The Role of the End Time in Experimental Asset Markets

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Joint work with Matthias Weber (U of St. Gallen)

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Bamberg
Outline

1. Introduction
2. Experimental design
3. Results
4. Discussion
Motivation

- Laboratory experiments have taught us a lot about how (financial) markets work → we know much more about influencing factors and human behavior

- Consequently, there is a large literature on experimental asset markets
  - Subjects trade assets with each other in the lab
  - Usually, continuous double auction or call market mechanism (similar results)

- Usual setting: short time horizon and definite ending
Even though longer horizon and indefinite ending is more natural, the effect of the end time has not yet been investigated systematically.

We analyze the role of end time in a controlled 2x2 experimental design.

We implement:

- high C/A-ratio in order to give more space for bubbles to arise
- repeated markets to investigate the effect of experience
We investigate short vs. long horizon and definite vs. indefinite ending in a call market setting.

Our results show no substantial effect of the different end → bubbles keep occurring with repetition.
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Experimental asset market

- Subjects hold assets and cash, and they are allowed to **trade** on a call market.

- Initial endowment: 5500 points and 3 assets (800 points = 1 euro)

- Dividend on assets: 0 or 10 points with 50% chance, and the cash pays interest rate (4%) → booked “overnight” on a savings account (→ constant C/A-ratio)

- Buy-out price when market ends: 125 points → known to subjects

- **Constant** fundamental price (125 points)
Further features

- Restrictions on trading:
  - no short selling, no borrowing
  - ask prices higher than bid prices

- Each session with 3 rounds → rounds are identical (except for the number of periods in some treatments)

- Groups of 6 staying together for the three rounds

- Payment per round: final cash, interest rate earnings, dividend earnings, buy-out of the assets in the end → 1 round is randomly chosen for payment
Treatments

2x2 design:
1. Definite vs. Indefinite end
2. Short vs. Long horizon

- Minimum 13 (28) periods in short (long) indefinite
- Probability of continuation in the indefinite treatments: 90%

<table>
<thead>
<tr>
<th></th>
<th>Definite</th>
<th>Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>15,15,15 (9)</td>
<td>17,16,14 (8)</td>
</tr>
<tr>
<td>Long</td>
<td>30,30,30 (7)</td>
<td>32,31,29 (8)</td>
</tr>
</tbody>
</table>

**Table 1:** Number of periods per round (number of groups in brackets)
Decide your decision for period 11 in round 1:

You have 0 assets and 6500.00 points in your cash account.

I would like to buy this quantity at this price
I would like to sell this quantity at this price

Past information:

<table>
<thead>
<tr>
<th>Period</th>
<th>Assets you sold</th>
<th>Assets you bought</th>
<th>Market price</th>
<th>Realized dividend per asset (end of period)</th>
<th>Asset holdings (end of period)</th>
<th>Cash holdings (end of period)</th>
<th>Savings account balance (end of period)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>6500.00</td>
<td>2974.35</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>0</td>
<td>360.00</td>
<td>10</td>
<td>0</td>
<td>6500.00</td>
<td>2607.64</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0</td>
<td>360.00</td>
<td>10</td>
<td>0</td>
<td>6500.00</td>
<td>2255.04</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>360.00</td>
<td>10</td>
<td>0</td>
<td>6500.00</td>
<td>1925.23</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>360.00</td>
<td>0</td>
<td>0</td>
<td>6500.00</td>
<td>1608.11</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>300.00</td>
<td>0</td>
<td>0</td>
<td>6500.00</td>
<td>1323.18</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>300.00</td>
<td>0</td>
<td>2</td>
<td>5800.00</td>
<td>1049.21</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>5800.00</td>
<td>765.70</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>300.00</td>
<td>0</td>
<td>2</td>
<td>5800.00</td>
<td>453.28</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>275</td>
<td>10</td>
<td>3</td>
<td>5500.00</td>
<td>251.20</td>
</tr>
</tbody>
</table>
Outline

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Main results

- Bubbles arise in all of our treatments
- Bubbles do not disappear with experience in any of the treatments
- Mean prices are lower in the long treatments
- No significant effect of definiteness on pricing accuracy
Short treatments (Definite left, Indefinite right)

Figure 1: Market prices for rounds 1 to 3 (top to bottom)
Long treatments (Definite left, Indefinite right)

Figure 2: Market prices for rounds 1 to 3 (top to bottom)
A market exhibits a bubble when the mean price in the market is at least twice as high as the fundamental value.

<table>
<thead>
<tr>
<th></th>
<th>Definite</th>
<th>Indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short</td>
<td>8,8,7 (9)</td>
<td>7,7,7 (8)</td>
</tr>
<tr>
<td>Long</td>
<td>6,5,3 (7)</td>
<td>6,5,5 (8)</td>
</tr>
</tbody>
</table>

_Table 2: Number of bubbles per round (number of groups in brackets)_
Pricing accuracy

Figure 3: Mean prices in all treatments and rounds

- (Weakly) significantly higher mean prices in short than in long treatments in all rounds
## Regression results: mean prices

<table>
<thead>
<tr>
<th></th>
<th>Round 1</th>
<th>Round 2</th>
<th>Round 3</th>
<th>Mean R1-R3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>479.2***</td>
<td>519.9 ***</td>
<td>465.4***</td>
<td>488.2***</td>
</tr>
<tr>
<td></td>
<td>(45.4)</td>
<td>(44.0)</td>
<td>(57.9)</td>
<td>(38.7)</td>
</tr>
<tr>
<td>Long</td>
<td>-106.8**</td>
<td>-164.1***</td>
<td>-142.1**</td>
<td>-137.7***</td>
</tr>
<tr>
<td></td>
<td>(45.0)</td>
<td>(50.0)</td>
<td>(55.1)</td>
<td>(42.9)</td>
</tr>
<tr>
<td>Indefinite</td>
<td>-40.2</td>
<td>-36.0</td>
<td>-43.6</td>
<td>-40.0</td>
</tr>
<tr>
<td></td>
<td>(45.8)</td>
<td>(51.5)</td>
<td>(56.9)</td>
<td>(44.0)</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.16</td>
<td>0.26</td>
<td>0.18</td>
<td>0.26</td>
</tr>
</tbody>
</table>

This table shows regression results with mean market prices as dependent variable. Results are shown for the three rounds separately and for the means across rounds. Each observation corresponds to one group, each regression is thus conducted with 32 observations. The variables Long and Indefinite are dummy variables that equal one if the treatment has a long or indefinite horizon, respectively. Heteroskedasticity-robust standard errors are shown in parentheses. Stars by the entries represent the significance level (*: 10%; **: 5%; ***: 1%).

**Table 3: Treatment effects on mean prices**

- Results are robust to inclusion of additional controls such as the number of females or economics students, or age
- Adding an interaction term between the two treatment dummies have no effect on the results either
Learning over time

Figure 4: Mean prices in all treatments and rounds

- No significant differences between the mean price in round 1 and round 3 in any of our treatments (sign-rank test)
- Regressions confirm this finding
Speeding up of bubbles

<table>
<thead>
<tr>
<th></th>
<th>short-definite</th>
<th>short-indefinite</th>
<th>long-definite</th>
<th>long-indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 1</td>
<td>0.93</td>
<td>0.92</td>
<td>0.92</td>
<td>1.02</td>
</tr>
<tr>
<td>Round 2</td>
<td>1.00</td>
<td>1.06</td>
<td>1.16</td>
<td>1.11</td>
</tr>
<tr>
<td>Round 3</td>
<td>1.07</td>
<td>1.20</td>
<td>1.25</td>
<td>1.14</td>
</tr>
</tbody>
</table>

Table 4: Mean price in the first half of the round divided by the mean price of the whole round

- Subjects seem to expect bubbles occurring in later rounds → bubbles appear earlier in later rounds (except for long-indefinite)

- No significant treatment-differences in speeding up of bubbles
## Results

### Shape of bubbles

<table>
<thead>
<tr>
<th></th>
<th>short-definite</th>
<th>short-indefinite</th>
<th>long-definite</th>
<th>long-indefinite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round 1</td>
<td>108.14</td>
<td>112.65</td>
<td>129.55</td>
<td>85.28</td>
</tr>
<tr>
<td>Round 2</td>
<td>114.33</td>
<td>108.62</td>
<td>108.18</td>
<td>81.88</td>
</tr>
<tr>
<td>Round 3</td>
<td>112.67</td>
<td>105.06</td>
<td>105.33</td>
<td>79.51</td>
</tr>
</tbody>
</table>

**Table 5:** Standard deviation of prices

- No significant differences across treatments and rounds
Outline

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4 Discussion
Bubbles occur and do not disappear with experience...
  ... irrespective of the time horizon
  ... irrespective of the definiteness

Pricing is more accurate with longer horizon, but no effect of definiteness

No significant learning over time in any of the treatments
Thank you for your attention.

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