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The effects of social information and luck on risk behavior of small-scale fishers at Lake Victoria

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ABSTRACT

We use a lab-in-the-field experiment to examine how personal experience of good or bad luck and information about the behavior of others influence the risk taking behavior of small-scale fishers in Tanzania. These fishers make many risky decisions in their daily lives, and a better understanding of the factors influencing risky decisions is important from both a policy and scientific perspective. Our results show a slight tendency for fishers to take more risk in a lottery if they have been unlucky in another game shortly before. Risk taking is enhanced by social information when fishers learn that others have taken more risk. This is true although risks are independent and the fishers do not know whether the risk taking of others has ultimately paid off.

1. Introduction

Fishers in small-scale fisheries in the Global South face many risky decisions in their daily lives because political, social, and economic structures and institutions to mitigate individual risks are not well developed. For example, fishers must decide whether to engage only in fishing or in other activities as well, whether and how much to invest in their fishing equipment, whether to comply with the fishing regulations, how to market their caught fish, and whether and how much to save for a bad day or retirement. At the same time, these decisions have important ramifications for the long-term sustainability of the fish stock and the local ecosystem. Previous research has shown that fishers who are prepared to take risks are more likely to adopt new technologies (Brick & Visser, 2015; Giné & Yang, 2009) but also to fish intensively or illegally (Brick, Visser, & Burns, 2012; Eggert & Lokina, 2007). Yet, we still know relatively little about how the risk behavior of fishers in small-scale fisheries can be influenced.

In this paper, we use a lab-in-the-field experiment with Tanzanian fishers at Lake Victoria to investigate potential factors influencing risk behavior. The main task in the experiment, inspired by Gneezy and Potters (1997), is to decide how much money to invest in a risky lottery where the investment triples if a person is lucky and is lost if a person is unlucky. Using two treatments variables, we investigate if and how the investment decisions change when subjects have an experience of good or bad luck just before the investment decision is made and when they are informed about how much other fishers have invested in the risky lottery.

The first treatment variable in our experiment is the experience of good or bad luck before the subjects decide how much money to invest in the risky lottery. To induce this experience, we have subjects make a simple bet in which they win a high prize if they are lucky and a low prize if they are unlucky. This means that about half of the participants start the lottery with the feeling that they have just

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been lucky and the other half with the feeling that they have just been unlucky. Importantly, and in contrast to much of the previous literature (see the next section), we design the treatments in a way that allows us to differentiate between the income effect of the betting task and the experience of good or bad luck. The psychology literature offers various explanations as to why the experience of good or bad luck should influence investment behavior, even though the probabilities in the two games are completely independent of each other. The first explanation is the 'gambler's fallacy,' which describes the human tendency to misconceive random sequences and expect alternating appearances of outcomes even when the sequence is short (Tversky & Kahneman, 1974). Applied to our setting, this means that subjects who experience bad luck in the first game are more likely to expect good luck in the second game and therefore invest more. Conversely, those who are lucky in the first game are more likely to expect bad luck in the second game and therefore invest less. It is also possible that good luck or bad luck will shift a person's position to their targeted reference point and that those who were unlucky want to make up for the loss by increasing risk while those who were lucky do not. This effect is known as the 'escalation of commitment' (Staw, 1976). Possible explanations suggesting a positive effect of luck in the first game on investment in the second game include availability bias and outcome bias. Availability bias is the tendency to make predictions based on information that can be accessed very easily, for example, because it has been recently recalled to memory (Tversky & Kahneman, 1974). Outcome bias describes the tendency of people to judge the quality of a decision by whether its outcome was good or bad, even when the outcome is determined by a random process (Baron & Hershey, 1988). Transferred to our setting, this means that subjects who are unlucky in the first game subsequently think that they have made a bad decision and conclude that they should act cautiously in the second game. On the other hand, those who are lucky in the first game think that they have made a good decision and may act more boldly in the second game. Availability bias may strengthen this tendency by causing some people to think that they are a person who makes bad decisions or has no luck.

With regard to the second treatment variable, social information, we distinguish between three conditions in the experiment: (i) when fishers do not know how much others have invested in the risky lottery, (ii) when they are informed that others have invested a lot, and (iii) when they are informed that others have invested little. We see this investigation as complementary to the literature on the effects of social information in situations where a person's decision has an influence on the well-being of other people and the behavior can be classified according to its prosociality (see the next section). Information about the behavior of others signals what behavior can be expected and may be considered appropriate. It exerts influence by causing the decision maker to change their beliefs about others' behavior, adjust their own views about the appropriate behavior, or anticipate social reactions to their decision (Ajzen, 1985; Fishbein & Ajzen, 2010). The influence of social information on individuals' prosocial decisions depends on whether they have conditional preferences; that is, whether they are more likely to behave prosocially when they know that others are doing the same or consider it appropriate (Bicchieri & Dimant, 2019). The channel through which social information affects risk behavior is different because the decision does not have any implications for others but only for oneself. In this case, the social information is expected to exert an influence through imitation and learning. People follow others when they are uncertain how to decide and the norm is taken to be evidence for effective action (Bicchieri, 2016; Cialdini, Reno, & Kallgren, 1990; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007).

We have chosen a specific sample of people for the study because fishers in small-scale fisheries have little access to formal insurance yet face many risky decisions in their everyday lives and because it is important for local policymakers to learn more about the behaviors of key stakeholders. Many of the decisions fishermen make have a direct impact on how much money they have available at the end of the day. These include decisions such as what fishing technology to use, what fish to catch, whether to make major investments in a boat, whether to switch to a motorized boat, whether to take another job outside of fishing, or how much money to save. The decisions fishermen make also have an indirect impact on their expected earnings because they affect fish stocks. Lake Victoria is the largest lake in Africa. The fisheries in all three riparian states, Kenya, Uganda, and Tanzania, are small-scale but economically important overall (Njiru, Kazungu, Ngugi, Gichuki, & Muhoozi, 2008). The fisheries focus on two species, the dagaa, which is mainly sold in local markets, and the Nile perch, which is mainly exported (LVFO, 2016; Njiru, van der Knaap, Kundu, & Nyamweya, 2018). Both fish populations are threatened by overfishing and ecological changes due to climate change and intensive agriculture around the lake (Mgaya, 2017). There are legal provisions to regulate fishing in all three countries. However, the size of the lake and the low financial resources make it difficult to enforce the rules (Njiru et al., 2018), which can help to explain why intensive and illegal fishing has continued (Eggert & Lokina, 2010; Njiru et al., 2018). Ecological conditions at Lake Victoria thus represent another important dimension of uncertainty and risk for fishers, as their livelihoods and income would be threatened if aggregate fish levels were to exceed a tipping point.

With these different dimensions of uncertainty and risk, which affect income directly or indirectly, it is not possible to say whether risk taking is generally welfare enhancing for fishers or not. For example, investments to dry fish on elevated racks instead of on barren ground or exploring new marketing channels such as eco-certification are likely to be among the welfare-enhancing measures. In contrast, investments in larger boats or shifting from sail and paddles to outboard engines may increase fishing pressure and threaten fish stocks in the long run (Bramoullé & Treich, 2009; Sandler & Sterbenz, 1990). The interplay between risk and collective responsibility for fish stocks can lead to biased perceptions and self-deception. For instance, fishermen may attribute large catches to good luck rather than excessive efforts (Dana, Weber, & Xi Kuang, 2007; Haisley & Weber, 2010) or they may feel entitled to expand fishing efforts to compensate for a period of bad luck and low catches (Hopfensitz, Mantilla, & Miquel-Florensa, 2019). A better understanding of how fishers' risk behavior can be influenced allows policymakers to improve existing institutions and intervene in a more targeted way. Of course, risk is only one factor among many that are relevant to fishers. For analytical reasons, however, it is advisable to examine the factors separately and risk behavior of fishers has not received much attention so far. Furthermore, while risk taking in the everyday lives of fishermen may have both positive and negative effects on social welfare, we restrict our experiment to a situation in which risk-taking is welfare-enhancing on average.

The research is, of course, also interesting and important from an academic point of view. By far the most research in psychology and behavioral economics has taken place in industrialized nations in the Global North, and it is not clear to what extent the results can be transferred to other cultures and regions. Research in less developed regions therefore is essential to gain a more comprehensive understanding of human behavior. Tanzanian fishers belong to a tight culture with strong social norms and low tolerance of deviant behavior (Uz, 2015), which may be related to ecological and human-made threats in the past (Gelfand, 2011). Industrialized nations, where most research has been done so far (for a notable exception, see Carlsson, Johansson-Stenmanm, & Nam, 2015), are often characterized by a loose culture where social norms are weak and the tolerance of deviant behavior is relatively high.

2. Related literature

In the following, we summarize the most important findings from the social psychology and behavioral economics literature on whether and how the experience of good or bad luck and the provision of social information influence risk behavior.

The previous literature does not provide a clear picture of how the experience of good or bad luck affects risk behavior. Darke and Freedman (1997) find in an experiment with undergraduate students that subjects who experience good luck are more willing to take risk afterwards but only when they see themselves as a lucky person. Luck has no influence on subjects who do not have this belief about themselves. The experimental task used to measure risk behavior involves not only risk but also ability, so that no precise distinction can be made between risk behavior and confidence in one's ability. Wohl and Enzle (2003) confront a student sample with a rigged wheel of fortune, which either just misses the jackpot or bankrupt, to induce feelings of good or bad luck without changing the endowment. They find that subjects are more willing to take risks after they just escaped bankruptcy and presumably felt lucky. Xu, Zwick, and Schwarz (2012) run an experiment with students and staff of a university in Hong Kong. Their way of inducing feelings of good or bad luck is similar to ours by having subjects bet on the color of a ball that is drawn from a closed bag. They find that subjects who are lucky subsequently invest more in a risky bet. However, it is not clear whether this is driven by higher income or the experience of good luck. The effect of luck is reduced when subjects wash their hands between the two tasks, leading the authors to conclude that luck or bad luck can be washed away. Fafchamps, Kebede, and Zizzo (2015) let Ethiopian farmers, Ethiopian undergraduate students, and British undergraduate students repeatedly decide how much to invest in a risky lottery. They find for all three samples that the experience of luck in one round has no significant effect on the investment decision in the next round. The accumulated gains have a positive influence on investments of the Ethiopian farmers and students but not of the British students. Finally, Hopfensitz (2009) provides a *meta*-study of five different experiments that use the investment task of Gneezy and Potters (1997) to study risk behavior. The results show that being unlucky in the previous round tends to increase investment in the current round, supporting the gambler's fallacy hypothesis. In summary, based on these rather mixed results, it is difficult to derive any reliable conclusions on the effect of luck on risk behavior.

Regarding social information, the vast majority of research has been conducted for situations where people's payoffs are interdependent and behaviors can be classified according to their prosociality. In a wide range of contexts, from charitable donations to eco-friendly consumption to decisions in experimental cooperation games, it has been shown that people adapt their behavior towards the social norm, especially when there are close social ties with the reference group (Allcott, 2011; Bicchieri, Dimant, & Xiao, 2018; Diekert, Eymess, Luomba, & Waichman, 2020; Dimant, 2019; Duflo & Saez, 2002; Hallsworth, List, Metcalfe, & Vlaev, 2017). There is much less knowledge when it comes to the effects of social information on risk behavior.

The above mentioned experiment with Ethiopian farmers, Ethiopian undergraduate students, and British undergraduate students by Fafchamps et al. (2015) also considers how information about others' investment decisions and winnings affect risk behavior. Others' average past investment in a lottery does not cause the subjects to adjust their own investment. By contrast, others' past lottery winnings cause subjects to increase their own investment, which can be explained by a 'keeping-up-with-the-Joneses' effect according to which people take more risk in an effort to catch up with others. Delfino, Marengo, and Ploner (2016) let a student sample first decide how much to invest in a lottery and then confront them with the decision of one other person or the average decision of several other persons. They find that subjects adjust their next investment decision towards the social information, especially when the difference between the own initial investment and the investment level of the others is large and when the social information refers to a group and not only a single person. Lahno and Serra-Garcia (2015) let a student sample repeatedly choose between two lotteries and then provide them with information either about how another person decided, how a random device decided for another person, or how a random device decided without any consequences. Perhaps not surprisingly, subjects imitate the presented decision more strongly when it was made by a person. They are also more likely to follow risk-averse decisions than risk-seeking decisions. Adaptation towards the risk behavior of others is also found among clients of brokerage firms who decide whether to invest in a risky asset (Bursztyn, Ederer, Ferman, & Yuchtman, 2014) or among tax payers who decide whether to comply with the tax rules (Garcia, Opromolla, Vezzulli, & Marques, 2020; Hallsworth et al., 2017). In contrast, homeowners' decision whether to buy insurance in a flood-insurance game is not very sensitive to the decision of others (Mol, Botzen, Blasch, Kranzler, & Kunreuther, 2020). Offerman and Schotter (2009) examine what social information subjects choose when they have a choice. Before making a risky decision, subjects are given a list of previous participants, ranked by their payoff, and then select a limited number of participants whose decisions they want to see. Most subjects choose to view the decisions of those previous participants who earned the most. Because these are the people who have been lucky with a risky decision, and because subjects adapt their own decision towards the self-selected social information, behavior becomes significantly riskier compared to the control treatment without social information. In short, the literature shows us that people tend to take more risk when they learn that other risk takers were lucky. Informing subjects about the risky decision of others without its outcome seems to have a weaker effect and sometimes no effect at all.

Importantly, while not all research in this field has been conducted with students, most of it has been conducted in industrialized countries in the Global North where most people's daily lives are not characterized by high risks. We contribute to these strands of literature by providing evidence on how personal experience of good or bad luck and the provision of social information influences risk behavior in a culturally distinct sample of small-scale resource users in the Global South.

3. Experimental design and implementation

To induce the feeling of good or bad luck, we use a simple betting task. Participants are shown a bag containing 5 blue and 5 orange balls and are asked individually to bet on one of the two colors. After all participants in the session have made their decision, a ball is randomly drawn from the bag. If the color of the drawn ball matches the color a participant has chosen, they win a high prize. If the color does not match the chosen color, they win a low prize. To be able to distinguish between the effect of income and luck, we use two different versions of the betting task. In the version with low stakes, the winner who has chosen the right color gets 1,000 Tanzanian Shilling (TZS) and the loser who has chosen the wrong color gets 500 TZS. In the version with high stakes, the winner gets 2,000 TZS and the loser gets 1,000 TZS. This allows us to study the effect of luck by comparing people who have won the same amount but either by a lucky event or by an unlucky event. It also allows us to study the effect of income by comparing people who are both lucky (or unlucky) but are awarded different amounts. The money won in the betting task is pocketed by the participants and not used in the second game.

In the second game, we use a lottery task, similar to the task developed by Gneezy and Potters (1997), to elicit risk behavior. Participants are freshly endowed with 1,000 TZS and offered to invest all or part of that endowment into a lottery. They know that, if they are lucky, their investment is tripled and, if they are unlucky, their investment is lost. They also know that the part of the endowment that is not invested does not change and will be pocketed. To make their investment decision subjects use a digital slider, starting at 0 and going up to 1,000 in steps of 1 TZS. The probability of being lucky or unlucky is 50% each. To implement the random draw, 5 white and 5 black balls are put in a closed bag and then one ball is drawn out of the bag. If the drawn ball is white, the investment triples and, if the drawn ball is black, the investment is lost. With these parameters, a risk seeking or risk neutral person would invest everything while a risk averse person may keep at least part of the endowment. This task or modified versions of it has been widely used to measure risk behavior (e.g. Gneezy & Potters, 1997; Charness & Gneezy, 2012; de Oliveira, Smith, & Spraggon, 2017; Buser, Ranehill, & van Veldhuizen, 2021).

Both games, the betting task and the investment task, are explained carefully before subjects make any decisions, including examples and control questions (further details are provided below). The reason to first explain both games before they are played is that the experience of being lucky or unlucky should be fresh when subjects make their investment decision. The two decisions should therefore be made in quick succession and not be separated by lengthy instructions.

The social information is not mentioned when the two games are explained. Subjects who take part in one of the information conditions, get the following information just before they make the investment decision:

> *"This is not the first landing site where fishermen participate in this survey. In a previous landing site, the majority of the participants chose to keep [invest] most of their 1,000 TZS."*

We will refer to the "keep message" as low information and the "invest message" as high information. The message is not deceptive because it refers to real participants in different early sessions (where no social information was provided): In some of these sessions, the majority kept most of their endowment, and in some of these sessions, the majority invested most of their endowment. The message is accompanied by a picture of the slider that shows an example of a decision that was made in the respective previous session (either 300 or 700 TZS but the number itself is not shown or mentioned). The picture is shown on a poster in front of all participants and is removed when the participants are asked to make their own decision. Subjects in the no information condition do not get any information about how other fishers decided.

After subjects have made their investment decision and before they learn the outcome of the random lottery draw, they are asked to guess how much the other participants in the same session have invested on average. If their guess is correct, meaning the actual average plus/minus 50 TZS, they get an additional bonus payment of 500 TZS. The main purpose of this task is to be able to check if the social information has an influence on subjects' beliefs about others' behavior.

The experiment was carried out in March 2020 in cooperation with local authorities, who helped to prepare and translate the instructions, find research assistants, plan the travel itinerary, organize the necessary on-site arrangements, and communicate with the villagers. A total of 648 fishers took part in the experiment, in 36 sessions of 18 participants each, spread across 22 villages in all five Tanzanian regions that have access to the lake (see the map in Fig. 1). The sessions were held in a roofed facility in the village close to where the fishers work and live. We aimed at a distribution of dagaa and perch fishers that is roughly representative of the population of fishers at Lake Victoria and visited dagaa and perch landing sites along the entire Tanzanian coastline. Sessions were scheduled both in the morning and in the afternoon to accommodate the different work schedules of the fishers. The participants were randomly seated with the restrictions that the fishers from the same boat were seated far apart. A sample picture of a session is shown in the appendix. Before the subjects completed the two risk games, they played another unrelated game which is not part of this paper. The payoff from this game was not known to the subjects until the very end of the experiment. In addition, a relatively long demographic questionnaire

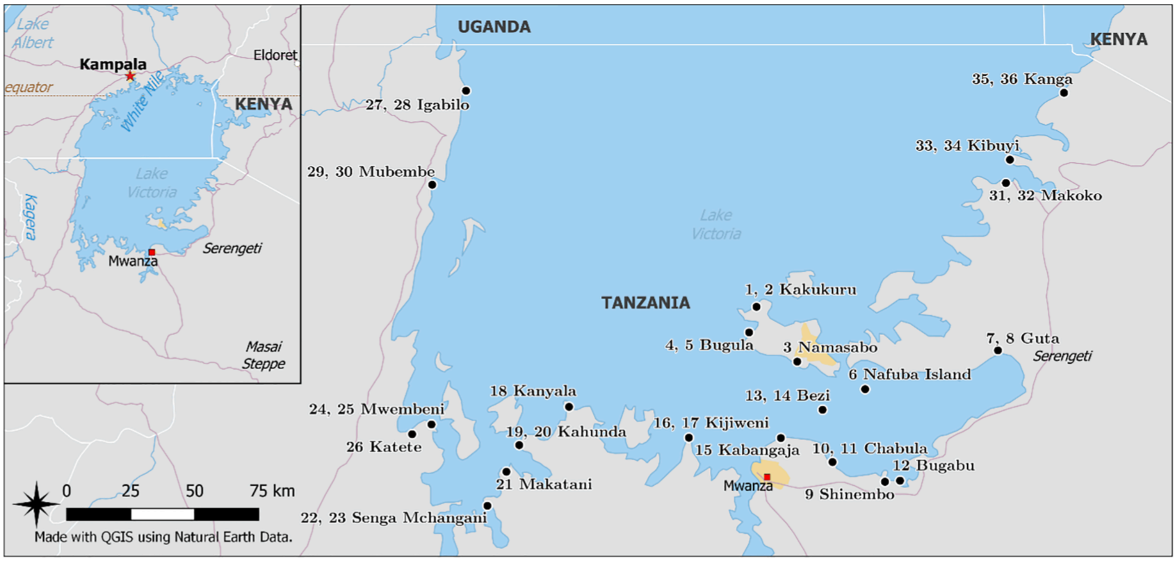

Fig. 1. Map of visited villages at Lake Victoria. The black circles show the visited villages and the numbers describe the order of the conducted sessions.

was inserted in order to reduce possible spill-over effects.[1]

The instructions were explained orally by the same Tanzanian research assistant in all sessions based on a treatment-specific script (one version is provided in the appendix). The research assistant had received extensive training on how to execute the experiment and was standing in front of the room. The oral presentation was accompanied by posters on a flipchart explaining the two games with pictures and several examples. The research assistant guided the participants step by step through the examples and showed how the closed bag and the 10 balls are used for the two random draws. After the examples, participants were asked to answer some control questions.[2] Three additional Tanzanian research assistants helped participants who had difficulties to understand the instructions or to submit their decisions. The research assistants also interviewed illiterate participants who were unable to complete the questionnaires on their own. Participants were provided with tablets with which they submitted their decisions and learned the results. As in the oral presentation, pictures were used to prompt decisions and display results. The games were programmed using oTree (Chen, Schonger, & Wickens, 2016). The tablets were connected through a local network, which ensured that all participants were on the same page and did not click through the games too quickly or too slowly. Each tablet was equipped with a physical cover, ensuring that decisions and feedback were kept private.

The three information levels (no information, low information, high information) and the two stakes levels in the betting task (low stakes, high stakes) were randomized at the session or village level. Randomization was determined ex ante with treatments alternating over time, subject to the following restrictions: (i) information levels were evenly distributed across sessions, (ii) low and high stakes were evenly distributed across information levels, (iii) the no information condition was conducted more often at the beginning until suitable data for the information conditions were available, (iv) when two sessions were conducted in the same village, the same stakes level but different information levels were used. We decided against randomization at the individual level because villagers would later certainly exchange thoughts about the experiment and might find different chances of earning money unfair and different information untrustworthy. This is different to the randomization of the experience of good or bad luck, which was done at the individual level, because it did not imply ex ante different opportunities to earn money. Randomization at the session level also made it much easier to explain everything in the oral presentation held in front of the group. Despite the restrictions, the sample is fairly balanced across the treatments, which we will show later. After the experiment, subjects answered a questionnaire on their personal background and their life as a fisher. At the end, subjects left the room one by one to make the random draw for their investment decision and receive their money from one of the research assistants. Subjects earned on average 2,629 TZS in the two risk games,[3] which corresponds to approximately half of their daily wage. Completing the two risk games together with the questionnaire at the end took about 1–1.5 h.

[1] The other game was a repeated prisoners dilemma (PD) game. Only one out of the five rounds was paid and subjects learned only at the end of the experiment which round was selected. The treatments in this game were desynchronized with the treatments in the risk games so that we can control for possible spill-over effects.

[2] The purpose of the control questions was twofold. First, they were part of the process of making the two games understandable to all participants. Many of the participants made mistakes when answering them and received further explanations about the games afterwards. Second, we use the answers to the control questions in the regression analysis as control variables for how quickly participants understood the games.

[3] This amount does not include the earnings from the other game and the show-up fee.

4. Results

We present our results in three steps. We will first provide an overview of the sample characteristics and discuss balance across treatments. We will then show descriptive results and non-parametric tests for treatment differences in risk behavior and, finally, present regression results and discuss additional robustness tests.

4.1. Sample characteristics and their distribution across treatments

Of the 648 participants, only four are female. Participants are between 18 and 89 years old and the average age is 36 years. About one-third (31.9%) of the fishers specialize in fishing dagaa at night, whereas the remaining participants target Nile perch and other species at day. These two fisheries supply different markets; dagaa is sold locally, while Nile perch is exported to the world market. Prices in the world market can fluctuate widely, while prices for dagaa are more predictable. As the resource stock for perch, where individual fish can grow very large, is more stable than the resource stock for dagaa, the overall variance in revenue in the two fisheries is similar. About a quarter of our sample are boat owners (24.2%). Boat owners face larger financial risks than crew because they incur the capital expenses that are certain, while the income from fishing is variable and uncertain. Moreover, boat owners are often responsible for other strategic decisions, such as investments in gear or where to go fishing which also affect risk exposure. For example, fishing in breeding areas close to shore is more convenient for the crew but it is illegal and therefore riskier than fishing in more distant legal fishing areas. Nearly half of the fishers (47.8%) save money as a member of a savings organization. These informal savings organizations help fishers smooth consumption over time. Savings organizations are an important substitute to formal safety nets such as insurance or pension schemes, which are not readily available at Lake Victoria. Another important way to manage risk is to diversify income possibilities; 44.0% of the participants work in agriculture in addition to being a fisher. As yields in agriculture and fishing are not correlated (or sometimes even negatively correlated), diversification reduces income risk. On average, fishermen report to earn 41,320 TZS per fishing trip, with wide variation among individuals. The median earnings are 15,125 TZS.

Table 1 shows how participants' main socio-demographic variables are distributed across treatments. It can be seen that these characteristics are approximately but not perfectly evenly distributed across the different treatments.[4] For the data analysis, we therefore use not only statistical tests but also regressions where we can control for the socio-demographic characteristics.

4.2. Summary statistics and non-parametric tests

The fishers invest on average 506.6 TZS in the risky lottery. The first important result is that the stakes in the betting task do not have a statistically significant effect on the investment decisions in the risky lottery, allowing us to pool the participants with high and low stakes. The no information condition provides the cleanest setting for this test: Lucky participants who have won 1,000 TZS invest on average 429.1 TZS in the lottery whereas lucky participants who have won 2,000 TZS invest on average 467.6 TZS. Using a Mann-Whitney-Wilcoxon (MWW) test, we cannot reject the hypothesis of equal investment in the two conditions ($p = 0.327$). Likewise, unlucky participants with low stakes invest on average 474.7 TZS which compares to 510.2 TZS invested by unlucky participants with high stakes ($p = 0.489$). We also find no significant differences between high stakes and low stakes participants in the two information conditions.

The experience of good or bad luck, on the other hand, appears to have an effect on behavior in the lottery. As Fig. 2 shows, subjects who have bad luck in the betting task invest more in the lottery than those who have good luck. This is not only true for the no information condition but also for the low information and the high information conditions where the social information could potentially interfere with the prior experience of luck. When comparing all subjects who have good luck and all those who have bad luck, irrespective of the social information, the difference in their investment level is statistically significant (MWW test, $n = 648$, $p = 0.028$). The p-value increases to $p = 0.074$ if we consider only the subjects in the no information condition ($n = 216$) and it further increases if we consider only the participants in the high information condition ($n = 216$, $p = 0.182$) or in the low information condition ($n = 216$, $p = 0.205$). We get stronger results if we focus on the participants who won the same amount in the betting task (1,000 TZS) but some by luck and others by bad luck. Those who are unlucky invest more than those who are lucky, but the effect is not significant ($n = 325$, $p = 0.059$). If we further distinguish by information, we obtain a significant difference between lucky and unlucky subjects in the no information condition ($n = 113$, $p = 0.030$) but not in the two information condition.

Turning to the information treatments, we see that the provision of social information has a strong effect on behavior. Fig. 2 shows that high information increases subjects' investment compared to both low and no information. The differences between high and low information are highly significant irrespective of whether we consider lucky and unlucky subjects separately ($n = 228$, $p < 0.001$ and $n = 204$, $p < 0.001$, respectively) or pool them ($n = 432$, $p < 0.001$). Likewise, the differences between high and no information are highly significant for lucky subjects ($n = 241$, $p < 0.001$), unlucky subjects ($n = 191$, $p < 0.001$), and both groups pooled ($n = 432$, $p < 0.001$).

In contrast, low information seems to have no effect. Participants who received low information and participants who received no information invest at a similar level and the differences are far from significant regardless of whether we compare lucky and unlucky subjects separately or pool them (MWW tests, $p > 0.5$ each).

[4] Out of 78 statistical tests that compare the main socio-demographic characteristics between treatments, 6 show a difference at a significance level of 5% or lower. A Holm-Bonferroni correction for multiple hypothesis testing reduces this number to 3.

Table 1
Distribution of socio-demographic characteristics across treatments.

Stakes in betting task	Good or bad luck	Social information	Number of participants	Share of dagaa fishers	Share of fishers who also work in agriculture	Share of boat owners	Share of fishers who are member of a saving organization	Share of fishers in high income class	Mean age
Total	**Total**	**Total**	**648**	**0.31**	**0.44**	**0.24**	**0.48**	**0.50**	**36.1**
high	good	low	61	0.30	0.53	0.19	0.50	0.49	33.4
high	good	no	59	0.16	0.42	0.19	0.47	0.56	33.3
high	good	high	55	0.32	0.44	0.19	0.44	0.45	38.7
high	bad	low	47	0.30	0.39	0.26	0.35	0.45	32.2
high	bad	no	49	0.19	0.38	0.23	0.46	0.33	33.8
high	bad	high	53	0.37	0.51	0.29	0.52	0.55	42.2
low	good	low	49	0.29	0.37	0.25	0.37	0.53	34.2
low	good	no	64	0.39	0.52	0.19	0.59	0.55	38.8
low	good	high	63	0.44	0.38	0.31	0.46	0.56	36.4
low	bad	low	59	0.37	0.34	0.25	0.52	0.49	38.8
low	bad	no	44	0.34	0.51	0.30	0.50	0.52	34.3
low	bad	high	45	0.32	0.47	0.30	0.52	0.49	35.0

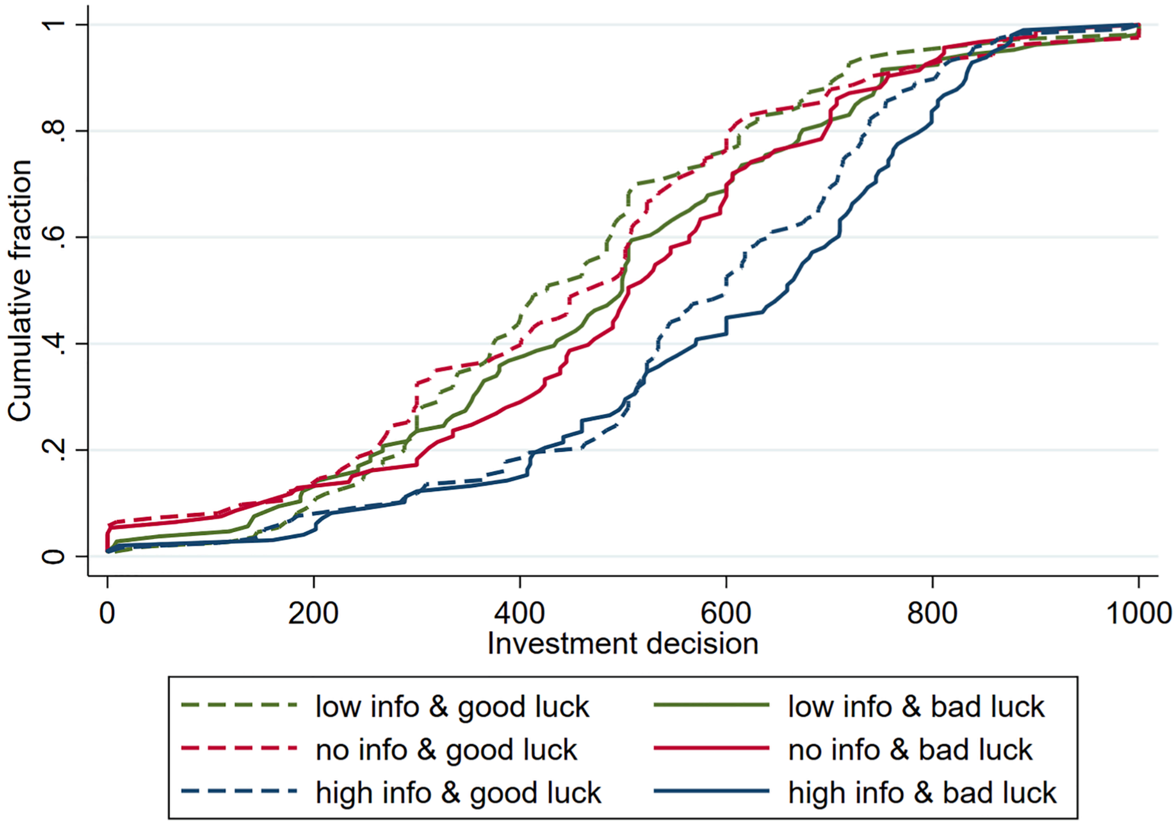

Fig. 2. Cumulative distribution of fishers' investment decisions by experience of good or bad luck and social information. Note: The cumulative distribution in this graph shows the fraction of participants within the same treatment condition who invest the respective amount or less. Participants with high and low stakes in the betting task are pooled.

4.3. Regression analysis

Table 2 presents results from OLS regression analyses of subjects' investment and Table 3 presents equivalent results on subjects' beliefs about others' investment. The standard errors are based on a cluster robust estimation, with clustering at the session level. We show regression results with and without control variables. The control variables include age, gender, boat owner, high income, saving member, secondary occupation in agriculture, dagaa fisher, average payoff in the game played in the first part of the experiment, and whether participants got the control question right at the first attempt. About half of the participants (54.8%) managed to answer the

Table 2
Regression results on risk behavior.

	(1) Investment	(2) Investment	(3) Investment
Low info	−3.2387	2.2185	18.9554
	(22.6163)	(23.2353)	(20.0924)
High info	**118.2248*** **	**123.7501*** **	**86.0467*** **
	(24.4405)	**(21.8724)**	**(19.6511)**
Good luck	−35.8887	−30.2395	−23.7597
	(20.2720)	(19.8557)	(17.7201)
High stakes	6.4263	8.6121	19.6765
	(19.0231)	(19.9293)	(16.7274)
Belief about others investment			**0.4217*** **
			(0.0496)
Control variables	No	Yes	Yes
Constant	**484.5244*** **	**350.9533*** **	**231.6255* **
	(22.5600)	**(85.0575)**	**(90.9194)**
N	648	608	608
R^2	0.0697	0.1379	0.2826
Adjusted R^2	0.0639	0.1175	0.2644

Numbers show results from OLS regression analyses. Dependent variable: Subjects' investment in the lottery. Standard errors are based on cluster robust estimations (by session) and shown in parentheses. Significance levels: *p < 0.05; **p < 0.01, ***p < 0.001. Model 3 includes beliefs about others' investment as explanatory variable; models 1–2 do not. Models 2–3 include the following control variables: age, age^2, gender, boat owner, high income, saving member, correct control questions, secondary occupation in agriculture, dagaa fisher, average payoff in PD game played in the first part of the experiment.

Table 3
Regression results on beliefs about others' risk behavior.

	(1) Belief about others' investment	(2) Belief about others' investment
Low info	−43.0516	−39.6869
	(23.6204)	(23.4072)
High info	**92.7679*** **	**89.4027*** **
	(25.5427)	**(23.5940)**
Good luck	−23.6258	−15.3651
	(17.0859)	(15.6152)
High stakes	−37.0112	−26.2362
	(18.7944)	(18.2023)
Control variables	No	Yes
Constant	**529.5147*** **	**282.9515* **
	(21.9863)	**(118.8302)**
N	648	608
R^2	0.0783	0.1090
Adjusted R^2	0.0725	0.0880

Numbers show results from OLS regression analyses. Dependent variable: Subjects' beliefs about others' investment in the lottery. Standard errors are based on cluster robust estimations (by session) and shown in parentheses. Significance levels: *p < 0.05; **p < 0.01, ***p < 0.001. Model 2 includes the following control variables: age, age^2, gender, boat owner/managerial duties, high income, saving member/saving plan, correct control questions, secondary occupation in agriculture, dagaa fisher, average payoff in PD game played in the first part of the experiment.

control questions correctly at the first attempt while all others needed additional explanations.

The regression results in Table 2 confirm most of the results presented before. High information has a significantly positive effect on investment (column 1). The positive effect of high information remains significant if we add the control variables (column 2) and also if we control for the fishers' beliefs about others' investment (column 3). The latter finding indicates that social information has an effect beyond affecting the beliefs about others' actions. Subjects' beliefs about others' investment and their own investment are positively correlated. The experience of good luck leads to a small reduction of the investment but the effect is not significant (column 1) and becomes smaller in absolute terms if we include control variables and beliefs (columns 2 and 3).

The results in Table 3 show that high information increases the beliefs about others' investment significantly while low information has only little effect on beliefs. The decrease in the beliefs due to low information is smaller when we include other control variables in the model. Although we do not want to overemphasize the findings on beliefs because our data do not allow us to draw conclusions about causal relationships, we note that the findings on beliefs are consistent with the findings on behavior.

We do not show the control variables in Tables 2 and 3 to save space and because their impact is not our main focus. To provide a short summary, income and answering the control questions correctly do not have a significant effect on the investment decision. Middle-aged people invest more than younger or older people. Boat owners and members in a savings organization invest more while fishers who also work as farmers invest less. Dagaa fishers invest less than other fishers but, unlike in previous studies (Eggert & Lokina, 2007), the effect is not significant. These effects most likely reflect the respective risk preferences of the fishermen and existing protection. The complete results are provided in the appendix (Tables A1 and A2). We also show regressions in the appendix in which we interact the treatment variables with the correct answering of the control questions (Table A4). Whether subjects answer the control questions correctly does not matter for the reaction towards high information. As for low information, there is a small difference, as those who do not answer the control questions correctly respond with a lower investment. This interaction effect becomes insignificant when we control for beliefs. In the appendix we also look at interactions between luck and social information and find no statistically significant interaction effect (Table A5).

5. Conclusions

The aim of this paper is to examine possible determinants of risk behavior in a special sample of people who make many risky decisions in their everyday life and whose decisions have important effects on the surrounding ecological and economic systems. The key finding is that fishers in a small-scale fishery at Lake Victoria are willing to take significantly more risk when they know that others have taken high risks. This imitation is not driven by a desire to keep up with those who have earned high incomes, since the fishers do not know how well others have done with their risky decision. The information that other fishers have taken little risk does not cause fishers to take less risk themselves. A possible explanation for this difference in imitation is that the fishers, consciously or unconsciously, perceive the courage of those who take high risk as more competent and worthy of emulation than the caution of those who take little risk. This is consistent with the finding that the beliefs about the decisions of other fishers in the same session also adjust much more when information about high risk taking is provided rather than low risk taking. Regarding the experience of good or bad luck, we find that the fishers tend to be more willing to take risk if they were unlucky before, supporting the gambler's fallacy hypothesis. However, the effect is small and the statistical evidence is relatively weak. It could be interesting for future research to examine if the results generalize to other settings with different reference groups or where not only the decision but also the outcome is known.

Our findings are particularly relevant for policymakers seeking to promote behavior that includes a risk dimension. An example is the introduction of new marketing avenues, for example through eco-labeled value-chains, or the adoption of new technologies, such as more selective fishing gears. Here, social information about those who are already using new marketing channels or have adopted new technologies could help other fishers. Illegal fishing is an example where it may be more difficult to work with information campaigns to the extent that fishermen tend to imitate risky behavior. Here, a combination of measures, including the dissemination of information, could be used to ensure that those who break rules are not perceived as clever or successful. Should the local authority decide to inspect illegal fishing more often, then the announcement might be even more important than the inspection itself because an individual fisher who has been caught might assume that he is off the hook for a while. Feelings toward inspectors can also have an impact on compliance behavior (Enachescu et al., 2019).

Of course, risk is only one factor among many that are relevant for the fishers. Social considerations are certainly important, which have been investigated in a related strand of literature (Bicchieri & Dimant, 2019; Bicchieri, 2016). It could be a promising way forward to combine the two factors, risk and prosociality, in future research on social information and norms. An interesting extension would be to examine risk behavior and social information when risk affects not only one's own payoff but also the payoff of others. Risk-taking behavior has been found to change when one is responsible for another person's payoffs (Pahlke, Strasser, & Vieider, 2015; Vieider, Villegas-Palacio, Martinsson, & Mejía, 2016), and social information may reinforce or reduce these tendencies. Jagau & Offerman (2018), for instance, show that individuals in charge of a group align their risk decisions with the group's preferences. Another extension would be to test social information in a setting where one's own risky decision also affects other people, but the interests are in conflict, so that one has no incentive to take risk but it would be useful for the group or vice versa (Barrett & Dannenberg, 2012; 2014).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joep.2022.102493.

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