Using Experiments to Test Beliefs: Three Cases from Experimental Economics

Ukraine

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Theme: Widely held beliefs can be wrong, but experiments may gradually enable false beliefs to be changed.

Here are three beliefs (theories) widely taught in economics that were unexpectedly falsified by experiments:

1. Efficient competitive market outcomes require all participants to have complete knowledge of supply and demand; also large numbers; price-taking behavior. (1950s-60s)

2. If asset value is known (transparent), price bubbles will not occur. (1980s)

3. People will not cooperate in single play trust games. (1990s)

# Case 1. False beliefs about participant knowledge requirements in markets.

The claim that market equilibrium was unattainable unless people had perfect (or complete) knowledge of supply and demand had its origins in Jevons:

"A market...is theoretically perfect only when all traders have perfect knowledge of the conditions of supply and demand, and the consequent ratio of exchange (price)..." (W.S. Jevons, 1871/1888, pp 86-87; he needed it!)

# Supply and Demand Experiments Using Bid/Ask Double Auction Trading Rules

- **Information on Buyer Values and Seller Costs is strictly private (decentralized) in experiment.**

- **Buyers announce bids, sellers announce asks.**

- **But contract prices converge quickly to near competitive equilibria.**

- **Results falsified the belief that full information is necessary.**

- **Here are early and recent experiments:**

FIRST EXPERIMENT: JANUARY, 1956; a flawed accident of symmetry?
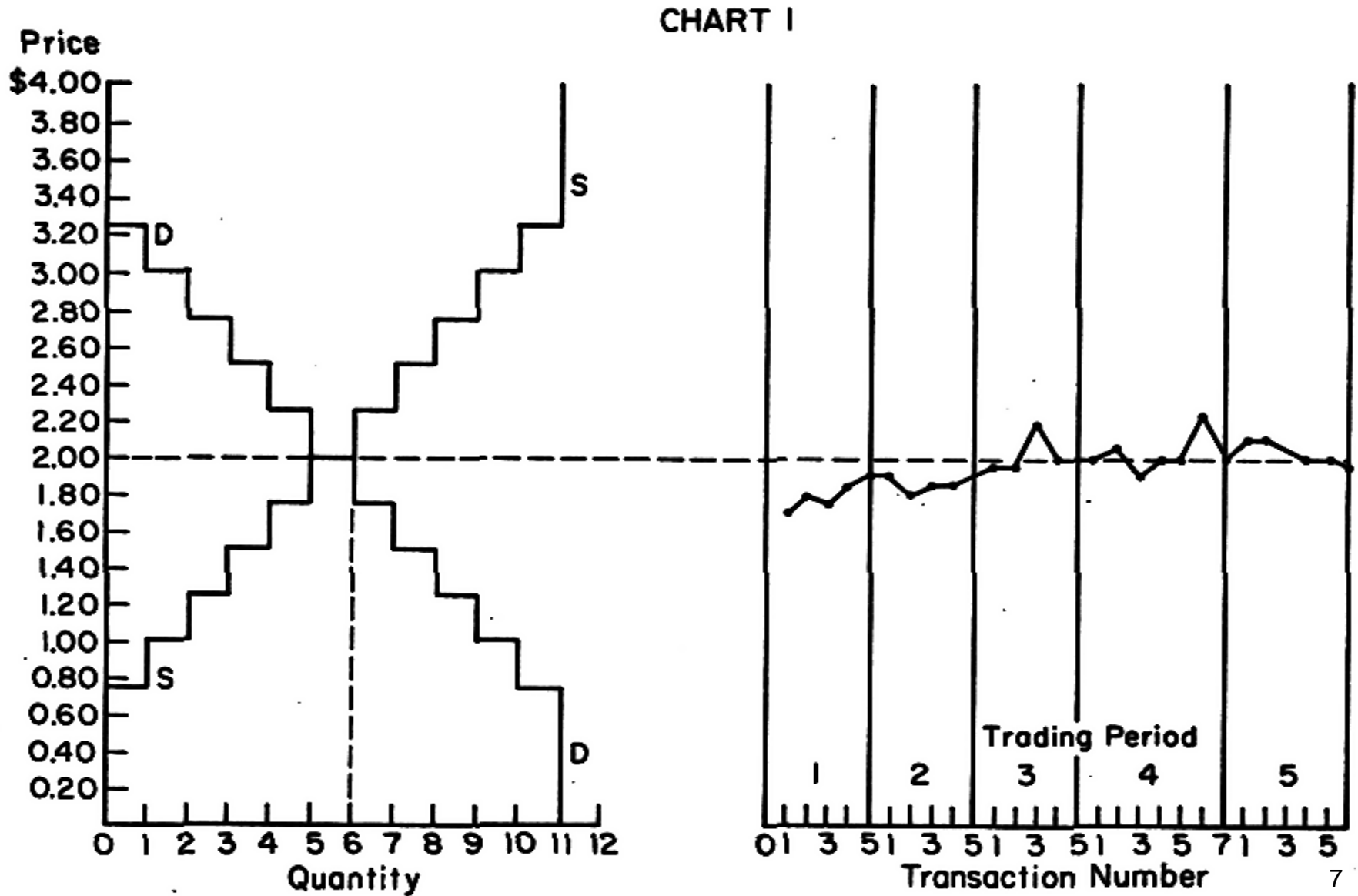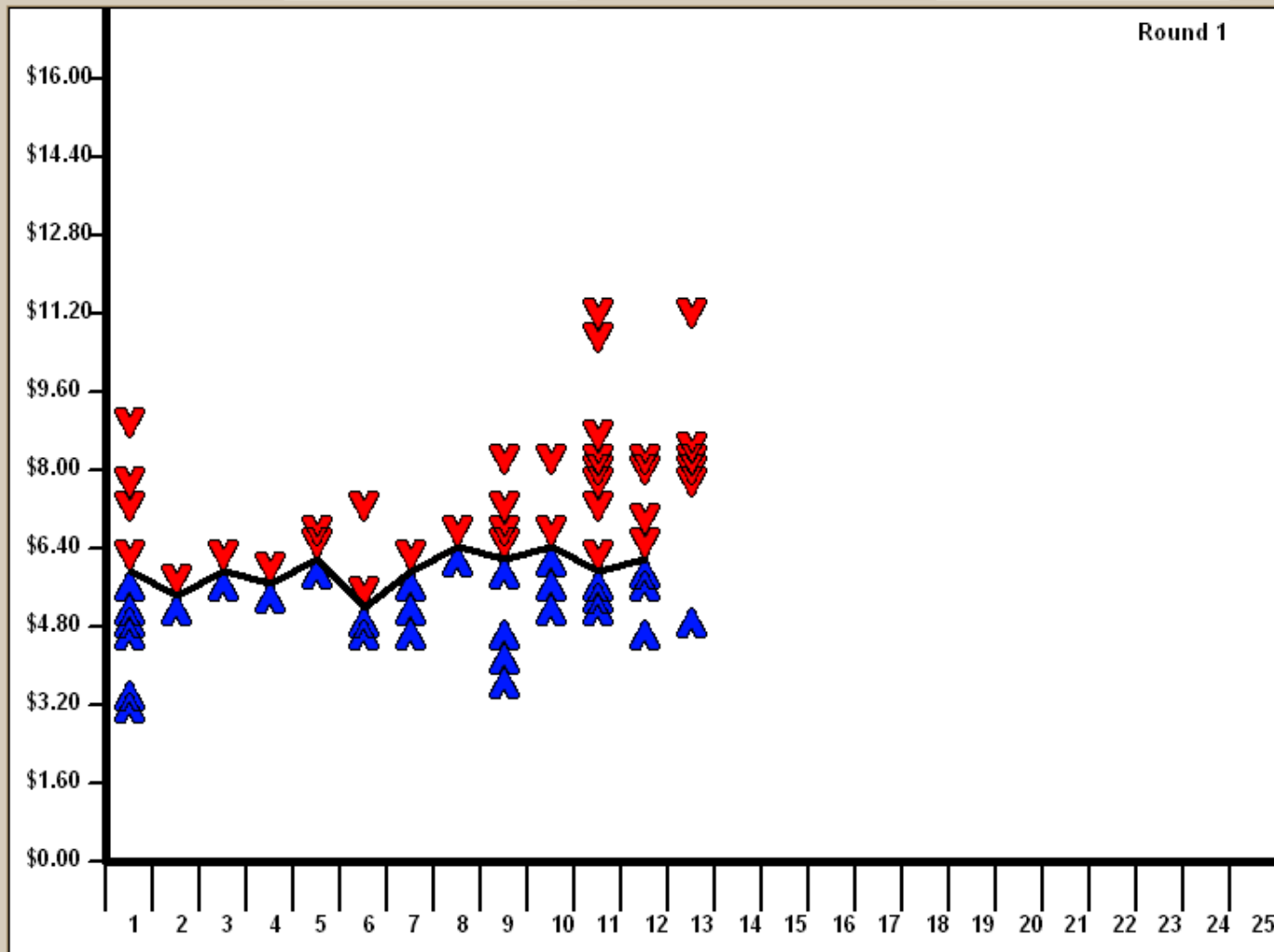

CHART I

Asymmetric case; not an accident

CHART 3

8

Server

| | Control | Experiment | Summary | Demo |
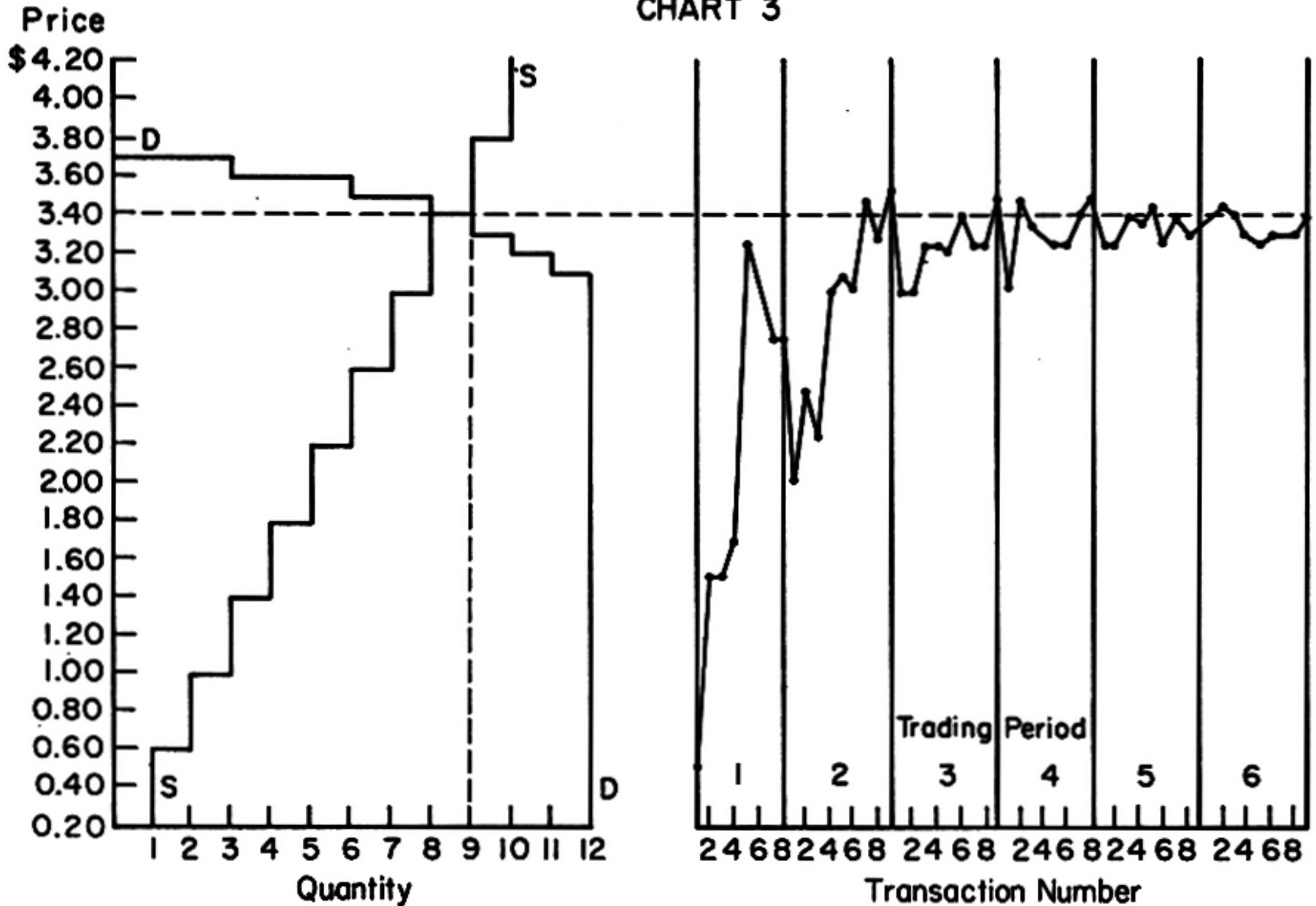
Current Ask [-]

Current Bid [-]

Quantity Traded [12]

ID [ ]   Bid / Ask [ ]

Submit
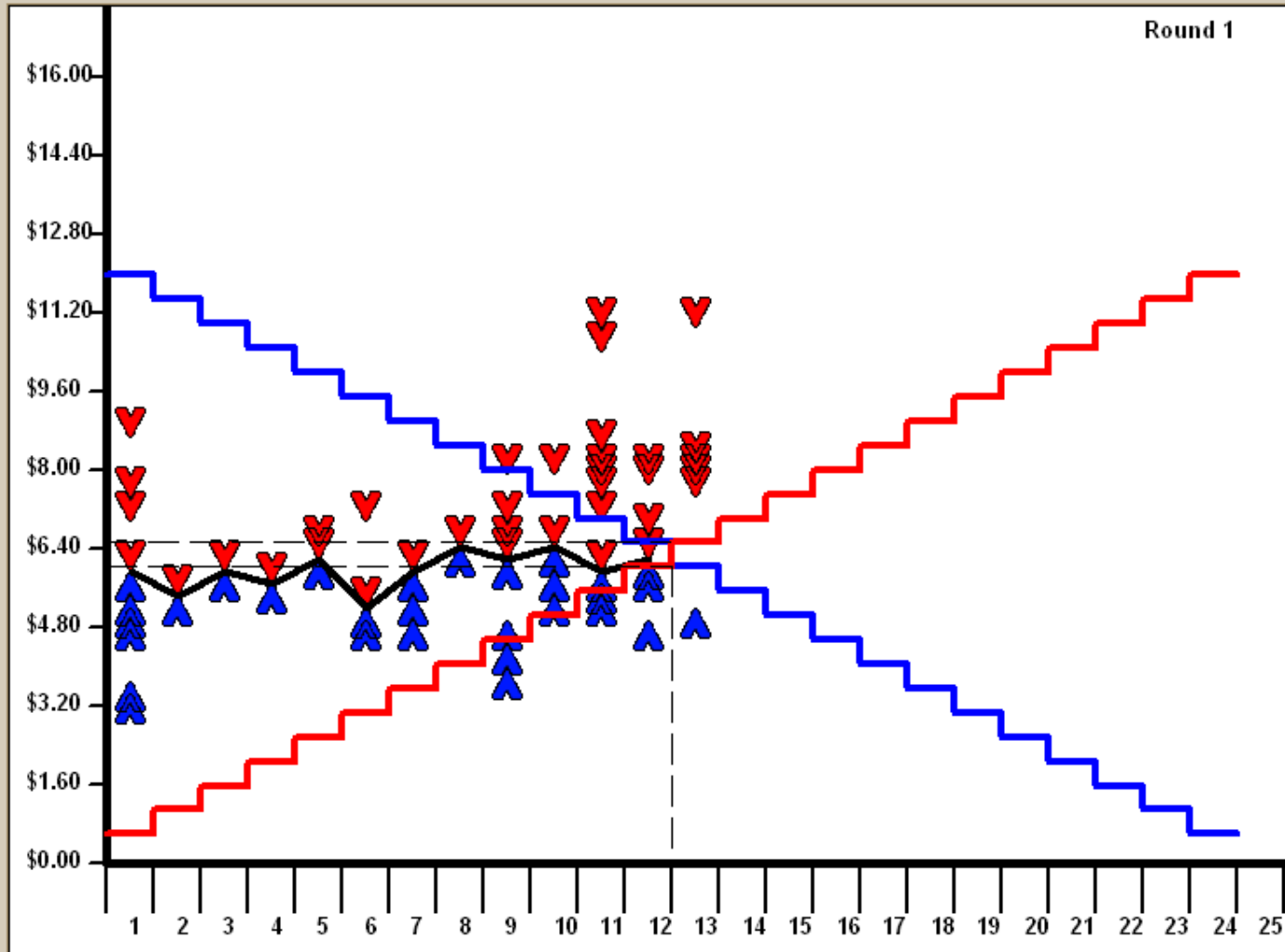
Round 1

Price	Buyer	Seller
$6.00	B1	S5
$5.50	B4	S3
$6.00	B2	S4
$5.75	B3	S2
$6.25	B4	S5
$5.25	B1	S1
$6.00	B2	S6
$6.50	B6	S3
$6.25	B5	S6
$6.50	B5	S1
$6.00	B6	S2
$6.25	B3	S4

Price (vertical axis): $16.00, $14.40, $12.80, $11.20, $9.60, $8.00, $6.40, $4.80, $3.20, $1.60, $0.00

Quantity (horizontal axis): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25

Reset

Load Data File

Ticks [10]   Max Value [16]   Min Value [0]

☑ Bids / Asks
☑ Contract Line
☐ Arrays

Round

[-] [1] [+]

The observed convergence was inexplicable by the microeconomic (game) theory of the 1950s and 60s. Equilibrium was defined, given demand values and supply costs, but economists (starting with Jevons in 1870) had not satisfactorily articulated message-contract trading processes showing how people might explore trading opportunities and discover prices.

Contrasts with Adam Smith's first axiom: "Propensity to truck barter and exchange…"; leads to prices, learning and specialization—an evolutionary discovery process!

Experiments enlarged the space of exploration; helped us to relearn process ways of thinking, but in new context of equilibrium theory; economics becomes experimental.

New experiments varied information, message-contract procedures, numbers, firm sizes, etc.

Also applications to the design and testing of new markets,e.g. Gas, Electric Power, 1980s-90s.

NOTE: All the above experimental markets were for the special case of NON-DURABLES; i.e., a trader:
*knew in advance she was either a buyer or a seller;
*could not resell a purchased unit to a buyer;
*and could not switch buyer/seller role depending on price.

It's like hamburgers, hotel rooms, haircuts-HHH,...Non-durable goods make up 75% of final private product, (GDP—G).
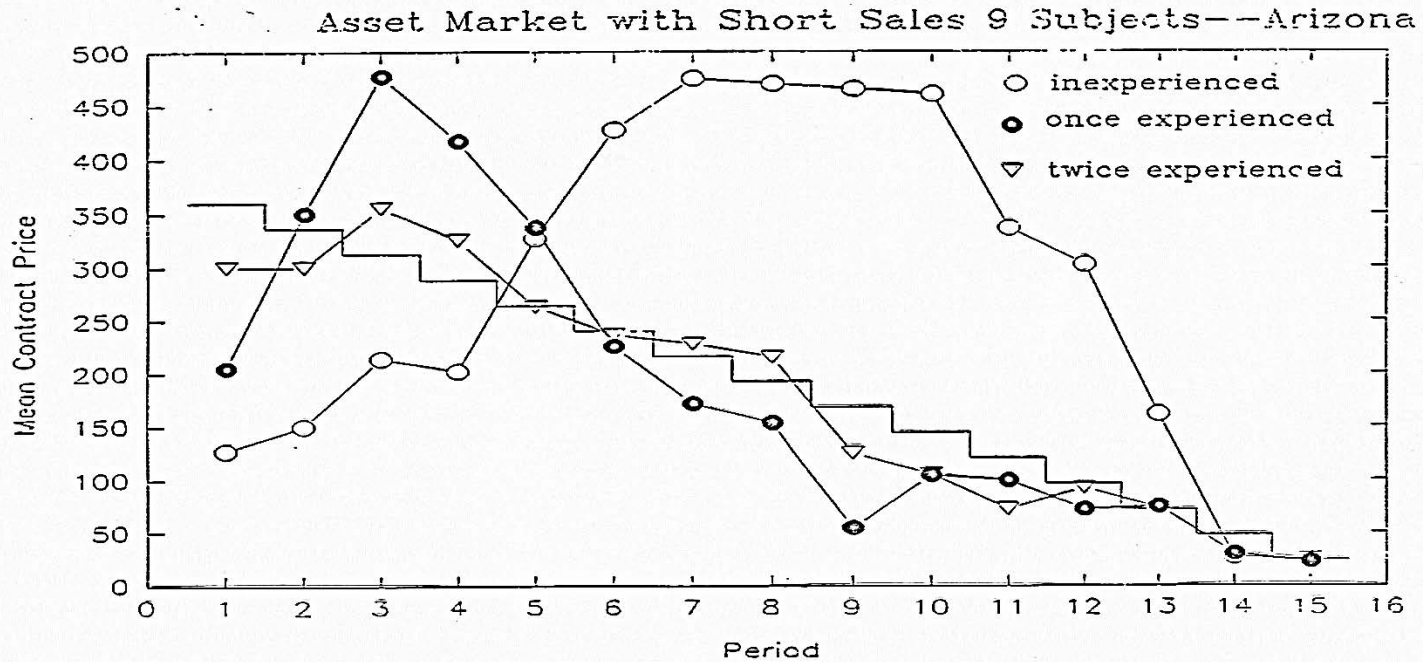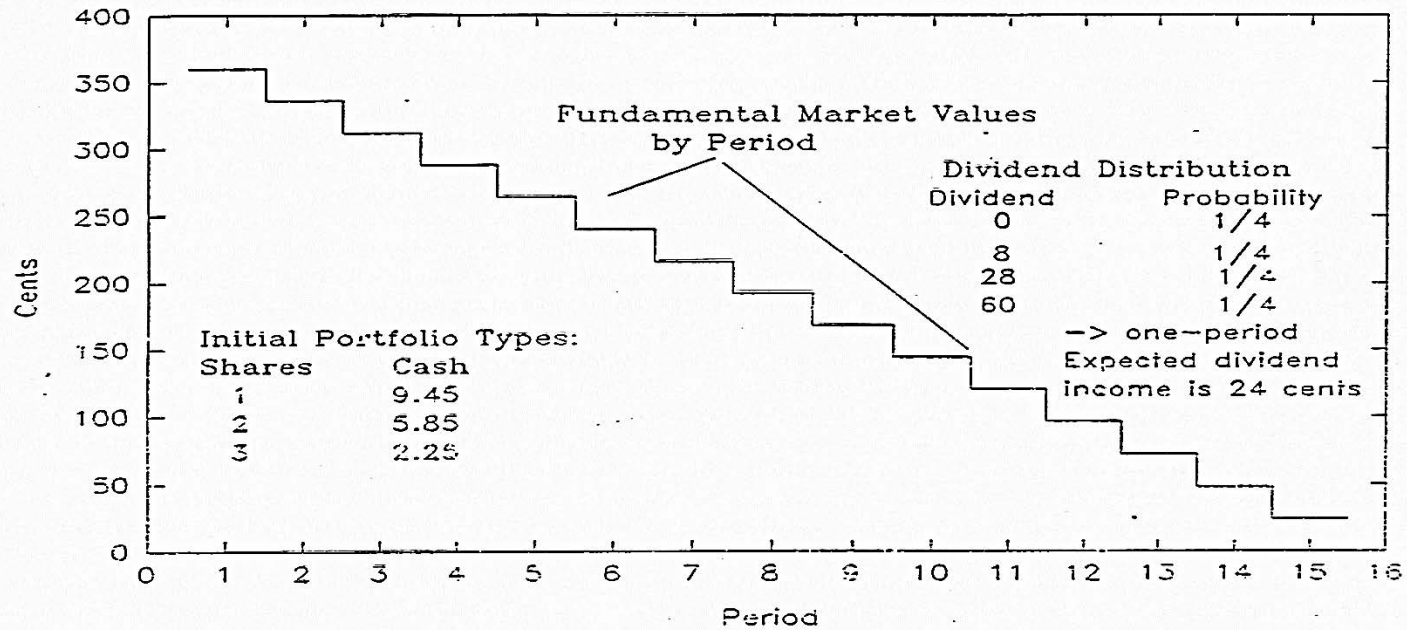**How are markets for durables different?**

Case 2. False belief: If durable asset value is known price bubbles will not occur.

We created complete information asset markets. Idea was to do baseline experiments with no bubbles, then vary information to produce bubbles.

But we did not know what we did not know: the baseline experiments bubbled!

Figure 6
Baseline Asset Market Experiment Parameters

Fundamental Market Values by Period

Dividend Distribution

Dividend	Probability
0	1/4
8	1/4
28	1/4
60	1/4

-> one-period Expected dividend income is 24 cents

Initial Portfolio Types:

Shares	Cash
1	9.45
2	5.85
3	2.25

Asset Market with Short Sales 9 Subjects—Arizona

○ inexperienced
● once experienced
▽ twice experienced

How do these two kinds of market experiments relate to the economy, and its sources of instability? The learning:
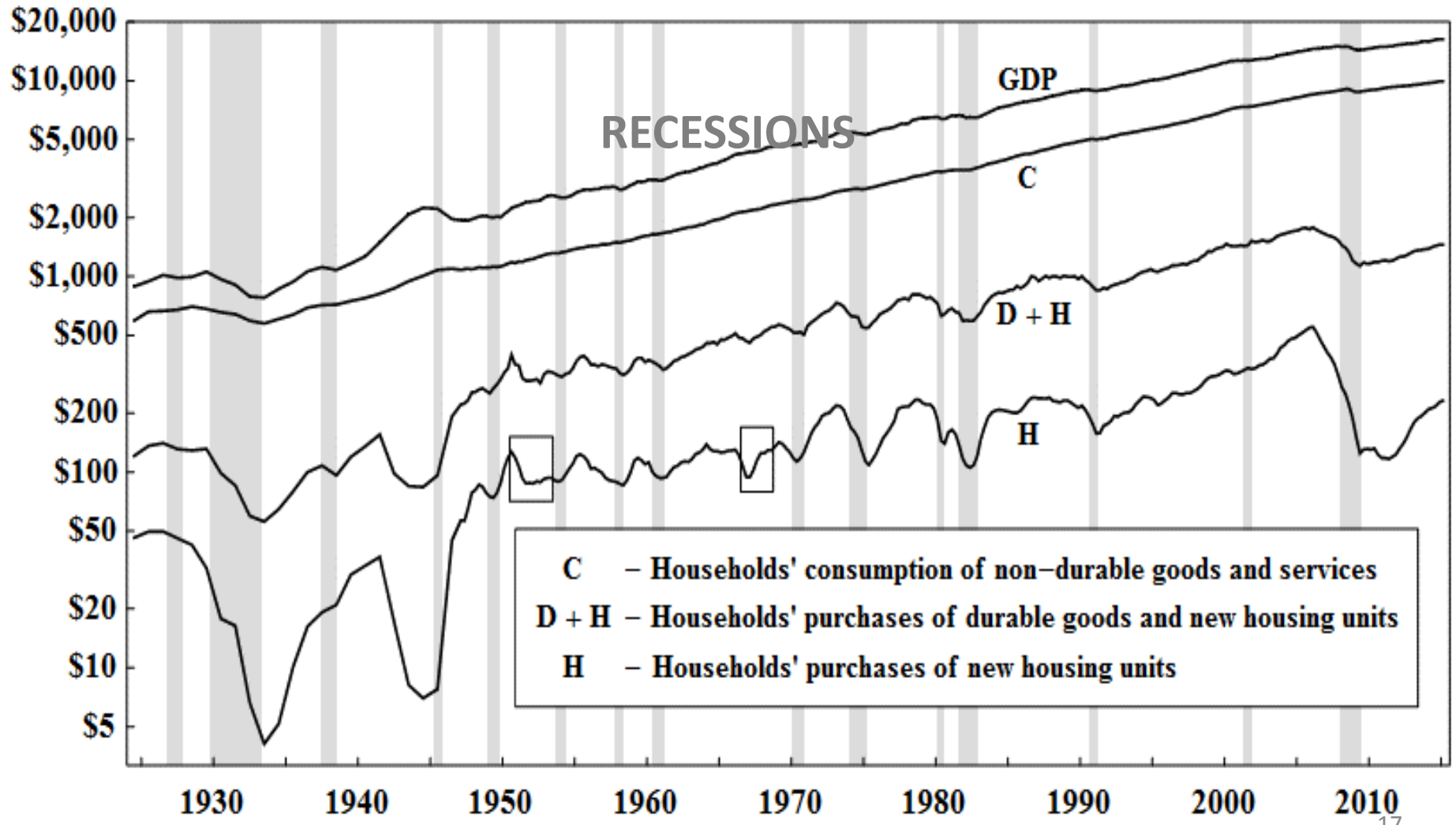
- **Markets tend strongly to be stable, if items can't be re-traded.**

- **With re-trade arises tension between mkt value & consumption/yield value. Re-trade a necessary condition for sustained bubble deviations of market price from value.**

- **Explains transport deregulation success, &**

- **Failed finance/mortgage mkt deregulation**

Figure 1

Real GDP and Household Sector Consumption, 1924−2015

(in Billions of 2009 Dollars)

Log Scale

RECESSIONS

C — Households' consumption of non−durable goods and services

D + H — Households' purchases of durable goods and new housing units

H — Households' purchases of new housing units

Case 3. False belief that people will not cooperate in single play trust games. (1990s)

To understand why, we return to the Scottish Enlightenment

David Hume (1740) distinguished disinterested from interested commerce.

Disinterested commerce refers to our other-regarding sociability toward others in our close-knit family, extended family, neighbor groupings. Interested commerce concerns our own-regarding market transactions with others.

Adam Smith wrote a book on each of these defining elements of "humanomics":
Social psychology; *The Theory of Moral Sentiments* (1759) TMS
Economics; *The Wealth of Nations* (1776) WN

Sentiments is NOT about:

- **Max-U (own outcome), as in traditional neo-classical economics. The process is not one in which: Action--> Outcome--> Utility.**

- **Altruism; (rather people are self-interested)**

- **Social preferences [U (own, other); as in behavioral & experimental economics] Preference is about outcomes; social is about relationships, mutual fellow-feeling.**

Smith's Model of Human Conduct:

- **Each knows that all are self-interested; each judges the beneficial or hurtful intent of actions in the shared context of interaction; e.g.,game.**

- **Rules (as conventions, norms) map these contextual judgements into actions depending on "propriety" (socially appropriate).**

- **Actions can be read & responded to as signals, and such exchanges are rule-governed; disciplined by propriety; and based on mutual fellow-feeling.**

- **"Equilibrium" is harmony or resonance in rule space; discord motivates rule adjustment.**

Consider the following Trust Game between anonymously paired individuals, similar to many such well-known two-person games studied in the 1990s with baffling results at the time.

The Context: Extensive Form Trust game
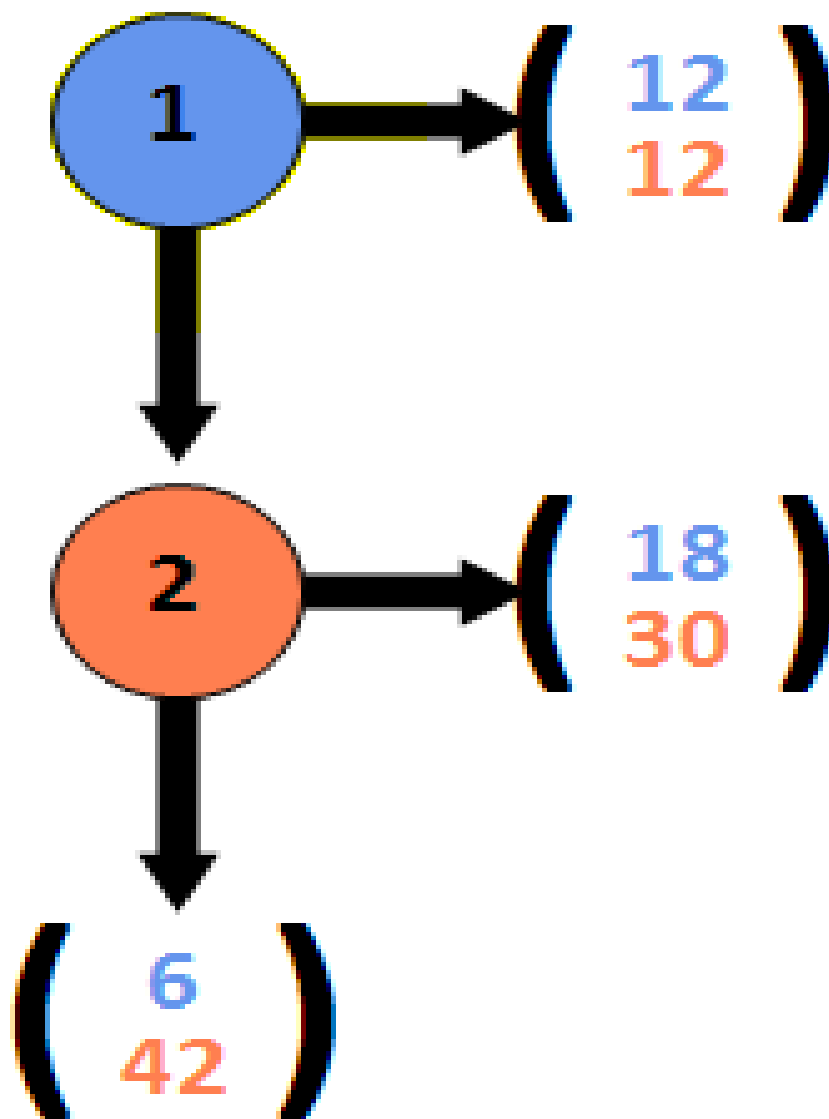
Traditional Extensive Form Analysis of Trust game:

1.   Common knowledge that all Players are strictly self-interested and non-satiated.

2.   Only own payoff outcomes matter in choosing action.

3.   Apply backward induction to the game tree.

4.   Determine each player's choice in reverse sequence of play.

5.   If Player 1 passes to Player 2, the latter is motivated to move down.

6.   Player 1's best strategy is to move right, the equilibrium of the game.

Results, Trust game
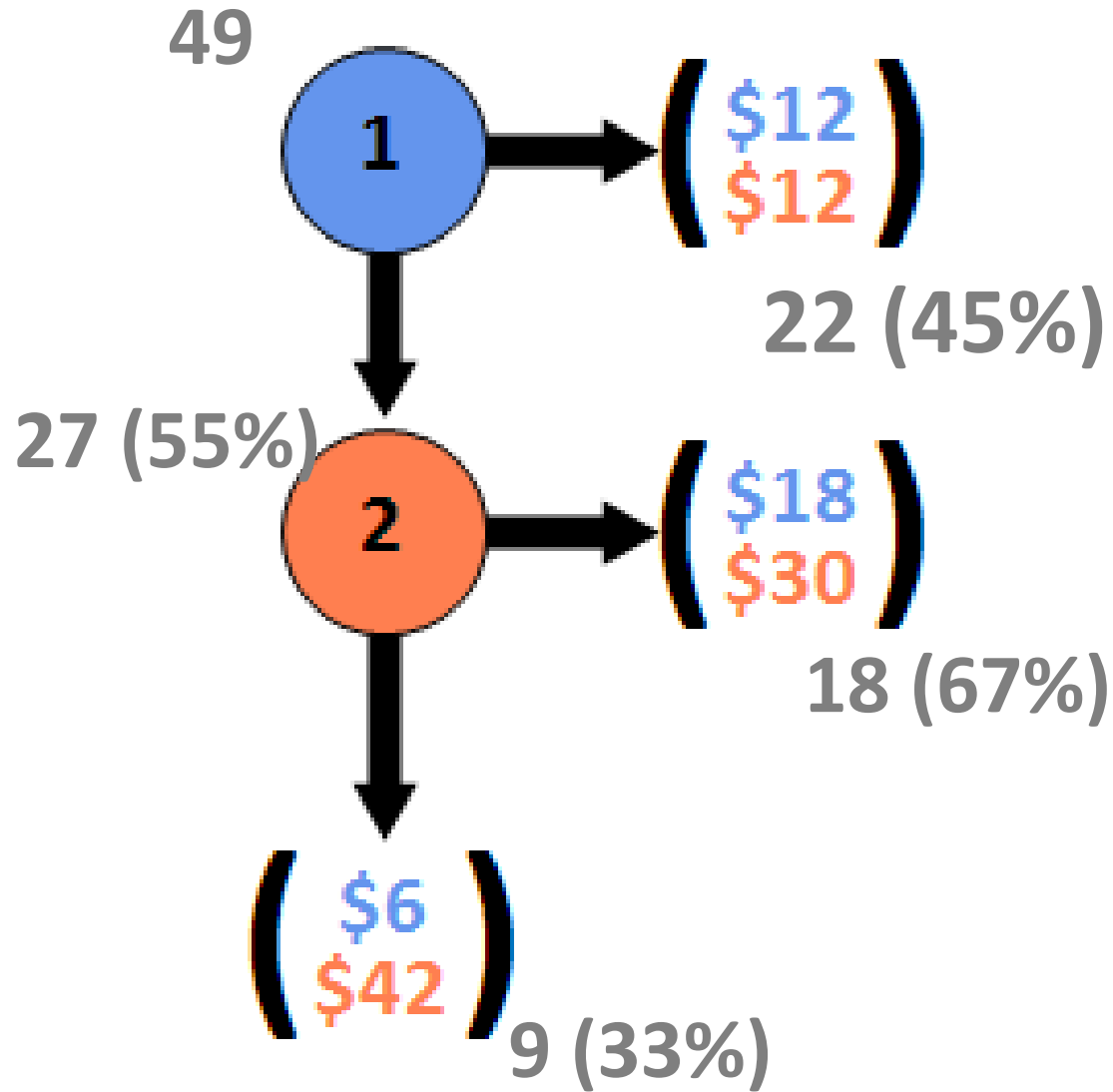
Results are consistent with TMS *Beneficence Proposition 1:* **Intentional actions that benefit another, alone require reward, because of the gratitude we feel in response (*TMS,* 1759, p 78)**

Analysis in *Sentiments* Involves: Inferred intentions, imagining other's role, and "self-command."

1. Common knowledge that all Players are strictly self-interested and non-satiated.
2. But action is determined by who is hurt or benefits from an action, and an inference of intent.
3. Hurt, benefit and intentions are inferred from opportunity cost of action taken.
4. Intentional Beneficence →Gratitude→Impulse to Reward;

   Intentional Hurt→Resentment→Impulse to Punish;
5. Apply backward induction to the game tree to determine who is hurt or benefits from an action at each node and to judge intent.
6. Each Player's imagines herself in the role of the other in judging intent and probable responses.
7. Forward play is then a signaling game—a conversation—that reveals intent.
8. If Player 1 would cooperate if in the Player 2 role, will Player 2 see it in the same way if given opportunity to act?
9. Will Player 2 cooperate, given unambiguous signal of Player 1's beneficial intentions?

49
1 → ($12 / $12)
22 (45%)

27
55%) 2 → ($18 / $30)
18 (67%)

($6 / $42)
9 (33%)
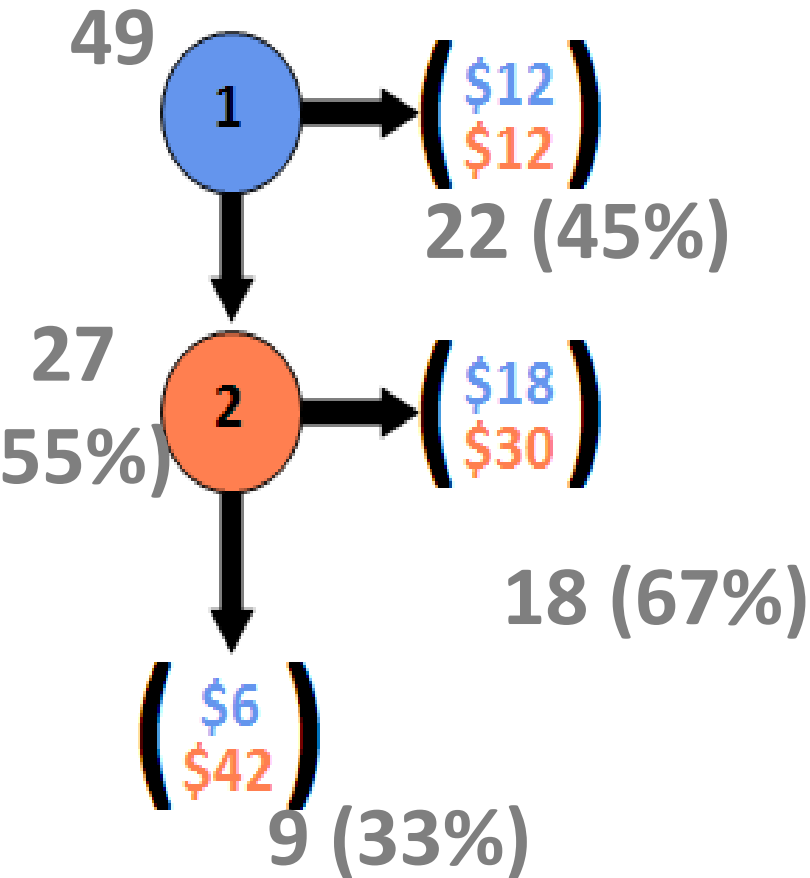
Knowing the action taken by Player 1, 18 of 27 Player 2s reveal gratitude and self-command. In the population sampled, 2/3 conform to Beneficence Proposition 1.

Random assignment implies that the same proportion of Player 1s would play right if they had been assigned position 2.
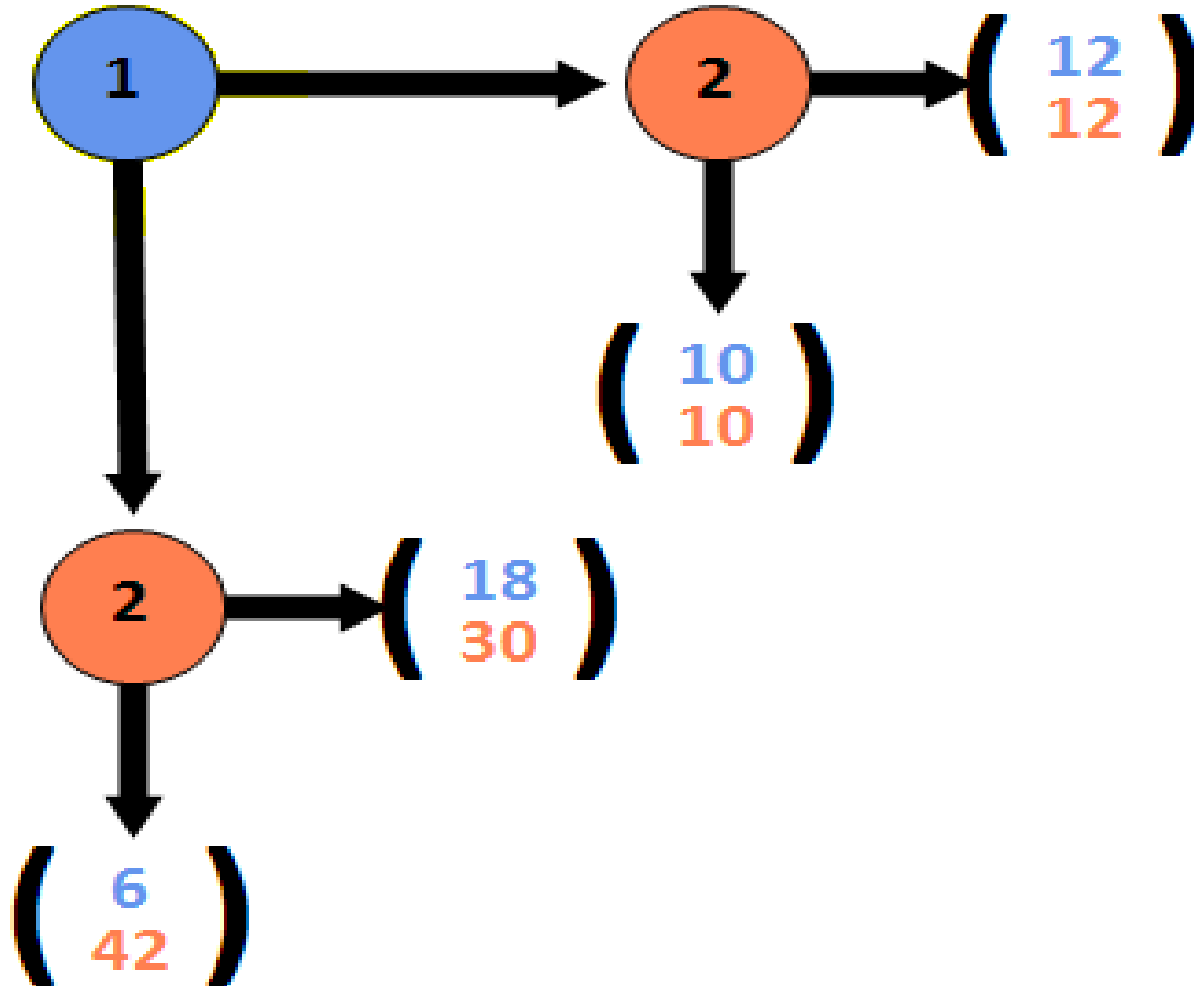
Hence, proportion of Player 1s deterred from down move by uncertainty that Player 2 is a person like them (my "type") = 0.67 – 0.55 – 0.12
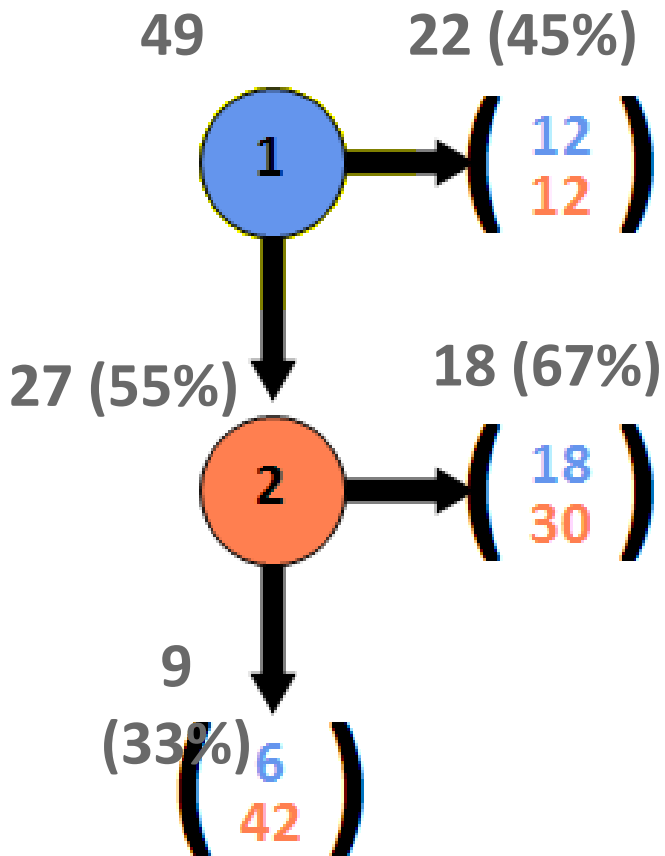
Sentiments **states other conditional predictions**

Beneficence Proposition 2: "Beneficence is always free, it cannot be extorted by force…"; failure to choose to benefit another provokes no punishment; because it…"tends to do no real positive evil." (Only fails to do good) (p 78)

Hence, in trust games we should not expect Player 2s to feel resentment or be willing to incur cost to punish Player 1s for choosing not to be beneficent. That is their respected right.
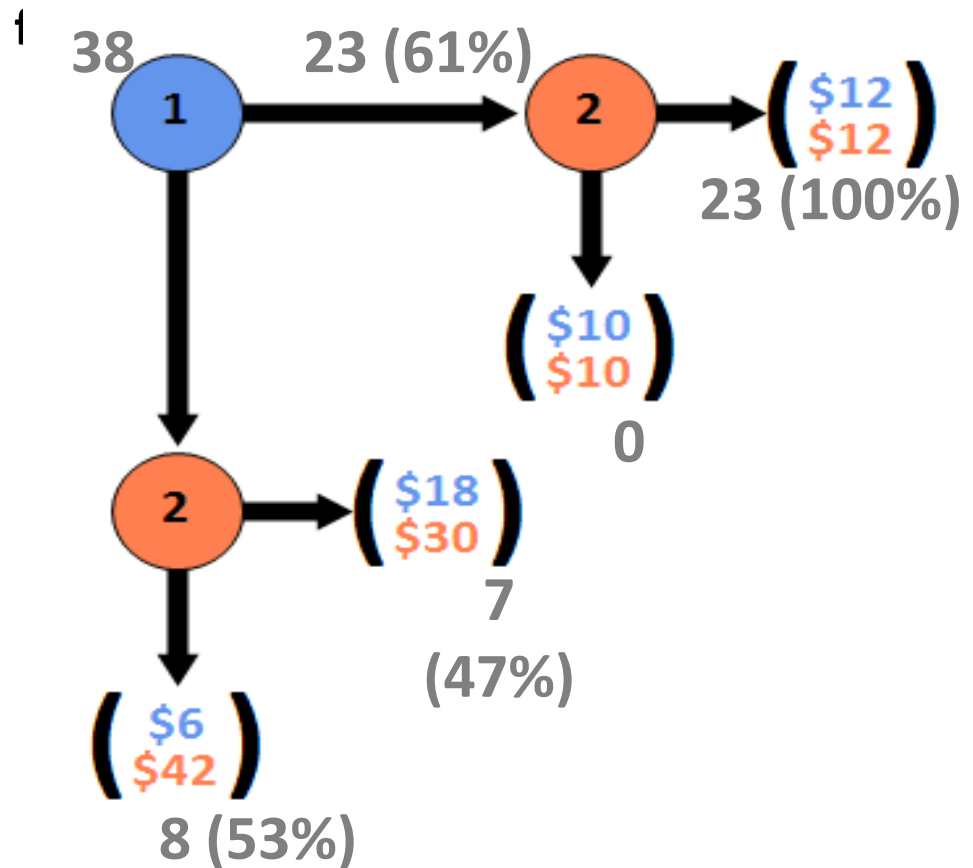
Trust with Option to Punish Failure to Trust

NP Trust

49　　　**22 (45%)**

$\begin{pmatrix} 12 \\ 12 \end{pmatrix}$

27 (55%)　　　**18 (67%)**

$\begin{pmatrix} 18 \\ 30 \end{pmatrix}$

9

(33%) $\begin{pmatrix} 6 \\ 42 \end{pmatrix}$

PWB? No, BUT Tst/Tsw reduced! Trust signal is now ambiguous, noisy. 53% Players 2s now choose defection. Adding node changes inference

38　　　**23 (61%)**

$\begin{pmatrix} \$12 \\ \$12 \end{pmatrix}$

23 (100%)

$\begin{pmatrix} \$10 \\ \$10 \end{pmatrix}$

0

$\begin{pmatrix} \$18 \\ \$30 \end{pmatrix}$

7

(47%)

$\begin{pmatrix} \$6 \\ \$42 \end{pmatrix}$

8 (53%)

31

Justice Proposition 1: Improperly motivated actions of a hurtful tendency alone deserve punishment; because of the resentment they provoke (p 78)

Suppose Player 2 defects on the offer of Player 1 to cooperate. JP 1 predicts that many Player 1s feel resentment, and are willing to incur cost to punish Player 2s.
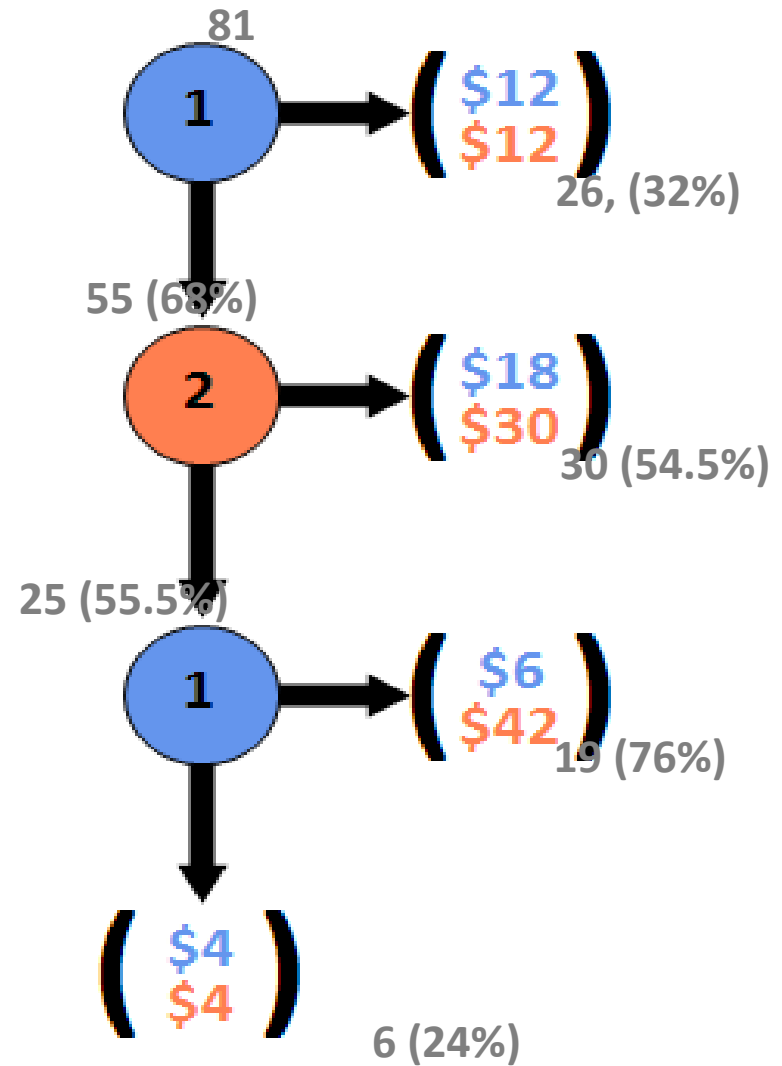
Punish Hurt, Trust Game
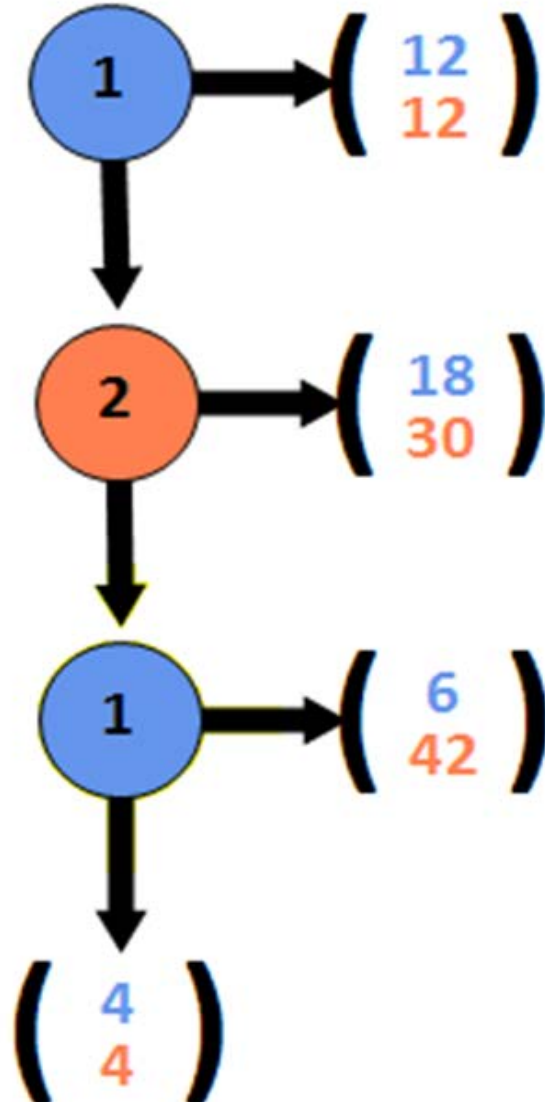
NP (Trust)
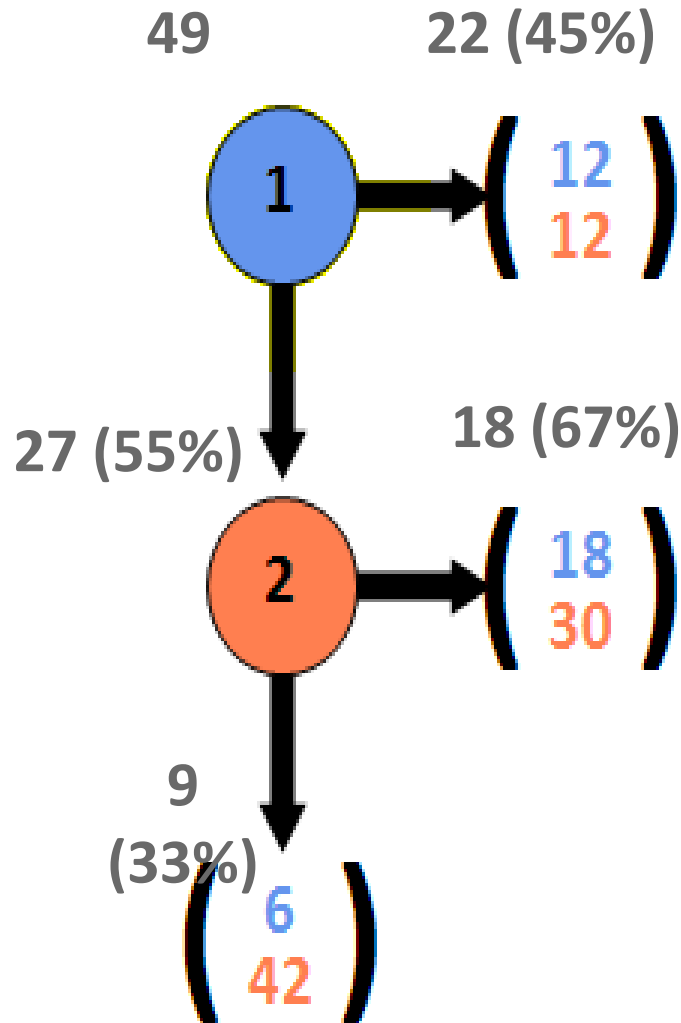
More 1s play down; signal is less credible under punishment threat; 43% of 1s punish. Beneficence must be free, not extorted.

49   22 (45%)

1 → (12 / 12)

27 (55%)   18 (67%)

2 → (18 / 30)

9 (33%)   (6 / 42)

81

1 → ($12 / $12)   26, (32%)

55 (68%)

2 → ($18 / $30)   30 (54.5%)

25 (55.5%)

1 → ($6 / $42)   19 (76%)

($4 / $4)   6 (24%)

Sentiments and *Wealth of Nations*

Property rights necessary but not sufficient in *Wealth.*

Smith adds what I call his Axiom of Discovery: "..the propensity to truck, barter and exchange…"

Exchange is simply an expression of human sociality—Hume's interested commerce, as contrasted with dis-interested commerce. (Shopping is social & socializing.)

Sentiments, Wealth both emphasize process not outcomes. .

Wealth defines a discovery process: Exchange→ Prices→ Facilitate comparisons/calculations (grow more corn less hogs)→ The Discover Specialization process.

Conclusions

- **Supply & Demand for non-durables with strictly private values converge to efficient equilibrium outcomes. Price discovery is a bottom-up trial-and-error process over time. In the economy non-durables are a similar and comparable rock of stability.**

- **Prices in markets for re-tradable assets show tendencies to bubble relative to fundamental value; the results helped us see how house markets, bought with mortgage credit, could contribute repeatedly and routinely to economic instability.**

- **The neo-classical marginal revolution too eagerly abandoned process for equilibrium & lost its rudder.**

- **You learn the most when proving yourself wrong.**

- **Adam Smith provides the big picture; but it badly needs our evidence, whether pro or con, better modelling.**

THANK YOU

References

S. Gjerstad & V. Smith, RETHINKING HOUSING BUBBLES. Cambridge U, Press 2014.

Smith, V.L. and B.J. Wilson (2014) "Fair and Impartial Spectators in Experimental Economic Behavior. *Review of Behavioral Economics,* 1, pp 1-26.

Smith, V.L. (2013) "Adam Smith: From Propriety and Sentiments to Property and Wealth." *Forum for Social Economics,* 42, Issue 4 July 16, 2013.

Classic experiments in science have helped to change false beliefs:
Michelson-Morley experiment failed to support the concept of absolute space and time. (1887), N=2.
**Eddington's solar eclipse experiment (1919), N=3, supported Einstein's GT (1916), rejected Newton.**

Theme:
Widely held beliefs can be wrong, but experiments may gradually enable false beliefs to be changed.

Why resistance to change?

- **Resistance is a defensible consequence of confirmation bias in science.**

- **Bias favors tradition, accumulated know-how; a source of stability in beliefs.**

- **But if you overcome false beliefs & thinking, you enter entirely new space of questions.**
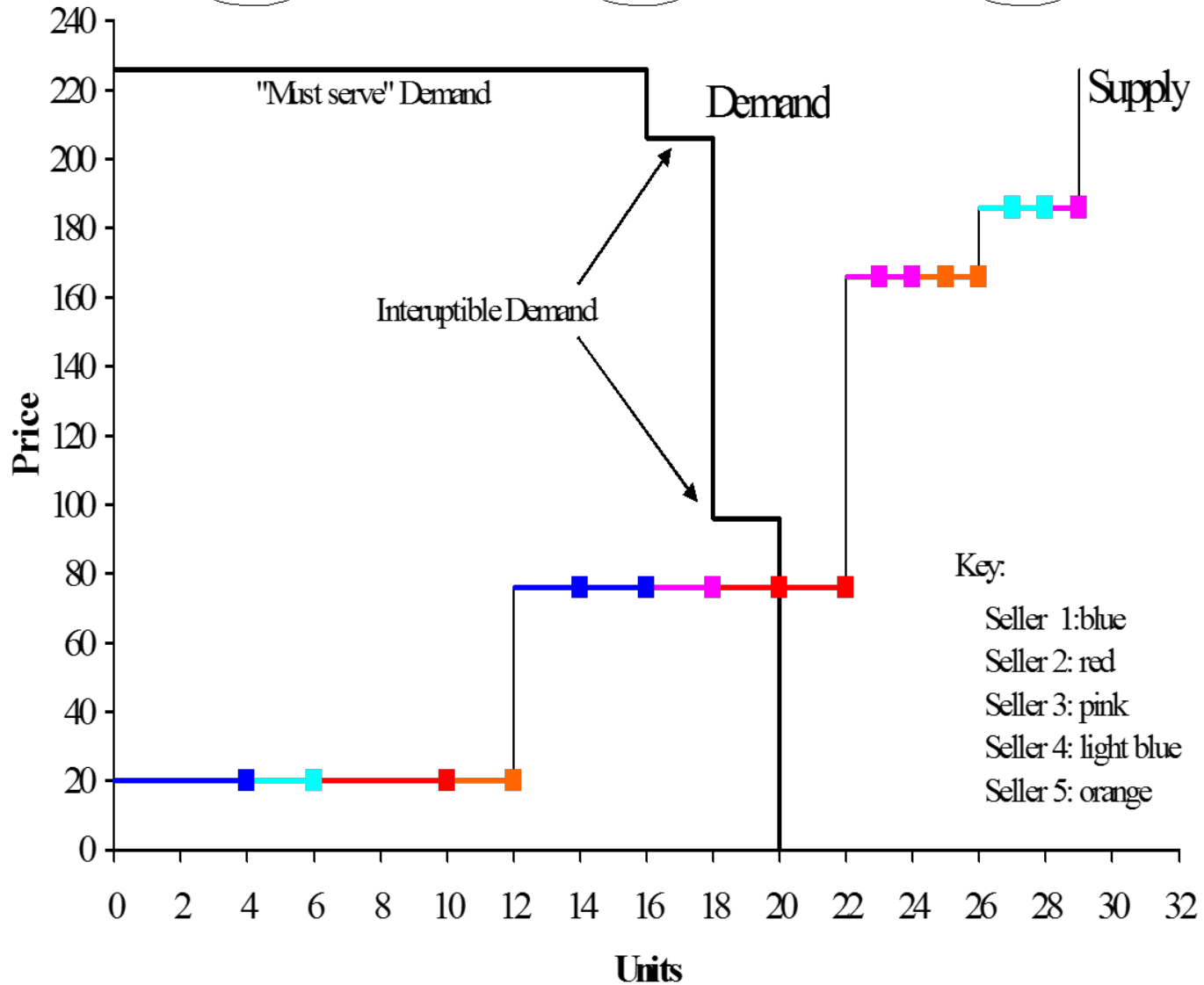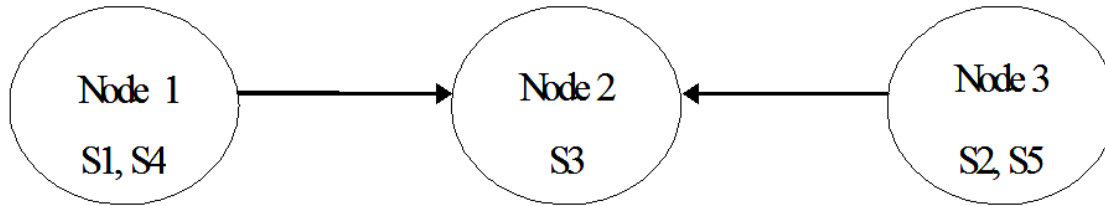
Impact of Demand Side Bidding on Bids, Offers & price.

Left: For equilibrium only marginal units need to be revealed
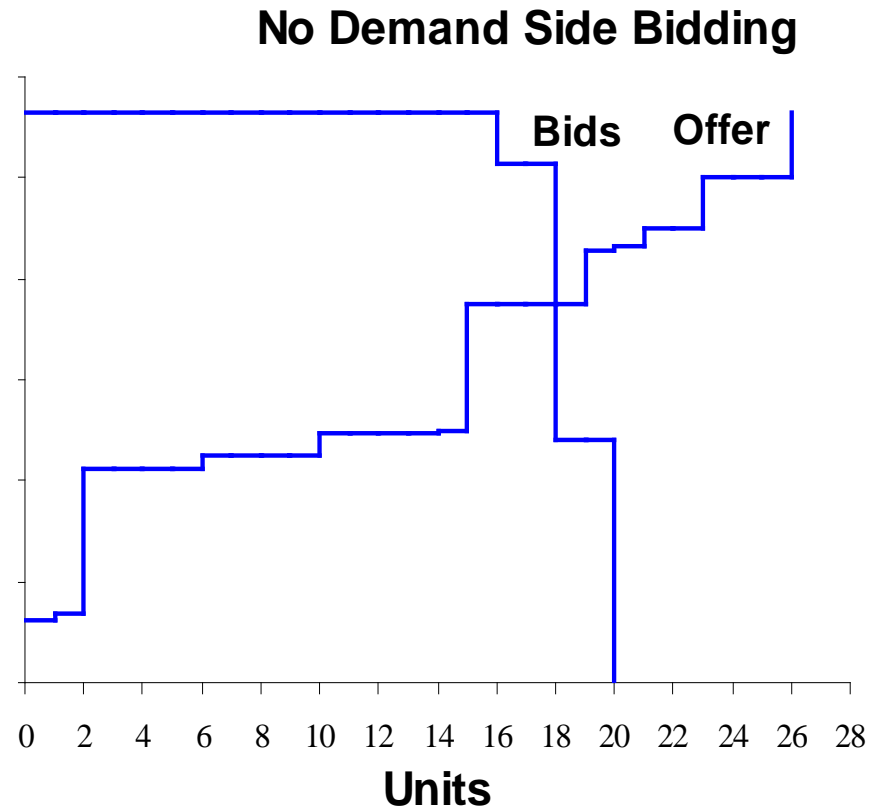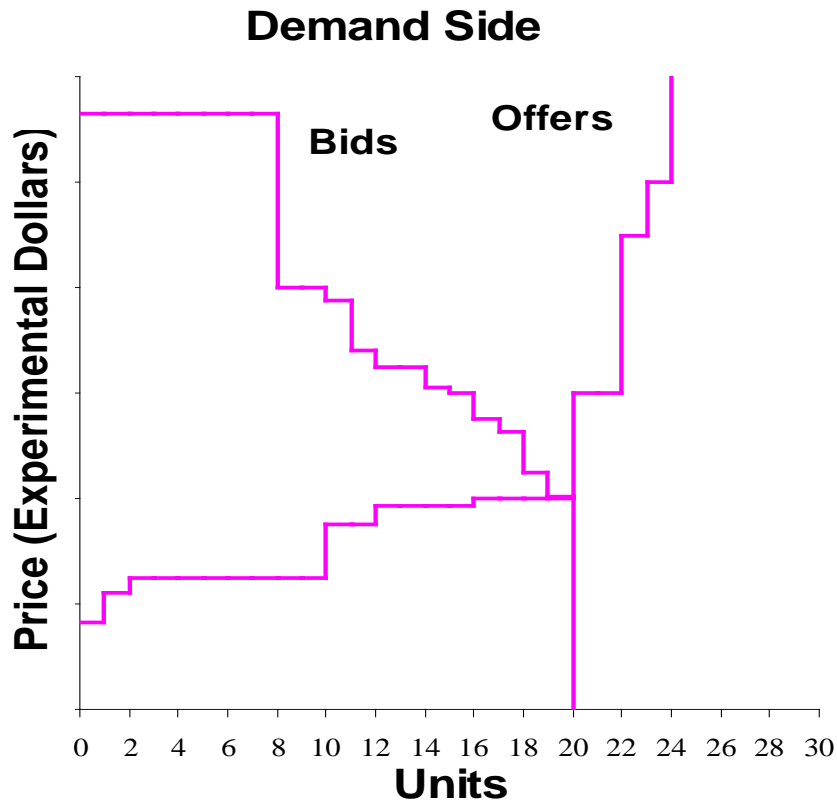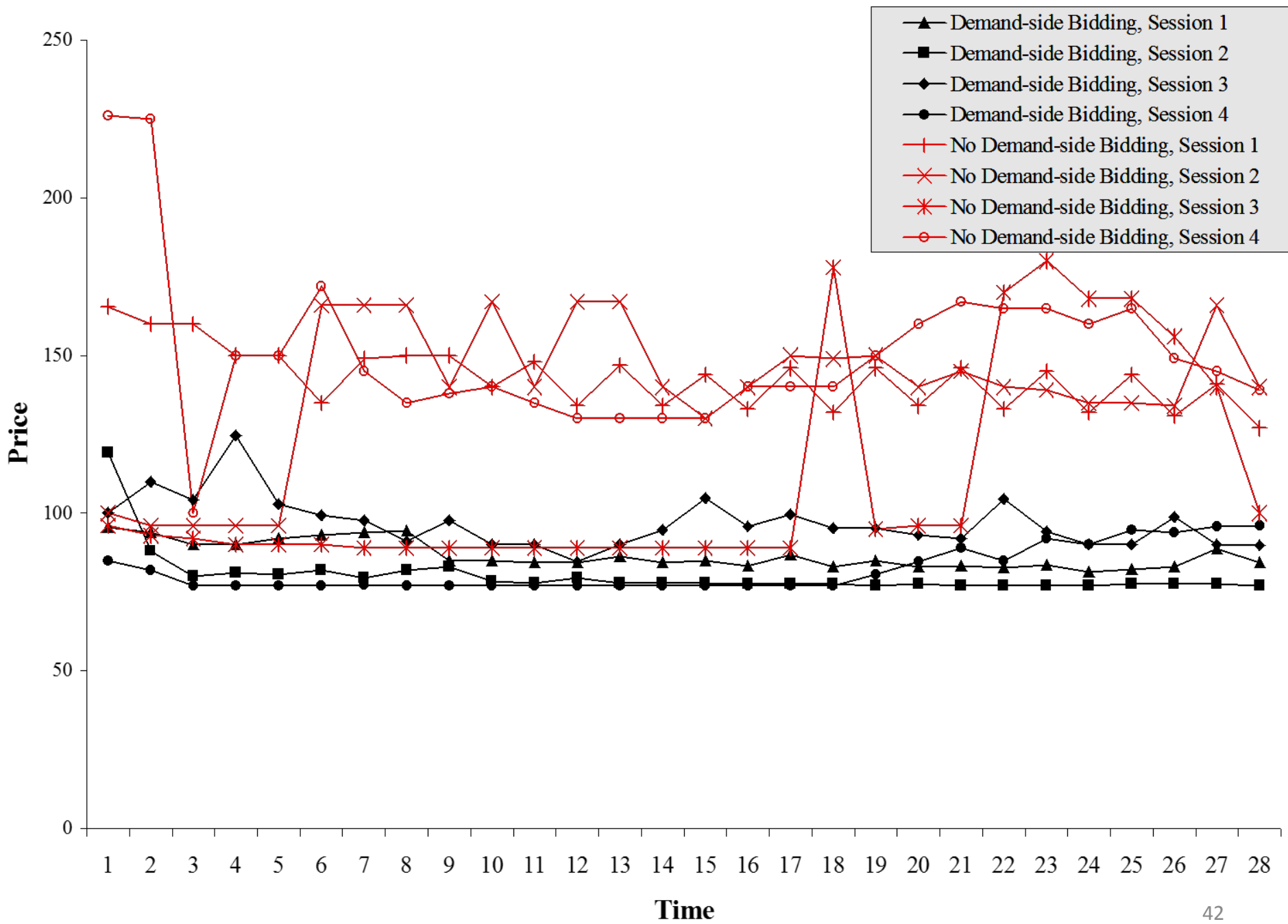
Why study Adam Smith?

1. Sentiments **provides a model of human conduct that seamlessly connects action in social groupings with that in markets. No two-selves—selfish here, unselfish there.**

2. Sentiments **offers propositions that predict action where standard self-interested maximization models failed decisively in the 1990s. These propositions apply naturally to trust (and ultimatum?) games.**

3. Sentiments **offers propositions that suggest and predict action in unique new experiment designs (as in the Lakatos test).**

4. Sentiments **connects human conduct in experimental games to broad socio-economic themes of property, beneficence and justice in stable societies, countering parochial mis-perceptions of experimental economics.**

In *Sentiments:*

Beneficence is about actions that encourage & reward increased human social well-being. (societal gain)

Justice is about discouraging/punishing actions that hurt and reduce social well-being. (societal loss avoidance)

In *Sentiments* Justice Proposition 1 is Bigtime Key to the Origin of Property

Common feelings of resentment toward improperly motivated (intentionally) hurtful actions within close-knit communities is the origin of the civil order of law, and of punishment proportioned to resentment.

"As the greater and more irreparable the evil that is done, the resentment of the sufferer runs naturally the higher…" (TMS, p 83)

***Sentiments* combines this proposition with asymmetry of gains and losses to explain differential penalties applied to loss of property under law in nation states:**

NP (Trust)

24% punish defection. But punishment prospect changes play! Beneficence must be freely offered; it cannot be extorted.
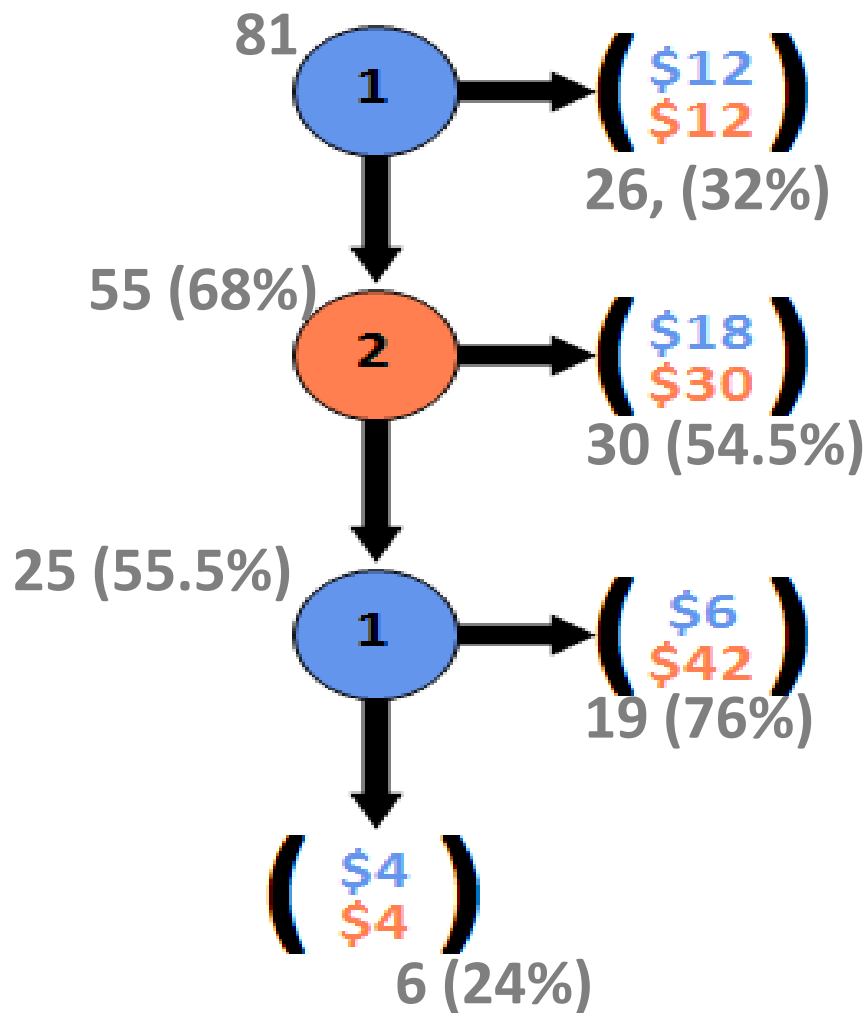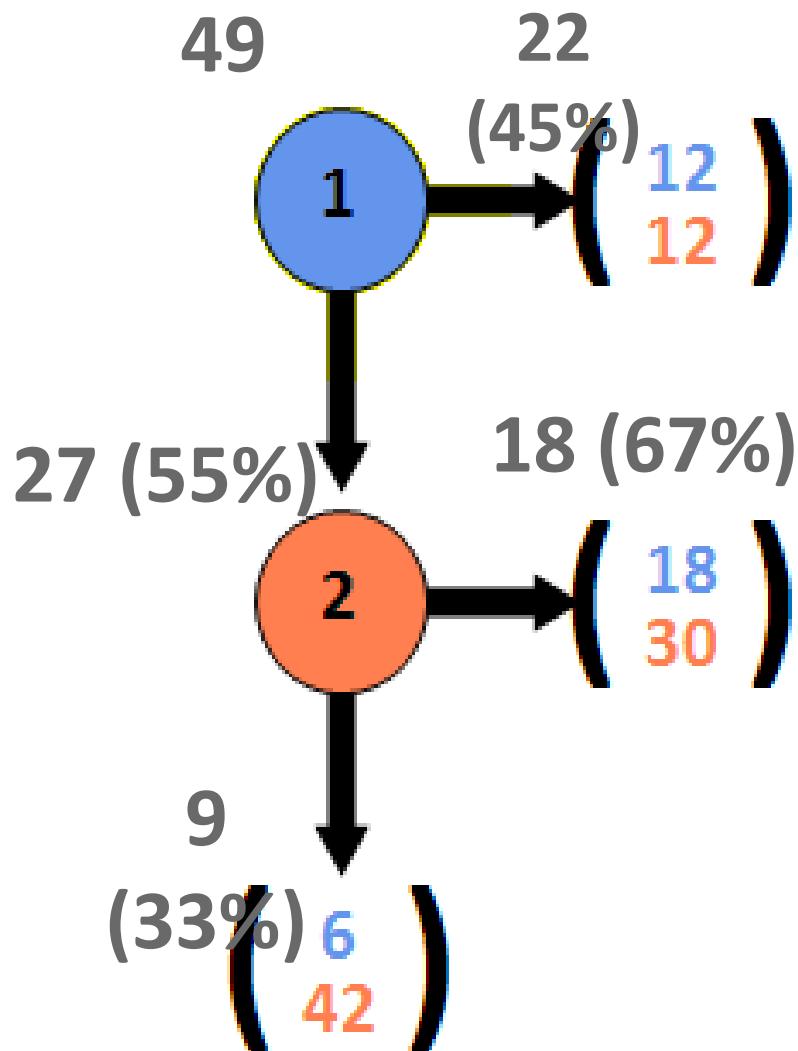
- "To be deprived of that which we are possessed of, is a greater evil than to be disappointed of what we have only the expectation.
- *Breach of property, therefore, theft and robbery, which take from us what we are possessed of, are greater crimes than breach of contract, which only disappoints us of what we expected.*
- The most sacred laws of justice, therefore, those whose violation seems to call loudest for vengeance and punishment, are the laws which guard the life and person of our neighbour;
- next are those which guard his property and possessions;
- and last of all come those which guard what are called his personal rights, or what is due to him from the promises of others." (TMS, p 84; italics added)

*Justice Proposition 2: "*Though the breach of justice…exposes to punishment, the observance of the rules of that virtue seems scarce to deserve any reward."

Thus, there are no rewards for stopping at a red light or for not disturbing your neighbor. These are your duty under classical rule-of-law liberalism.

As want of beneficence is not subject to punishment, so just action (want of injustice) is not subject to reward.

Under our rule-of-law classical liberal heritage, justice is a residue; it is what is left over after introducing penalties for unjust action. Society does good by discouraging the bad.

the

Testing Justice Prop 2: Adam Smith Bats 700+. But more defection!
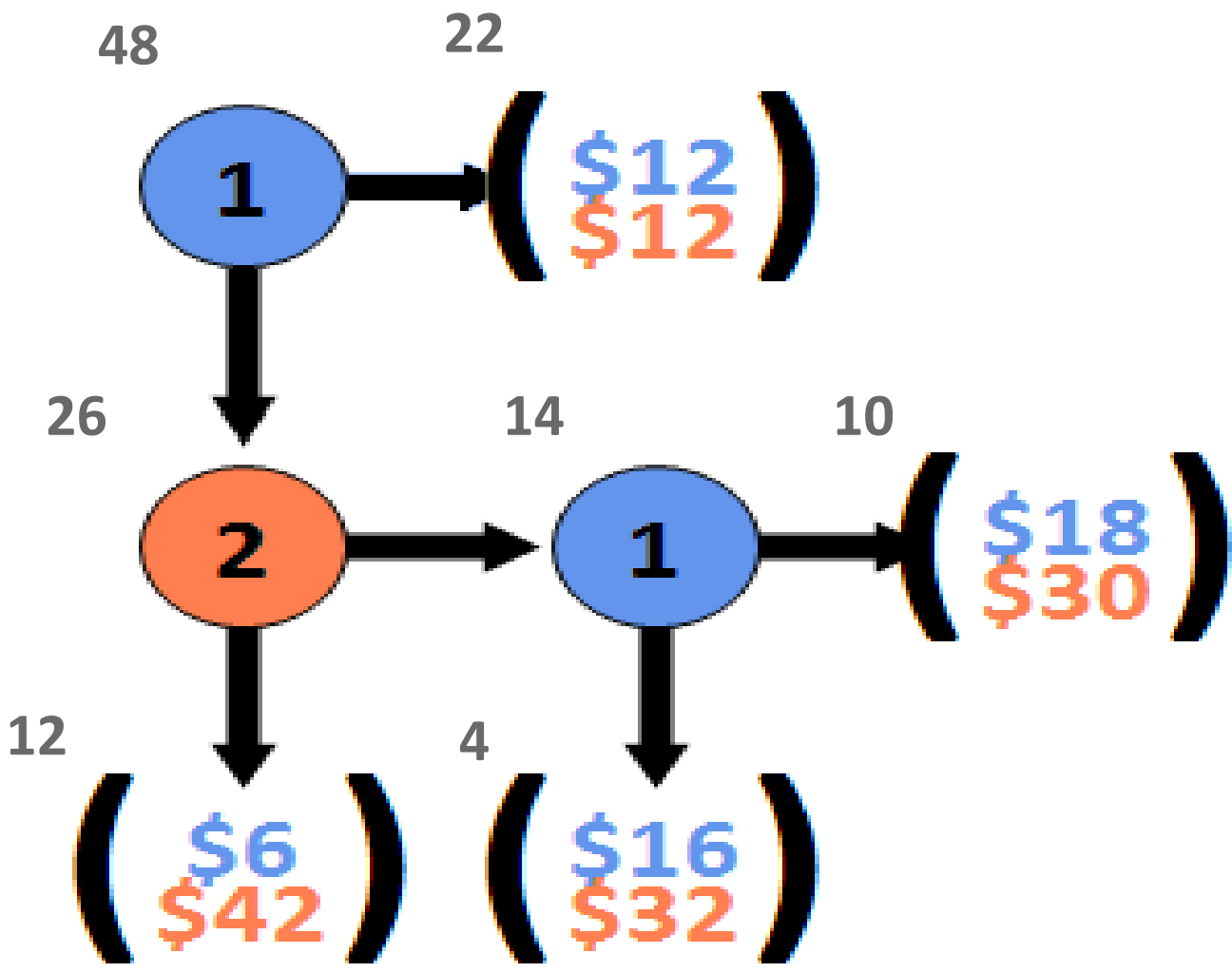
Smith's Axioms & Principles of Conduct

I. Fundamental axiom:" Self-love"/non-satiation is common knowledge; for each more is beneficial, less is hurtful. But in our maturation process, in becoming social, "we humble the arrogance of our self-love to bring it down to what others will go along with." ("go along with" appears 41 times). You cannot look your neighbor in the face and avow that ALL your decisions are driven by self-love. This principle was lost in neo-classical economics

II. Human desire (i.e., motivation for conduct) is inseparable from our sociality.

III. Desire is expressed as a fundamental asymmetry between gains & losses

      A. Gain Domain: Desire for praise and praise-worthiness

      B. Loss Domain: Desire to avoid blame and blame-worthiness

Gain/Loss asymmetry derives from an underlying human joy/sorrow asymmetry.