A joint Initiative of Ludwig-Maximilians-Universität and Ifo Institute for Economic Research

Working Papers

ILLUSION OF EXPERTISE IN PORTFOLIO DECISIONS - AN EXPERIMENTAL APPROACH

Gerlinde Fellner
Werner Güth
Boris Maciejovsky*

CESifo Working Paper No. 621

December 2001

CESifo
Center for Economic Studies & Ifo Institute for Economic Research
Poschingerstr. 5, 81679 Munich, Germany
Phone: +49 (89) 9224-1410 - Fax: +49 (89) 9224-1409
e-mail: office@CESifo.de
ISSN 1617-9595

* Financial support by the Deutsche Forschungsgemeinschaft (SFB-373, C5) is gratefully acknowledged. We are indebted to Silke Meiner, Sylvia Schikora, and Volker Zieman for their research assistance. Valuable comments by Martin Weber and by participants at the GEW-meeting in Magdeburg are also acknowledged.

CESifo *Working Paper No. 621*
December 2001

ILLUSION OF EXPERTISE IN PORTFOLIO DECISIONS - AN EXPERIMENTAL APPROACH -

Abstract

Overall, 72 subjects invest their endowment in four risky assets. Each combination of assets yields the same expected return and variance of returns. Illusion of expertise prevails when one prefers nevertheless the self-selected portfolio. After being randomly assigned to groups of four subjects are asked to elect their "expert" based on responses to a prior decision task. Using the random price mechanism reveals that 64% of the subjects prefer their own portfolio over the average group portfolio or the expert's portfolio. Illusion of expertise is shown to be stable individually, over alternatives, and for both eliciting methods, willingness to pay and to accept.

JEL Classification: C91, D80, D84, G11.

Keywords: investment decisions, portfolio selection, overconfidence, unrealistic optimism, illusion of control, endowment effect.

Gerlinde Fellner
Max-Planck-Institute for Research into Economic Systems
Strategic Interaction Group
Kahlaische Str. 10
07745 Jena
Germany

Werner Güth
Max-Planck-Institute for Research into Economic Systems
Strategic Interaction Group
Kahlaische Str. 10
07745 Jena
Germany
gueth@mpiew-jena.mpg.de

Boris Maciejovsky
Max-Planck-Institute for Research into Economic Systems
Strategic Interaction Group
Kahlaische Str. 10
07745 Jena
Germany

1. Introduction

Standard economic theory – still the dominant paradigm in finance – assumes that investors are fully rational utility maximizers and are able to identify relevant information in order to arrive at optimal decisions. Empirical evidence, however, shows that individuals systematically deviate from the predictions of standard theory. It, for instance, indicates that individuals exhibit overconfidence, unrealistic optimism and illusion of control, even when the decision outcome is purely determined by chance.

Overconfidence is regarded as one of the most robust findings in the psychology of judgment (e.g., De Bondt and Thaler, 1995) and can be defined as a systematic overestimation of the accuracy of one's decisions and the precision of one's knowledge (e.g., Alpert and Raiffa, 1982; Fischhoff, Slovic and Lichtenstein, 1977; Lichtenstein, Fischhoff and Phillips, 1982). Overconfidence has been observed in many professions (see Yates, 1990, for an overview), and is positively related to the personal importance of a task (Frank, 1935). Correspondingly, experts have been shown to exhibit overconfidence more often than relatively inexperienced individuals (Griffin and Tversky, 1992). Psychological research also indicates that individuals tend to be unrealistically optimistic about the future. They judge positive traits to be overwhelmingly more characteristic of self than negative attributes (Alicke, 1985; Brown, 1986), and positive personality information can be recalled more quickly than negative information (Kuiper and Derry, 1982). Most people also show poorer recall for information related to failure than to success (Silverman, 1964), and tend to recall their task performance as more positive than it actually was (Crary, 1966). Additionally, individuals were found to credit themselves for past success, and blame external factors for failures (Fischhoff, 1982; Langer and Roth, 1975). People do also believe that their chances of success at a random task are greater than justified by objective analysis; this phenomenon is referred to as illusion of control (Langer, 1975). Individuals, for instance, simply believe they can skilfully influence and control outcomes of chance events.

With respect to financial decision making overconfidence has been both studied analytically and empirically. The model by Daniel, Hirshleifer and Subrahmanyam (1998), for instance, predicts that (i) overconfidence implies excess volatility, and that (ii) investors overreact to private information signals and underreact to public information signals. Odean (1998) emphasizes that overconfidence (i) increases expected trading volume, (ii) increases market depth, and (iii) decreases the expected "utility" of traders. Gervais and Odean (2001) ascertain that levels of overconfidence are greatest for inexperienced traders. By analyzing more than 10,000 individual accounts at a large discount brokerage house, Odean (1999) demonstrates that, on average, investors sell securities that outperform those they purchase. Maciejovsky and Kirchler (forthcoming) compare two different and independent measures of over-confidence in the context of an experimental asset market and show that overconfidence increases with experience, but is moderated by the methodology used. Dittrich, Güth and Maciejovsky (2001) also demonstrate in an experimental asset market that overconfidence (i) increases with the absolute deviation from optimal choice, (ii) increases with task complexity, and (iii) decreases with uncertainty.

Since overconfidence can be defined as believing to be better than others it is certainly interesting to study situations in which "being better than others" is experimentally ruled out by ensuring that all possible actions that can be taken yield the same expected outcome. Is self-reported expertise objectively well founded or is it just vaguely perceived as such without a solid manifestation? In our experiment we try to provide an answer to this question by investigating the participants' willingness to give up their individually selected portfolio in

favor of two alternative portfolios, the average group portfolio and the portfolio of an individually chosen "expert". Since all three portfolios yield the same expected return and variance of returns, individuals with quadratic utility functions[1] are indifferent between any combination of assets, irrespective whether the portfolio was chosen by themselves or by others. Reluctance to give up the individually selected portfolio in favor of an equally good alternative portfolio is referred to as illusion of expertise. Our results indicate that 64% of the participants are reluctant to switch from their self-selected portfolio to the average group or expert's portfolio, thereby exhibiting illusion of expertise. Furthermore, we find that illusion of expertise is individually stable, both observable with respect to the average group portfolio and the expert's portfolio, and occurs in both ways of eliciting evaluations, asking for the willingness-to-pay and the willingness-to-accept. Participants, however, do not discriminate between the average group and their expert's portfolio.

The paper is organized as follows. In section 2 we describe the experimental design and procedure. Section 3 presents the results, and in section 4 we summarize and discuss our results.

2. The experiment

2.1 Participants

Overall, 72 students at the Humboldt-University of Berlin participated in six sessions with 12 participants each. Each session comprised three groups of four participants. Average earnings amounted to DM 19.63, approximately €10 with a standard deviation of DM 9.52 (about €5). The time required to conduct the experiment was about 65 minutes. Twenty-seven females and 45 males, aged 19 to 29 (M = 22.44, SD = 3.40), participated in the experiment.

2.2 Experimental design and procedure

The experiment consisted of two phases: in the first phase participants were asked to complete a short decision task, and made their investment decisions in the second phase, which consisted of two periods. The exact sequence of events of the computerized (using z-Tree; Zurich Toolbox for Readymade Economic Experiments; Fischbacher, 1998) experiment is shown in Figure 1.

Phase 1: After privately reading the instructions, participants completed a short decision task, involving four analytical decision tasks, three financial knowledge tasks, and two self-ratings (see Appendix B for an English translation of the decision task).

The four analytical problems required (i) to complete a numerical series, (ii) to reason deductively, (iii) to compute conditional probabilities, and (iv) to decide in the Wason selection task (see e.g., Wason, 1966; 1968). The three financial knowledge questions concerned the correct definition of (i) market maker, (ii) convertible bond, and (iii) zero-bond. Both, the analytical and the financial knowledge tasks were presented as multiple-choice questions with four response alternatives each. Additionally, participants were asked to (i) rate their expertise and (ii) their experience on a nine-step scale. Participants were granted a bonus of 10 Experimental Guilders[2] for each correct answer. No bonus was given for the two

[1] The assumption of quadratic utility functions in experimental investigations on portfolio decisions and on empirical tests of the capital asset pricing model (CAPM) are standard, since both, portfolio theory (Markowitz, 1952) and the CAPM, are based on quadratic utility functions.

[2] The exchange-rate for Experimental Guilders was 80:1, that is 100 Experimental Guilders equal DM 1.25.

rating tasks. Participants were not informed about the correct answers. The time required for conducting phase 1 ranged from 15 to 20 minutes.

Phase 2: This phase consisted of two identical periods. In each period participants were randomly assigned to groups of four, and were endowed with 1,250 Experimental Guilders each. An English translation of the instructions of phase 2 is to be found in Appendix C. Participants could invest their endowment in four risky assets. In each period 1,000 Experimental Guilders were granted as (interest free) credit and were deducted from subjects' earnings at the end of the experiment.

Participants were informed that their portfolios could consist of any combination of assets and money. A non-invested residual endowment earned zero-interest. The assets were denoted by A, B, C, and D. The future prices of the assets, F_A, F_B, F_C, and F_D, depended on the states x, y, and z. The probability of state x was w_x, w_y for y, and w_z for z, where $w_x + w_y + w_z = 1$. Participants were informed that the four assets were perfectly positively correlated. The purchasing prices of the assets were indicated as P_A, P_B, P_C, and P_D. Table 1 displays the purchasing prices, the future state dependent prices, the expected values of returns, and the variances and standard deviations of the returns for the four assets.[3]

Table 1: Future prices of assets A, B, C, and D in Experimental Guilders

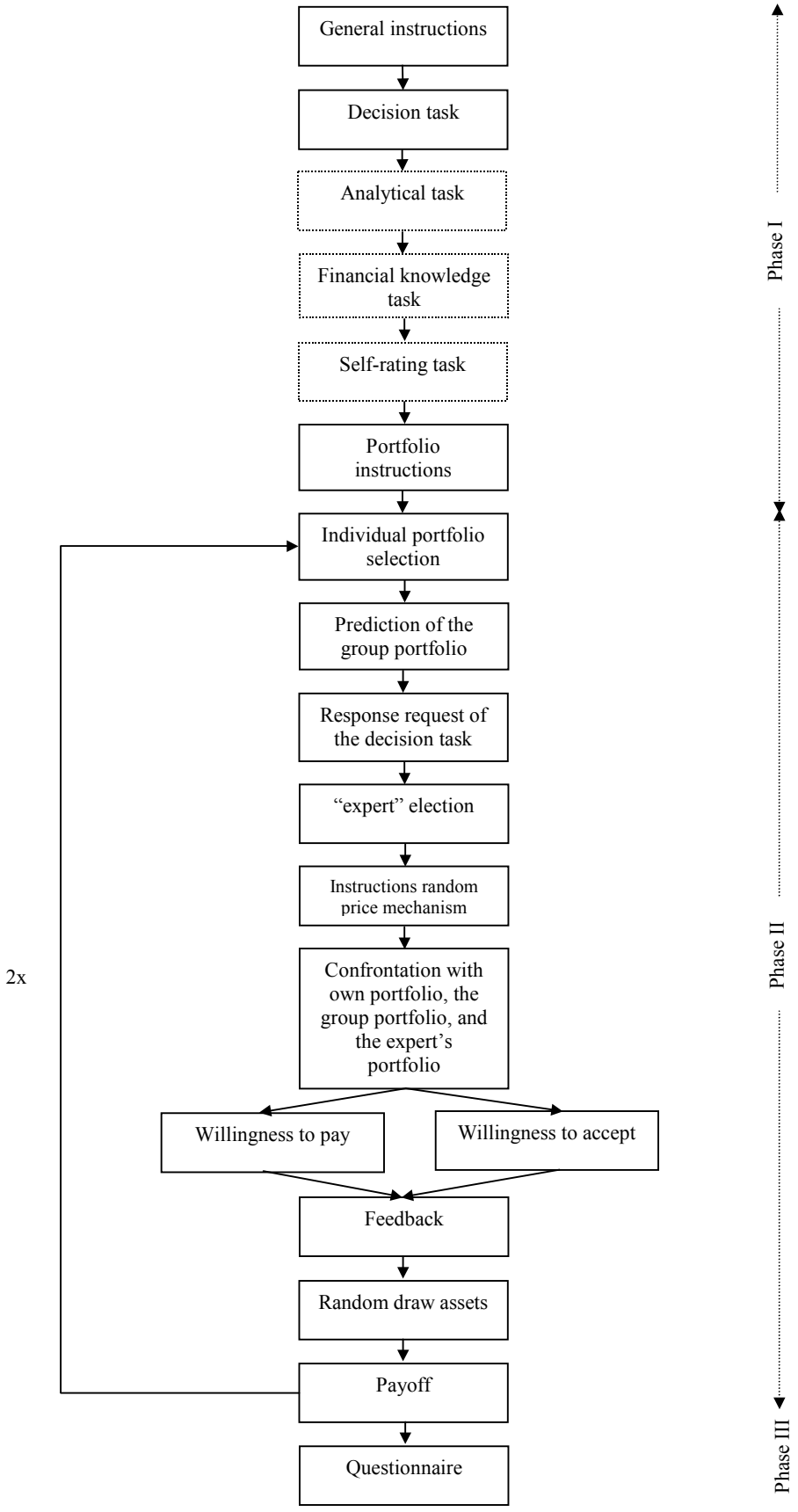
Asset	State	Probability	Purchasing price	Future price	Expected value of returns	Variance or returns	Standard deviation of returns
A	x	1/3	60	45	8.33%	6.02%	24.53%
	y	1/3		70			
	z	1/3		80			
B	x	1/3	48	36	8.33%	6.02%	24.53%
	y	1/3		56			
	z	1/3		64			
C	x	1/3	72	54	8.33%	6.02%	24.53%
	y	1/3		84			
	z	1/3		96			
D	x	1/3	96	72	8.33%	6.02%	24.53%
	y	1/3		112			
	z	1/3		128			

The asset parameters were chosen such that (i) expected returns of all four assets, and (ii) the variances (standard deviations) of their returns are identical. Furthermore, assets are perfectly positively correlated. Thus, any possible combination of the four assets into a portfolio without money results in equal expected returns and equal variances (standard deviations) of returns. Correspondingly, individuals should be indifferent between any combination of assets, regardless whether the portfolio was selected by themselves or by others (for a proof see Appendix A).[4]

[3] The rates of returns are computed as: $\left(\frac{F-P}{P}\right)*100$

[4] While the assumption of quadratic utility functions is employed in the capital asset pricing model as well as in portfolio selection theory (Markowitz, 1952), such a restriction is not strictly necessary since analogously results also hold for more general types of utility functions (e.g., Hellwig, 1993; Rau-Bredow, 1996; Speckbacher, 1996).

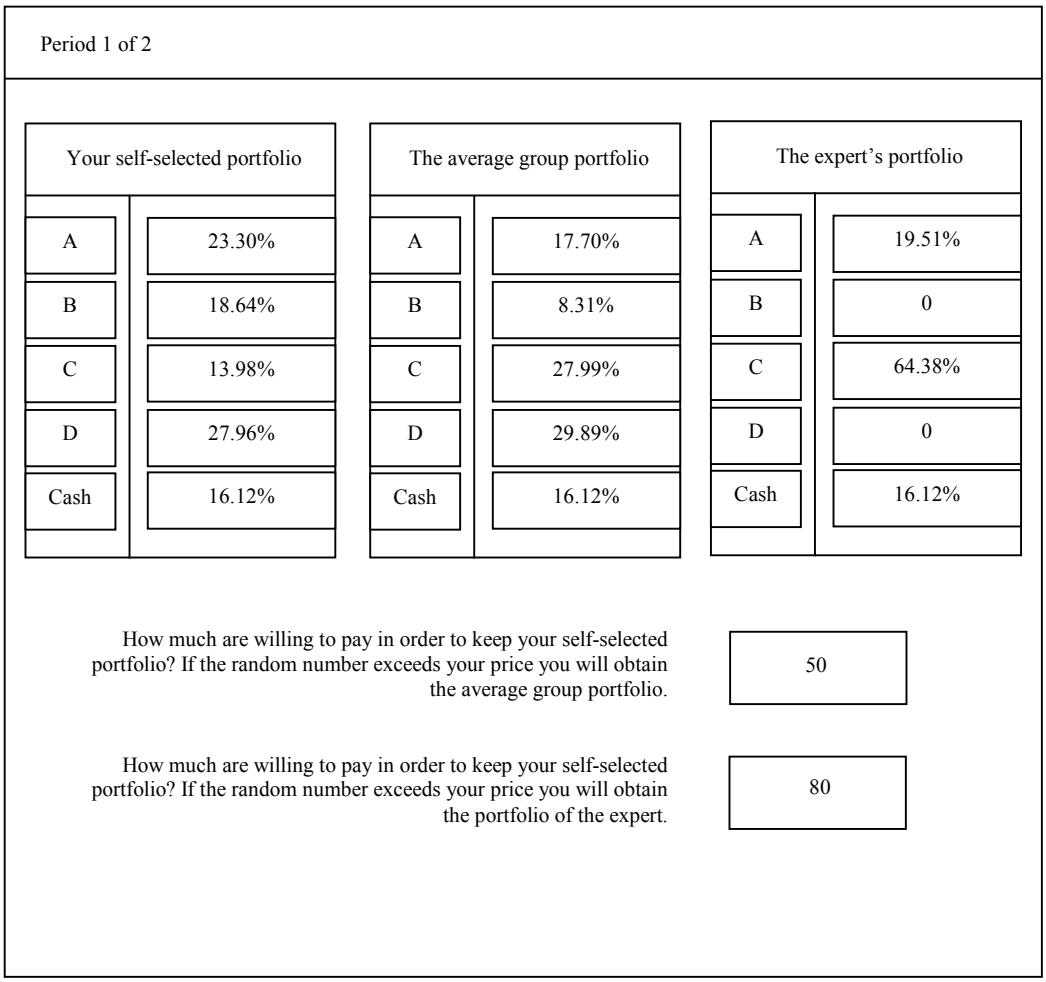
Figure 1: The sequence of events in the experiment



After participants made their investment decisions, they were asked to predict the average portfolio of their group. Subsequently, participants could request up to four responses to the decision task (analytical, financial knowledge and self-rating task) by their three other group members. Then, participants were asked to elect the other group member with the highest perceived expertise in financial matters (their "expert").

Subsequently, participants were instructed about the random price mechanism (Becker, De Groot and Marschak, 1964), which was used to reveal preferences. Participants could substitute their self-selected portfolio for the average group portfolio as well as for the expert's portfolio. All three portfolios were presented to them on the screen (see Figure 2). In order to ensure that preferences are not affected by different underlying risk attitudes, the proportion of assets to cash of the two alternative portfolios was the one of the individually selected portfolio.

Figure 2: The computer screen for price choices in the condition "willingness to pay"



Prior experimental evidence indicates that the results of the random price mechanism depend on whether people are asked to reveal their willingness to pay or their willingness to accept (see e.g., Hoffman and Spitzer, 1990; Knetsch and Sinden, 1984). To control for this effect, participants were randomly assigned to the willingness-to-pay-condition and the willingness-to-accept-condition. This role assignment remained the same throughout the two periods.

In the willingness-to-pay-condition[5], participants were asked to bid their maximum purchasing price p, from the interval –100 to +100 Experimental Guilders, entitling them to keep their self-selected portfolio. Participants were asked to bid for the average group portfolio as well as for the expert's portfolio. For both cases, their bid was then compared to a randomly determined price p^*, drawn from a uniform distribution over the interval from -100 to 100. If the participant's bid exceeded or was equal to the randomly drawn number ($p \geq p^*$), the participant was entitled to keep his/her self-selected portfolio at the cost of p^*, otherwise (s)he had to switch to the alternative portfolio at no cost (see Table 2).

Due to the incentive compatibility of the random price mechanism and the irrelevance of the asset combination the optimal bids p^{opt} are always 0, regardless whether the alternative is the group average or the expert portfolio. Illusion of expertise prevails if one is willing to pay positive prices for keeping or buying the self-selected portfolio. Similarly, low confidence in one's decisions is revealed by one's willingness to keep or buy the own portfolio only when being compensated by negative prices.

In the willingness-to-accept-condition, participants were asked to bid their minimum selling price p, from the interval –100 to +100 Experimental Guilders, at which they would switch from their self-selected portfolio to the alternative portfolio. Participants were asked to bid for the average group portfolio as well as for the expert's portfolio. For both cases, their bid was then compared to a randomly determined price p^*, drawn from a uniform distribution again ranging from –100 to 100. If the participant's bid was lower than the randomly determined price ($p \leq p^*$), the participant switched to the alternative portfolio and received the randomly determined price, otherwise (s)he kept his/her self-selected portfolio at no cost (see Table 2).

Table 2: The random price mechanism with respect to purchasing and selling prices

		Keep the self-selected portfolio	Cost of
Maximum purchasing price	$p \geq p^*$	yes	p^*
	$p < p^*$	no	0
Minimum selling price	$p \leq p^*$	no	$- p^*$
	$p > p^*$	yes	0

After choosing their minimum purchasing price and their maximum selling price, respectively for both alternative portfolios it was independently determined for both alternatives whether participants kept their self-selected portfolio or whether they switched. Thus, participants either held (i) twice their self-selected portfolio, (ii) their self-selected portfolio and the average group portfolio, (iii) their self-selected portfolio and the expert's portfolio or (iv) the average group portfolio and the expert's portfolio. Then, the future prices of the assets were determined by randomly selecting one of the states x, y or z. Finally, participants were informed about their payoff. Phase 2 was repeated once. Total payoffs included the payoffs from both portfolios held at the end of each period. From the proceeds of their four portfolios the total credit amount of 4,000 Experimental Guilders was deducted. The time required for conducting phase 2 was about 40 to 50 minutes.

[5] Willingness to pay, respectively to accept, refers to the self-selected portfolio.

3. Experimental results

In this section, we report the results (i) of the decision task, involving analytical tasks, financial knowledge, and self-declared expertise and experience in financial matters, (ii) of requests for such answers to the prior decision task, and (iii) of illusion of expertise in the portfolio decisions.

3.1 Analytical skills, financial knowledge, and self-declared expertise and experience

The overall percentage of correct answers in the decision task was 58.54%. With respect to the analytical part of the decision task 64.4% of the participants' answers were correct, whereas with respect to the financial knowledge part of the decision task only 50.47% of the answers were correct. Table 3 indicates that no participant managed to solve all seven problems correctly, and also that nobody failed in all seven problems. The majority of participants solved four (33.33%), five (29.17%), and three problems (15.28%) correctly.

Table 3: Frequency and percentage of correct answers in the decision task

Number of correct answers	f	%
0	0	0
1	3	4.17
2	5	6.94
3	11	15.28
4	24	33.33
5	21	29.17
6	8	11.11
7	0	0

Generally, participants achieved higher solution rates in the analytical decision task – with exception to question 4, the Wason selection task which only four participants managed to solve correctly (see Table 4).[6] The highest solution rates were achieved for the deductive reasoning task (88.9%), followed by the compound lottery task (87.5%), and the numerical series task (76.4%). Concerning the financial knowledge task participants found it most difficult to identify the correct definition of "market maker".[7]

[6] Sixty-two participants turned the "E"-card (86.1%), 39 turned the "2"-card (54.2%), and 13 participants turned the "K"-card (18.1%) and the "7"-card (18.1%), respectively.

[7] Only 22 participants out of the 72 (or 30.6%) managed to correctly solve this task. The frequencies of correct answers for the definitions of "convertible bond" and "zero-bond" were 41 and 46 out of 72 participants, or 56.9% and 63.9%, respectively.

Table 4: Frequency and percentage of correct choices in the decision task

Decision task	Question	Frequency of		Percentage of	
		Correct answers	Wrong answers	Correct answers	Wrong answers
Analytical	1	55	17	76.4	23.6
	2	64	8	88.9	11.1
	3	63	9	87.5	12.5
	4	4	68	5.6	94.4
Financial knowledge	5	22	50	30.6	69.4
	6	41	31	56.9	43.1
	7	46	26	63.9	36.1

Average self-rating of expertise in financial matters was 4.83 (SD = 2.15), and average rating of personal experience in financial matters was 3.54 (SD = 2.66). Both rating scales ranged from 1 = "I do not agree" to 9 = "I fully agree". According to the Spearman correlation analysis self-declared expertise and experience are both positively correlated with the number of correct answers in the prior decision task ($\rho(72) = .37$, $p < .001$; $\rho(72) = .43$, $p < .001$): the higher the self-declared expertise or experience the larger the number of correct answers. Thus, we feel confident that our task selection seems appropriate to identify financial expertise.

3.2 Requesting answers by others

Participants could request up to four answers to the prior decision task by the three other group members in each of the two periods in order to elect their "expert". The overwhelming number of participants exploited the potential of four possible answers in both periods.[8] Overall, the number of requested answers increased from period I to period II, from 256 to 269 requests.

Participants were mostly interested in the self-rating with respect to individual experience (question 9). Forty-one participants in period I, and 42 participants in period II asked for the self-declared experience of their group members. In period I, this request was followed by two questions from the financial knowledge set, "market maker" and "zero-bond" (question 5 and 6). Thirty-nine participants requested question 5, and 35 participants requested question 7, which was actually only correctly answered by 22 participants. According to Table 5 participants were also interested in the answers to the compound lottery task (question 3) and to the numerical series task (question 1).[9]

[8] More precisely, 59 participants requested 4 answers, 3 requested three, 1 requested two, and 9 participants requested one answer in period I. In period II, 63 participants requested four answers, 3 requested three, 2 requested two, and 4 participants requested one answer.

[9] Question 3 was requested by 34, and question 1 was requested by 31 participants.

Table 5: Frequency and percentage of requested answers of the decision task

Decision task	Question	Period I		Period II	
		f	%	f	%
Analytical	1	31	12.11	34	12.64
	2	17	6.64	22	8.18
	3	34	13.28	27	10.04
	4	21	8.20	25	9.29
Financial knowledge	5	39	15.23	31	11.52
	6	21	8.20	28	10.41
	7	35	13.67	30	11.15
Self-rating	8	17	6.64	30	11.15
	9	41	16.02	42	15.61
	Total	256	100	269	100

In period II, again self-declared experience (question 9) was most frequently requested, followed by the numerical series task (question 1), the definitions of "market maker" and "zero-bond" (question 5 and question 7), and the self-declared expertise of the participants (question 8). Forty-two participants requested question 9, 34 requested question 1, 31 requested question 5, and 30 participants requested question 8 and 9, respectively (see Table 5).

Table 6 displays the frequency of requests with respect to position of requested answers to the decision task and period. The most frequently requested questions at position I in both periods were the self-declared experience (question 9) and the numerical series task (question 1). At position II, participants most frequently requested answers to the deductive reasoning task (question 2) in period I, and to the compound lottery task (question 3) and to the self-declared expertise in financial matters (question 8) in period II. At position III, participants were particularly interested in answers to the definition of "zero-bond" (question 7), in the compound lottery task (question 3), and in the definition of "market maker" (question 5) in period I, and in the definition of "convertible bond" (question 6) in period II. At position IV, participants most frequently checked the definition of "market maker" (question 5) in period I, and the definition of "zero-bond" (question 7) in period II.

Table 6: Frequency of requested answers of the decision task with respect to position and period

Question	Position I		Position II		Position III		Position IV	
	Period I	Period II	Period I	Period II	Period I	Period II	Period I	Period II
1	15	17	5	5	6	4	5	8
2	1	4	11	4	1	6	4	8
3	10	4	8	12	12	8	4	3
4	4	3	4	7	5	7	8	8
5	5	8	8	6	12	8	14	9
6	4	1	8	9	5	12	4	6
7	7	7	6	4	13	9	9	10
8	3	8	8	12	3	7	3	3
9	23	20	5	9	5	5	8	8

Electing the expert in one's group was significantly different from random with respect to being chosen as an expert twice and being chosen as an expert three times, however this is significant only in period 1 (see Table 7). Thus, our experimental manipulation seems to be successful, participants did not elect their experts randomly, but according to specific answers in the prior decision tasks.

Table 7: Expected and observed probability of being chosen as an expert

	Frequencies		Relative frequencies			z-values		
Elected	Period 1	Period 2	Period 1	Period 2	Expected p	Period 1	Period 2	z-crit[a]
Never	28	26	0.389	0.361	0.296	1.473	1.204	1.96
Once	22	25	0.306	0.347	0.33	- .499	0.249	1.96
Twice	16	16	0.222	0.222	0.11	2.998	2.988	1.96
Three times	6	5	0.083	0.069	0.037	2.083	1.458	1.96

[a]: The critical value refers to α=0.05.

3.3 Illusion of expertise

Participants were confronted with the average group portfolio as well as with their privately selected expert's portfolio. Since all possible combinations of assets into a portfolio yield the same expected return and the same variance of return a positive bid for purchasing as well as for selling the own portfolio indicates illusion of expertise.[10] Conversely, a negative bid for purchasing as well as for selling indicates low confidence in one's decisions.[11] Only bids of zero indicate indifference between the individually selected portfolio and the alternative portfolio.

Figure 3 shows that the majority of purchasing and selling bids across the two periods, with respect to the average group portfolio as well as with respect to the individually chosen expert's portfolio, reflect illusion of expertise.[12] If one pools the purchasing and selling bids for the two alternative portfolios, 63.89% of the participants can be classified as being prone to illusion of expertise, 19.79% as having low confidence in their decisions, and only 16.32% as well-calibrated.[13]

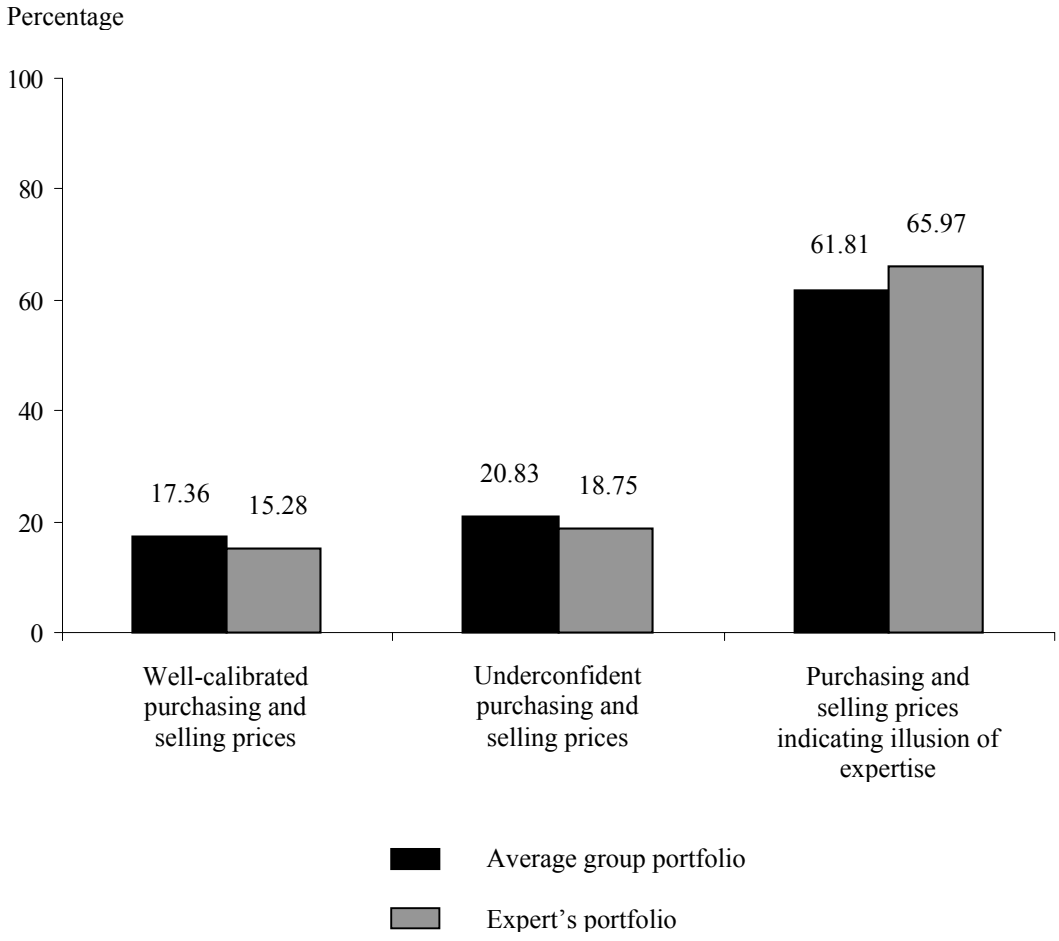
[10] One is either willing to pay for the right to keep his/her individually selected portfolio or is requiring compensation for giving it up.

[11] One either is looking for compensation when having to keep the individually selected portfolio or is actually willing to pay for getting rid of it.

[12] We define portfolios with less than three assets as not well diversified. The hypothesis that the higher average level of illusion of expertise and the lower average level of underconfidence for the expert portfolios than for average portfolios may be due to experts' insufficient diversification has to be rejected: the relative frequency an expert's portfolio that is not well diversified does not significantly differ between underconfident and well-calibrated participants and those exhibiting illusion of expertise.

[13] If one substitutes $p = 0$ by $p \in (-\varepsilon, +\varepsilon)$ well-calibration increases to 21.9% for $\varepsilon = 10$.

Figure 3: Percentage of well-calibrated and underconfident participants as well as of those exhibiting illusion of expertise with respect to the average group portfolio and to the expert's portfolio



To control for the endowment effect, participants were asked for their willingness to accept and their willingness to pay as a between-subjects factor. Table 8 shows the overall results and allows differentiating between the two different conditions. As expected, bids in the willingness-to-accept condition are significantly higher than those in the willingness-to-pay condition, for the average group portfolio as well as for the expert's portfolio (see Table 9).

However, positive bids are generally the modal responses irrespective of the experimental conditions, the portfolios, and the periods. This finding provides strong evidence for the illusion of expertise bias in the context of portfolio decision making. Nevertheless in line with previous experimental evidence (e.g., Hoffman and Spitzer, 1990; Knetsch and Sinden, 1984), the same question, once presented in terms of willingness to pay, and once presented in terms of willingness to accept, leads to different individual responses. In general, participants are less willing to than they are willing to accept.

Table 8: Frequency and percentage of well-calibrated and of underconfident participants as well as of those exhibiting illusion of expertise with respect to the average group portfolio, the expert's portfolio, the willingness-to-accept-condition, the willingness-to-pay-condition for both periods

			Willingness to accept		Willingness to pay	
			f	%	f	%
Period 1	Average group portfolio	Well-calibrated	7	19.4	8	22.2
		Underconfident	1	2.8	13	36.1
		Prone to illusion of expertise	28	77.8	15	41.7
	Expert's portfolio	Well-calibrated	8	22.2	6	16.7
		Underconfident	6	16.7	9	25
		Prone to illusion of expertise	22	61.7	21	58.3
	Total	Well-calibrated	15	20.8	14	19.4
		Underconfident	7	9.7	22	30.6
		Prone to illusion of expertise	50	69.4	36	50
Period 2	Average group portfolio	Well-calibrated	6	16.7	4	11.1
		Underconfident	2	5.6	14	38.9
		Prone to illusion of expertise	28	77.8	18	50
	Expert's portfolio	Well-calibrated	6	16.7	2	5.6
		Underconfident	2	5.6	10	27.8
		Prone to illusion of expertise	28	77.8	24	66.7
	Total	Well-calibrated	12	16.7	6	8.3
		Underconfident	4	5.6	24	33.3
		Prone to illusion of expertise	56	77.8	42	58.3
	Overall total	Well-calibrated	27	18.75	20	13.9
		Underconfident	11	7.6	46	31.9
		Prone to illusion of expertise	106	73.6	78	54.2

Table 9: Mean ranks for the average group portfolio and for the expert's portfolio with respect to the willingness-to-pay-condition and to the willingness-to-accept-condition

	Average group portfolio		Expert's portfolio	
	Mean rank	Rank sum	Mean rank	Rank sum
Willingness-to-pay	59.37	4274.5	64.67	4656.5
Willingness-to-accept	85.63	6165.5	80.33	5783.5
z-Value	- 3.81		- 2.27	
p	< .001		< .05	

On an individual level and across the two periods, 53 participants (73.6%) are classified as being constantly well-calibrated, underconfident, or prone to illusion of expertise with respect to the average portfolio. For the remaining 19 participants (26.4%) the sign of their bids changed. Similar results hold for the expert's portfolio. Again 53 participants are classified as being constantly well-calibrated, underconfident, or prone to illusion of expertise, whereas for 19 participants the sign of their bids changed from period 1 to 2. Regarding both alternatives still 42 participants (58.3%) are classified as being constantly well-calibrated, underconfident, or prone to illusion of expertise, whereas for the remaining 30 participants (41.7%) the sign of their bids changed at least once.

According to Table 10 the individual stability of illusion of expertise is much higher than the stability of well-calibration or of low confidence across the two periods. The vast majority of participants can be classified as being prone to illusion of expertise both in period 1 and in period 2. Thirty-eight (88.4%) out of the 43 participants whose bids concerning the average portfolio indicated illusion of expertise in period 1 were also prone to this bias in period 2, whereas for the remaining 5 participants (11.6%) the sign of their purchasing and selling prices changed. Similar results hold in case of the expert's portfolio: 41 (95.3%) out of the 43 participants whose bids indicated illusion of expertise in period 2 were also prone to this bias in period 2, whereas for only 2 participants (4.7%) the sign of their purchasing and selling prices changed.

Table 10: Individual stability of well-calibration, underconfidence and illusion of expertise across the two periods

		Average group portfolio		Expert's portfolio	
Period 1	Period 2	f	%	f	%
Well-calibrated	Well-calibrated	7	46.7	5	35.7
	Not well-calibrated	8	53.3	9	64.3
Underconfident	Underconfident	8	57.1	7	46.7
	Not underconfident	6	42.9	8	53.3
Prone to illusion of expertise	Illusion of expertise	38	88.4	41	95.3
	No illusion of expertise	5	11.6	2	4.7

Considering the positive bids across the two periods and for both the average and the group portfolio15 participants never submitted positive bids, 3 participants submitted one positive bid, 12 participants two positive bids, 11 participants three positive bids, and the remaining 31

participants submitted positive bids in all four situations. Conditional on submitting at least one positive bid, 57 cases, the number of subjects revealing persistently positive bids in all four observations, 31 cases, justifies the conclusion that most participants (54.39%) are prone to illusion of expertise. This finding supports the conjecture that illusion of expertise does not occur accidentally – once, twice or three times out of four possible situations – but systematically and more importantly seems to be individually stable.

4. Discussion

If someone claims to have more, less or average competence one usually faces the difficulty that individuals rely on different aspects when judging their competence. In the well-known self-ranking of car driving (Svenson, 1981) better car driving can be, for instance, judged by years without accident, by how fast one can safely drive etc. Thus, the fact that 93 percent of the American students considered themselves as being more skillful drivers than others could simply reflect that people rely on different ideas what accounts for being a good driver.

In this paper we avoided such ambiguity by employing a financial setting with a well-defined decision aspect, namely the composition of one's portfolio. Since overconfidence can be defined as believing to be better than others we studied a situation in which "being better than others" is experimentally ruled out by ensuring that all possible actions that can be taken yield the same expected outcome. More precisely, in our experiment we investigated the participants' willingness to give up their individually selected portfolio in favor of two alternative portfolios, the average group portfolio and the portfolio of an individually chosen "expert". Since all three portfolios yield the same expected return and variance of returns, individuals with preferences which can be represented by quadratic utility functions are expected to be indifferent between any combination of assets, irrespective whether the portfolio was chosen by themselves or by others.

Our main findings are that illusion of expertise can be verified and shown to be stable, individually (in period 1 *and* 2), over alternatives (for the average *and* the expert's portfolio), and for both ways of eliciting evaluations (willingness to pay *and* willingness to accept). According to our classification, based on the bids in the random price mechanism, on average 2/3 of all bids reveal illusion of expertise, whereas well-calibration is nearly as frequent as low confidence in period 1 and is even less frequent in period 2. The majority of individual bids reveal illusion of expertise in both periods and for both alternatives indicating that illusion of expertise does not occur accidentally but systemically. Apparently, individuals are not indifferent between objectively equally good alternatives. Instead, they exhibit decision inertia by revealing a strong preference to favor their own previous choice over alternative ones.

Limitations of our study could be seen in the experimental procedure of eliciting one's expert: we did not provide the possibility to (i) select oneself as an expert and (ii) to elect no expert at all. One might also argue that the prior decision task and the portfolio choices are not closely linked. At least for financial expertise and experience this must be denied. Furthermore, our reported positive correlation between self-reported expertise and solution rates in the decision task questions the criticism that participants considered the decision task as somehow loosely connected with the investment task.

Future research should not only focus on individual investment behavior but also allow for market interaction and learning. In addition, the relation between investment behavior and personality traits, such as attribution styles, and risk attitude should be explored.

References

Alicke, M. D. 1985. Global self-evaluation as determined by the desirability and controllability of trait adjectives. *Journal of Personality and Social Psychology*, 49, 1621-1630.

Alpert, M. and Raiffa, H. 1982. A progress report on the training of probability assessors. In: D. Kahneman, P. Slovic and A. Tversky (eds*.). Judgment Under Uncertainty: Heuristics and Biases*. Cambridge: Cambridge University Press.

Becker, G. M., De Groot, M. H. and Marschak, J. 1964. Measuring utility by a single-response sequential method. *Behavioral Science*, 9, 226-232.

Berg, J. E.. Daley, L. A., Dickhaut, J. W. and O'Brien, J. R. 1986. Controlling preferences for lotteries on units of experimental exchange. *Quarterly Journal of Economics*, 2, 282-306.

Brown, J. D. 1986. Evaluations of self and others. Self-enhancement biases in social judgments. *Social Cognition,* 4, 353-376.

Crary, W. G. 1966. Reactions to incongruent self-experiences. *Journal of Consulting Psychology*, 30, 246-252.

Daniel, K., Hirshleifer, D. and Subrahmanyam, A. 1998. Investor psychology and security market under- overreactions. Journal of Finance, 53, 1839-1885.

De Bondt, W. F. M. and Thaler, R. H. 1995. Financial decision-making in markets and firms: A behavioral perspective. In: R. Jarrow. A. Jarrow, V. Maksimovic and W. T. Ziemba (eds.). *Finance. Handbooks in Operations Research and Management Science 9*. Amsterdam: North Holland, (pp. 385-410).

Dittrich, D., Güth, W. and Maciejovsky, B. 2001. Overconfidence in investment decisions: An experimental approach. *Discussion Paper 3*. Papers on Strategic Interaction, Max-Planck-Institute for Research into Economic Systems.

Fischbacher, U. 1998. *Zurich Toolbox for Readymade Economic Experiments: Experimenter's Manual.* University of Zurich, Switzerland.

Fischhoff, B. 1982. For those condemned to study the past: Heuristics and biases in hindsight. In: D. Kahneman, P. Slovic, and A. Tversky (eds.). *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge: Cambridge University Press.

Fischhoff, B., Slovic, P. and Lichtenstein, S. 1977. Knowing with certainty: The appropriateness of extreme confidence. *Journal of Experimental Psychology: Human Perception and Performance*, 3, 552-564.

Frank, J. D. 1935. Some psychological determinants of the level of aspiration. *American Journal of Psychology*, 47, 285-293.

Gervais, S. and Odean, T. 2001. Learning to be overconfident. *Review of Financial Studies*, 14, 1-27.

Griffin, D. and Tversky, A. 1992. The weighing of evidence and the determinants of confidence. *Cognitive Psychology*, 24, 411-435.

Hellwig, K. 1993. Renditeorientierte Portfolioplanung. *Zeitschrift für Betriebswirtschaft*, 63, 89-98.

Hoffman, E. and Spitzer, M. L. 1990. The divergence between willingness-to-pay and willingness-to-accept measures of value. *Working Paper 755*. California Institute of Social Science.

Kahneman, D., Knetsch, J. L. and Thaler, R. H. 1990. Experimental tests of the endowment effect and the Coase theorem. *Journal of Political Economy*, 98, 1325-1348.

Kirchler, E., Maciejovsky, B. and Weber, M. 2001. Framing effects on asset markets: An experimental analysis. *SFB-373 Discussion Paper 17*. Humboldt-University of Berlin, Germany.

Knetsch, J. L. and Sinden, J. A. 1984. Willingness to pay and compensation demanded: Experimental evidence of an unexpected disparity in measures of value. *Quarterly Journal of Economics*, 99, 507-521

Kuiper, N. A. and Derry, P. A. 1982. Depressed and nondepressed content self-reference in mild depression. *Journal of Personality*, 50, 67-79.

Langer, E. J. 1975. The illusion of control. *Journal of Personality and Social Psychology*, 32, 311-328.

Langer, E. J. and Roth, J. 1975. Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task. *Journal of Personality and Social Psychology*, 32, 951-955.

Lichtenstein, S., Fischhoff, B. and Phillips, L. 1982. Calibration of probabilities: The state of the art to 1980. In: D. Kahneman, P. Slovic and A. Tversky (eds.). *Judgment Under Uncertainty: Heuristics and Biases*. Cambridge: Cambridge University Press.

Maciejovsky, B. and Kirchler, E. forthcoming. Simultaneous over- and underconfidence: Evidence from experimental asset markets. *Journal of Risk and Uncertainty*

Markowitz, H. M. 1952. Portfolio selection. *Journal of Finance*, 7, 77-91.

Odean, T. 1998. Volume, volatility, price, and profit when all traders are above average. *Journal of Finance*, 53, 1887-1934.

Odean, T. 1999. Do investors trade too much? *American Economic Review*, 89, 1279-1298.

Rau-Bredow, H. 1996. Portefeuilletheorie bei nicht-klassischen Risikonutzenfunktionen. *Schmalenbachs Zeitschrift für betriebswirtschaftliche Forschung*, 48, 803-815.

Samuelson, W. and Zeckhauser, R. 1988. Status quo bias in decision making. *Journal of Risk and Uncertainty*, 1, 7-59.

Selten, R., Sadrieh, A. and Abbink, K. 1999. Money does not induce risk neutral behavior, but binary lotteries do even worse. *Theory and Decision*, 46, 211-249.

Silverman, I. 1964. Self-esteem and differential responsiveness to success and failure. *Journal of Abnormal and Social Psychology*, 69, 115-119.

Speckbacher, G. 1996. Der Erwartungswert relativer Rückflüsse als Kriterium der Portfolioselektion. *Zeitschrift für Betriebswirtschaft*, 66, 475-486.

Svenson, O. 1981. Are we all less risky and more skillful than our fellow drivers? *Acta Psychologica*, 47, 143-148.

Wason, P. C. 1966. Reasoning. In: B. Foss (ed.). *New Horizons in Psychology*. Harmondsworth: Penguin Books, (pp. 135-151).

Wason, P. C. 1968. Reasoning about a rule. *Quarterly Journal of Experimental Psychology*, 20, 273-281.

Yates, J. F. 1990. *Judgment and Decision Making*. Englewood Cliffs: Prentice-Hall.

Appendix A:

The efficient portfolio P is the one with greatest ratio of excess return (expected return minus risk-free rate) with respect to the standard deviation, which satisfies the constraint that the sum of proportions invested in the assets equals 1. To determine the efficient Portfolio P, the slope the slope of the capital market line has to be maximized under the given constraint.

$$\max \frac{R_P - R_f}{\sigma_P} \qquad \text{s.t. } \sum_i X_i = 1$$

R_f denotes the risk-free rate of lending and borrowing, R_P denotes the expected return on the portfolio, σ_P denotes the standard deviation of the return on the portfolio, and X_i denotes the fraction of investor's funds invested in asset i.

Given 4 assets with equal expected returns ($R_i = R_k \; \forall$ i=1.....4), equal standard deviation of returns ($\sigma_i = \sigma_k \; \forall$ i=1.....4), and perfect positive correlation between all assets ($\rho_{i.k}= +1 \; \forall$ i.k=1.....4) the expected return on the portfolio is:

$$R_P = \sum_i X_i R_i = R_i \qquad \sum_i X_i = 1$$

and the expected variance of the return on the portfolio is:

$$\sigma_P^2 = \sum_i X_i^2 \sigma_i^2 + \sum_i \sum_{\substack{k \\ i \neq k}} X_i X_k \sigma_{ik} = \qquad \{\sigma_{ik} = \sigma_i \sigma_k \rho_{i,k} \text{ with } \rho_{i,k} = +1, \text{ thus } \sigma_{ik} = \sigma_i \sigma_k = \sigma_k^2\}$$

$$= (X_1^2 + X_2^2 + X_3^2 + X_4^2)\,\sigma_k^2 + 2X_1X_2\sigma_k^2 + 2X_1X_3\sigma_k^2 + 2X_1X_4\sigma_k^2 + 2X_2X_3\sigma_k^2 + 2X_2X_4\sigma_k^2 + 2X_3X_4\sigma_k^2 =$$

$$= [(X_1 + X_2 + X_3 + X_4)\,\sigma_k]^2 = [\sum_i X_i \,\sigma_k]^2 = \sigma_k^2$$

The expected return and the standard deviation of the expected return on the portfolio do not depend on the particular fractions X_i invested. Every feasible allocation of the 4 assets results in a portfolio P with identical expected return and variance. Therefore – under the assumption of quadratic utility functions – the objective function of the maximization problem above is also independent of the particular composition of the 4 risky assets. Every asset allocation yields an efficient outcome. Thus participants should be indifferent between any allocation of the 4 assets.

Appendix B:

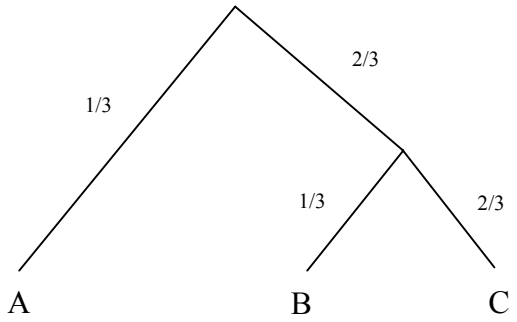
1: The following numerical series obeys a linear rule. according to next number = α*(previous number)+β. Please complete the following numerical series:
1 2 5 14

a) 45
b) 15
c) 41
d) 28

2: Please verify which of the following conclusions can be unambiguously derived from the two premises.
All As are Bs
All Bs are Cs

a) No C is A
b) All As are Cs
c) Some Bs are Cs
d) All Cs are Bs

3: In the following decision tree either A is reached with a probability of 1/3, or a random draw decides whether B is reached with a probability of 1/3 or C is reached with a probability of 2/3. Which of the following paths is most likely?



a) The path to A is most likely
b) The path to B is most likely
c) The path to C is most likely
d) All paths are equally likely

4: Please verify the following rule: "If there is a vowel on one side of the card, then there is an even number on the other side". Which card(s) do you have to turn at most in order to test it?

a) E b) K c) 2 d) 7

5: What is a market maker?

a) Institutions or organizations that guarantee the smoothly dealing in stocks.
b) Market participants who quote binding bids and offer prices for shares.
c) Trading activity of enterprises with large market shares.
d) Brokers and investment houses that issue new shares.

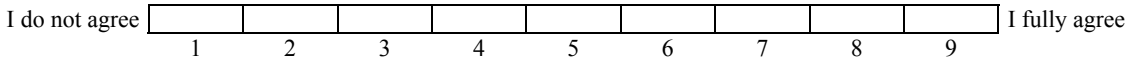
6: What is a convertible bond?

a) Bonds that can be converted into a predetermined amount of the company's equity at certain times during its life.
b) Temporary right on a bond to accept or reject a quoted bid or ask.
c) Bonds issued by an investment bank that certifies the holder the right to convert into a pre-specified investment fund at certain times during its life.
d) Special kind of stocks that certifies the holder the right to convert into a predetermined amount of bonds.

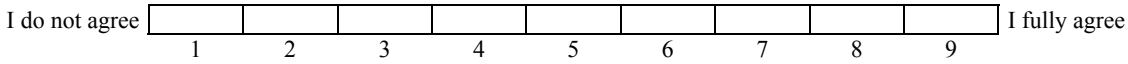
7: What is a zero-bond?

a) Bonds and fixed-interest securities that hold limited risk.
b) Bonds that in contrast to shares do not certify the right of membership, but the right of equity and of liquidity.
c) Bonds and fixed-interest securities with limited opportunity of profits.
d) Bonds that pay no interest, instead they are redeemed at maturity for their full face value.

8: In financial matters I trust in my own abilities.



9: I am experienced in stock dealing.



Appendix C:

Thank you for participating in our experiment!

The experiment deals with individual decision making.

Your responses will be dealt with anonymously and will not be handed over to third parties.

For your participation in the experiment, you will be financially rewarded, depending on your decisions. During the experiment all amounts are quoted in Guilders. At the end of the experiment you will obtain the corresponding amount cash in DM. The exchange rate is 80:1, that is 100 Guilders equal 1.25 DM.

The time required is about 1 hour and 20 minutes.

On the screen, you will be asked to answer a few questions. For each correctly solved question you will obtain 10 Guilders, which will be paid out to you at the end of the experiment. Seven out of the 9 questions are multiple-choice-questions, whereas the remaining 2 questions should be answered on a rating scale. For these 2 questions you will not obtain any financial reward.

The experiment lasts for two periods. In each period, you will get an endowment of 1,250 Guilders. From your endowment you cannot invest more than 1,000 Guilders in the four assets A, B, C, and D. You can invest in assets of the same type or in assets of different types. Thus, you can choose any possible combination of assets. The amount not invested will be subject to a zero-interest rate, and will be added to your earnings from the experiment.

Each of the assets has a certain purchasing price and three possible future values, which depend on the states x, y and z. Each of the three states has the same probability. The purchasing price of the assets will be deducted from your earnings at the time of purchase. The future value of the assets will be determined at the end of each period and will be added to your total earnings.

In the following table you will find the purchase price of the assets and the corresponding possible future values.

Asset	State	Probability	Purchase price	Future value
A	x	1/3	60	45
	y	1/3		70
	z	1/3		80
B	x	1/3	48	36
	y	1/3		56
	z	1/3		64
C	x	1/3	72	54
	y	1/3		84
	z	1/3		96
D	x	1/3	96	72
	y	1/3		112
	z	1/3		128

The future values of the assets are dependent from one another. That is, if state x occurs, this state determines the price of the assets A, B, C and D. The same is true for the other states, y and z.

The difference between your wealth at the end of the period and the 1,000 Guilders, you could have invested, determines your earnings. Your earnings of both periods, plus your earnings from the questionnaire, will be paid out to you at the end of the experiment.

In the following you will be assigned to a group consisting of 4 members. Groups will be randomly determined at the beginning of each of the two periods. There is a positive possibility that you will meet one or more of your group members more than once.

Instead of selecting a portfolio on one's own, people often invest in funds, hoping that these funds are adequately allocated and will yield higher returns than one's own portfolio. In order to offer you a similar possibility you can

- inform yourself about the responses to the questionnaire of the three other group members. Whereby you cannot request more than **4** responses.
- then elect the one of your group members with the highest perceived competence in portfolio decisions. This member is referred to as your expert.

You should carefully answer the last question, because your earnings may depend on the decisions of your group members and on the decisions of your elected expert.

You will get twice the possibility, to switch from your self-selected portfolio to an alternative portfolio. Both alternative portfolios consist of the same proportion of cash than your self-selected portfolio. That is, the only difference to your self-selected portfolio is the allocation of assets.

The two alternatives are:

- first, the average portfolio of all four group members. We refer to the first alternative as the average group portfolio
- second, the portfolio of your individually elected expert, that is the person you nominated as the one of your other three group members with the highest perceived competence in portfolio decisions. We refer to the second alternative as the expert's portfolio.

Treatment: Willingness to Pay

How can you switch from your individually selected portfolio to an alternative portfolio?

You must now state your maximum purchasing price p for each of the two alternative portfolios, which you are willing to pay, in order to keep your self-selected portfolio. Otherwise you will switch to the alternative portfolio. For your decisions you will get a budget of 200 Guilders. You can choose your purchasing price from the interval –100 to +100. Your specified price p will be compared to a randomly determined price p^*, which is also drawn from the interval - 100 to +100.

You can keep your individually selected portfolio if:
$p > p^*$, and pay p^* (that is, p^* will be deducted from your earnings).
You obtain the alternative portfolio if:
$p < p^*$, in this case nothing will be deducted from your earnings.

You must independently state your maximum purchasing price p both for the average group portfolio as well as for the expert's portfolio. After your decisions, the future values of the assets will be determined according to the states x, y and z. The net-earnings of both portfolios will be added to your total earnings and the period ends.

Treatment: Willingness to Accept

How can you switch from your individually selected portfolio to an alternative portfolio?

You must now state your minimum selling price p for each of the two alternative portfolios, which you are requiring, in order to switch from your self-selected portfolio to an alternative portfolio. You can choose your selling price from the interval –100 to +100. Your specified price p will be compared to a randomly determined price p^*, which is also drawn from the interval - 100 to +100.

You can switch to the alternative portfolio if:
$p^* > p$, and obtain p^* (that is, p^* will be added to your earnings).
You keep your self-selected portfolio if:
$p^* < p$, in this case nothing will be added to your earnings.

You must independently state your minimum selling price p both for the average group portfolio as well as for the expert's portfolio. After your decisions, the future values of the assets will be determined according to the states x, y and z. The net-earnings of both portfolios will be added to your total earnings and the period ends.