firms they invest in. Good money managers are more likely to hold blocks in firms without agency problems and money managers who sell shares of poorly managed firms are more likely to be bad money managers. Inherent in this setup is a conflict of interest. When money managers sell shares of poorly managed firms, they signal to the investors that the quality of their portfolios is lower than anticipated, which leads investors to change money managers. As a result, the revenues of these money managers will decrease. In our laboratory experiment, money managers similarly have an incentive not to announce under-performing firms in their portfolio.

A less obvious feature that our design captures is the ratings shopping phenomenon present in the certifier or rating agency market. Bolton et al. (2012) illustrate how competition in the rating agency market can lead to inefficient outcomes because sellers will only pay for favorable ratings when buyers are gullible. The effect of ratings shopping appears in our experimental design in the form of funds being redirected to Agents that recommend to continue, which occurs at a higher rate in the competitive market. Thus our results indicate that ratings shopping hinder the efficiency of markets and provide further clarification regarding the somewhat ambiguous role of competition in rating services (Dranove and Jin, 2010).

Our work is related to other experimental papers that study the effect of competition on the moral hazard of market participants. Most (if not all) prior studies find that competition does not harm market efficiency. Huck et al. (2012) employ a binary-choice Trust game and conclude that reputation based on past quality enhances trust, and that competition reinforces this effect. As mentioned earlier, our game abstains from reputational concerns which helps to realign the incentive to misreport across the two market structures. Surprisingly, we still find that the rates of misreporting are affected by market structure.

Dulleck et al. (2011) design a buyer-seller game in which buyers are uncertain about the quality of a service they need (high or low) and then subsequently receive. The seller knows the required quality with certainty and can provide a high or low quality service, charging either a high or low price. The authors find that both reputation building and competition significantly increase market transactions. Moreover, while reputation helps increase efficiency, competition has no effect, neither harming nor helping market efficiency.

In a different buyer-seller game, Rabanal and Rud (2016) find that competition in the rating agency market fosters truth-telling. Their experiment follows the work of Bolton et al. (2012). The seller is uncertain about the quality of her asset (high or low) and may shop for a report, to be issued by a rating agency. Buyers only observe the report if the seller accepts it. The rating agency also incurs a penalty when they misreport a low type asset as a high type. The combination of downward pressure on price due to competition and exogenous penalty costs for misreporting help explain the positive effect of competition on moral hazard. Additionally, Rabanal and Rud also find that buyers are not completely gullible in the competitive treatment because the bids approach the low fundamental value when no report is available.

In the present paper, our gullible Principals have neither access to previous Agent recommendations nor the ability to appropriately use current recommendations to infer the actual state of nature. There is a possibility for a regulator to protect the interests of the Principal by imposing penalties for misreporting. However, we assume that the revenues for misreporting exceed the possible costs and therefore, for sake of simplicity, these costs are normalized to zero.

The next section presents our game using the assumption of a profit-maximizing Agent. In section 3, we describe in detail our experimental procedure and in section 4 we present the results for monopoly, monopoly-high and competitive markets. We conclude with a discussion of our results in section 5. The appendix includes instructions given to the subjects as well as the information on the user-interface used in the experimental sessions.

2 The Multi-Principal-Agent Game

In our environment, there are two types of players: Principals and Agents. Each Principal begins the game with 100 point initial endowment, which they can invest in either a blue b (high value) project or a red r (low value) project. The project state space is $\omega \in \{b, r\}$.

Both projects are equally likely to occur and require an investment of 100 points each. Principals investing in a b type project earn 200 points (100 net change on initial investment) while Principals investing in a r type project earn 100 points (no net change on initial investment). Principals are profit-maximizing individuals who prefer to invest in b type projects. However, they cannot cannot determine project type until after their investment decision.

Agents, on the other hand, are able to observe with certainty whether the project is b or r before making a recommendation. An Agent's action set is $a \in \{c, s\}$, where c is a recommendation to continue and s is a recommendation to stop. In other words, an Agent can either recommend that a Principal continues (c) with the investment opportunity or that they stop (s). Agents collect a fee (ϕ) for overseeing and servicing the investment. Thus, an Agent will earn $100 \times \phi$ if and only if she recommends c. We assume that the Principal is naïve and blindly trusts Agent recommendation.

Equation 1 summarizes Agent A's profit possibilities and shows that the payoff for recommending c varies across market structures. In the monopoly market, there are two treatments: (i) the monopoly treatment (MT) where the fee is 10 percent of the initial investment value and (ii) the monopoly high-fee treatment (MHT) where the fee is 30 percent of the initial investment value. In the competitive market, there is only one competitive treatment (CT) where the fee is set at 10 percent of the initial investment value. Therefore, the fee varies by treatment such that $\phi \in \{0.1, 0.3\}$.

$$\pi^A = \begin{cases} 100 \times \phi & \text{if } a = c \text{ under monopoly} \\ 100 \times [\phi + \phi \times \frac{\text{Agents that stop}}{\text{Agents that continue}}] & \text{if } a = c \text{ under competition} \\ 0 & \text{if } a = s \end{cases} \tag{1}$$

In the CT, each Agent is assigned to a subgroup, comprised of three Agents. All Agents within the subgroup then compete to provide investment recommendations to the Principals. Initially, each of the three Agents is randomly matched with a Principal, to serve as an investment adviser. If an Agent recommends c to the Principal, then the Principal will invest. If an Agent recommends s, then her principal will be randomly assigned to one of the two remaining Agents in that subgroup. If the next Agent recommends c, then the Principal will invest with that Agent. If only one Agent recommends c while the other two recommend s, then the Agent recommending c will earn the highest possible profit

(100×0.3).

In the baseline MT and CT treatments, we set the fee $\phi = 0.1$. Therefore, when an Agent recommends c in the MT, the profit is calculated as 100×0.1. In the CT, the final profit of an Agent who recommends c depends on the fee collected from the initially assigned Principal, as well as the number of added Principals when the other Agents within the same subgroup recommend s. Agents in the CT can earn a maximum 30 points when one Agent recommends c while the other two recommend s. For robustness, we also test the effect of $\phi = 0.3$ in the MHT. In all treatments, when an Agent recommends s, the profit for that Agent is zero.

Equation 2 summarizes Principal P's profit possibilities and shows that the final profit depends on the Agent's decision and the project type.

$$\pi^P = \begin{cases} 200 - \phi \times 100 & \text{if } a = c \text{ and } \omega = b \\ 100 - \phi \times 100 & \text{if } a = c \text{ and } \omega = r \\ 100 & \text{if } a = s \end{cases} \tag{2}$$

Since strategy c always yields higher profit, the unique Nash equilibrium requires that an Agent play c regardless of project type, fee rate or group matching environment (treatment). This is summarized by Prediction 1.

Prediction 1 *Regardless of market structure and project type, an Agent will always choose to continue.*

Note that Prediction 1 assumes a profit-maximizing Agent who compares the payoff of playing c against the payoff of playing s. According to equation (1), playing c will always yield higher profit, regardless of market structure and project type. Therefore, a profit-maximizing Agent should always play c.

However, this is not always the case. For example, Gneezy (2005) and more recently Lopez-Perez and Spiegelman (2013) found that subjects prefer being honest even when there are material negative consequences. In literature, this behavior is known as "lie aversion." In our Multi-Principal-Agent game, the alternative hypothesis is that an Agent will choose s after observing $\omega = r$ due to lie aversion.

3 Procedures

Subjects were recruited through the Online Recruitment System for Economic Experiments (ORSEE) (Greiner, 2004). Seventy-nine subjects participated in the experiments at the "Econ Lab" at Bates College. The pool of subjects included undergraduate students and staff members from various majors and departments.

All recruited participants were assigned to the role of Agents. As discussed above, we assume that the Principals are naïve and fully trust the Agents' recommendations. Thus, in this experiment, the Principals are automated (robots).

Subjects were randomly assigned to one of the three treatments: (i) MT, where $\phi = 0.1$, (ii) MHT, where $\phi = 0.3$, and (iii) CT, where $\phi = 0.1$. We provide screen shots of the user interface in Appendix *B*, which was designed using oTree (Chen, et al., 2016). In order to analyze the impact of competition on Agent behavior, the treatments follow a between subject design.

As shown in Table 1, 21 subjects participated in the MT game, 22 subjects participated in the MHT game, and 36 subjects participated in the CT game. Each session lasted 20 rounds. Since this is a simplified game with limited action space, we chose to keep the number of rounds low to avoid game fatigue. Overall, we ran three MT sessions, three MHT sessions and four CT sessions.

Table 1: Sessions overview

	Monopoly (MT)	Monopoly-High (MHT)	Competition (CT)
N (of subjects)	21	22	36
Profit ($, mean per subject)	11.8	27.0	13.1
N (of sessions)	3	3	4
Continue when blue (mean)	0.99	0.98	0.99
Continue when red (mean)	0.56	0.68	0.86

Note: Profit includes a show-up fee of $5.

Each round in the MT and MHT sessions proceeded as follows:

Stage 1: Agents observe project type and choose whether to continue c or stop s.

Stage 2: After selecting c or s, Agents observe current round payoff, π^A, as well as all previous decisions and respective payoffs (history).

In the CT treatment, we randomly assign nine Agents to one of the three subgroups, making sure that every group is unique in all rounds throughout the session. The user interface is similar to the one used in the monopoly treatments, except that the interface also displays the number of Agents who chose c in the second stage. According to equation (1), the number of agents who choose c affects the distribution of profit and is therefore relevant information for players.

Appendix *A* contains the instructions for CT that were read to the participants at the beginning of each session.[2] All subjects were paid a $5 show-up fee. The final payment to subjects was calculated using the sum of points earned from two randomly selected periods at the exchange rate of $4 per 10 points plus the show-up fee. On average, sessions lasted just under 40 minutes.

[2] The complete set of instructions and the data obtained from the laboratory sessions can be found at `https://github.com/rabsjp/multiPA`

4 Results

Since 98 percent or more of b projects result in a recommendation to continue (Table 1), we focus our analysis on states where Agents observe a r project. The left panel in Figure 1 uses pooled data to show Agent choices (c or s) over three treatments (MT, MHT and CT) when observing a low value r project. The right panel shows the cumulative density function (CDF) when Agents choose c given a low value r project.

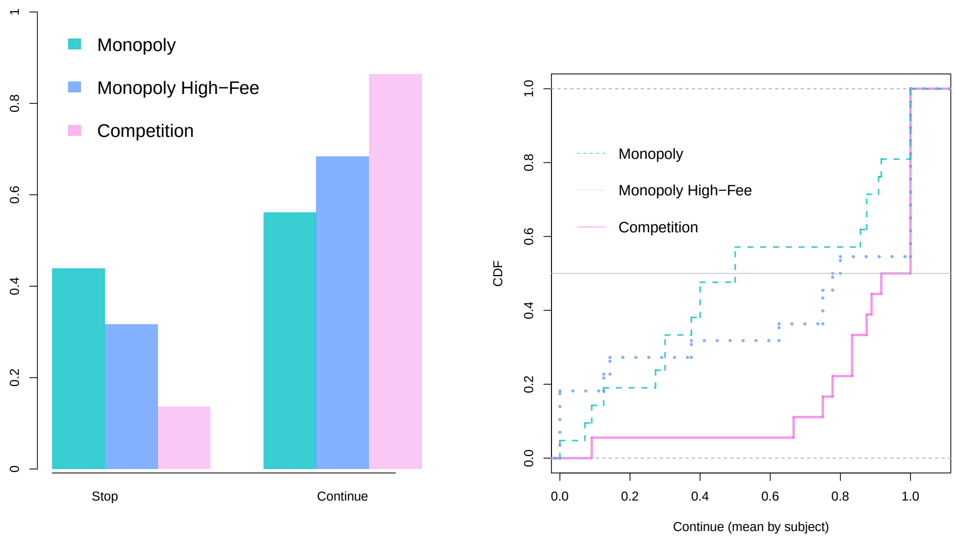

Figure 1: Agent choices when a red project is observed: (i) the left panel displays the fraction of continue/stop choices using pooled data and (ii) the right panel presents the CDF when agents choose continue using mean subject data.

Result 1 *Agents in the CT choose to continue more often than Agents in the MT and MHT after observing a low value r project .*

We calculate the mean continuation choice for each subject by dividing the total number of c choices per subject by the total number of rounds when the state is r. We then use the mean continuation choice to construct the CDF for each treatment, which is shown in the right panel of Figure 1. Using subject data, we find that the difference between the median MT and the median CT is about 50 percentage points and the difference between the median MHT and median CT is about 20 percentage points. Since 50 percent of the MT subjects always continue, the median continuation rate for the CT is 100 percent.

Considering that the fee in the MHT is 300 percent higher than the fee in the MT, the fact that the difference in the mean continuation choice is not greater between the MT and the MHT is remarkable. Though the MHT median choice c could have increased by 100 percent above the MT median, it only increased by roughly 60 percent. Also, according to the CDF, at low continuation rates, the probability mass in the MT and MHT is quite similar while at higher continuation rates, the probability mass is higher in the MHT than in the MT. However, when we perform the Wald test to see if the continuation rates in MT and MHT are equivalent, we fail to reject the hypothesis (see Result 2 below).

Overall, compared to MT and MHT, the results in the CT are skewed toward choice c. Likewise, at low continuation rates, the CDF densities under MT and MHT are lower than in the CT. Thus, despite the fact that an Agent can earn up to 30 points each period in the CT, which is equivalent to the profit in the MHT, the higher rate of continuation in the CT is not solely driven by higher monetary incentives.

Next, we perform a logit estimation to formally test whether there is a difference in subject choices when they are assigned to either a monopolistic or competitive market structure. Table 2 summarizes these results. Choice c is our model's dependent variable. The independent variables MT and MHT are dummies that capture the treatment effects. In our specification, the constant captures the CT effect, the MT variable captures the MT effect, and the MHT variable captures the MHT effect. Computed using a bootstrap method, our estimation includes subject random effects and clustered standard errors at session level for the competitive market structure and at subject level for the monopolistic market structure. Specification (I) reports estimation results when all observations are included and specification (II) reports estimation results when only low value r projects are included.

Table 2: Decision to continue (logit)

	(I) All	(II) Red Only
Constant	0.93^{***}	0.87^{***}
	(0.02)	(0.04)
MT	-0.16^{***}	-0.29^{***}
	(0.05)	(0.08)
MHT	-0.10^{**}	-0.20^{**}
	(0.05)	(0.09)
Prob.> Wald χ^2	0.00	0.00
N	1 580	754

The coefficients reported above are (i) the probability to continue for the constant and (ii) the marginal effects for MT and MHT. The logit estimation includes clustered standard errors at either session level (competition) or subject level (monopoly), using bootstrap.
$^{***}p \leq .01$, $^{**}p \leq .05$, $^{*}p \leq .1$

In specification (I), the coefficient on the constant is 0.93, which indicates that the likelihood of an Agent choosing c in the CT is 93 percent. Compared to the CT, the likelihood of choosing c in the MT decreases by 16 percentage points, and the likelihood of choosing c in the MHT decreases by 10 percentage points.

Specification (II) shows that when we restrict our sample size to red states only, an Agent in the CT will choose c 87 percent of the time. The likelihood of choosing c decreases by 29 percentage points for an Agent in the MT and by 20 percentage points for an Agent in the MHT.

Result 2 *Agents in MHT who receive high fees ($\phi = 0.3$) do not chose to continue more often than Agents in the MT who receive low fees ($\phi = 0.1$) after observing a low value r project.*

We perform a Wald test to determine whether the likelihood that an Agent will choose c is the same in the MT and the MHT. Recall that Agents in the MHT receive higher fees and therefore can earn 300 percent higher profits than the Agents in the MT. Furthermore, the profit in the MHT is equivalent to the highest possible profit in the CT, where the final payoff depends on the number of continuing Agents. We fail to reject the hypothesis that the likelihood of choosing c is the same in the MT and the MHT, at a five percent significance level.

5 Discussion

In this study, we compare the behavior of Agents under two distinct market structures: (i) competitive and (ii) monopolistic. We find that Agents are more likely to tell the truth in the less competitive environment (MT), even when we significantly increase the profitability from misreporting (MHT). In the competitive market, Agents who observe a low value r asset are 29 percent more likely to misreport than the Agents in the monopoly market. Our findings imply that competition can significantly affect Agent behavior and market morals.

To test the robustness of our results, we include a high fee treatment for the monopoly market. In this treatment, Agent earnings are equivalent to the maximum amount that can be earned in the competitive treatment. Even though the fee is 300 percent higher than in the baseline monopoly treatment and Agents are likely to earn more than in the competitive treatment, Agents still misreport more often in the competitive environment. Agents are likely to earn the most in the high-fee monopoly treatment because when all Agents in the competitive treatment choose to misreport, they earn the same as an Agent who misreports in the baseline (low-fee) monopoly treatment.

There are two possible behavioral reasons for our results: (i) people prefer to win without consideration for the morality of their actions and (ii) people dislike seeing others get ahead, especially by cheating. Note that our experimental design cannot help us to identify the explanation that is most appropriate in this case. Further work is needed in order to adequately identify the drivers of moral behavior. Overall, our results indicate that policies recommending competition in financial services should be studied carefully. Moreover, such policies may need to be complemented with others that observe and impose penalties on misconduct.

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Appendix

Appendix A: Instructions competition treatment

Welcome! You are participating in an economics experiment at Bates Economics Laboratory. In this experiment you will participate in a decision making game. If you read these instructions carefully and make appropriate decisions, you may earn a considerable amount of money that will be immediately paid out to you in cash at the end of the experiment.

Each participant is paid $5 for attending. Throughout this experiment you will also earn points based on the decisions you make. The rate at which we exchange your points into cash will be explained to you shortly. We reserve the right to improve this in your favour if average payoffs are lower than expected.

Please turn off all cell phones and other communication devices. During the experiment you are not allowed to communicate with other participants. If you have any questions, the experimenter will be glad to answer them privately. If you do not comply with these instructions, you will be excluded from the experiment and deprived of all payments aside from the minimum payment of $5 for attending.

The experiment you will participate in will involve interaction within groups. In each group, there are prospective clients and intermediaries. The client side of the market will be automated, and your role will be that of an intermediary, which you will keep throughout the duration of the experiment.

Clients would like to participate in a project, by making an investment worth 100 points. The value of the project is uncertain. Blue projects will be worth 200 at the end of the round. Red projects will not bring any additional value to the client and will be worth 100 points at the end of the period. As an intermediary, you have access to information regarding project type. Therefore, your task is to offer the client a recommendation, to continue or to stop participating in the project.

You will be playing a series of rounds. In each round, you will make a decision regarding the project. In the instructions below we explain how your decisions as an intermediary will affect your points and total earnings.

THE EXPERIMENT

The experiment will feature a number of rounds. In each round, you will be assigned to a group that consists of 3 clients and 3 intermediaries. Initially, each client is matched with a single intermediary. While the groups you interact in will change throughout the course of the experiment, your role will remain the same.

Each round, a client will ask for a recommendation, whether to proceed with an investment in a particular project. The client does not know whether the project is red or blue.

They do, however, know that the project is blue with the probability of 50% and red with the probability of 50%. The intermediaries (you) each have access to information regarding project type. As an intermediary, you can collect a fee for your recommendation, that is worth 10 percent of the initial investment.

After observing the project type and the value associated with it, the intermediary makes a recommendation to the client. If you recommend to proceed, you will collect 10 percent of the initial investment value. If you advise the client to stop, or pull out of the project, you will not earn any points. Your earnings will depend on the number of clients you have, which depends on the action of the other intermediary. That is, if you continue while other intermediaries in your group decide to pull out, your earnings will increase based on the number of clients reallocated to you. Similarly, when you decide to stop while other intermediaries continue, your clients will be reallocated to those continuing.

Each round will consist of 2 stages. Stage 1: The three intermediaries in each group receive information on the project. Each must then decide how to advise the client. If an intermediary advises the client to stop, then they will not earn any points. If an intermediary advises the client to continue then they will collect points, based on payoffs described below.

Stage 2: All players view the outcome of the round. They will see the decision and outcome of each player. The intermediaries will see the choice of the other intermediaries based on the number of clients they end up with and will also have access to the record of their own decisions made throughout the rounds.

EARNINGS

Your earnings will be computed according to the formula for your role:

Intermediaries: Earnings of a Continuing Intermediary =

10% $\times$ Your client's Investment + 10% $\times$ Other clients Investments whose Intermediary stopped / continuing intermediaries

Earnings of a Stopping Intermediary = 0

Clients: Earnings of a Continuing Client =

	Value	- Fee	Total
Blue	200	- 10	= 190
Red	100	- 10	= 90

Earnings of the Stopping Client =

Initial Investment = 100

There are 9 participants in this session. There will be 3 groups at any point. Every round you will be rematched with different players. While you will not know who you are playing with, you will end up interacting with players more than once. No two groups you participate in will have exactly the same people.

The points you earn from 2 randomly selected rounds will be added up, exchanged into dollars and paid to you, along with your show up fee, in cash at the end of the experiment. Your exchange rate is written on the board.

Who are the clients? The clients are computerized robots who invest when there is an intermediary available.

Appendix B: User-interface competition treatment

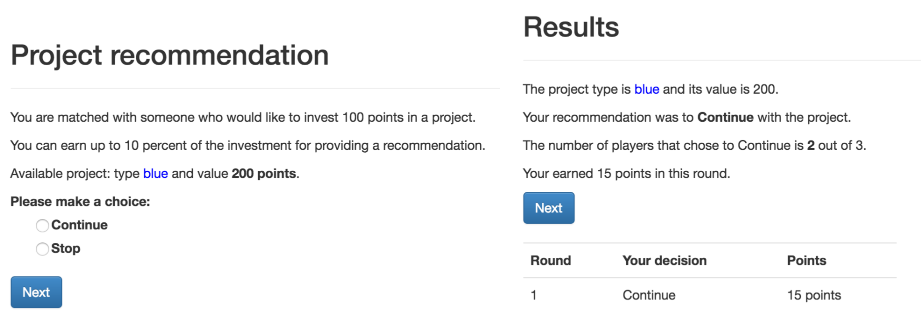

Figure 2: Panels display the choice interface (left) and the results (right) user-interfaces for the competition treatment