The Design of Secondary Markets for Slots

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Markets for regulated assets

- Markets improve economic efficiency
    - Aggregate profits of the users are higher
    - Gains can be shared - winners can compensate losers

- An old problem and solution
    - Commons dilemma
        - Overgrazing a shared resource
    - Solution: create limited access
        - Enclosure movement
    - Political problem: who gets to keep the gains?

- Applications: Environment (smog credits), Project management (Cassini spacecraft), Fishing rights, Scheduling fixed capacity (computers, MRIs, classes, NASA shuttles,..)

How does it work?

- Markets align incentives with information
- Command and control (top down engineering) punishes resource saving innovation
  - If I admit I can realign my schedule and save use, I will lose that right to use. (No good deed….)
- Markets reward organizations which recognize and implement resource saving innovations.
  - If I can realign my schedule and save use, I can sell or trade that right and pocket a gain.
  - Notice that the person I sell to also gains

There is not just one market

- Primary Market - the initial allocation of a right from regulator to regulated
  - Lottery, auction, grandfather, ……
  - Determines allocation of gains
  - There can be winners and losers
- Secondary Market - the reallocation among the regulated (sans consent of the regulator)
  - Where the gains are created
  - Voluntary trade implies all parties to the trade gain

My focus today is on Secondary Markets

- What are features of good secondary markets?
- Steps in setting up a market
- Examples from other situations

- Note: I will present this as if it is only a scientific problem. It is not. It is often a difficult negotiated compromise.

What makes a market work?

- Voluntary trade occurs when both parties gain
  - Those with less immediate value sell to those with more immediate value
  - Want all such possible gains to occur easily
  - Liquidity
- Some examples
  - Good markets: T-bills, LA-NYC flight, bread
  - Mediocre markets: houses, cars, corp bonds
  - Bad markets: clean air at 330 California Blvd in Pasadena CA in 2050, insurance against floods in 2007 in New Orleans
- How does this apply to slot markets?

What steps must be taken to set up a market?

- Decide what is to be traded
  - The property right
- Decide who can participate
  - Who qualifies to participate
- Decide on the market design
  - Brokers or call or continuous, etc.
- Clearance and settlement
  - Enforcement and market regulation

What is to be traded?

- What we would like for good markets
  - Lots of traders, order flow = Liquidity
  - Renewable perishable good, new information, …..
  - Homogeneous commodity, transparency
  - No encumbrances
- Regulators vs Market Designers
  - Control vs liquidity
    - Homogeneity good for liquidity
      - Slots usable any time
    - Heterogeneity good for control
      - Slot only good for 15 minute period if VFR in summer

An example: Scheduling a shared resource

- Availability known
  - Choose time periods (a compromise)
  - Fix quantity of each period, allocate, allow trading
  - Price will be the correct peak-load price
    - Cost based prices are almost always wrong!
  - Eliminates planned delays, allows better planning
- But if there are random shocks to supply
    - Shuttle launches, hot days in electricity, IFR vs. VFR,
  - Then designing for max availability means delays in low supply situations

An example: Scheduling a shared resource

- Availability unknown (random shocks)
  - Choose Priority classes (interruptible demand) and quantities in each (two is usually enough)
  - Allocate and allow trading - prices will be the correct congestion prices
- Improves coordination in response to anticipated but random events
  - Better planning, easier re-scheduling
  - Improves efficiency (those who benefit most from use in restricted times will pay for and get it)

Who can participate: buy, sell, hold?

- What we would like for good markets
  - Everyone: Airlines, Airports, Passengers, Speculators, ….
    - Speculators (arbitragers) provide liquidity, would lose $ if not used (so might expect leases), ….
    - Passenger organizations could buy and hold slots if they don't like delays… (free rider problem)

- Possible problems
  - Looks bad if not "used"
  - Cornering the market, hold up problems

What market design to use?

- What would we like for good markets?
  - Liquidity and Transparency

- Some options
  - Frequency: Brokered or continuous or call markets or
    - Call markets improve on "brokers"
      - Multilateral information vs. bi-lateral information
  - Types of bids: Separate market for each type of slot or package bidding across all slots
    - Package bidding (e.g. swaps) reduces risk of incomplete transaction is the key to improving efficiency through reallocations of schedules, etc. (Portfolio alignment problem)
    - All or none bidding reduces risk of incomplete acquisition.

What market design to use?

- What would we like for good markets?
  - Liquidity and Transparency

- More options
  - Information during market: Blind vs not
    - Closed book (blind) improves efficiency of the market
      - Closed book means only see clearing prices
    - Combined Value - seeing quantities ordered can help fitting (don't need to know the names)
  - Information after market: report trades or not
    - Want to protect strategic information
    - Knowing all opportunities and prices is the key to better investment decisions
    - Can post prices and quantities without names of traders.

Oversight and Modifications?

- **Oversight issues:**
  - The property right
  - Clearance and settlement
    - Package bidding poses some challenges
      - Can clear multi-lateral deals bi-laterally
      - But unraveling can occur
  - The market operator
- **Modification issues:**
  - Creating and retiring rights
    - Can the market do this?

Example - Emissions trading for SCAQMD (RECLAIM)

- What? 136 <u>different</u> credits
  - Regulators imposed <u>yearly</u> caps on NOx and SOx
    - 2x17 different "securities" (1994-2010)
  - Created 2 wind zones
    - Vs 37 which would have meant 1258 "securities"
  - Created 2 overlapping cycles
    - The economists' suggestion to reduce volatility

- Who? Anyone

Example - Emissions trading for SCAQMD (RECLAIM)

- Market design? None. Left to private sector
  - Initially few trades
    - Few bi-lateral matches
    - Brokers taking 40% on each side
    - AQMD bulletin board not used

- Firms asked for and got a privately funded package bid call market (included futures)
  - Fees reduced to 3% on each side
  - Trades $10 million/ month
    - Processed in one call each month
   - Prices around $2-5/lb
    - Quantities around 2-5 million

Example - Emissions trading for SCAQMD (RECLAIM)

- Reasonably successful at first
  - Accomplished a 50% reduction in emissions in a very few years
  - Prices indicated regulators really hadn't penetrated the available abatement technologies

- Three problems
  - Initial allocations: grandfathered generously
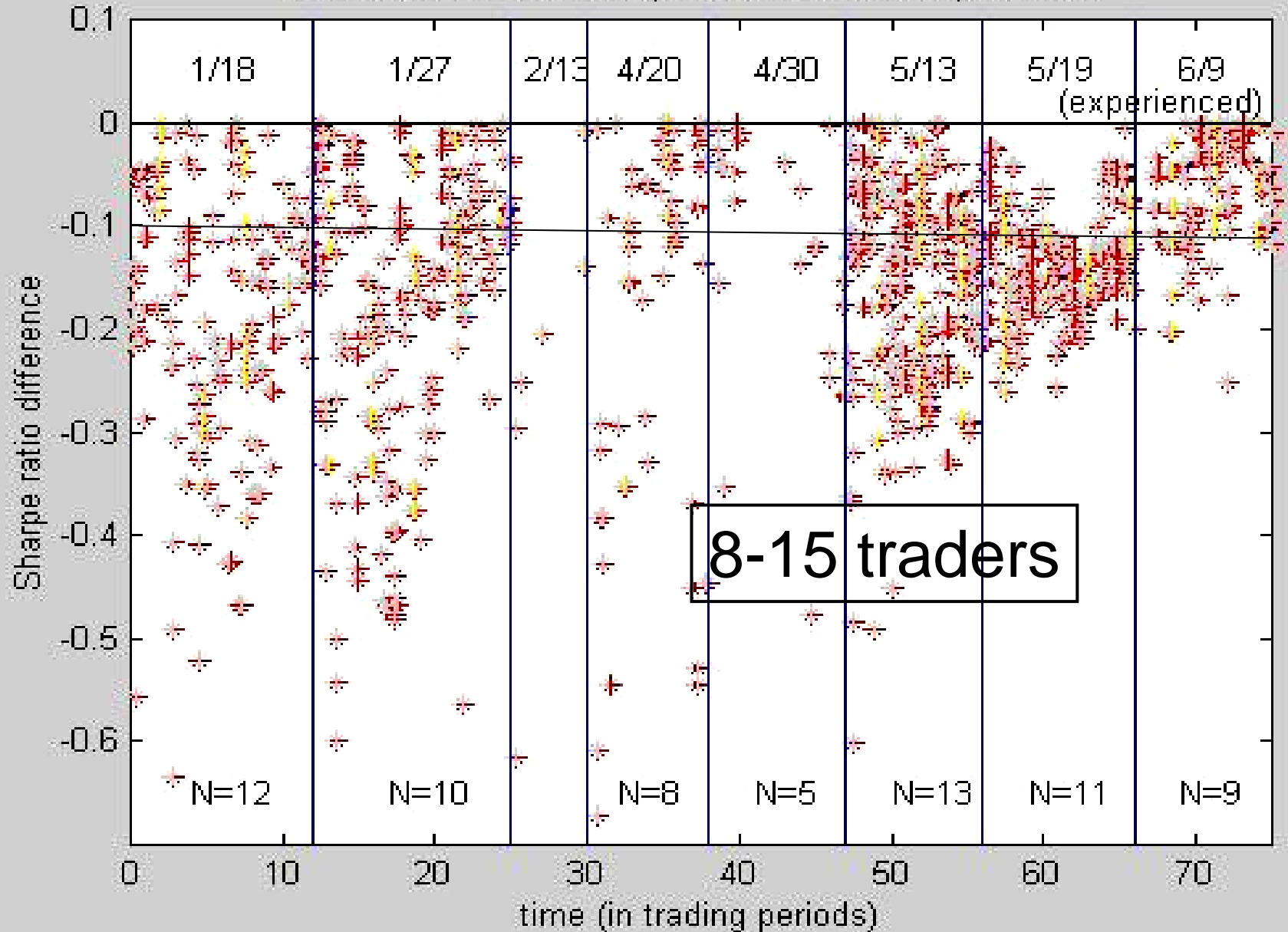 - California electricity crisis
  - Fraudulent market operator

Example - Stock Markets

- Setting
  - 2 securities and cash
  - Payoff known, different across 3 possible states
  - Endowments like 5 of A, 4 of B, $400 cash
    - Can differ across traders
  - Let them trade, then draw state, then pay $, then restart

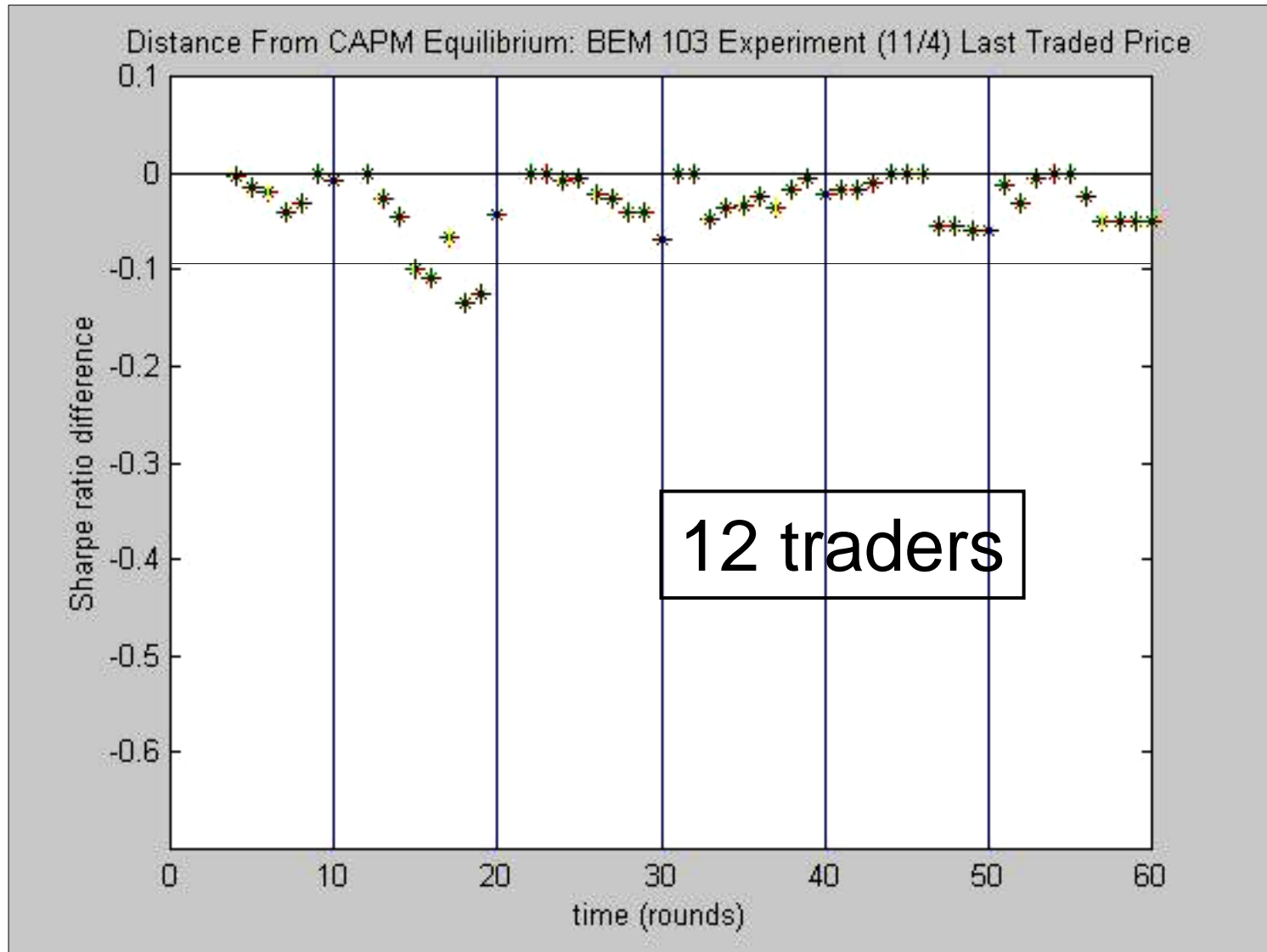- Mechanisms
  - Double Auction
  - Package Bid Call Market

Distance From CAPM Equilibrium: Thick-Market Yale Experiment

40 traders
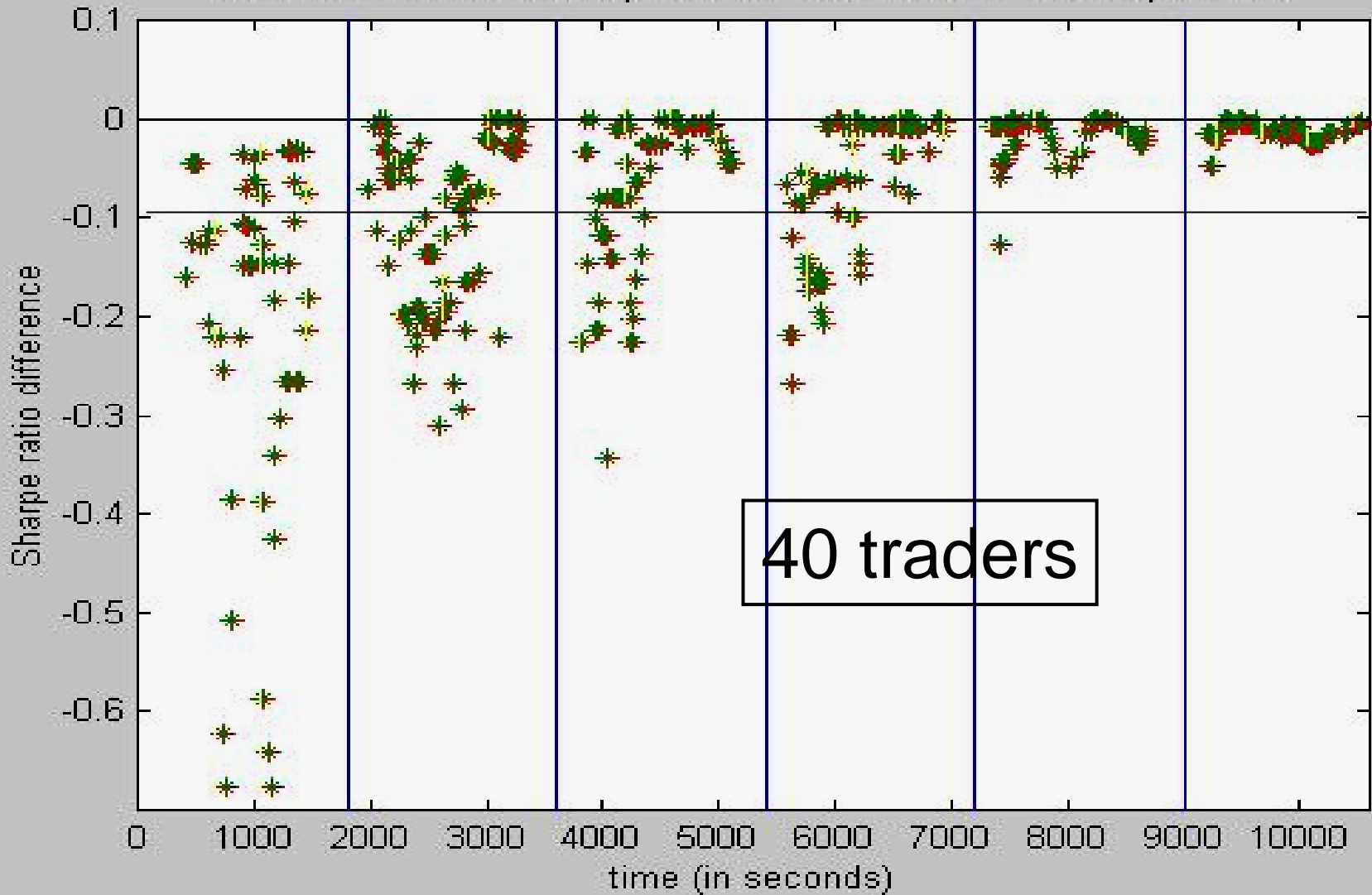
Distance from CAPM equilibrium: MUDA experiments

8-15 traders

What a PBCM can do to a thin market!

Distance From CAPM Equilibrium: BEM 103 Experiment (11/4) Last Traded Price
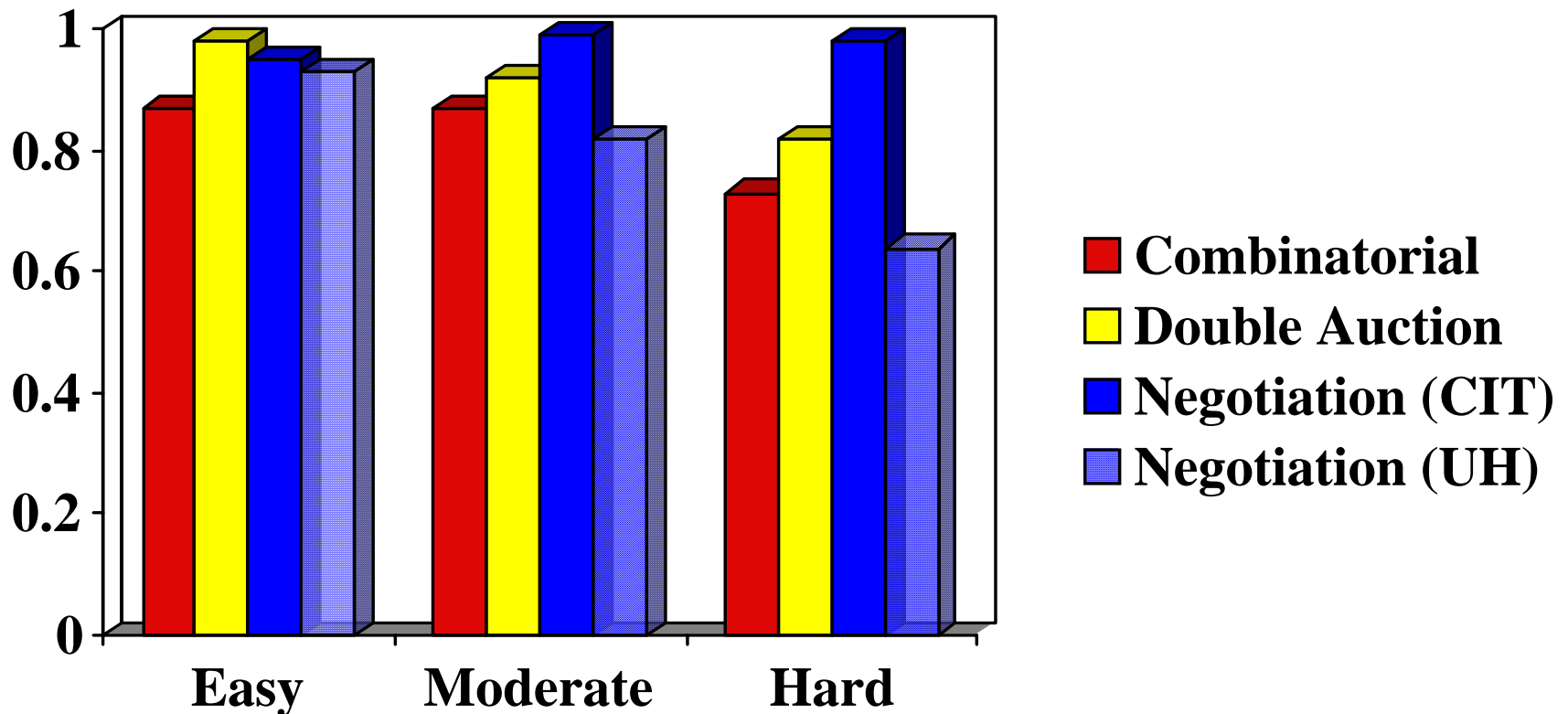
12 traders

Example - Land Reallocation

- Setting
  - Individuals initially hold land parcels dispersed in multiple locations.
  - There is a cost associated with holding dispersed land. The cost increases with the distance between parcels.
- Mechanisms
  - Package Bid Call Market
  - Double auction
  - Direct negotiation

Efficiency Gains

Series 1 (simple: no exposure)

Efficiency Gains

Series 2 (Exposure)