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FORECASTING MARKETS - AN INDUSTRIAL APPLICATION

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Part I.

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Abstract:

In this paper we report about a first industrial application of an experimental stock market, which was designed to support project management decisions. People who work in a software development project were motivated to trade in simple real money double auction markets. The design of these markets was focused on the date the project should be finished and should help to aggregate privat and semi-public information on the progress of the project more quickly than conventional management techniques. Part one of this paper present an overview of the first half of the experiment - the experimental setup and the first 2 months of trading.

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1. The Main Idea

In this experiment we have tried to exploit insights gained in a variety of in the field studies in experimental economics in the past in shaping an industrial application. Especially we were interested in forecasting real events. This problem is well known from the Political Stock Market (PSM) experiments like the Iowa Electronic Markets (IEM) and many others (→ Forsythe et al 1990-92). Our challenge was to design and run markets that do not focus on political election processes or stock market related events. By coincidence we came in contact with some people from Siemens Austria, who think of new possibilities of increasing internal project management skills and were interested in the technology of forecasting events by market mechanisms. So we started working on markets, which (hopefully) might generate additional information to support decisions in project management.

2. Why Projectmanagement?

One of the key problems in project management is controlling of already started projects and to counteract unintentional tolerances. This also means, that it is very important to receive as much as possible up-to-date information on the progress of the project from within the group of people working on that project. There are a couple of project management techniques, like milestone trend analysis, which should help to recognize delays and other problems that might occur as soon as possible. But especially bad news like delays, technical problems or other reasons which causes delays are often not voluntary passed through, because the people who are involved are afraid of suffering negative feedback. That means, a technology which enables the management to get additional (anonymous) information as quick as possible can help to improve management strategies.

As we see from experiments (like the IEM), markets are able to collect various pieces of information and aggregate them like a puzzle (→ like the ESLDA experiments by V. Smith et al 1992-94). All this can be done in an anonymous way, by trading in a simple market environment. Motivated by earning profits (→ Smith 1991d), participating traders reveal their private information bit per bit and don't have to fear any negative feedback, because market rules can guarantee that they stay anonymous. Anyone who is involved in a project can contribute some of the pieces of information and can help to improve the predictive power of market prices (→ Hayek 1945).

3. What Question do we want to answer?

The question we tried to ask and answer in this first industrial test is, if a special project can be finished at the date planned. And if it can not be finished until the planned deadline, we are interested in the expected delays (one week, two, three,... or prefinished). Approx. 200 people (most of them engineers) should work together and finish a project within 6 months. There was a clearly formulated and measurable event which marks the end of the project. Per definitionem, the project is finished when it has passed a special test program and was handled to another division (of Siemens Germany) which acts as customer. This was called reaching milestone B500.
So it was our task to design and run a market with up to 200 participants for approx. 6 months and predict the finishing date as excactly as possible.

4. Design of the markets for planned project time evaluation

In the beginning we designed two different markets. A very simple version and a second one with a sightly more complicated payoff rule.

1. Market/Claim (called "B500"):
   This market asks a very simple question: "Can the project be finished in the planned time horizon?". The payoff rule was a simple Winner Takes All design. One YES share in this market will pay 1 ATS if the project can be finished in time and nothing if not. The NO share will then pay 0 and 1 ATS respectively.

2. Market/Claim (called "Verzug"):
   The second market was designed to predict a possible delay. There was a share called "Early" (or YES) and a second called "Late" (or NO). The payoff rule follows the (linear) specification:
   YES: max (1 - 0.2 * weeks late, 0) ATS and NO: min(0.2 * weeks late, 1) ATS

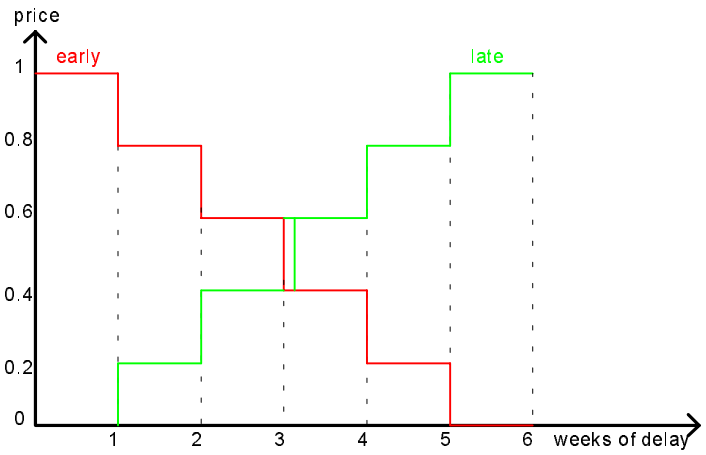

Fig 1: Payoff Rule in "Verzug" Market

5. The Experimental Setup

We implemented a fully computerized double auction market (DAM) on the Siemens Austria[3] intranetwork and used a software product called FX developed by Kumo Inc.[4]. The project where we tried to forecast a milestone was a software development project in telecomunication industry. The original project was launched by Siemens at the beginning of April 1997. At the same time we started to set up the software in the lab of the Department of Managerial Economics and Industrial Organization at University of Technology Vienna, run some initial tests, translate the software documentation to german and prepare some training material (all WWW based stuff) to teach and train the participants. Then we started to port the whole installation to the intranet server of the project. The market, its goals and the entire procedure was presented in a first short briefing to all participants before the markets started. We discussed some final questions and offered all potential participants (all people who are working in the project except the management crew) to join to the market. To motivate as much traders as possible, a free 200 ATS cash endowment was offered (by the Siemens Quality Managment Division) to every volunteer who was ready to invest 100 ATS of her/his own money. Markets opened at May 12th 1997 and stay open until early October 1997. Approx. 60 traders decided to join the markets.

[3] see http://www.siemens.at/
[4] see http://www.kumo.com/

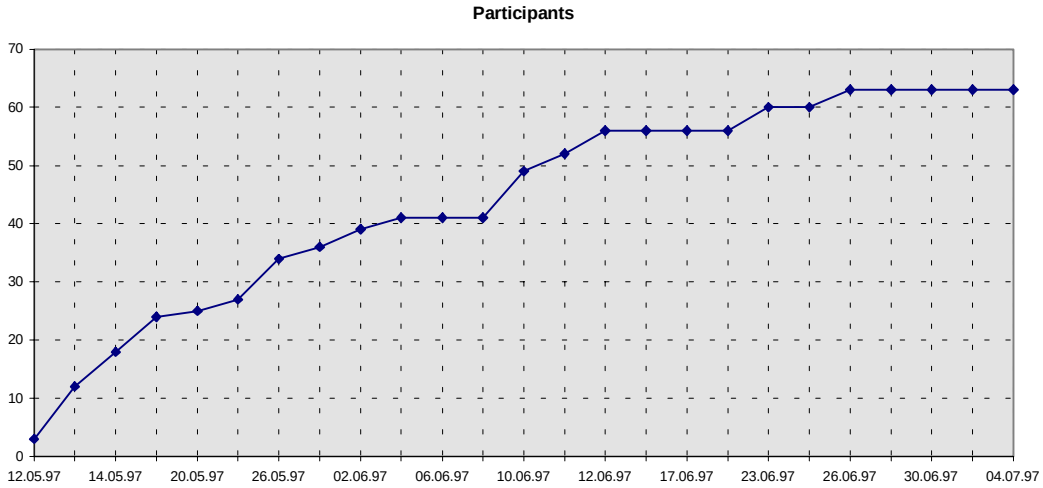

Fig. 2: Number of Participants

6. Results

6.1. The Particpants

When a new trader decides to join the markets s/he had to fill up a short questionnaire. A short statistic of this data shows us the following structure of the market participants.

Gender:
88.1 % male
11.9 % female

Experienance with stock markets:
12% declare experience
88% no experience

Function:
67% of market participants turned out to be developers,
31% to be group managers
2% to be project managers (second level - first level managers are not allowed to join the experiment, because of their manipulating power)

Age structure:
The average trader was about 33 years old and on average 7.9 years employed in the firm. That also means that on average people participating in the market join the firm with age 25.2 The average membership to the project (it's previous releases) of a trader was 3.4 years (that's 44% of the time since people were hired) and allow traders to gather some experience of the problems which might occur. Fig 3 shows that average developers are 32.6 years old and younger than their group managers (average age 33.8). They have worked in the firm for 7.4 years - 1.4 years less than their average group managers - and are involved in the project for

3.2 years - group managers for 3.8 years. Participating project managers were quite young with an age of 36 and have worked within the project on average since 6.5 years.

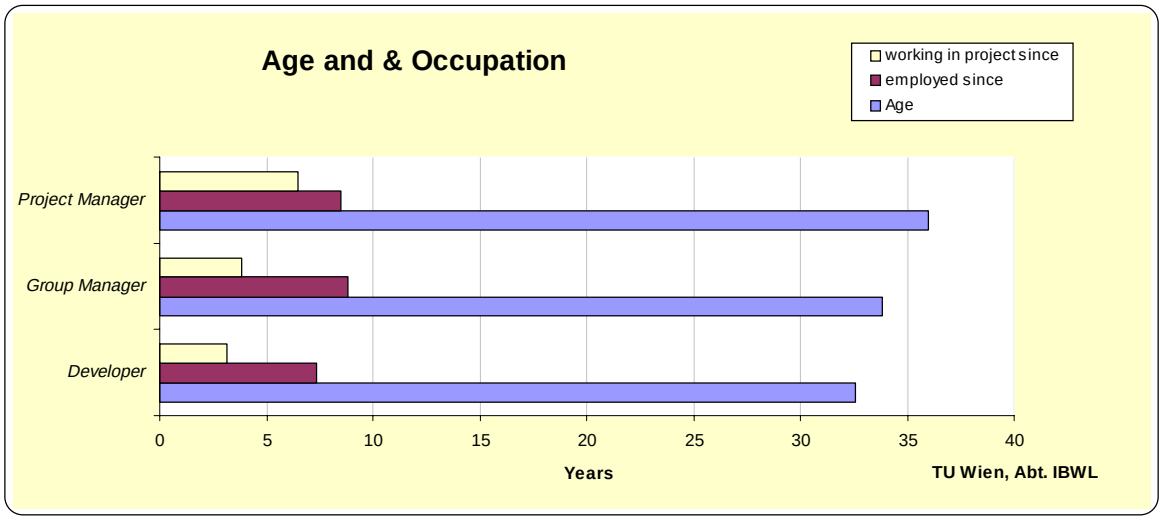

Fig 3: Age Structure and Function of Market Participants

Beliefs of Market Participants:

We asked all participants, if they are thinking that a market like this can be a meaningful new tool in project management. The graphic below shows the results. It was interesting to see, that the opinion of people with stock market experience and of traders without experience did not significantly differ.

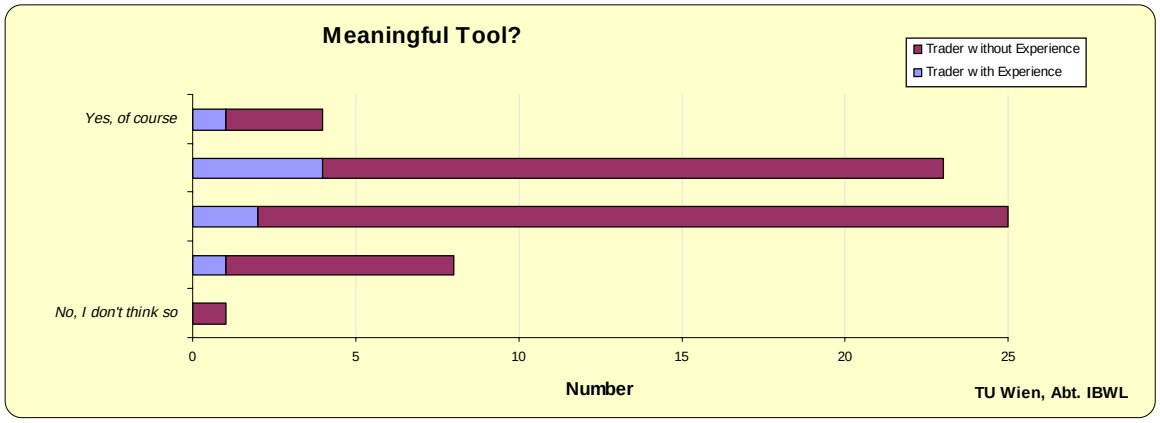

Fig 4: Traders Opinion on the Market

6.2. Market Prices and Events (in the first 2 months)

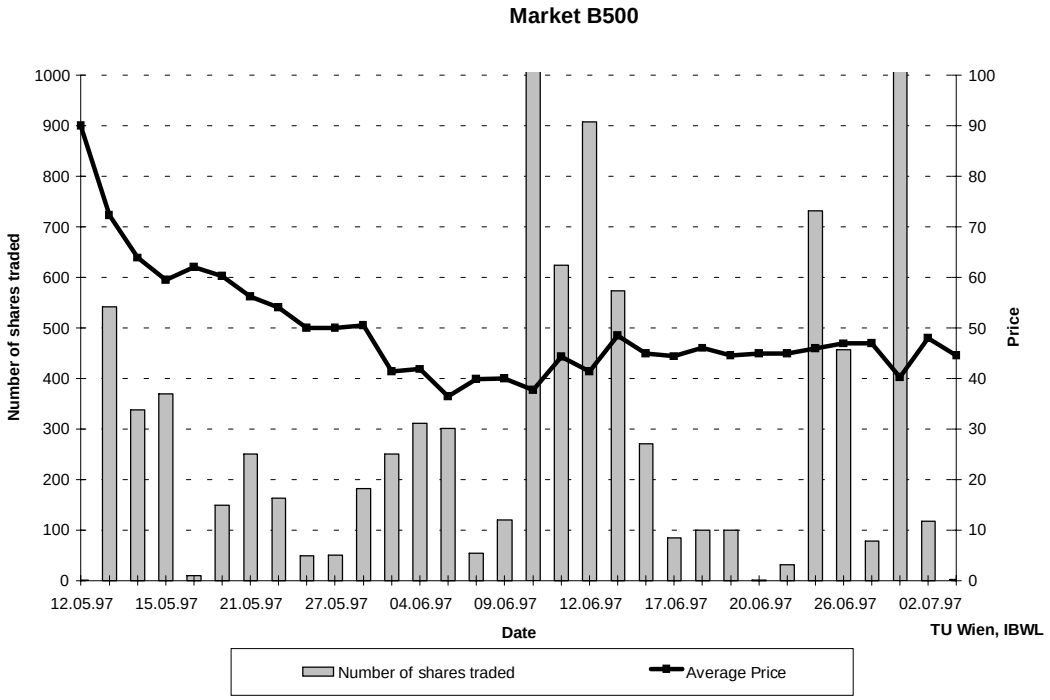

Fig. 5: Daily average market prices and quantities traded in market "B500"

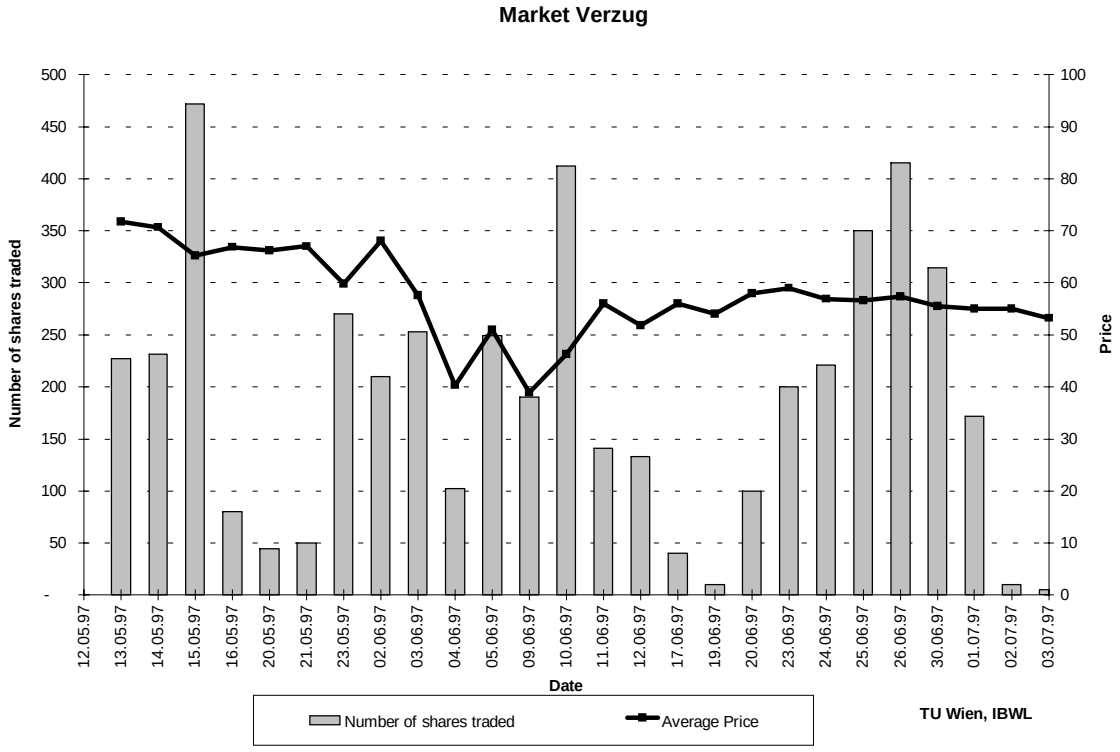

Fig. 6: Daily average market prices and quantities traded in market "Verzug"

Figures 5 and 6 show the development of the average daily prices in the markets. In both markets, price levels became pretty stable after the first month of trading. It turned out, that trading activity (numbers of shares traded) in the B500 market was much higher than in the Verzug market. One reason may be, that this market asked a simpler question (YES-NO vs. number of weeks delayed). 3 months before the planned deadline traders could have some difficulties in getting enough information to make forecasts on the exact dimension of a potential delay.

Some special Events :

- Week 21: developer meeting in Berlin, previous version is delayed, market prices drop to 60 in the "B500" market and to 70 in the "Verzug" market
- Week 22: B200 (another milestone) documentation going into AFI phase (available for inspection). The chart of the B500 market shows a significant decrease in market prices in the first 3 weeks of trading. Market management interpreted the drop in market prices as a signal of some "bad" news in a review meeting. They decided to start a "information campaign" among project members.
- Week 23: B500 prices down to 40, reviews of the B200 documents in Vienna and Berlin, BR (workers' council) meeting about salaries and overtime
- Week 24: Reaching milestone B200 in time, announcement of a new project organization, poll among project staff, prices growing again slightly
- Week 25: announcement of the estimated expenditures of the project, prices become stable at 45 in B500 and 55 in Delay market.
- Week 26: announcement of the expenditure and time schedule plans, MTA (milestone-trend-analysis) paper, developer meeting,
- Week 27: announcement of the results of the developer meeting

7. Conclusions (after first 2 months)

Although most of the market participants in this field experiment did not have any experience in stock markets, markets started with a surprising high level of market activity. Markets found a first quite stable equilibrium after approx. one month of trading at a satisfying level of trading activity. So we infer, that both the design of the markets (the question we asked and the institution we use - the DAM) and the implementation of the markets itself (software, user interface, ...) became familiar to the participants very quick and started to generate (aggregate) the desired information after an gratifying short period of time.
It will be very interesting to watch market prices and trading activity along the time path. Especially a potential shift in activity from the B500 market to the Verzug market can reveal

the moment, when traders have found enough information to make better predictions on the delay question.

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