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Gregarious Analysts - Experimental Evidence for Reputational Herding

Previous evidence has shown that the most prominent form of rational herding, informational cascades, is at least questionable. This paper investigates another form of rational herding. Basically following the reputational herding hypothesis (Keynes, 1936) we set incentives to follow the herd but also to risk an individual forecast. Our experiment allows us to separate rational from irrational herding. It is shown that more than 95 per cent of the subjects tend towards herding of one kind or another. 82 per cent exhibit rational herding, at least 78 per cent are clearly reputational herders, while 14 per cent behave irrationally, but within the herd. (JEL: C91, G10)

Banerjee (1992) as well as Bikhchandani, Hirshleifer and Welch (1992) have greatly enlivened the discussion about the possible herding behavior of financial analysts with their model of informational cascades. The model assumes that the subjects not only take note of their private signal, but that they also observe the decisions of their predecessors and – as far as possible – draw conclusions about their private signals. All the available information is then gathered and the alternative with the highest probability of success is determined with the aid of Bayes' rule. The theory of informational cascades shows that rational herding behavior can arise even though all of the analysts are making a sincere and serious effort to make the best possible forecast.

However, a series of experimental investigations into the informational cascades theory leads to disappointment. For example, both Huck and Oechssler (2000) and Spiwoks, Bizer and Hein (2007) show that subjects are only prepared to or able to make rational decisions in exceptional cases in this type of decision-making situation. It is also shown that 'correct' choices usually occur purely coincidentally due to the application of non-rational thumb rules. Subjects often cannot even adequately deal with decision-making situations demanding more than little effort.

The debate on possible rational herding behavior by financial analysts is currently dominated by the theory of informational cascades. The rejection of this approach based on experiments therefore raises doubts whether rational herding actually exists. In the course of informational cascades experiments, a large majority of subjects only exhibit a weak tendency to make a serious effort to reach a rational decision. Every type of herding behavior could possibly be an expression of irrational decision-making.

However, before such far-reaching conclusions can be drawn, experiments should be carried out to test other theories of rational herding. This study examines the theory of reputational herding. This approach assumes that financial analysts make strategic use of an information asymmetry. For the clients of the forecasts it remains hidden whether the market evaluation given by the analyst mirrors his actual opinion, or if he is merely imitating other analysts' market evaluations for strategic reasons. If an individual analyst comes to a conclusion which differs from those of other financial analysts, he has to undergo a calculation, which was first described by Keynes (1936, pp. 157-158): Should the analyst's estimation – which is contrary to the common market opinion – be wrong, his reputation will suffer badly from the false forecast. Should he be right his singular forecast among the many contrary forecasts would be considered a fluke – his reputation would not benefit. If he follows the common estimation against his better judgment, his reputation would benefit should the majority's opinion be proved correct. Yet, even if he and the other analysts were wrong this would not lead to a loss of reputation. As all analysts were wrong, the unexpected development would be regarded as unforeseeable.

Considering these calculations, it would not make sense to follow one's own judgment when it is contrary to the collective estimation. The financial analyst who always joins the prevailing opinion has the best prospects of increasing or at least retaining his reputation. An increase in reputation normally leads to an increase in income. A loss of reputation often increases the risk of the analyst losing his or her job.

The reputational herding theory goes against intuition in one respect. Some authors expect there to be a clear gain in the reputation of an analyst who is the only one to make a correct forecast. Zitzewitz (2001) or Laux and Probst (2004), for example, state that there are incentives – at least for some analysts – to diverge from the dominating opinion in the analyst community.

This study therefore conducts an experimental analysis of a specific variation of the reputational herding model. In this variation, successful forecasts which deviate from the consensus forecast are rewarded significantly higher than a mere orientation towards the analyst community. The experiment offers an incentive to stray from the herd alongside the incentives to move with the herd. If there is a tendency towards herding even under these circumstances, then Keynes' assessment of the forecaster's situation should be all the more valid, that the successful lone wolf does not expect an appropriate reward.

The theory of reputational herding differs from the theory of informational cascades in two important ways: 1. Whereas the theory of informational cascades demands a high level of ability to think in abstract terms and requires confidence in the process of probability calculus, the theory of reputational herding is characterized by relatively simple decision-making which subjects can grasp quickly and easily. 2. The incentive for rational decisions in the informational cascades model lies in maximizing the probability of the success of one's own decision only and thus the expected value of the reward (positive incentive). In the reputational herding model there is a double incentive. An increase in reputation leads to an increase in income (positive incentive). A decreasing reputation increases the risk of the analyst losing his or her job (negative incentive).

Against the background of these two fundamental differences, it is meaningful to examine reputational herding as a way of explaining rational herding behavior.

Until now there has only been one experimental study on reputational herding. Cotes and Sanders (1997) provided the members of an investment club with relevant data on fictitious companies. After making a first forecast they were shown the consensus forecast. They were then allowed to correct their forecast. With the aid of the herding ratio it was then possible to show that most of the subjects clearly corrected their forecasts towards the consensus forecast. These results are highly interesting. But the form of this experiment does not facilitate a differentiation between rational and irrational herding behavior. It remains unclear whether the adjustment of the forecasts in the second round is caused by the subjects rationally wishing to increase the expectancy value of their payoff, or whether it is based on an irrational conformity preference.

Unlike the study by Cotes and Sanders, our experiment permits a clear differentiation between rational and irrational herding behavior. The description of the experimental design (chapter I)

is followed by the analysis of the results (chapter II). The conclusion of the investigation is presented in chapter III.

I. Experimental Design

Students of the Georg-August-Universität Göttingen and members of GWC investment club take on the role of a financial analyst and have to deal with 24 successive forecasting tasks. The problem is to forecast the future share price of the company XY. This share price always moves between EUR 200 and 300 and does not assume any values between EUR 10 stages. The share price can thus have eleven different values (200, 210, 220, 230, … , 300). The subjects are provided with an experts' forecasting program which offers a forecast proposal before each forecast is made. The success rate of the forecasting program is exactly 50 percent. Before each forecast, the subjects are additionally informed about which forecast the analyst community made.[1] The subjects can orientate their forecast towards the opinion of the analyst community or the proposal of their forecasting program, or they can decide on one of the nine other possible prices.

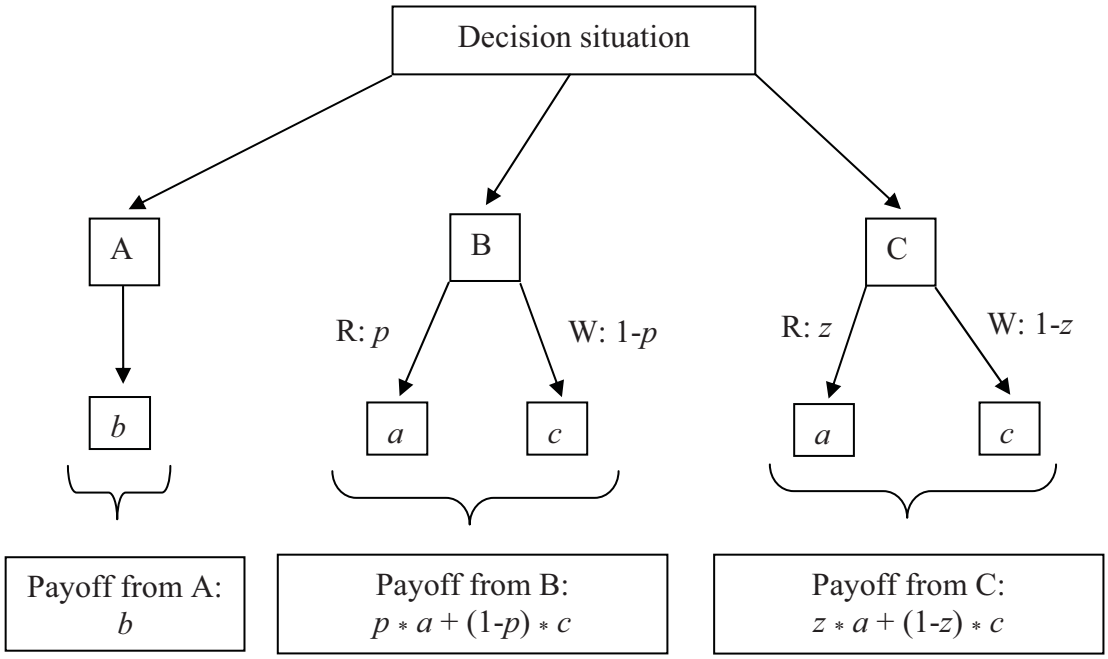
The changes in the share price are modeled as a random process. In each round it is randomly determined which of the eleven possible prices has the probability of 0.5. This price is the forecast recommended by the experts' program. The remaining ten alternatives each occur with a probability of 0.05.

Alongside the payment of EUR 3.00 which is independent of their success, the students can earn a reputation bonus. Regardless of the success of their forecast, the reputation bonus rises by EUR 0.10 if the subject makes the same forecast as the analyst community (= herding behavior). The reputation bonus rises by EUR 1.00 if the subject makes a forecast which deviates from that of the analyst community and turns out to be correct. The reputation bonus does not rise if the subject makes a forecast which deviates from that of the analyst community and does not turn out to be correct. The first four cases in which a subject does not follow the analyst community and where his or her forecast is wrong do not have any consequences. Within these four trials there will be no reputation bonus if the forecasts are wrong, but analysts will not lose their job. But if the maverick risk is realized for a fifth time, the subject loses the previously built reputation and is eliminated from the game.

[1] The experiment is not interactive. The forecasts of the expert community are exogenously given.

The members of the Göttinger investment club (GWC) receive markedly higher payoffs in order to allow for an appropriate incentive. The mark-up was the fifth of students' payoffs. The entire payoff structure of the experiment is given by figure 1.

Subjects are fully informed about these circumstances. Before the start of the experiment, targeted questions are put to the subjects to ensure their full and correct understanding of the situation. The instructions for the game and the catalogue of control questions are in the appendices A and B.



A = Strategy "analysts community"
B = Strategy "forecasting program"
C = Other action
R = Right
W = Wrong
p = Probability of a correct forecast when the recommendation of the forecasting program is followed (= 0.50)
z = Probability of a correct forecast when the recommendation of the forecasting program is not followed (= 0.05)
a, b, c = Increases in the reputation bonus
where a > b > c (a = EUR 1.00; b = EUR 0.10; c = EUR 0.00)[2]
where E(A) = EUR 0.10 ; E(B) = EUR 0.50; E(C) = EUR 0.05[3]

FIGURE 1. THE PAYOFF STRUCTURE OF THE EXPERIMENT

[2] GWC investment club: a = EUR 5.00; b = EUR 0.50; c = EUR 0.00.
[3] GWC investment club: E(A) = EUR 0.50 ; E(B) = EUR 2.50; E(C) = EUR 0.25.

The following rational behavior strategies can be expected:

1. With a perfectly rational strategy, the subject follows the forecasting program until the four failed forecasts which have no consequences have been used up. After that he or she will join the herd. This way subjects maximize the expected value of the payoff and the danger of losing the reputation bonus is averted.

2. The second strategy is characterized by the subject clearly taking note of probabilities but lacking in the transformation into a mathematical process. We call this a quasi-rational strategy.[4] The quasi-rational subject tries to follow the forecasting program during the course of the 24 rounds of the game in such a way that the four permissible failed forecasts have been used up at the end. However, there is a high level of probability (0.97) that 14 rounds of the game are sufficient for this. They can thus also afford to occasionally deviate from the recommendation of their forecasting computer before the four failed forecasts have been used up. They perhaps do this in order to try out the alternative of the 'herd', upon which they will presumably be dependent later on. In this way, the subject can gain a higher feeling of security with regard to the circumstances of the game. After the fourth failed forecast, the subject aligns him/herself with the course taken by the analyst community.

3. The rational subject with a high risk aversion will follow the strategy of staying in the herd from the very beginning if the expectancy value of EUR 0.50 for a forecast according to the forecasting program does not appear to be sufficient compensation for the safe result (EUR 0.10 for orientation towards the analyst community).[5] These cases can be identified because the risk aversion of each subject is determined in a test before participation in the experiment (see Appendix C).

The following behavior patterns, which can be described as irrational strategies, are also possible:

1. After using up the fourth failed forecast, the forecaster continues to avoid the herd.

[4] The concept of quasi-rationale decisions borrows from Herbert Simon's (1955) "bounded rationality". He argues that because optimization is costly and humans are naturally limited in their abilities, they engage in „satisficing", an alternative to optimization in which individuals make choices that are merely satisfactory, not necessarily optimal. Slightly differing we speak of quasi-rationale decisions, if the approach to reach a solution resembles bounded rationality but the result is equal to an optimization and fully rational strategy. We speak of quasi-rationale behavior if, in other words, the subject moves occasionally into the herd before four successless trials of individual forecasts are used up, but fully uses four such trials before the experiment ends.

[5] GWC investment club: expectancy value of EUR 2.50 is not sufficient compensation for safe EUR 0.50.

2. In spite of a 'normal'[6] level of aversion to risk, the subject follows the herd from the beginning so that the four failed attempts are not used up.

The first case can appear with non-conformists who as a matter of principle do not want to bow to the circumstances. Subjects who prefer to make intuitive decisions and are not put off by possible disadvantages can also fall into the first category. The second category includes those who tend towards irrational herding behavior. They give up the opportunity to possibly maximize their reputation bonus in order to join the herd early on.

II. Results

A total of 138 subjects took part in the experiment. They are members of GWC investment club and students of the Georg-August-Universität Göttingen. The majority of the students belong to the faculties of economics, law and theology (see Table 1).

TABLE 1 – COMPOSITION OF THE SUBJECTS

	Students				GWC investment club	Σ
	Economics	Law	Theology	Others		
Women	22	10	11	9	3	55
Men	39	14	9	4	17	83
Σ	61	24	20	13	20	138

Thirty-two of the subjects (23.19%) behaved in a completely rational way. They orientated their forecasts towards the recommendations of the forecasting program and only joined the herd after their fourth failed attempt. 76 of the 138 subjects (55.07%) behaved in a quasi-rational way. Even before they had reached their fourth failed attempt, they deviated once or several times from the recommendation of their forecasting program. In total, however, they followed the recommendation of the forecasting program often enough to have used up the four failed attempts after 23 rounds of the game at the latest. After that they joined the herd

[6] A 'normal' level of risk aversion means the subject's risk aversion is below the offered expected compensation.

and stayed with it. In spite of having a 'normal' level of risk aversion, 19 of the 138 subjects (13.77%) joined the herd so early on that they did not succeed in using up their four failed attempts. This behavior has to be interpreted as irrational herding behavior, as they joined the herd at a time when it was still advantageous to make their own forecasts. Six of the 138 subjects (4.35%) continued to rely on the recommendation of their personal forecasting program although they had already used up their four failed attempts. They took the maverick risk for the fifth time, lost, and were thus eliminated from the game and forewent the entire reputation bonus which they had accumulated until that moment. Enquiries established that their behavior was by no means based on a lack of understanding of the rules of the game, but on a fundamental dislike of following the opinion of the majority. Measured against the experiment's payoffs, their behavior has to be viewed as irrational.

Five of the 138 subjects (3.62%) exhibited such a high level of risk aversion that they did not consider the EUR 0.50 for following the recommendation of the computer to be sufficient compensation. Instead, they preferred to take the safe EUR 0.10 which could be obtained by orientating themselves towards the analyst community. These subjects behaved in a completely rational way. In the survey carried out before the game they indicated that an amount of at least EUR 1.00, which they would receive with a probability of 50%, would be appropriate compensation for a safe EUR 0.10.[7]

In summary, the following can be established:

- 132 out of 138 subjects (95.65%) exhibit herding behavior.
- 113 out of 138 subjects (81.88%) exhibit rational herding behavior.
- 19 out of 138 subjects (13.77%) exhibit irrational herding behavior.
- 6 out of 138 subjects (4.35%) refused to align themselves with the herd.

Under our experiment's conditions subjects show a strong herding tendency. The predominant strategy is rational herding. In contrast to experiments testing informational cascades in this one a single individual cannot block the genesis of a herd. Instead, our reputational herding experiment allows each individual regardless of the behavior of others to step into the herd at any moment. This allows to interpret the results as a solid confirmation of the plausibility of reputational herding.

[7] No such cases occured with the GWC investment club.

The final assessment of these results can be influenced by whether the different subject groups exhibit significant deviations from each other. The results are therefore differentiated in tables 2 and 3 according to gender and to subject groups.

TABLE 2 – DIFFERENTIATED OVERVIEW OF RESULTS ACCORDING TO GENDER

	Women	Men	Total
Rational herding behavior	43	70	113
- completely rational strategy	10	22	32
- quasi-rational strategy	31	45	76
- rational risk avoidance	2	3	5
Irrational herding behavior	9	10	19
No herding behavior	3	3	6
Total	55	83	138

TABLE 3 – DIFFERENTIATED OVERVIEW OF RESULTS ACCORDING TO GROUPS OF SUBJECTS

	Students				GWC	
	Eco-nomics	Law	Theo-logy	Others	investm. club	Total
Rational herding behavior	50	18	16	12	17	113
- completely rational strategy	19	7	3	1	2	32
- quasi-rational strategy	29	9	13	10	15	76
- rational risk avoidance	2	2	0	1	0	5
Irrational herding behavior	7	6	4	0	2	19
No herding behavior	4	0	0	1	1	6
Total	61	24	20	13	20	138

At first glance no significant deviations occur between subject groups in table 2 and 3. In addition, a chi-square test shows whether there are significantly different results according to gender or according to subject groups. The necessary contingency tables take the three main categories into account (rational herding behavior, irrational herding behavior, no herding behavior).

TABLE 4 – CHI-SQUARE TEST: INFLUENCE OF GENDER AND SUBJECT GROUPS ON DECISIONS

	χ^2-distribution	Critical value	p-value
Deviations between the sexes	0.8581	5.9914	0.6511
Deviations between subject groups	8.2881	15.5073	0.4058

χ^2-test critical value on 0.95 significance level.

It can be seen that there are no significant differences between the different clusters of subjects. Neither gender nor the groups of subjects have an important influence on the behavior of the subjects. This is an indication of robust results.

In addition, it is necessary to determine whether the behavior of the subjects is significantly influenced by the realization of random events. When the subject follows the recommendation of the forecasting computer, this will lead to success in 50% of the cases and failure in 50% of the cases. If a success (or a failure) increases the probability of the player again following the forecast of the computer (or joining the herd) in the next round of the game, this would indicate decision-making behavior which is highly dependent on the current situation. However, if the subjects act largely rationally, they would realize that success or failure in the previous round are merely expressions of a random process and thus have no bearing on the chances of success in the coming round. Again, the behavior of the subjects is tested by a chi-square test for the first ten rounds of the game.[8]

TABLE 5 – CHI-SQUARE TEST: THE INFLUENCE OF PREVIOUS SUCCESS OR FAILURE ON DECICI-ON-MAKING

	Round 1 to round 2	Round 2 to round 3	Round 3 to round 4	Round 4 to round 5	Round 5 to round 6	Round 6 to round 7	Round 7 to round 8	Round 8 to round 9	Round 9 to round 10
χ^2-dist.	1.873	0.061	1.214	0.207	0.618	0.2307	2.761	1.113	0.909
p-value	0.1711	0.8056	0.2705	0.6495	0.4319	0.6310	0.0966	0.2915	0.3401

[8] After the tenth round of the game, the number of independent forecasts occurring is so low that no reliable results can be achieved.

The test statistics in the chi-square test have values between 0.020 and 2.761 and are thus not in the rejection region on a 0.95 significance level (> 3.814). There is nothing to indicate that the decision-making behavior of the subjects has been influenced by success or failure in the respective previous round.

All results indicate that the individual behavior of subject is in line with Keynes' reputational herding hypothesis. This holds even though the experimental design allows for positive payoff if an individual stands alone in making a correct forecast.

III. Conclusion

The strength of the reputational herding hypothesis lies in its convincing basic assumptions. The goal of the analyst is not to make the best possible forecasts, but to improve his or her career prospects. The quickest and most reliable way for an analyst to lose his or her job is to make exotic forecasts which then turn out to be wrong. As it is difficult or perhaps even impossible to always make correct capital market forecasts, the analyst should refrain from making forecasts which are so far away from the opinion of the analyst community that they are perceived as being exotic.

In order to provide conclusions which are as reliable as possible and to be able to distinguish between rational and irrational herding behavior, the experiment is orientated towards a variation of the reputational herding theory. Here, successful forecasts which deviate from the general opinion lead to an increasing reputation and thus also to monetary rewards.

The results of the experiment support the opinion that the reputational herding theory is a suitable approach for plausibly explaining the herding behavior of financial analysts, which can be frequently observed in reality. More than 95 percent of the subjects tend towards herding behavior under the conditions of the experiment. Just below 82 percent of the subjects do this in a calculated way. Only about 4 percent of the subjects consciously refuse to join the herd. It can be assumed that people of this type would not have long careers in the investment business. A young analyst who manages to realize the maverick risk in more than 20 percent of the forecasts he or she makes (in the experiment: 5 out of a maximum of 24), will hardly be able to hope for support from his bosses, not to mention encouragement.

The reputational herding theory is not fundamentally called into question by diverging behavior of individuals. Even if some subjects do not behave rationally and tend to be rather irra-

tional, herd formation can take place. This theory thus forms a sharp contrast to the theory of informational cascades. The latter suggests that all economic players act purely rationally, always make use of the information available, and apply Bayes' rule correctly. If a subject has to fear that one or several of his or her predecessors made their decisions according to different criteria, their decisions cannot be used to draw conclusions about their private signals. Then one can only orientate oneself towards one's own private signal, the cascade is broken and there is no herd formation.

Unlike the informational cascades theory, the reputational herding theory, which is now already over 70 years old, thus proves to be a convincing and sound explanation for the herding behavior of financial analysts. Future research should try to determine whether the assumed incentive mechanisms coincide with the actual circumstances. Of particular interest here is whether there is something as a maverick chance, in other words whether analysts who make successful forecasts outside the herd actually receive a reward.

Appendix A: Instructions for the game

Game situation:

Imagine you are a stock market analyst who works for a large bank. You have to make a forecast twice a month for a year. You will complete this 'year' within the next 10-20 minutes. Your job is to forecast the share price of the company XY. Before each new forecast you make, you will be informed whether your previous forecast has been successful.

Payment:

You will receive a fixed payment of EUR 3.00 as an 'annual salary'.[9] You receive this fixed payment regardless of the results of your forecasts. In addition, you can receive a performance-related bonus at the end of the year. The performance-related bonus increases in line with the reputation which you have built up during the year as a stock market analyst. There are two ways of building up your reputation:

1. You can achieve a moderate increase in your reputation when you make forecasts which correspond to those of your fellow analysts – regardless of the success of your forecasts. In that case you are always exactly as successful (or unsuccessful) as your fellow analysts. In this way, there is no danger of making a fool of yourself, and your bonus increases by EUR 0.10 with every round of the game.[10]

2. You can achieve a high increase in your reputation when you make forecasts which turn out to be correct and which deviate from those of your fellow analysts. In that case, you were better than your colleagues. The bonus increases by EUR 1.00 with each round of the game.[11]

There is no increase in your reputation when you make forecasts which deviate from those of your fellow analysts and which turn out to be wrong. Your bonus remains unchanged as long as you only make such a mistake on rare occasions. If, however, you make a forecast which deviates from that of your colleagues and which turns out to be wrong on more than four occasions, your employer will consider you to be an incompetent analyst. You will lose your

[9] GWC investment club: No fixed payment.
[10] GWC investment club: EUR 0.50
[11] GWC investment club: EUR 5.00.

entire entitlement to the reputation bonus and will be fired immediately. You will only receive the fixed payment of EUR 3.00.[12]

Available information:

1. Before each forecast you will be informed about the forecasts of your fellow analysts.
2. You have a relatively reliable forecasting computer with the help of which you can estimate the future share price of the company XY. In 5 out of 10 cases, your forecasting computer is right – also in those cases when the forecast of your computer deviates considerably from the forecasts of your colleagues. All other alternatives have a probability of 0.05 to be correct. Before each forecast you are informed about which share price your forecasting computer expects.
3. You will also be informed about how often you have made forecasts in the previous rounds which did not coincide with those of your colleagues and which turned out to be wrong. (*Please note: If this happens more than four times, your entire reputation bonus will be forfeited and you will be made redundant immediately.)*

[12] GWC investment club: No fixed payment.

Appendix B: Questions to gauge the player's understanding of the instructions

Which payment amount do you receive:

- When you follow the opinion of your fellow analysts and are right?

My payment in this case is: EUR 0.10 / 0.50*

- When you follow the opinion of your fellow analysts and are wrong?

My payment in this case is: EUR 0.10 / 0.50*

- When your computer forecast is different to that of your colleagues and is correct?

My payment in this case is: EUR 1.00 / 5.00*

- When your computer forecast is different to that of your colleagues and is wrong?

My payment in this case is: EUR 0.00 / 0.00*

- How high is the probability that your forecasting computer is right?

The probability is: 50% / 50%*

- Which payment can you expect when you follow the recommendation of your forecasting computer?

My expected payment is: EUR 0.50 / 2.50*

- Does it matter how large the difference is between your computer forecast and the forecast of your colleagues?

☐ yes ☒ no

- In which case would you forfeit your entire reputation bonus?

More than four times wrong and alone.

* correct answers for the subjects of Göttingen investment club (GWC).

Appendix C: Measurement of the individual tendency towards risks

In order to measure risk aversion, test persons are asked to decide between the two alternatives A and B. If a person chooses alternative A, he or she receives the absolutely certain amount *y*. If the test person chooses alternative B, on the other hand, he or she receives the amount *x* with a probability of 50%. It is clear in this context that alternative B becomes more attractive (unattractive) as the amount *x* increases (decreases). The test person now has to name the amount *x* where he or she has no preference between the two alternatives. To make this more understandable, the risk aversion measurement instrument is illustrated in the following diagram.

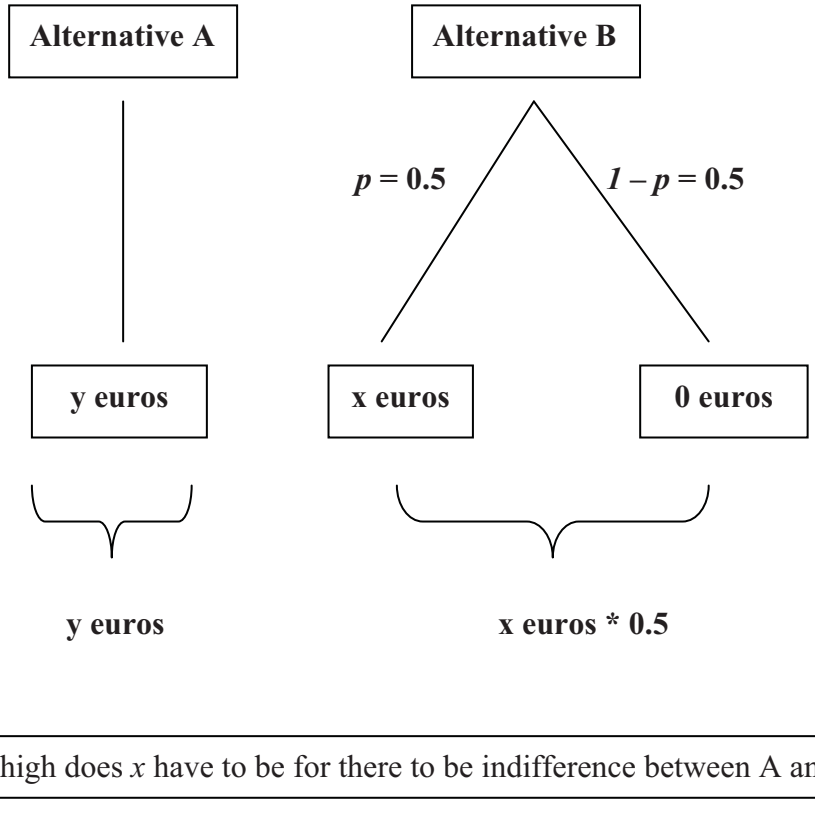


FIGURE 2. INSTRUMENT FOR MEASURING RISK AVERSION

If the amount *x* is 2 *y* euros, the test person is risk neutral, as both alternative A and alternative B have an expectancy value of 0.5 $x = y$ euros. By contrast, a test person who is averse to risk would demand an amount $x > 2\ y$ euros in order to renounce a certain *y* euros. By contrast, a test person who likes to take risks would only demand an amount $x < 2$ y euros in order to

renounce a certain y euros. The lower the amount *x*, the more the person tends to take risks. The amount *x* thus provides clarity about the subject's attitude towards risk (Figure 3).

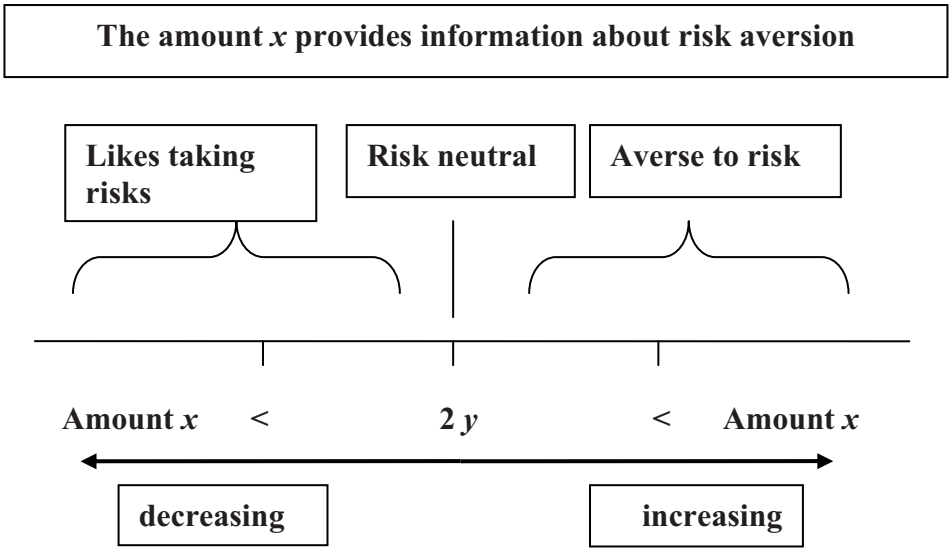


FIGURE 3. ATTITUDES TO RISK

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