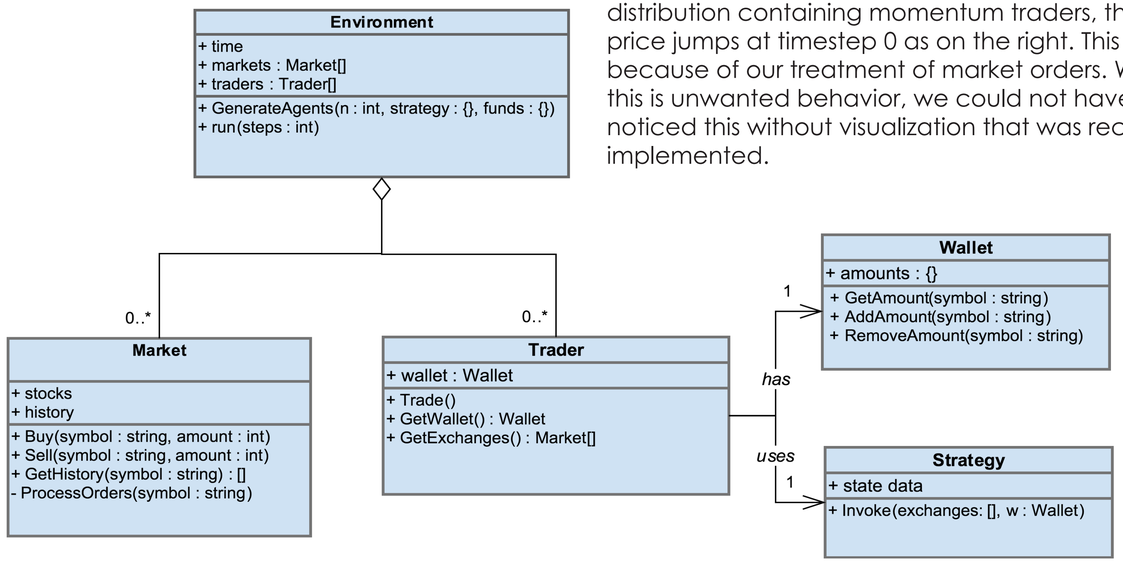
STOCK MARKET SIMULATOR

Assumptions

We made a list of assumptions when creating our stock market simulator. Some of these assumptions limited the amount of strategies we were able to test, and others explain the behavior of our example market. Here is a list of assumptions:

- Only one stock market - This means traders can't take advantage of arbitrage between markets
- Only one stock. This means traders can't attempt to diversify and reduce risk
- When a agent makes an offer to buy or sell, they cannot use those money in shares in another transaction until the first transaction clears.
- Momentum traders always place market orders
- There is no derivative trading (like options)
- There is no short selling. This limits the anti-momentum strategy
- All agents start with the same amount of money and shares

Code Base



Experiments

After completing what we set out to accomplish on our code base, we ran a series of experiments.

Variables:

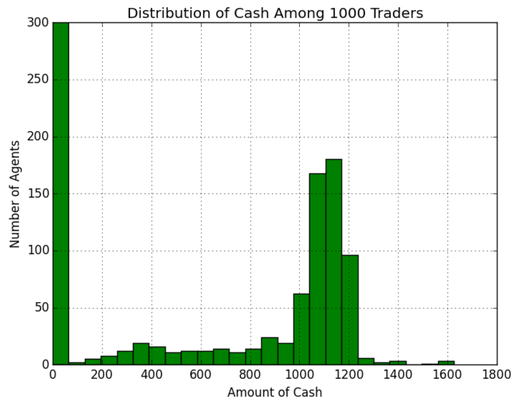
- Number of agents
  Mainly tested 10 and 1000
- Distribution of strategies
  Mainly tested 60/30/10, 40/20/40, and 0/100/0, where distribution = momentum/random/anti
- Price History
  Tested an upward trend before start of trading, a downward trend, and an "IPO" trend, where trading started at some initial price without a history
- Wealth Initialization
  Tested various starting dollars and shares for agents to start with

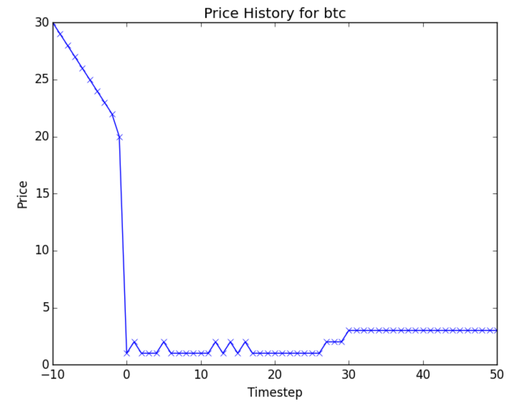
We found that even with momentum and anti-momentum traders, the stock still reached an equilibrium point. However we believe this is an artifact of our assumption that money and shares are locked up until transactions are completed. This complete lock-up of price is avoided in an 100% Random Strategy distribution because random traders add volatility to the market and less predictability.

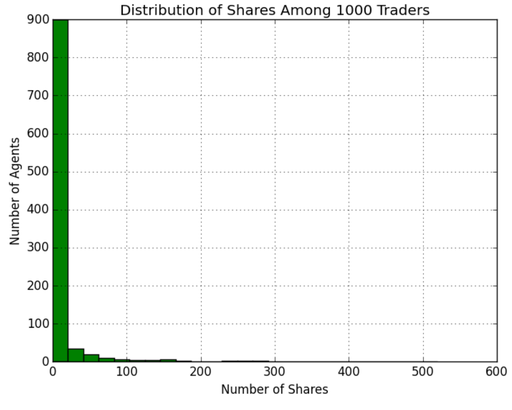
Our sorting of bids and asks also led to interesting behavior for momentum traders. In any significant distribution containing momentum traders, the price jumps at timestep 0 as on the right. This is because of our treatment of market orders. While this is unwanted behavior, we could not have noticed this without visualization that was recently implemented.

60% Momentum Strategy
30% Random Strategy
10% Anti-Momentum Strategy

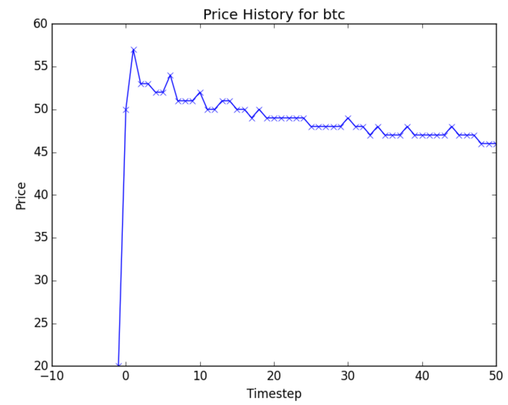
This distribution of strategies seems to be the most accurate based on literature of stock market strategies. We found that based on a downward history, this distribution seemed mostly to liquidate their shares, and was about even odds for whether any given agent made a profit or not.







100% Random Strategy Traders

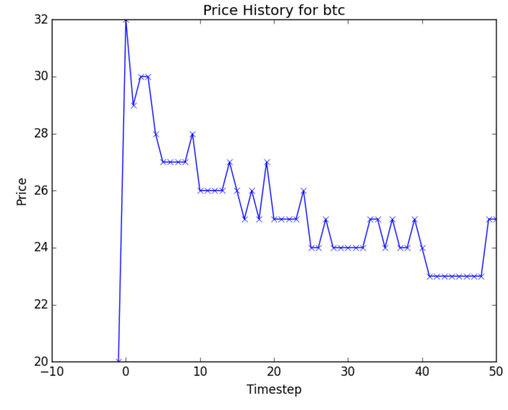


Our random strategy traders randomly decide whether to buy or sell, then check how many dollars/shares they have, and randomly pick a number of shares to buy or sell at a randomly selected price.

Clearly we have created a simulation of a market that is a good model of basic supply and demand. Both simulation runs pictured had 1000 agents, however the one above had each agent start with $1000 and 10 shares of BTC, while the one below had each agent start with $500 and 10 share of BTC.

Based on our experiments it seems that our market reaches equilibrium at

PRICE = (TOTAL_MONEY/(TOTAL_SHARES*2))



by Jeremy Stephens and Hans Bergren