

The Policy Analysis Market: “Market in Death” Or Your Next Decision Support Tool?

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Immediate Background

On July 28, the Policy Analysis Market (PAM) became the D.C. story of the week. Derided on the floor of the Senate as a “Market in Death,” PAM was terminated on July 29.

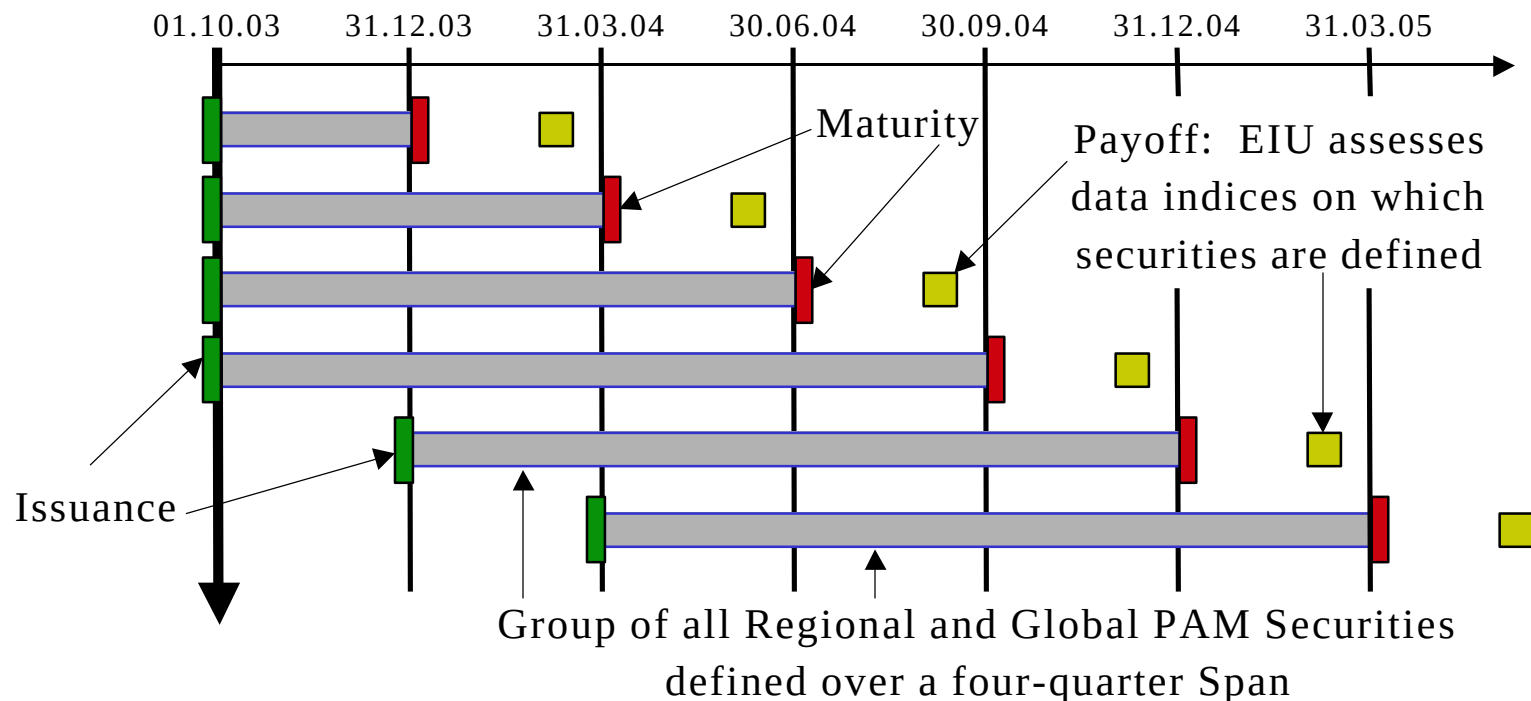
PAM is best seen as an application of an established information-processing tool -- markets. Markets aggregate pieces of information held by many and resolve signals of the underlying information state.

Within a firm, valuable information may be obtained through an internal market. PAM's technology offers firms a means to enhance their decision processes.

An *Infamous* Example -- The Policy Analysis Market

Write contracts off data indices that track policy interests

- Indices for each country in the Middle East: economic health, civil stability, military preparedness, and U.S. involvement (econ. & mil.)
- Global Indices: economic and conflict indicators



Focusing on Specific Events, *When Warranted*

Issue specific event securities (yes/no) into PAM if index-based trading suggests that focus is warranted:

- Imagine a surge of trading activity in Q3 2004 Jordanian Econ. Health
- Try to illuminate by issuing event securities correlated to Road Map

Jordanian Economic Health Increases in Q3'04 (~ means NOT)			
		A	~A
Hamas Joins PA in Q2'04	B	0.45	0.05
	~B	0.25	0.25
Price of \$1 face value security A (& probability)		0.70	0.30

Trader Views & Actions

Mossad agent thinks Hamas mil. wing will not disband -- Buys ~B @ \$0.50.

Jordanian banker believes gov. processes add 6-month lag to foreign investment effect -- Sells AB @ \$0.45.

Swedish firm preparing to invest in Jordan wants to hedge preparation costs -- Buys ~A|~B @ \$0.50.

A Brief History of Information Markets

1. Village market: prices indicate current distribution of values among villagers and impact future production.
2. Futures markets: separate current pricing from forward pricing (thus, more effectively plan future production & investment)
3. Derivative markets: allow futures to be combined so that specific risks can be hedged (focus on the risks you can affect)
4. Iowa Electronic Market for elections: *pure* info. market
5. *Economic Derivatives* futures contracts written off trusted data indices that track something of interest to traders; e.g., CPI
6. Decision Support: Firm-internal market to aid investment and risk management decisions. (see *The Economist*, 9 May 2003)

Overview of the Classic Information Market -- Iowa

Specific event securities associated with elections

- Security sets that *span* all possible states (Bush, Gore, Nader, Other)
- Each security has a \$1.00 face value and traders buy a set for \$1.00
- Trading through a bid/ask bulletin board (double auction)
- Evolution of prices (all \$1.00) interpreted as % predictions of victory
- Securities must have clear, objective definitions (% of popular vote)

Summary of performance to date

- Election markets give superior predictions to polls (451/596)
- Limitations: fixed horizon, no endogenous definition, limited to pre-structured derivatives.

Debuted in 1988 & remains the deployed state of the art

Combinatorial Information Market (highly efficient derivatives)

Combinatorial Market -- a market in which traders can structure multi-item orders by themselves.

Derivatives are based off of several futures contracts

- Only the most liquid are exchange traded (interest swaps)
- Most are structured contracts traded Over the Counter, and the *Counter* balances its book by trading in the underlyings

In a PAM-like market, traders structure derivatives from the underlyings (e.g., Kerry drops out if Dean wins New Hampshire)

Contention: If items of interest are interconnected and knowledge about the items is fragmented, then a combinatorial information market yields superior information performance to traditional, serial markets.

Candidate Commercial Combo. Info. Markets

Industrial Decision Support Tool

- Pharmaceuticals R&D Funnel (and similar)
- Complex product development

Market Research

- Movies (Box Office, advertising, and *inputs*)
- Product Design and Marketing (e.g., HP case)

Risk Hedging Exchanges

- Area Risk Analysis (e.g., PAM)
- Financial markets (pure and physical-derived)

Something real, not just hype: Cassini Payload Mgt.

Cassini mission to Saturn faced a fixed budget (*really*)

- Payload instrument R&D greatest historical cause of overruns
- JPL asks Caltech Economics Division for advice

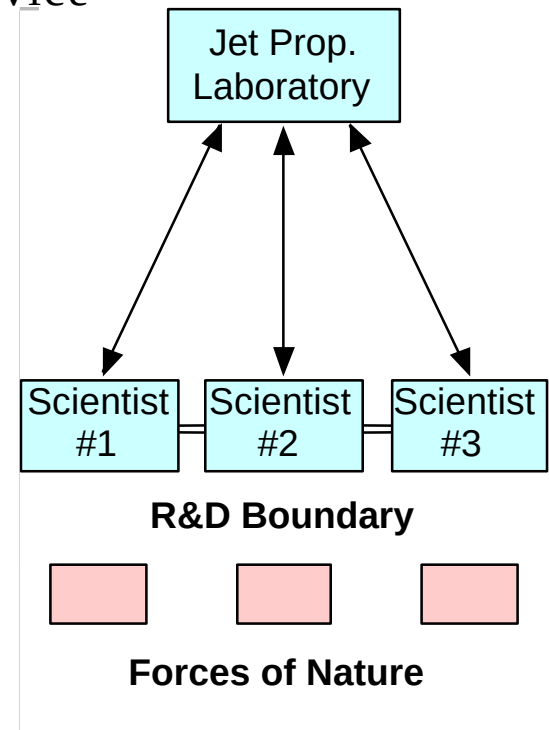
Problem: *Tragedy of the Commons*

- Motives + asymmetric info. = moral hazard
- Classic management is counterproductive
 - Scientists reveal bad luck & hide good
 - Management reserves expended early

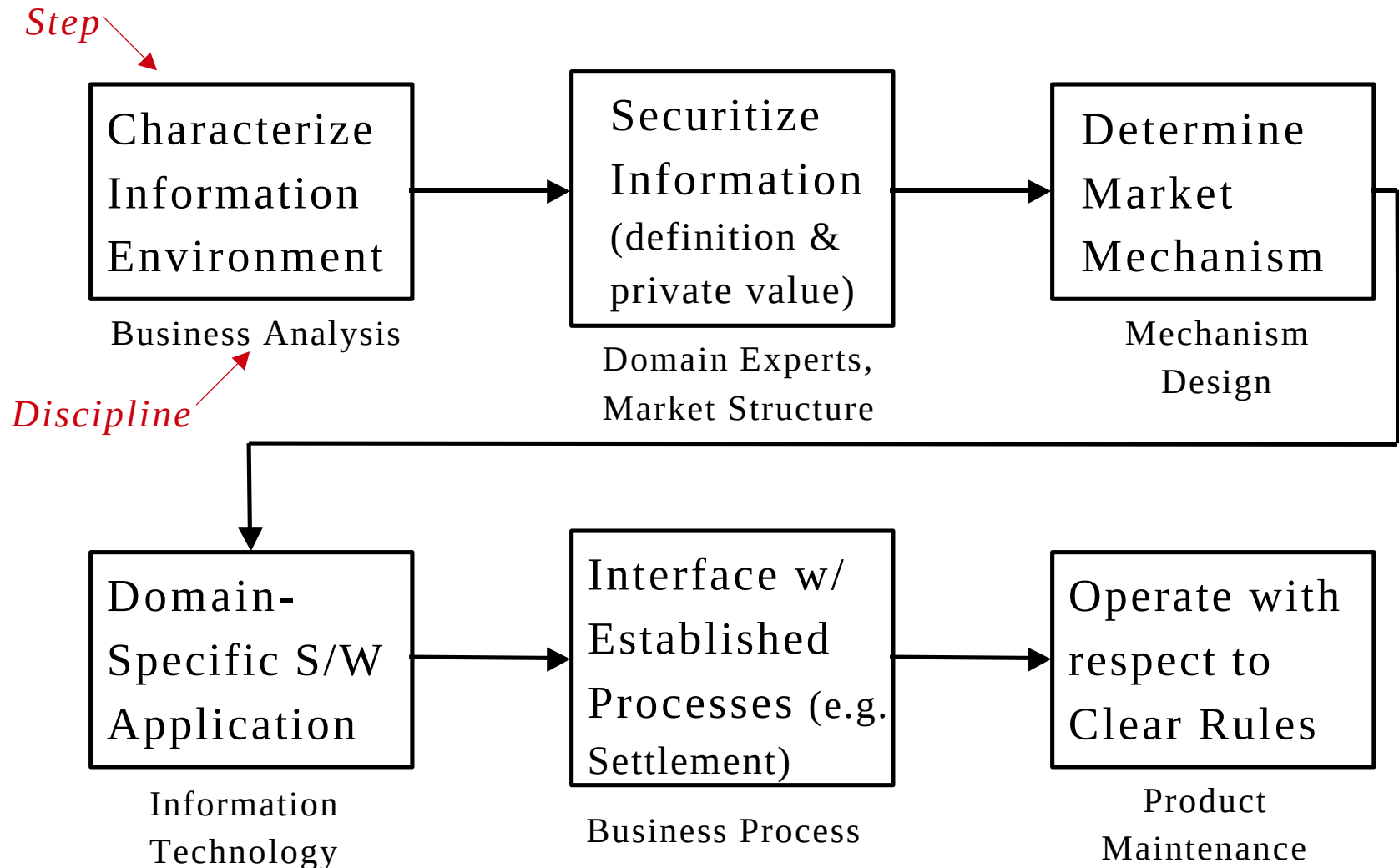
Solution: Property Rights + Trading

- All resources given to Scientists at start
- Trading to smooth out good and bad luck

Outcomes: Launched on budget, \$100 m saved, Net Exchange founded



Some Economics -- Building a New Market



Some Economics -- Market Mechanism Runoff

Two combo. mechanisms tested with same order format

- Combinatorial Call Market (CCM, established product)

- Orders accumulate during an order submission period
- Trades are identified through a batch solution process

- Combinatorial Automated Market Maker (CCAM, new)

- PAM* →
- Continuous trading through an automated intermediary
- Tech* →
- CAMM balances its risk across all its holdings

Environment for both (and a double auction)

- Binary Variables X, Y, Z; $2^3 = 8$ combinations
- $P(X=0) = .3$, $P(X=Y) = .2$, $P(Z=1) = .5$
- 3 people, see 10 cases of: AB, BC, or AC
- Goal is to trade information to figure out mapping

Actual Mapping

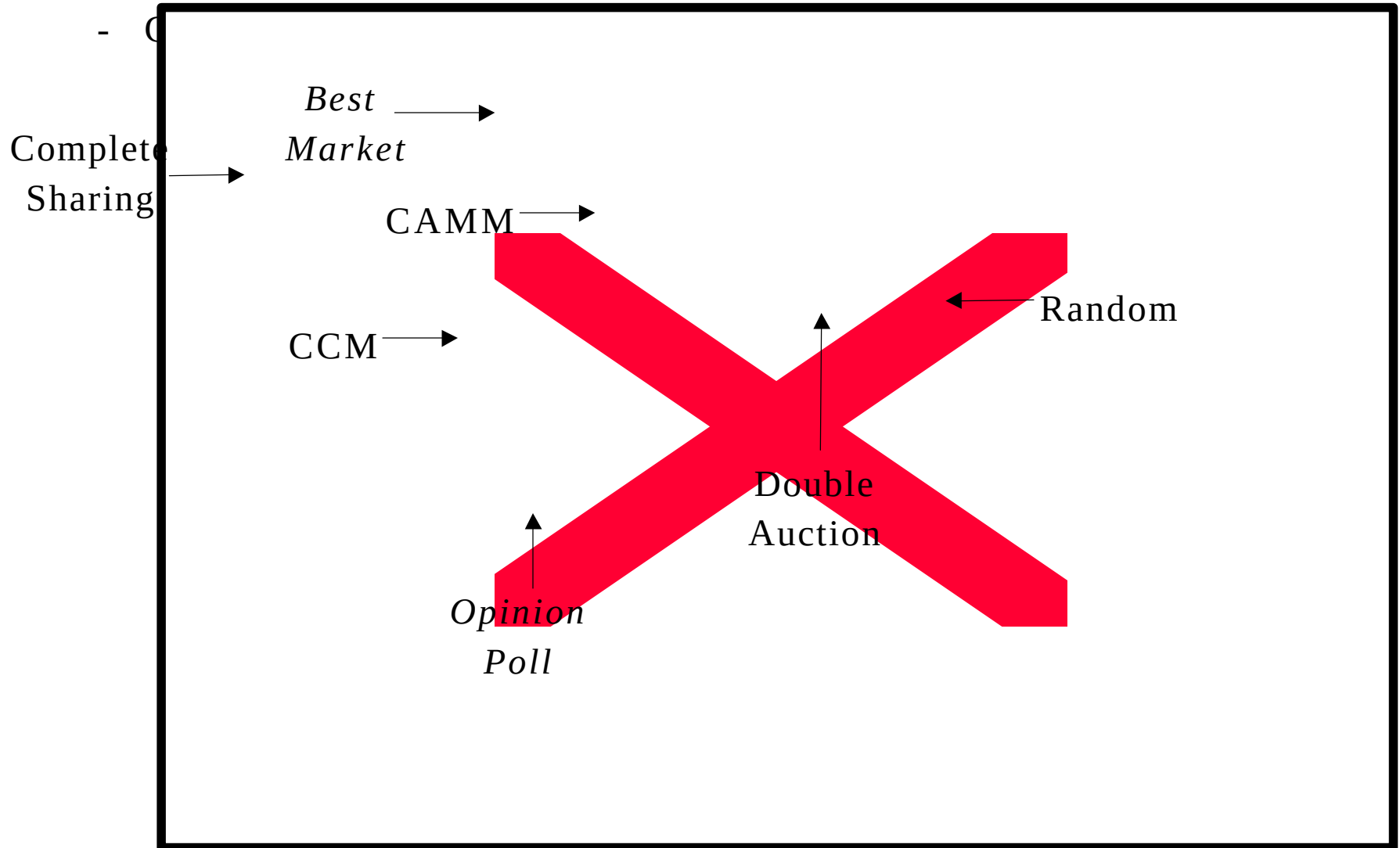
	X	Z	Y
Case	A	B	C
1	1	-	1
2	1	-	0
3	1	-	0
4	1	-	0
5	1	-	0
6	1	-	1
7	1	-	1
8	1	-	0
9	1	-	0
10	0	-	0

Sum: 9 - 3

Same	A	B	C
A	--	--	4
B	--	--	--
C	--	--	--

Some Economics -- Performance Comparison

Both combinatorial processes superior to double auction



Some Economics -- A Quick Look at CAMM

A market maker handles trades in N two-state securities

- 2^N *States of the World* -- combinations of individual futures contracts
- A derivative is some subset of these 2^N states; call it A
- When the market maker buys A from you, it sells A^c to you, adjusting the prices of all the states and thus keeping its book in balance.

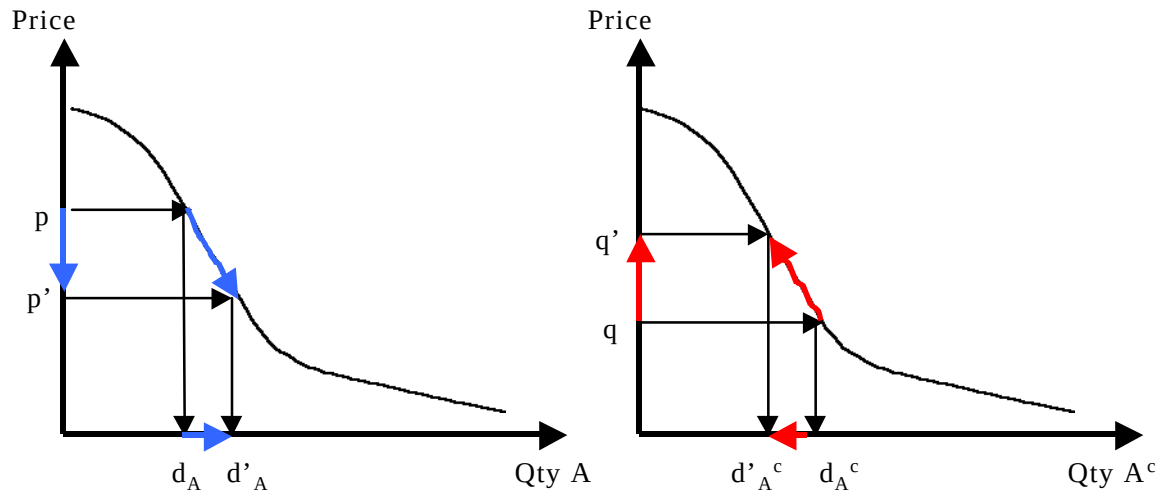


Figure 2. Market maker swaps A and A^c

Scaled via an overlapping market maker approach

Summary

All markets perform an information refining role

- Traditionally, this role is based on an underlying *real* commerce and is performed between separate entities.
- Futures market techniques are broadening *real* to *relevant*.
- If the information environment relevant to a firm distinguishes entities within the firm, then a market may be a good decision support tool.

Combinatorial mechanisms make a better information market if the items of interest are interconnected and knowledge about the items is fragmented.

The Policy Analysis Market is an appropriate application of a combinatorial mechanism (CMM) to an information environment of critical importance.

References

- All Bets are off at the Pentagon; Tim Hartford; Financial Times, September 2, 2003, page 8
- Information Aggregation Mechanisms: Concept, Design and Implementation for a Sales Forecasting Problem; Charles Plott, Kay-Yut Chen, Caltech HSS Working Paper 1131, March 2002
- Using Computerized Exchange Systems to Solve an Allocation Problem in Project Management; John Ledyard, David Porter, Antonio Rangel; Journal of Organizational Computing 4(3), 271-296 (1994)
- A Management Approach for Allocating Instrument Development Resources; Randii Wessen, David Porter; Space Policy 1997 13(3) 191-201
- Combinatorial Information Market Design; Robin Hanson; Information System Frontiers, 5:1, 107-119, 2003.