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Abstract

In this paper we present results from experimental asset markets and simulations with traders who receive asymmetric information about the fundamental value of an asset. In the experimental markets with repetition insiders outperform the market and uninformed computerized random traders (monkeys) perform equally well compared to average informed traders. This is in line with the results of the equilibrium simulation output in which traders choose between a random strategy and their fundamental strategy. We further find that pattern of average informed not being able to beat the uninformed is not due to their overconfidence but due to the asymmetric information structure of the market.
JEL classification: C91, C92, G14

Keywords: Information economics, experimental economics, agent-based model, overconfidence, value of information

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1 Introduction and Related Literature

In this paper we present asset markets with asymmetric information about the fundamental value of a company. To control for the influence of subjects experience we run six experimental markets three times with identical subjects. To check the influence of the asymmetric information structure on the distribution of traders abnormal returns we set up simple agent-based simulations.

In previous empirical studies by e.g. Lakonishok and Lee (2001), Lin and Howe (1990), and Seyhun (1986) for testing the strong form of the efficient market hypothesis (EMH) it is reported that insiders are able to outperform the market. Whereas the outperformance of (illegal) insider trading is widely accepted in the scientific and finance community questions on the performance of less informed traders are hardly being answered. Some empirical evidence is provided by Carhart (1997), Jensen (1968), and Malkiel (1995, 2003a,b, 2005) in studies on the performance of mutual funds. They all find that mutual fund managers fail to beat a passive investment strategy, as about 60 to 80% of the funds underperform their benchmark index. Whereas it is relatively easy to measure the returns of the funds, it is almost impossible to define the information level of their managers. One could assume that they are neither uninformed traders nor insiders, but their exact level of information is impossible to assess empirically.

Thus, Huber (2007) and Huber et al. (2008) tackle the question on the value of fundamental information with experimental markets. Here, one major advantage is that the experimenter can control the information level and measure abnormal returns accordingly. In analogy to the empirical evidence they find that insiders outperform the market significantly. More interestingly, Huber (2007) finds that the average informed traders underperform the worst informed (who still have some piece of fundamental information) and Huber et al. (2008) find that completely uninformed traders end up with the same return as average and relatively well informed traders. One potential shortcoming of these studies is that the subjects take part in only one experimental session lasting about one hour and thus the authors cannot control for potential learning effects of experienced subjects.

This shortcoming can be crucial for the experimental outcome as Dufwenberg et al. (2005) and Hussam et al. (2008) observe learning effects in experimental asset markets with experienced subjects. In a setting which is based on the seminal model of Smith et al. (1988) they report that markets with experienced subjects exhibit fewer bubbles and therefore show a higher degree of market efficiency. If this learning behavior would also be evident in the experimental markets presented in this paper, one could expect that traders ending up below the market return would learn and search for a more profitable strategy in the next repetitions of the market.

Alternatively, if no learning is observed and so the underperformers of one repetition underperform again in the following repetitions, one could assume overconfidence of the traders as a behavioral explanation. It is evident that humans are overconfident as they frequently overestimate their performance with respect to their abilities (e.g. Fischhoff et al. 1977 and Keren 1988 in studies with general knowledge questions). In a financial setting Törngren and Montgomery (2004) find that both experts and laypeople overestimate their judgements and experts even fail to outperform a strategy of randomly choosing stocks. Davis et al. (1994) report that the amount of information also interferes with overconfidence in financial settings. In a study with students predicting stock market fluctuations they find that more information, even when redundant, increase the level of overconfidence among the subjects. The widely observed overconfidence bias has directly measureable consequences on real markets, as traders trade too much with the consequence of decreasing net portfolio returns with increasing trading volumes (Barber and Odean 2000).

To examine the value of information when controlling for overconfidence and learning, we apply one of the market models presented in Kirchler (2008).[1] To

[1] The experimental model studied here differs from those presented in Huber (2007) and Huber et al. (2008). The information structure is different in both studies and the least informed

obtain benchmarks we run agent-based simulations. This is crucial as it allows us to check whether the asymmetric information structure itself can explain the persistent underperformance of certain information levels. As the center of our study we adopt an experimental treatment consisting of six markets. Each market is repeated three times at different days with identical subjects who are endowed with the same information levels as before. Furthermore, we run a questionnaire after each repetition to estimate overconfidence.

In the experimental treatment we find that uninformed computerized random traders (monkeys) perform equally well with respect to average informed traders throughout all three repetitions and that only insiders outperform the market significantly. This is in line with the equilibrium outcome of the simulation model in which agents can choose between a random and a fundamental strategy until equilibrium is reached. In this regime only the best and second best informed traders use a fundamental strategy while all other traders apply a random strategy. Additionally, we neither find evidence for overconfidence nor for learning of the traders in the experimental treatment. As we find relatively strong similarities in the use of fundamental strategies and in the distribution of abnormal returns between the experimental treatment and the equilibrium simulation, we conclude that the main reason why average informed do not manage to outperform the random traders lies in the asymmetric information structure.

The paper is structured as follows. In Section 2 we present the market model, the experimental treatment and the benchmark simulation setup. Section 3 shows the results for both the benchmark simulations and the experimental treatment and provides explanations on the origins of the persistent underperformance of certain information levels. Finally, Section 4 summarizes and discusses the results.

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traders either have some piece of fundamental information (former study) or are uninformed human traders (two treatments of the latter study). Instead, we implement computerized random traders as least informed.

2 Market Model

In each market 10 traders interact in a continuous double auction for K periods. They trade stocks of a virtual company for virtual money (Taler). The stock does not pay dividends and no interest is paid for cash holdings.

2.1 Information System

The fundamental value of the stock is governed by the following stochastic process:

$$FV_k = FV_{k-1} \cdot (1 + \epsilon_k), \tag{1}$$

where FV_k denotes the fundamental value of period k and ϵ_k is a normally distributed random variable with a mean of 0.5% and a standard deviation of 7.2%.[2]

To implement asymmetric information, we start with the idea of Hellwig (1982) that better informed traders get relevant information earlier than others, and we extend this concept to four information levels, Ij (I1 to I4). Only the best informed traders (I4) know the fundamental value of the current period k. Fundamental information provided to I4 in period k becomes available to I3 in period $k+1$, to I2 in period $k+2$, etc. At the start of each period traders are provided with new information. At this time information level I(j-1) receive the information Ij had one period earlier, while the best informed receive new information that nobody knew before. Subsequently, the expression CV_j denotes the conditional expected value of information level j. Figure 1 visualizes the information structure of one representative market. Furthermore, we add uninformed traders as a fifth information level (I0). They do not get any information on fundamentals throughout the whole experiment, although they receive the same information on prices and on orders as all the other traders.

[2] In this model one period equals one month in reality. With these parameters the fundamental value increases by 6.2% p.a. and the annual standard deviation reaches 25%.

Each information level is populated by two traders.

Insert Figure 1 about here

2.2 Market Architecture

Subjects trade in a continuous double auction market with open order book. All orders are executed according to price and then time priority whereby market orders have priority over limit orders and are executed instantaneously. Holdings of cash and stocks are carried over from one period to the next. Traders can submit as many bids and asks as they want, provided they have enough money to buy or enough stocks to sell. Any order size and the partial execution of limit orders are possible. Short selling is not allowed.

The trading screen provides subjects with current information on their stock and money holdings, a realtime chart of past transaction prices, their trades of the current period and their current wealth.[3] After each period a history screen informs subjects about their stock and cash holdings, wealth, conditional expected value, the closing price of the market, their trading volume and the total trading volume on the market of all previous periods. A chart of mean market prices completes the history screen.

2.3 Experimental Treatment

We conduct one experimental treatment in which the six markets are run three times on different days with identical subjects at identical information levels. We use three fundamental value processes which are perfectly randomized over repetitions. Furthermore, the role of the uninformed is covered by computerized random traders. They do not process any kind of information at any time, instead they randomly place bids and asks (only limit orders) as follows:

$$\begin{aligned} Bid_{k,t} &= P_{k,t} \pm \epsilon_{k,t}, \\ Ask_{k,t} &= P_{k,t} \pm \epsilon_{k,t}. \end{aligned} \tag{2}$$

[3]For further details see the screenshot in the Appendix.

Here $P_{k,t}$ denotes the current market price at time t in period k and $\epsilon_{k,t}$ is a standard normally distributed error term.

Insert Table 1 about here

Table 1 gives a brief overview over the parameter set of the two random agents. Among both computerized traders, "Agent 1" is designed actively with relatively short waiting times between his orders, Wt, and with a larger posted quantity in each order, Q.[4]

2.4 Experimental Implementation

At the beginning of each market traders were briefed with written instructions. Afterwards we ran four trial periods to allow subjects to become familiar with the market. Each market ended between period 20 and 22 of 100 seconds each.[5] To achieve a balanced panel of observations we limit our analysis to the first 20 periods within each repetition.

After the introduction and the trial periods subjects were randomly assigned to one of the information levels which they kept for each repetition of each market. In all experimental markets/repetitions each trader was initially endowed with 40 stocks and 1600 in cash. The information structure was public knowledge: Subjects knew how many information levels existed, how many traders were endowed with each information level, and they knew their own information level. They also knew that they will be endowed with the same information level in the other two repetitions and that the other traders in the repeated markets will be identical.

At the end of each repetition all stocks were bought back at the fundamental value FV_{end} (information of the insider, I4) of the last period. The final wealth, FW, was converted into EUR at the exchange rate of 1 EUR equalling 175 Taler.

[4]Both variables are uniformly distributed and a random agent either places a bid or an ask at once. The trading behavior of human traders of earlier experiments serve as a benchmark for the parameter set.

[5]To avoid end-of-experiment effects we told traders that the market is randomly terminated between periods 20 and 30 with equal probability in all three treatments.

We conducted all markets in May 2008 with business students on a bachelor or master level.[6] Each session lasted 80 to 90 minutes, and the average earnings were around 55 EUR. The market was programmed and conducted with z-Tree 3.0.6 (Fischbacher 2007) and the recruitment of the students was made with ORSEE (Greiner 2004).

2.5 Theoretical Predictions – Simulation

To obtain theoretical benchmarks and to explore whether the information structure discriminates certain information levels persistently we run simulations with almost identical parameters as in the experiments. Five agents with information levels from I0 to I4 trade in an order-driven continuous double auction market. In the simulation setting BASE all traders except the randomized I0 adopt a fundamental strategy according to their conditional expected value CV. In the setting EQUIL the informed traders I1 to I4 choose between their fundamental strategy and a random strategy until a Nash-equilibrium is reached.

2.5.1 Trading Strategies and Order Matching in the Setting BASE

Every three seconds t an uniformly distributed random variable decides which trader j wakes up who places both a bid and an ask. All informed traders (I1 to I4) strictly use a *fundamental strategy.* If they are randomly chosen to place a limit bid and a limit ask, they do it according to the following rule:

$$\begin{aligned} Bid_{j,k,t} &= CV_{j,k} - |\epsilon_{j,k,t}|, \\ Ask_{j,k,t} &= CV_{j,k} + |\epsilon_{j,k,t}|. \end{aligned} \tag{3}$$

Here, $CV_{j,k}$ is the conditional expected value of information level j in period k, and $\epsilon_{j,k,t}$ is a standard normally distributed error term. Identical to the experimental treatment uninformed traders I0 are programmed to use a *random*

[6]Most subjects already took part in other experiments in economics, but none of them participated in experimental asset markets before.

strategy,

$$Bid_{k,t} = P_{k,t} \pm \epsilon_{k,t},$$
$$Ask_{k,t} = P_{k,t} \pm \epsilon_{k,t}, \tag{4}$$

with $P_{k,t}$ denoting the current market price at time t of period k and $\epsilon_{k,t}$ stands for a standard normally distributed error term.

Finally, a matching algorithm checks whether the currently placed ask (bid) is lower (higher) than the best bid (ask) in the order book. In these cases a trade occurs at the price of the best bid (ask) in the order book. Those limit orders that can not be matched immediately are included into the order book.

2.5.2 Trading Strategies and Order Matching in the Setting EQUIL

With all other things being equal to BASE, the informed traders I1 to I4 can choose between both strategies. Beginning with the situation in which each agent except I0 uses his fundamental strategy, the worst performing agent after 5000 independent runs switches to the random strategy. The simulation is rerun and if the agent is better off than before, he remains with this strategy. In a next step, the algorithm searches again for the worst performing agent whose strategy is then switched, etc. This updating algorithm runs until a Nash-Equilibrium is reached in which no agent has an incentive to switch to the other strategy as this would only lower his return.

2.5.3 Simulation Parameters

Table 2 gives an overview over the similarities/differences of the experimental and the simulation approach. One can see that the experimental and simulation setting is very similar except for the number of traders per market, the possible trading quantity at each trade and the matching algorithm of the limit orders. This is because we want to keep the model as simple as possible and to limit the number of model assumptions to an absolute minimum. With this simplification we expect that the simulation output does not interfere with irrelevant model assumptions which could potentially distort the distribution of agents' returns.

Insert Table 2 about here

3 Results

3.1 Method for Measuring Abnormal Returns

To detect the performance of the traders in the experiment and in the simulations conditional on their information level we calculate abnormal returns (outperformance):

$$AR_{j,m} = \ln(FW_{j,m}) - \ln\overline{(FW_m)}. \tag{5}$$

Here, $FW_{j,m}$ stands for the final wealth (stocks multiplied with the fundamental value at the end of the experiment, FV_{end}, plus money holdings) of information level j in market m and $\overline{FW_m}$ defines the average final wealth across all traders in the market. The benchmarking on the market average in equation (5) is crucial to purge idiosyncratic characteristics of individual markets. The ability of different information levels to outperform the market and others is of main interest, irrespective of upward or downward movements of the market as a whole.

To check whether the experimental results are statistically significant, we run OLS regressions with the dependent variable $AR_{j,m}$,

$$AR_{j,m} = \alpha + \beta_1 \mathrm{I1}_m + \beta_2 \mathrm{I2}_m + \beta_3 \mathrm{I3}_m + \beta_4 \mathrm{I4}_m + \epsilon_{j,m}, \tag{6}$$

where I1 to I4 are binary dummy variables for the various information levels. With this approach we are able to analyze I0's outperformance to the market (intercept α) and the performance of each information level in relation to I0. The outperformance to the market of the other information levels and the differences in abnormal returns between all information levels will be addressed with a Wald-coefficient test. We account for heteroscedasticity in the residuals by using the White-statistics White 1980.

3.2 General Overview

Figure 2 presents the results for abnormal returns as a function of information level for the simulation setting BASE (top left panel), the simulation setting EQUIL (top right panel) and the experimental treatment (bottom panel) graphically.

Insert Figure 2 about here

In the simulation setting BASE insiders end up best while the average informed traders with information level I1 and I2 clearly underperform the market. The latter are clearly beaten by uninformed random traders I0 who underperform the market marginally. When looking at the simulation results of the equilibrium setting, EQUIL, (top right panel) we observe that traders from I0 to I2 apply a random strategy and underperform the market with roughly –1.7%. Agents with I3 and I4 adopt a fundamental strategy but only the insiders outperform all other agents clearly.[7]

When focusing on the aggregate data for the experimental treatment (solid line) we find that the results look similar to the EQUIL-case as the abnormal returns of I0 to I2 are equal at roughly –1%. The insiders outperform all other traders and the market by 2.4%. Interestingly, it is also evident that the dispersion of abnormal returns hardly decreases with repetition, which is a first hint of no learning throughout the repetitions.

[7]For each agent changing strategy would yield lower returns. For I0 to I2 and I4 a c.p. switch in strategy would result in much lower returns and the returns of I3 would drop from –0.009 to –0.016.

3.3 Experimental Results

3.3.1 Abnormal Returns

In Table 3 we run the model of equation 6 to test on differences between the information levels within each repetition.[8] For the aggregate data set (first column) we modify equation 6 in a way to apply a panel regression. The information levels in the six markets serve as cross-sections (30 observations) with three observations over time each.

Insert Table 3 about here

On aggregate we observe that the returns of all traders with I0 to I2 are indistinguishable from each other and that these traders do not underperform the market significantly. Only insiders I4 significantly outperform the market by 2.4% and subjects with I0 to I2 up to 3.5 percentage points. This pattern is very similar in each repetition, though not always significant due to a relatively low sample size. The results perfectly fit with the findings of Huber et al. (2008) although they adopt different market models.

In the following sections we analyze and discuss whether the consistent patterns over repetitions are based on overconfidence, no learning of the subjects or whether they are caused by the asymmetric information structure of the model.

3.3.2 Overconfidence as no Explanation for the Persistent Underperformance of the Average Informed

To test whether the persistent underperformance of average informed subjects across repetitions is due to overconfidence we ran a questionnaire after each repetition. Beside demographic questions we asked the subjects to self-evaluate their performance with respect to the performance of all other traders and with respect to the second trader of the same information level. In detail, we formu-

[8]Table E1 in Appendix B goes into detail for the experiment and provides both the abnormal returns and the trading volume of each information level in each repetition of each market.

lated the following two questions, which the subjects were able to answer only with "yes" or "no":

1. Do you think that your final wealth is higher than the average final wealth of all ten traders?
2. Do you think that your final wealth is higher than the final wealth of the other trader with the same information level?

Insert Figure 3 about here

In Figure 3 we present the results separated for information level and repetition. When looking at question 1 about being better than the market average (left panel) we find that especially for better informed traders confidence increases with information level, but only one value is above 50%. This means that most traders believe that they are below average, which is an indication of subjects underconfidence. Especially the worst performing traders I1 and I2 suffer from underconfidence as only roughly 20% of them believe that they outperform the market although they even did it in approximately 50% of all cases. Question 2 on subject's performance compared to the second trader of the same information level yields similar results for I1 and I2. Only about 35% of all traders believe that they outperform the other trader although the realized ratio is 50% by definition.[9]

Therefore we conclude that overconfidence has no influence on the persistent underperformance to the market return of the average informed subjects. In contrast, traders that slightly underperform the market seem to be underconfident as our overconfidence measures show values of approximately 20% for traders with I1 and I2.

3.3.3 No Learning over and Moderate Learning Within Repetitions

To get a first impression of the changes in subjects' abnormal returns over time, potentially due to learning, we calculate cumulative abnormal returns

[9]As the results clearly show no evidence for overconfidence we refrain to conduct tests on significance.

($CAR_{j,m,r,k}$) for each information level j of market m in repetition r of each period,

$$CAR_{j,m,r,k} = \ln(W_{j,m,r,k}) - \ln \overline{(W_{m,r,k})}, \tag{7}$$

with $\overline{(W_{m,r,k})}$ indicating the corresponding mean wealth. In a next step we sum up across the markets to get one measure of CAR for each information level in each repetition ($CAR_{j,r,k}$). The left panel of Figure 4 provides the details and we see no tendency towards declining CAR's over repetition.

Insert Figure 4 about here

In the right panel of Figure 4 we calculate the standard deviation of the five $CAR_{j,m,r,k}$'s in each period of each market. Then we average these six standard deviations across all markets to obtain one value for each period ("STD_CAR"). The same procedure is repeated for the difference between the maximum ($\max(CAR_{j,m,r,k})$) and the minimum ($\min(CAR_{j,m,r,k})$) CAR ("$MAX - MIN\_CAR$"). Out of the right panel of Figure 4 one can see that the cumulative abnormal returns develop similarly over time as there seems to be no trend towards declining STD_CAR and $MAX - MIN\_CAR$ over the repetitions. Again, this provides evidence that no learning regarding abnormal returns takes place over the repetitions.

To get a broader picture about learning behavior we do not only focus on abnormal returns but also on different variables such as trading volume, overvaluation, mispricing, trades, etc. To detect whether these variables change statistically significant over time we set up the following panel-regression model with 6 cross-sections (markets) and 60 observations over time:

$$\begin{aligned} y_{m,k} &= \alpha + \beta_1 \text{REP2}_{m,k} + \beta_2 \text{REP3}_{m,k} + \beta_3 (\text{PERIOD} \cdot \text{REP1})_{m,k} + \\ &\quad \beta_4 (\text{PERIOD} \cdot \text{REP2})_{m,k} + \beta_5 (\text{PERIOD} \cdot \text{REP3})_{m,k} + \epsilon_{m,k}. \end{aligned} \tag{8}$$

Here, REP2 and REP3 are binary dummy variables for the repetitions two and three and PERIOD stands for the periods 1 to 20 within each repetition. Thus, with the interaction terms of type PERIOD · REP we account for the specific time trend within each repetition.

As dependent variables $y_{m,k}$ we test for those variables which are frequently affected by experience according to existing literature. OVERVAL represents the difference between the mean price, $\overline{P}$, and the fundamental value, FV. According to Dufwenberg et al. (2005) and Hussam et al. (2008) repetition and thus experience decreases overvaluation in asset markets of the SSW-type (see the paper of Smith et al. (1988) for the model design). Therefore, we implement OVERVAL as a proxy for overvaluation and the absolute value of overvaluation as a proxy for mispricing.

In the literature it is commonly reported (e.g. Plott and Sunder 1982) that trading frequency declines in the course of an experimental session due to learning about the market institution. We investigate this by testing on the dependent variables "Volume", "Trades", and "Limit Orders". Furthermore, we modify the model of equation 8 for STD_CAR and $MAX - MIN\_CAR$ by excluding the interaction terms as they would distort the coefficient values of REP2 and REP3 due to the dominating time trend in the interaction terms.

Insert Table 4 about here

When focusing on OVERVAL and abs(OVERVAL) we find no learning effects over and within the repetitions. Instead, the average mispricing per period even increases significantly from REP1 to REP3 by 1.6. Furthermore, this pattern is also evident when looking at the interaction terms for REP1 and REP2, meaning that in these repetitions market efficiency decreases over time.

When measuring the learning effects with the variables Volume, Trades, and Limit Orders hardly any effects are observable over the repetitions with only one marginally significant negative coefficient. Interestingly, although overall trading frequency decreases insignificantly over repetitions, limit orders increase slightly but insignificantly. It seems that traders act more cautiously over the repetitions by placing more limit orders and trading a little less. Within each repetition the learning effects are much clearer and in line with existing literature. All nine interaction terms are negative with six coefficients being significant. Similar and thus insignificant patterns over the repetitions can be found for the measures of cumulative abnormal returns – STD_CAR and $MAX - MIN\_CAR$. This confirms the results which have already been shown in Figure 4.

We conclude that although moderate learning takes place within the repetitions, hardly any learning is observable over repetitions as repetition 1 already comes relatively close to the simulated equilibrium solution.

3.3.4 Information System as Origin of the Persistent Underperformance of the Average Informed

As the behavioral explanation overconfidence is rejected when looking for origins of the distribution of traders returns, we offer a non-behavioral explanation. When returning to the simulation results in Figure 2 we find that agents with I1 and I2 can at best improve their abnormal returns to those of a random trader when they ignore their fundamental information in equilibrium. Thus, it seems that for traders other than I4 it is impossible to outperform the market persistently. In repetition one of the experimental markets subjects already come relatively close to the equilibrium output of the simulation EQUIL with a relatively low dispersion of abnormal returns.

To check whether the distribution of subjects' trading strategies across information level comes close to the simulation benchmarks we calculate the number of trades conforming to fundamental strategy. For each information level in each repetition of each market we sum up all purchases at prices below its conditional expected value, CV, and all sales at prices above its conditional expected value, CV. Then we divide this sum by the number of trades of the corresponding information level to arrive at the percentage of fundamental strategy on all trades, FUND. Values close to 50% indicate no fundamental trading as even a random trader would exhibit 50% on average.

Insert Figure 5 about here

Figure 5 provides the average ratios for each repetition and information level. We find that traders with I4 apply a fundamental strategy in roughly 80% of all trades while the average informed traders I1 and I2 realize the uselessness of their information. With roughly 57% of their trades conforming to a fundamental strategy they reach values which are very close to those of a random trader, indicating that they mainly ignore their fundamentals and thus manage to avoid being even stronger exploited by the insiders which is the case in the simulation setting BASE.

With the OLS-regression in equation 9 we check whether the differences across the information levels are statistically significant and apply the same procedure as in equation 6 when testing for abnormal returns.

$$\text{FUND}_{j,m} = \alpha + \beta_1 \text{I2}_m + \beta_2 \text{I3}_m + \beta_3 \text{I4}_m + \epsilon_{j,m}, \tag{9}$$

Here, $\text{FUND}_{j,m}$ measures the percentage of fundamental strategy on all trades of information level j in market m. I2 to I4 are binary dummy variables for the various information levels. To check the aggregate data we modify equation 9 by setting up a panel with 30 cross-sections (five information levels in the six markets) and three observations over time each.

Insert Table 5 about here

Table 5 confirms the results of Figure 5. On aggregate the percentage of fundamental strategy for the insiders is significantly higher compared to both I1 and I2. Although the ratios for I4 decrease slightly over repetitions, the difference between insiders and the average informed remains significant in most repetitions separately.[10]

[10] This decrease in fundamental strategy of the insiders coincides with a stronger mispricing and thus a lowered market efficiency in repetition 3. See the results for abs(OVERVAL) in Table 4 for further details.

The indistinguishable returns of average informed traders and uninformed random traders are a robust finding of the presented model with asymmetric fundamental information. As long as traders with insider information mainly apply a fundamental strategy, average informed traders who use their fundamental information will end up below the market return and underperform a simple random strategy as is the case in the simulation setting BASE. Instead, their dominant strategy is to become an uninformed trader too by ignoring their fundamental information. Thus, it is not that much surprising that we find no learning over repetitions (measured by the abnormal returns of the traders) as the first repetition already comes relatively close to the simulated optimum when looking at the strategies of the various information levels.

4 Conclusion and Discussion

In this paper we presented results from experimental asset markets and simulations in which traders are asymmetrically informed about the fundamental value of an asset. To obtain benchmarks we ran two simulation settings. To control for potential learning over time we ran the experimental markets three times with identical subjects at identical information levels.

In the simulation setting BASE, in which all traders (except the randomized agents I0) traded according to their fundamental information, average informed (I1 and I2) underperformed the random traders who only marginally underperformed the market return. When we allowed for switching between a random and a fundamental strategy for all traders, I0 to I2 traded randomly and both I3 and I4 adopted a fundamental strategy. In this equilibrium setting EQUIL only I4 outperformed the market on the expense of the three worst informed traders who all ended up slightly below the market return. The aggregate results of the experimental markets came close to the equilibrium simulation setting and are in line with experimental evidence provided by Huber et al. (2008) and with empirical studies on insider trading and mutual funds performance (e.g. Lakonishok and Lee 2001, Lin and Howe 1990, and Seyhun 1986 for studies on insider performance and Carhart 1997, Jensen 1968, and Malkiel 1995, 2003a,b, 2005 for studies on mutual fund performance). Similarly, insiders outperform and mutual fund managers slightly underperform a broad benchmark index even before transaction costs. Clearly, it is impossible to assess the information level of mutual funds manager empirically but it is reasonable to assume that they are neither insiders nor completely uninformed.

The persistent underperformance to the market return of the average informed traders observed in the experimental markets was not due to overconfidence as our questionnaire provided evidence that they were underconfident. We attribute this underconfidence to the relatively complex market design. We think that this point is important to mention as in the studies on overconfidence cited above relatively easy general knowledge questions or relatively simple structured financial settings are used.

Furthermore, we observed no learning over the repetitions, as even the outcome of repetition one was in good accordance with the equilibrium solution. We attribute this finding which differs from Dufwenberg et al. (2005) and Hussam et al. (2008) to the good intuition of average informed traders that their fundamental information was useless. Only within the repetitions moderate learning effects were observed as trading volume and trades decreased.

We found that the origin of the persistent underperformance of traders with I1 and I2 is the asymmetric information structure of the model which makes it impossible for less informed traders to outperform uninformed random traders systematically. Although the experimental subjects with average information suffered from their informational disadvantage they quickly learned that ignoring their fundamental information would be better than being even more exploited while trading on the basis of their fundamental information. We confirmed this with our strategy analysis showing that average informed used their fundamental strategy very rarely while insiders applied a fundamental strategy in 80% of all trades which is in good accordance with the strategy distribution in the equilibrium simulation setting.

References

Barber, B.M., Odean, T. (2000), Trading is hazardous to your wealth: The common stock investment performance of individual investors. Journal of Finance, 55(2), 773–806.

Carhart, M.M. (1997). On the persistence in mutual fund performance. Journal of Finance, 52 (1), 57–82.

Davis, F.D., Lohse, G.L., Kottemann, J.E. (1994). Harmful effects of seemingly helpful information on forecasts of stock earnings. Journal of Economic Psychology, 15, 253–267.

Dufwenberg, M., Lindqvist, T., Moore, E. (2005). Bubbles and experience: An experiment. American Economic Review, 95, 1731–1737.

Fischbacher, U. (2007). z-tree: Zurich toolbox for ready-made economic experiments. Experimental Economics, 10(2), 171–178.

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

Greiner, B. (2004). Forschung und wissenschaftliches Rechnen 2003, GWDG Bericht 63. Gesellschaft fr Wissenschaftliche Datenverarbeitung, Gttingen, chapter An Online Recruitment System for Economic Experiments, pp. 79–93.

Hellwig, M. (1982). Rational expectation equilibrium with conditioning on past prices, a mean-variance example. Journal of Economic Theory, 26, 279–312.

Huber, J. (2007). j-shaped returns to timing advantage in access to information Experimental evidence and a tentative explanation. Journal of Economic Dynamics and Control, 31, 2536–2572.

Huber, J., Kirchler, M., Sutter, M. (2008). Is more information always better? Experimental financial markets with cumulative information. Journal of Economic Behavior and Organization, 65, 86–104.

Hussam, R.N., Porter, D., Smith, V.L. (2008). Thar she blows: Can bubbles be rekindled with experienced subjects? American Economic Review, 98, 924–937.

Jensen, M.C. (1968). The performance of mutual funds in the period 1945-64. Journal of Finance, 23, 389–416.

Keren, G. (1988). On the ability of monitoring non-veridical perceptions and uncertain knowledge: Some calibration studies. Acta Psychologica, 67, 95–119.

Kirchler, M. (2008). Underreaction to fundamental information and asymmetry in mispricing between bullish and bearish markets. An experimental study. Journal of Economic Dynamics and Control, forthcoming.

Lakonishok, J., Lee, I. (2001). Are insiders trades informative? Review of Financial Studies, 14, 79–111.

Lin, J.C., Howe, J.S. (1990). Insider trading in the OTC market. Journal of Finance, 45, 173–1284.

Malkiel, B.G. (1995). Returns from investing in equity mutual funds 1971 to 1991. Journal of Finance, 50, 549–572.

Malkiel, B.G. (2003a). The efficient market hypothesis and its critics. Journal of Economic Perspectives, 17 (1), 59–82.

Malkiel, B.G. (2003b). Passive investment strategies and efficient markets. European Financial Management, 9, 1–10.

Malkiel, B.G. (2005). Reflections onf the efficient market hypothesis: 30 years later. The Financial Review, 40, 1–9.

Plott, C., Sunder, S. (1982). Efficiency of experimental security markets with insider information: An application of rational-expectations models. Journal of Political Economy, 90, 663–698.

Seyhun, N.H. (1986). Insiders profits, costs of trading and market efficiency. Journal of Financial Economics, 16, 189–212.

Smith, V.L., Suchanek, G.L., Williams, A.W. (1988). Bubbles, crashes and endogeneous expectations in experimental spot asset markets. Econometrica, 56, 1119–1151.

Törngren, G., Montgomery, H. (2004). Worse than chance? Performance and confidence among professionals and laypeople in the stock market. Journal of Behavioral Finance, 5, 148–153.

White, H. (1980). A heteroskedasticity-consistent covariance matrix and a direct test for heteroskedasticity. Econometrica, 48, 817–838.

Figures and Tables

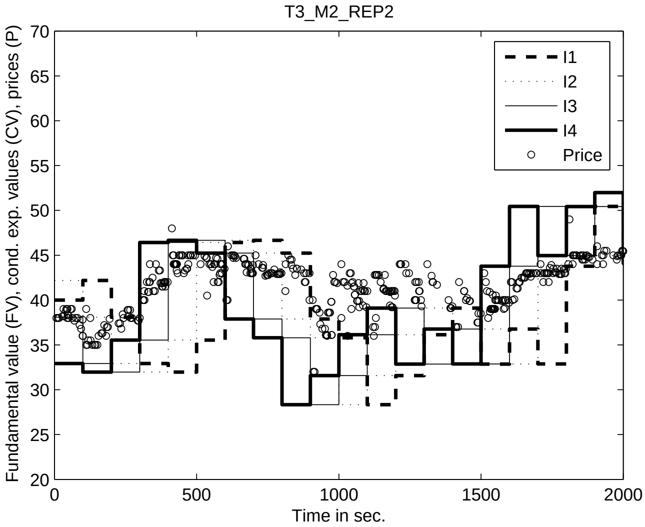

Figure 1: Conditional expected values, CV, of the different information levels as a function of time in one representative market. The fundamental value of the asset equals the CV of information level I4. Beginning with the insiders, I4, the CV-function of information level j is shifted (4-j) periods to the right.

Parameter	Agent 1	Agent 2
Range of Wt (sec.)	10-20	20-30
Range of Q	3-7	1-5

Table 1: Parameters for the computerized random traders, I0, in the experiments. "Range of Wt" indicates the uniformly distributed waiting time between consecutive limit orders. "Range of Q" defines the uniformly distributed span of stocks posted with each limit order.

Parameter	Simulation	Experimental treatment
Information levels	I0 to I4	I0 to I4
Number of traders per market	5	10
Periods per market	24 periods of 100 seconds each	24 periods of 100 seconds each
Initial endowment	40 stocks, 1600 in cash, no short selling	40 stocks, 1600 in cash, no short selling
Fundamental Value	see equation 1	see equation 1
Information system	see section 2.1	see section 2.1
Markets, Repetitions of Markets	5000 runs (independently drawn from equation 1)	6 with 3 repetitions each
Order types	Limit orders (matching algorithm)	Limit orders, market orders
Tradeable quantities	1 unit at each transaction	open, only restrictions with respect to stock/cash holdings
Order execution mechanism	Price, time priority	Price, time priority
Trading strategies	BASE: All but I0 use their fundamental information,	
	EQUIL: random or fundamental strategy until equilibrium is reached	up to subjects preferences

Table 2: Comparison of the parameters in the agent-based simulation and in the experimental treatment.

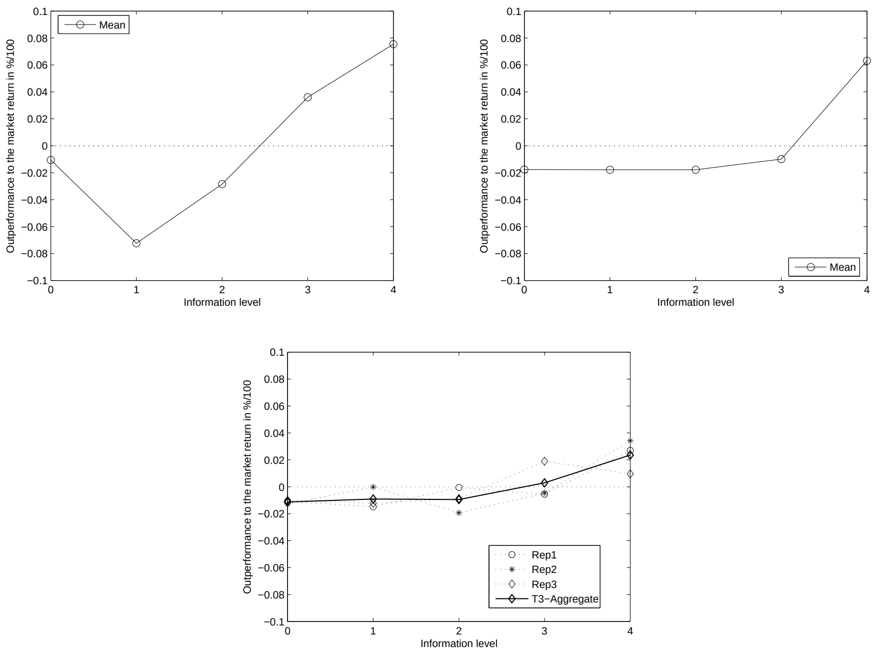

Figure 2: Outperformance to the market return in % (average abnormal returns, $AR_{j,m}$) as a function of information level of the simulation setting BASE (top left panel), the simulation setting EQUIL (top right panel) and the experimental treatment (bottom panel).

	Dependent Variable Abnormal returns in % ($AR_{j,m}$)			
Factor	Aggregate	REP1	REP2	REP3
α	−1.13	−1.09	−1.28	−1.00
	(0.265)	(0.595)	(0.422)	(0.345)
I1	0.22	−0.39	1.27	−0.22
	(0.877)	(0.909)	(0.566)	(0.924)
I2	0.18	1.05	−0.65	0.14
	(0.900)	(0.677)	(0.785)	(0.926)
I3	1.42	0.05	0.82	2.90
	(0.319)	(0.831)	(0.748)	(0.178)
I4	3.49**	3.79	4.70**	1.97
	(0.016)	(0.262)	(0.022)	(0.393)
R^2	9.17	8.82	21.07	10.20
n	90	30	30	30

*, ** and *** represent the 10%, 5% and the 1% significance levels.

Table 3: Panel (aggregate data) and OLS (single repetitions) regression results for the experiments. Dependent variable: abnormal returns, $AR_{j,m}$. The independent variables, I1 to I4, are binary dummy variables. The coefficient values are given in percent and the p-values are mentioned in parentheses for double-sided alternatives.

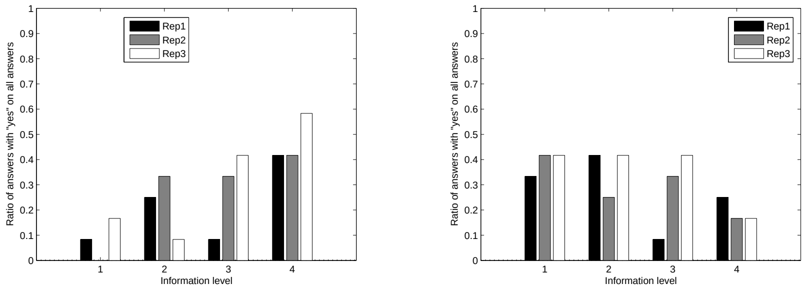

Figure 3: Questionnaire on overconfidence in the experimental markets: Question 1: Do you think that your final wealth is higher than the average final wealth of all ten traders? (left panel); Question 2: Do you think that your final wealth is higher than the final wealth of the other trader with the same information level? (right panel). The bars represent the ratio of answers with "yes" on all answers for each information level and repetition.

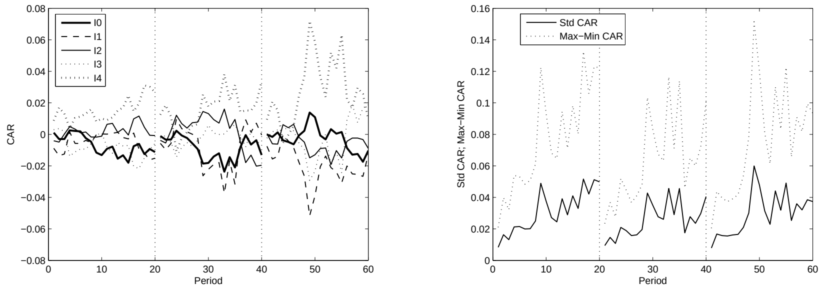

Figure 4: Cumulative abnormal returns of each information level, $CAR_{j,r,k}$, over periods and repetitions (left panel). The standard deviation (STD_CAR) out the CAR's and the difference between the maximum and the minimum of the CAR-functions ($MAX - MIN\_CAR$) over time are provided in the right panel.

	Dependent Variable						
Factor	abs(OVERVAL)	OVERVAL	Volume	Trades	Limit Orders	STD_CAR	$MAX - MIN\_CAR$
α	2.974***	0.838	44.837***	17.871***	12.394***	0.021***	0.053***
	(0.000)	(0.374)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
REP2	0.324	0.655	−7.177	−3.024	0.762	−0.005	−0.014
	(0.682)	(0.623)	(0.116)	(0.122)	(0.473)	(0.199)	(0.223)
REP3	1.595**	−0.413	−8.277	−4.229*	1.216	−0.006	−0.013
	(0.045)	(0.756)	(0.332)	(0.065)	(0.256)	(0.351)	(0.443)
PERIOD · REP1	0.087*	−0.155**	−0.592**	−0.204**	−0.007	–	–
	(0.064)	(0.049)	(0.017)	(0.050)	(0.880)		
PERIOD · REP2	0.080*	−0.184**	−0.803***	−0.278***	−0.060***	–	–
	(0.086)	(0.020)	(0.000)	(0.001)	(0.002)		
PERIOD · REP3	−0.028	−0.134*	−0.600***	−0.133	−0.022	–	–
	(0.548)	(0.089)	(0.001)	(0.116)	(0.735)		
R^2	2.17	3.55	4.49	5.74	4.30	2.79	2.48
n	360	360	360	360	360	360	360

*, ** and *** represent the 10%, 5% and the 1% significance levels.

Table 4: Tests on learning behavior in the experimental markets. Dependent variables: abs(OVERVAL), OVERVAL, Volume, Trades, Limit Orders, STD_CAR and $MAX - MIN\_CAR$. The independent variables, REP2 and REP3 are binary dummy variables for the repetitions 2 and 3 respectively and PERIOD accounts for the periods 1 to 20 within a repetition. The p-values are mentioned in parentheses for double-sided alternatives.

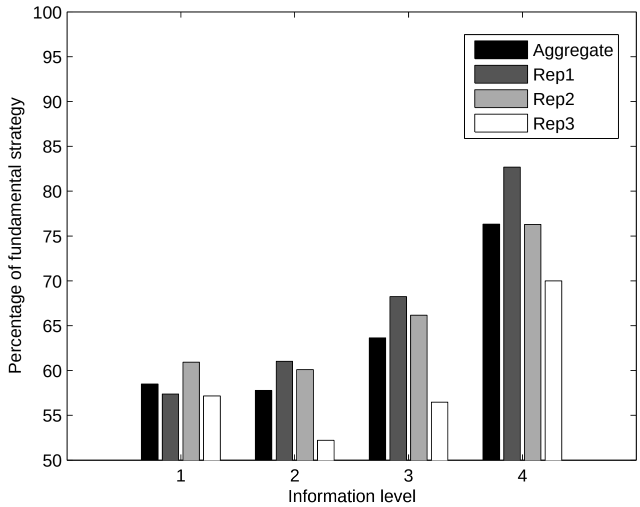

Figure 5: Average percentage of the use of fundamental information among all trades for each information level in each repetition in the experimental markets. 50% represent the ratio of a random trader.

	Dependent Variable Percentage of fundamental strategy, FUND			
Factor	Aggregate	REP1	REP2	REP3
α	58.49***	57.38***	60.93***	57.17***
	(0.000)	(0.000)	(0.000)	(0.000)
I2	−0.71	3.64	−0.83	−4.95
	(0.892)	(0.709)	(0.904)	(0.532)
I3	5.14	10.87	5.24	−0.70
	(0.328)	(0.154)	(0.452)	(0.946)
I4	17.83***	25.31***	15.35*	12.83
	(0.001)	(0.001)	(0.078)	(0.142)
R^2	19.32	31.86	19.08	14.47
n	72	24	24	24

*, ** and *** represent the 10%, 5% and the 1% significance levels.

Table 5: Panel (aggregate data) and OLS (single repetitions) regression results for the experiments. Dependent variable: Percentage of fundamental strategy, FUND. The independent variables, I2 to I4, are binary dummy variables. The coefficient values are given in percent and the p-values are mentioned in parentheses for double-sided alternatives.

Appendix

Appendix A: Fundamental Value Paths

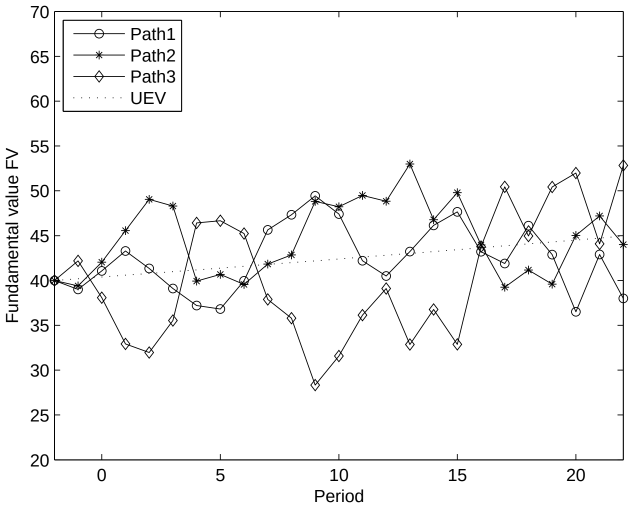

Figure E1: Fundamental value paths, FV_k, as a function of period of the experimental markets. The paths are perfectly randomized over repetitions.

Appendix B: Market Details for T3

		Abnormal returns in % ($AR_{j,m}$)					Trading volume				
Market	Repetition	I0	I1	I2	I3	I4	I0	I1	I2	I3	I4
1	1	−2.00	3.19	−1.58	−6.15	6.24	248	82	251	296	269
1	2	−0.12	0.83	−1.36	0.54	0.25	254	72	210	159	155
1	3	−2.10	2.15	−3.25	6.03	−3.03	215	78	161	103	179
2	1	0.65	−10.69	2.14	3.88	3.47	261	949	417	632	781
2	2	2.48	4.07	−7.93	−5.74	6.46	289	781	448	604	920
2	3	2.05	−10.79	1.20	−2.83	9.44	237	1128	322	921	1432
3	1	−1.38	−0.47	2.52	−1.50	0.93	277	465	200	343	161
3	2	0.67	−5.82	−0.14	−1.28	6.35	210	466	247	295	156
3	3	−5.40	−2.47	−4.45	8.11	3.67	179	386	197	218	250
4	1	0.54	−0.83	1.51	2.27	−3.44	297	359	314	317	287
4	2	−8.43	3.36	−5.76	7.44	2.64	133	97	152	97	145
4	3	0.05	1.35	0.96	−2.20	−0.04	180	69	60	131	86
5	1	5.37	7.35	−6.59	−2.75	−3.99	121	112	222	299	146
5	2	0.15	0.04	4.11	−5.06	0.71	86	69	98	165	64
5	3	−0.89	0.56	−1.46	2.32	−0.43	121	41	57	105	44
6	1	−9.73	−7.43	1.73	0.95	12.99	133	337	138	166	390
6	2	−2.43	−2.54	−0.49	1.33	4.13	224	404	220	75	243
6	3	0.27	1.86	1.80	−0.04	−3.84	133	193	150	127	173
Mean Agg.		−1.13	−0.91	−0.95	0.30	2.36	200	338	215	281	327
Median Agg.		−0.03	0.30	−0.32	0.25	1.78	213	265	205	192	176
Mean REP1		−1.09	−1.48	−0.05	−0.55	2.70	223	384	257	342	339
Mean REP2		−1.28	−0.01	−1.93	−0.46	3.42	199	315	229	233	281
Mean REP3		−1.00	−1.22	−0.86	1.90	0.96	178	316	158	268	361

Table E1: Descriptive statistics for each market: Abnormal returns in % and trading volumes for each information level.

Appendix C: Experimental Instructions

We welcome you to this experimental session and ask you to refrain from talking to each other for the duration of the experiment[11]

Background of the experiment

This experiment consists of a market in which ten traders trade the shares of a fictitious company for 20-30 consecutive periods (months).

Market procedure

The market is characterized by an asymmetric information structure. The best informed (I4) receive all relevant information on the company. The second best informed (I3) receive the same information one period later. This process continues until the worst informed, I1, receive the information, who have an informational disadvantage of 3 periods compared to the insiders.

Trading will occur with a double auction market mechanism. The price of the shares is determined by your and the other traders' actions in the market. You are free to submit as many bids and asks (in the range of 10 to 200 with up to two decimal places) as you wish.

Total wealth

Your wealth is the sum of your money balance and the market value of your shares (the number of shares you hold multiplied with the current price). Your wealth will change during a period as the market price changes, even if you do not trade; the most recent trading price will be used to value your shares.

Fundamental value and CV

All relevant information on the future development of the company are included in the variable "fundamental value", which stands for the fundamentally justified

[11] At the beginning of repetition 1 in T3 we handed out a brief additional written instruction which informed the subjects exactly about the procedure of the three repetitions.

valuation of the company at any time. The fundamental value starts at 40 and will change randomly each period. The random change each period is +0.5% with a standard deviation of 7.2%. Examples:

- The probability of the fundamental value increasing by more than 14.9% = 2.3%
- The probability of the fundamental value decreasing by more than 13.9% = 2.3%
- The probability for the fundamental value increasing by more than 7.7% =16%
- The probability for the fundamental value decreasing decrease by more than 6.7% =16%.

The fundamental value is especially relevant at the end of the experiment, since all shares will be bought back by the experimenter from you at that time at this value. Each period you (as well as every other participant with exception of I0) receive an estimate (CV) of the fundamental value. Traders with information level 4 (I4) get the most up-to-date information, i.e. the fundamental value of the stock in the current period. Traders with information level 3 receive the same information with one period delay. Traders with information level 2 get the same information as I4, just two periods later. Finally, investors with information level I1 receive the same fundamental information as I4 with three periods delay. As mentioned before, traders with I0 don't get any information on the fundamentals of the company.

The following table gives a brief overview on the number of traders per information level and their initial endowments:

At the end of each period a history screen will give a short summary on your endowments, past prices and trading activity on the market.

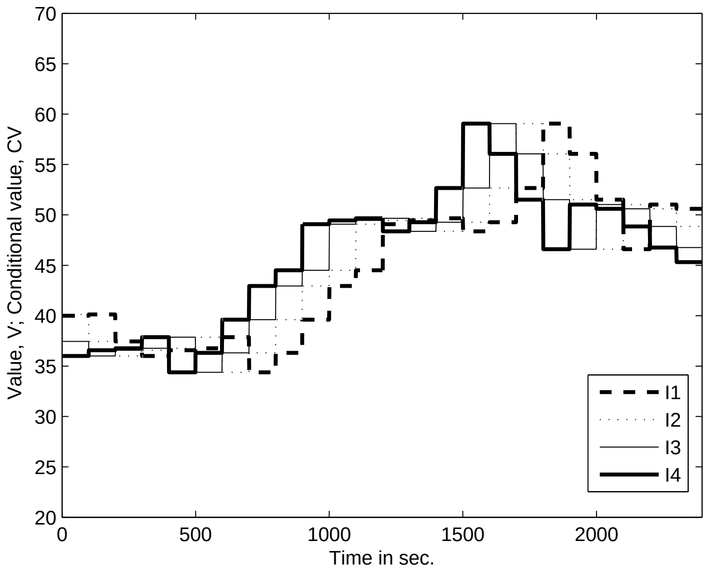

Figure E2: Example of a realisation of fundamental value/CV as a function of information level

Information level	Stocks	Money	No. traders	Lag to fundamental value
I0	40	1,600	2	no information
I1	40	1,600	2	3
I2	40	1,600	2	2
I3	40	1,600	2	1
I4	40	1,600	2	0

Table E2: Overview of initial endowments and traders per information level.

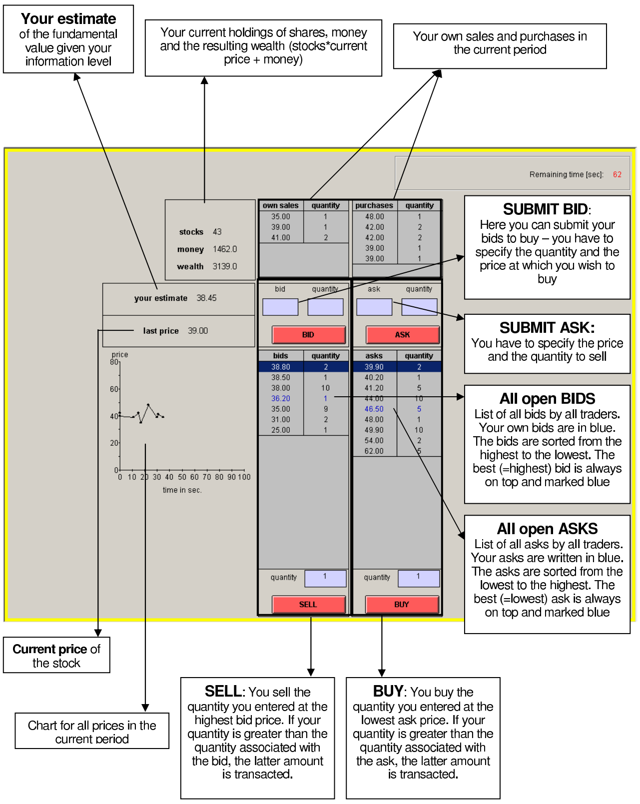

Figure E3: Trading screen

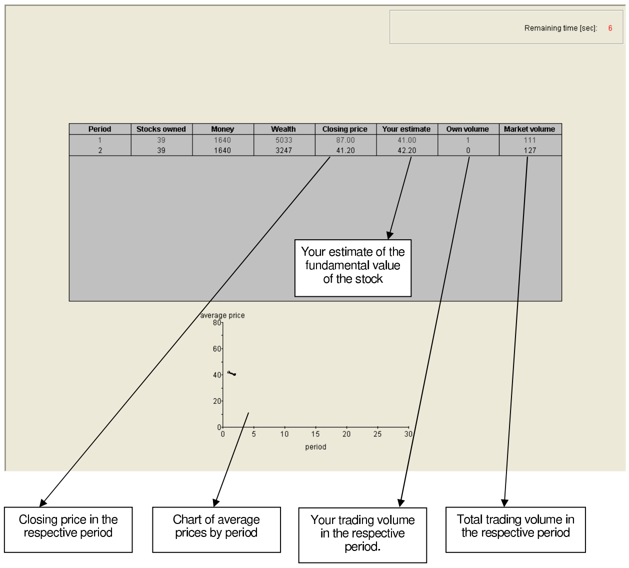

Figure E4: History screen

Some important details

- Each period lasts 100 seconds. The experiment will be terminated between periods 20 and 30, with equal probability at each termination date.

- Final payment: At the end of the experiment you will be paid in EUR. At this time all your stocks will be bought back at the fundamental value (equal to the estimate of I4 in the final period). Your money will be added to the value of your stocks and this amount will be converted into EUR at the rate of 1 EUR = 175 Taler. So, at the end of the experiment only I4 are perfectly informed on the fundamental value of the stocks. The worse your information level, the imprecise your estimate (CV) will be.

  Example: If your final wealth is 3860 units of money you earn 3860/175 = 22.10

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It is hard to beat the Monkeys - On the Value of Asymmetric Fundamental Information in Asset Markets

Abstract

In this paper we present results from experimental asset markets and simulations with traders who receive asymmetric information about the fundamental value of an asset. In the experimental markets with repetition insiders outperform the market and uninformed computerized random traders (monkeys) perform equally well compared to average informed traders. This is in line with the results of the equilibrium simulation output in which traders choose between a random strategy and their fundamental strategy. We further find that pattern of average informed not being able to beat the uninformed is not due to their overconfidence but due to the asymmetric information structure of the market.

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