

Introduction to market experiments

Path to equilibrium

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Bossaerts, P. (2009). The experimental study of asset pricing theory. Foundations and Trends® in Finance, 3(4), 289-361.

Economics and Finance

- One goal: to explain markets.
 - Observe a pattern/phenomenon.
 - Propose theories/models that explains the pattern/phenomenon
 - With a lot of assumptions.
 - Test of the main pricing predictions on historical data from field markets.
 - (increasingly important) predicting the future (now machine learning).
- Finance:
 - Cares about prices and its properties (second-order: variance).
- Economics:
 - Cares about allocation and holdings.

Equilibrium

- Price such that DEMAND=SUPPLY
- Theory:
 - Solve an optimization problem: $\text{argmax}(E(\text{Utility}))$ either for individual agent or the entire market.
 - (Typically) take the first order condition and get the results.
- In theory, do markets converge to equilibrium?
 - Only under **VERY** tight assumptions (otherwise you cannot solve the FOC).
- Does the theory tell how markets converge (assume they do) to equilibrium? (i.e., path towards equilibrium)
 - No.
- Which market structure (field of “microstructure”) gives you equilibrium?
 - Don’t know.

How most finance classes are taught

- Introduce tools and theories:
 - E.g., Net Present Value, CAPM, GARCH.
- Obtain historical data:
 - E.g., NYSE, NASDAQ, Binance.
- Ask questions: do prices (returns) look AS IF markets equilibrate?
 - Or can you use theory to explain field data?
 - E.g., $\text{return} = a + b * \text{factor 1} + c * \text{factor 2} + \dots + \text{error}$
 - Or e.g., $\text{return}_{\{t\}} = \text{return}_{\{t-1\}} + \dots + \text{error}$

How do we know the theory is “accurate” in the first place?

- Need lab experiments to independently verify the theory.
 - Test theory in a controlled environment.
 - Standard practice in science.
- Financial industry understands this.
 - Algorithms are typically tested independently and thoroughly before being deployed in the actual markets (which is a wild west, any mistakes can cost you \$\$\$).
 - Controlled environment and heavy backtests.

Policy making on financial markets

- The current approach of policy making in financial markets can be controversial.
- Either:
 - SEC introduces a policy for some time (often backed by theoretical justification), and researchers examine the “effectiveness” of this policy *ex-post*.
- Or
 - SEC conducts “field experiments”: implements a policy on a selected group of companies.

Problems if you don't do experiments...

- Market participants complain that some policies are ineffective and can hamper the markets (<https://www.optiver.com/insights/news-articles/review-of-mifid-ii/>)
- NYSE vs. SEC: <https://www.govinfo.gov/app/details/USCOURTS-caDC-21-01101/summary>
- SEC halted tick-size programme after 3 years: <https://www.sec.gov/news/public-statement/tm-dera-expiration-tick-size-pilot>

Example topics in experiments in economics and finance

- Risk aversion.
- Competitive markets and equilibrium.
- Information.
- Market microstructure, mechanism design.

How are market experiments implemented?

- Experiment lab with computers.
- Up to 35 participants (pre-covid) per session.
- We observe participants' behavior and market dynamics (e.g., prices) during the entire trading session.
- Admin can be quite tedious:
 - Coordination for time (2-3 hours per session).
 - Making sure ALL participants understand the trading rules.
 - Need a team of at least 3-5 people for each session.

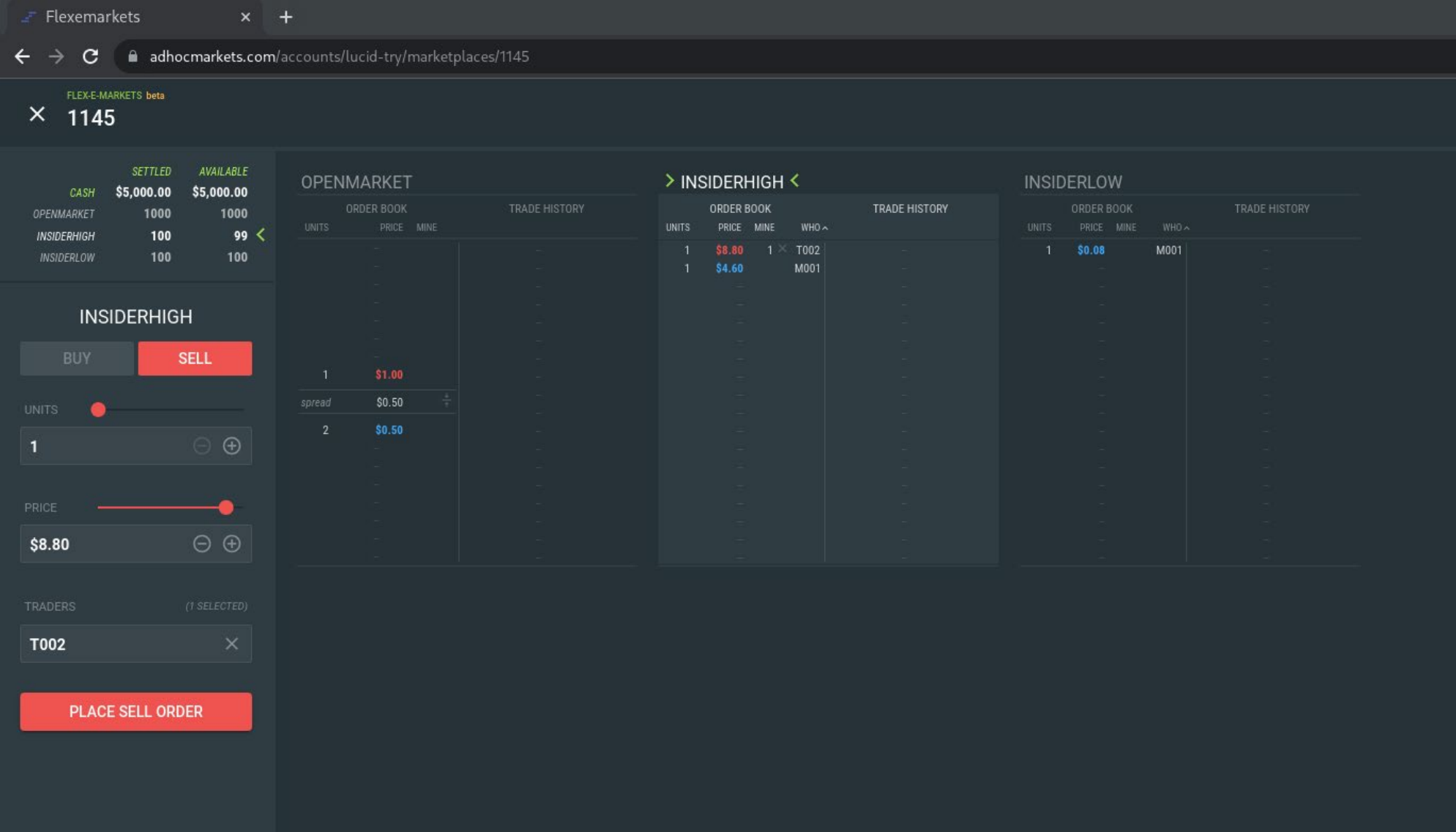


...and not just finance

- Market experiments with concepts of psychology and neuroscience in the lab.
- E.g., heart rate and skin conductance sensors (with Chris from Monash).
- Are traders excited/nervous when there is a bubble/crash?



Trading interface



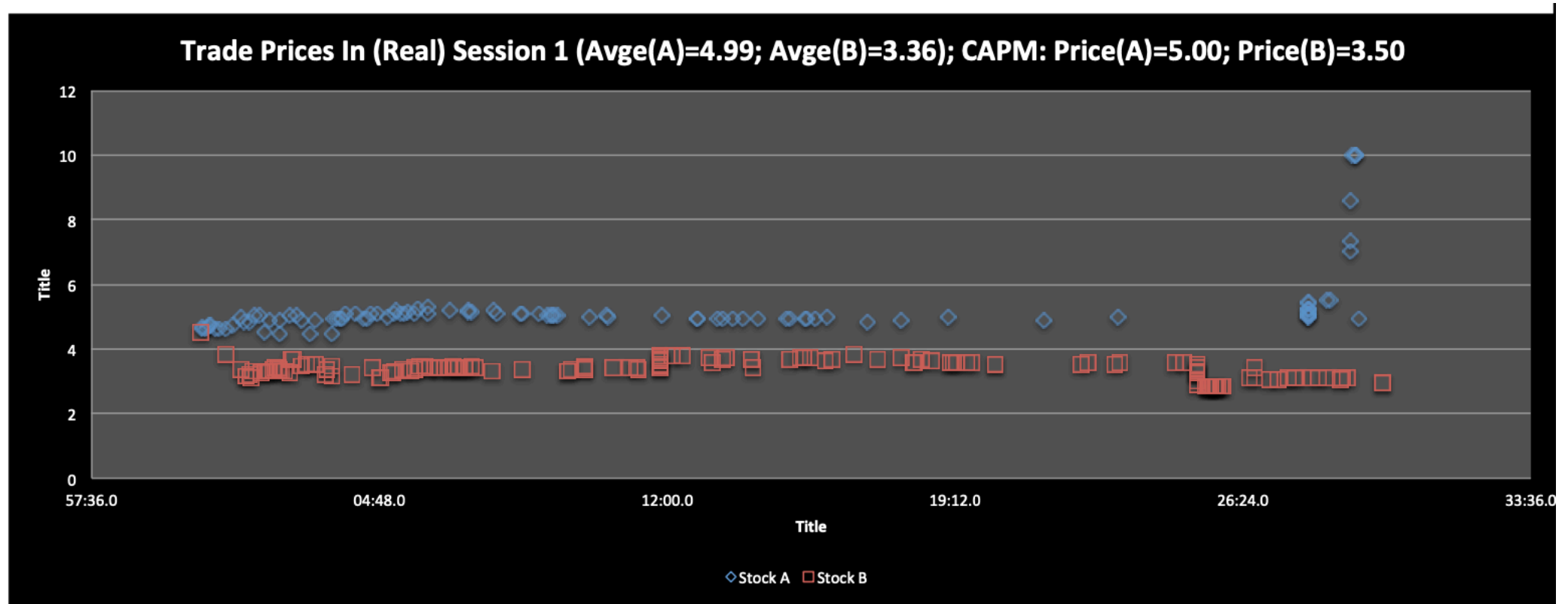
Emulating real-world trading



Implementation challenges

- MOST people do not know how to trade/how financial markets operate.
- MOST finance students underappreciate how hard trading can be.
 - Struggle even with basic concepts like best bid/ask, or at what price will a trade occur.
 - Typically believes that if they long(buy), price will go up or if they short(sell), price will go down....
 - Concepts of short-sale.
- You have to make sure every single participant understands basic trading concepts, as well as the task (but NOT the strategy).
- Real-world trading is A LOT more complicated.
 - E.g., margin/collateral requirement, broker, T+1 clearing by the clearing house, etc.

Results



Results

