



Predicting the Future: Prediction Market and Beyond

Berkeley Entrepreneurs Forum

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HP Labs



Wisdom of the Crowds

- Large groups of individual outperform experts
- One Example: 1906 Fat Stock & poultry Exhibition
 - Contest guessing weight of an ox
 - 800 participants
 - Average guess 1197 lbs vs real 1198 lbs

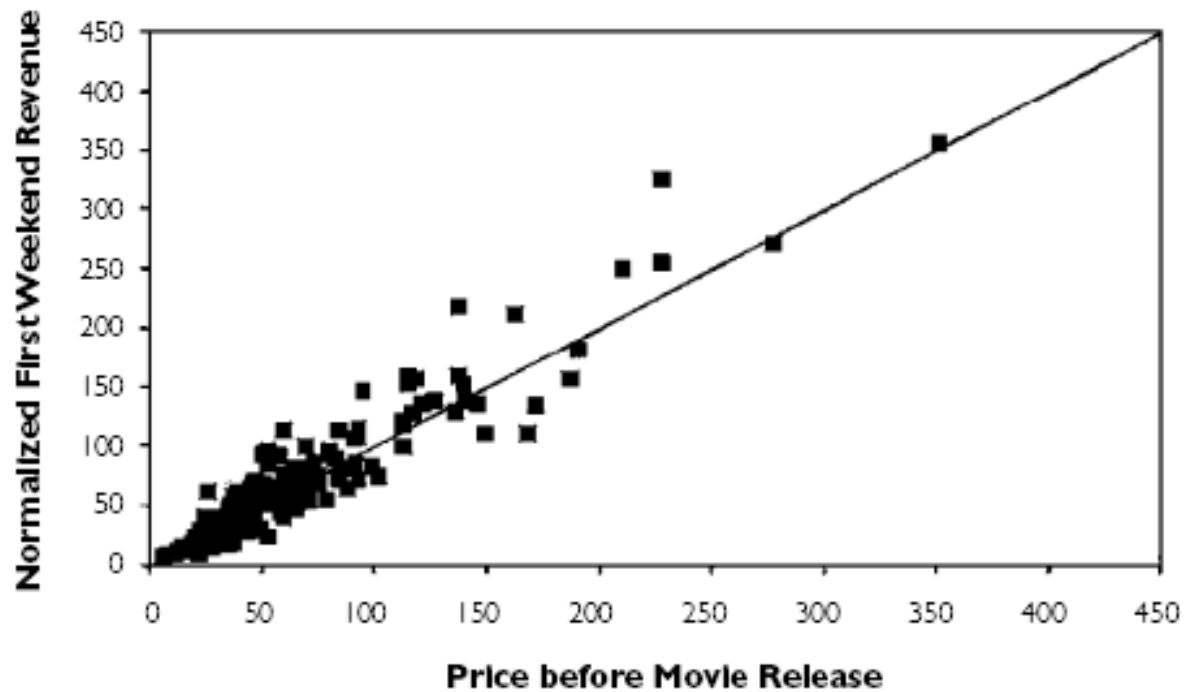


The Five Principles (I⁴C)

- Incentive
- Indicator
- Improvement
- Independence
- Crowd

Hollywood Stock Exchange

FIGURE I





An Example of Prediction Market

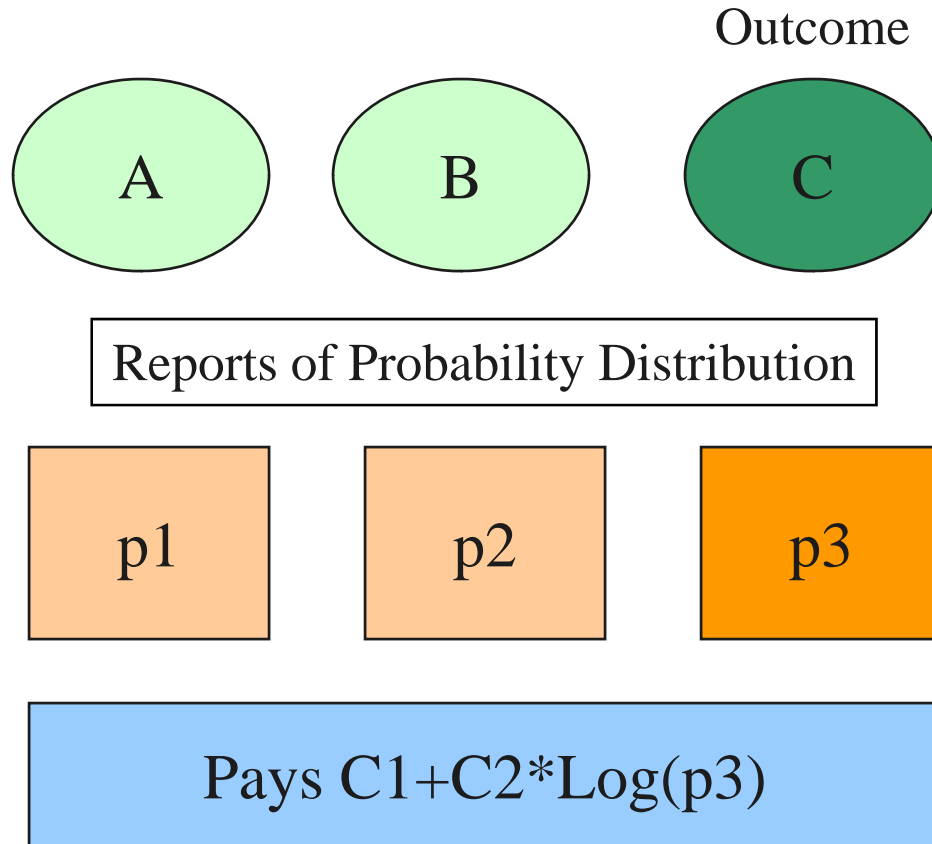
- Goal: sales forecasting
- Sales amount (unit/revenue) divided into (8-10) finite intervals
- Contingent state asset (i.e. winning ticket pays \$1, others \$0)
- Web-based real time double-auction
- 15-20 min phone training for EVERY subject
- Market open for one week at restricted time (typically lunch and after hours)
- Market size: 10-25 people



Issues and Resolutions

- Limitations
 - small groups, low participation
 - lack of information in the group
 - ability to change the outcomes
- Related Methods
 - scoring rules
 - two-stage pari-mutual market

Reporting with Scoring Rule



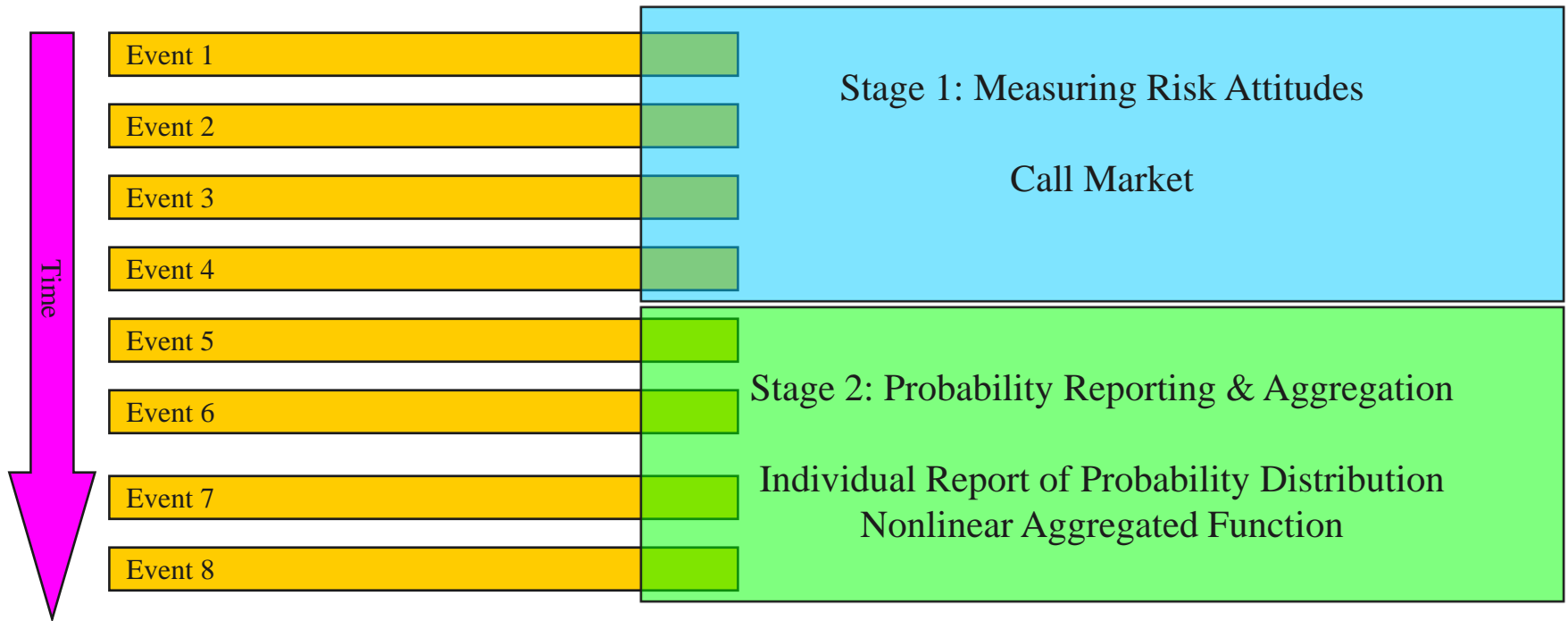


Information Aggregation Function

If reports are independent, Bayes Law applies ...

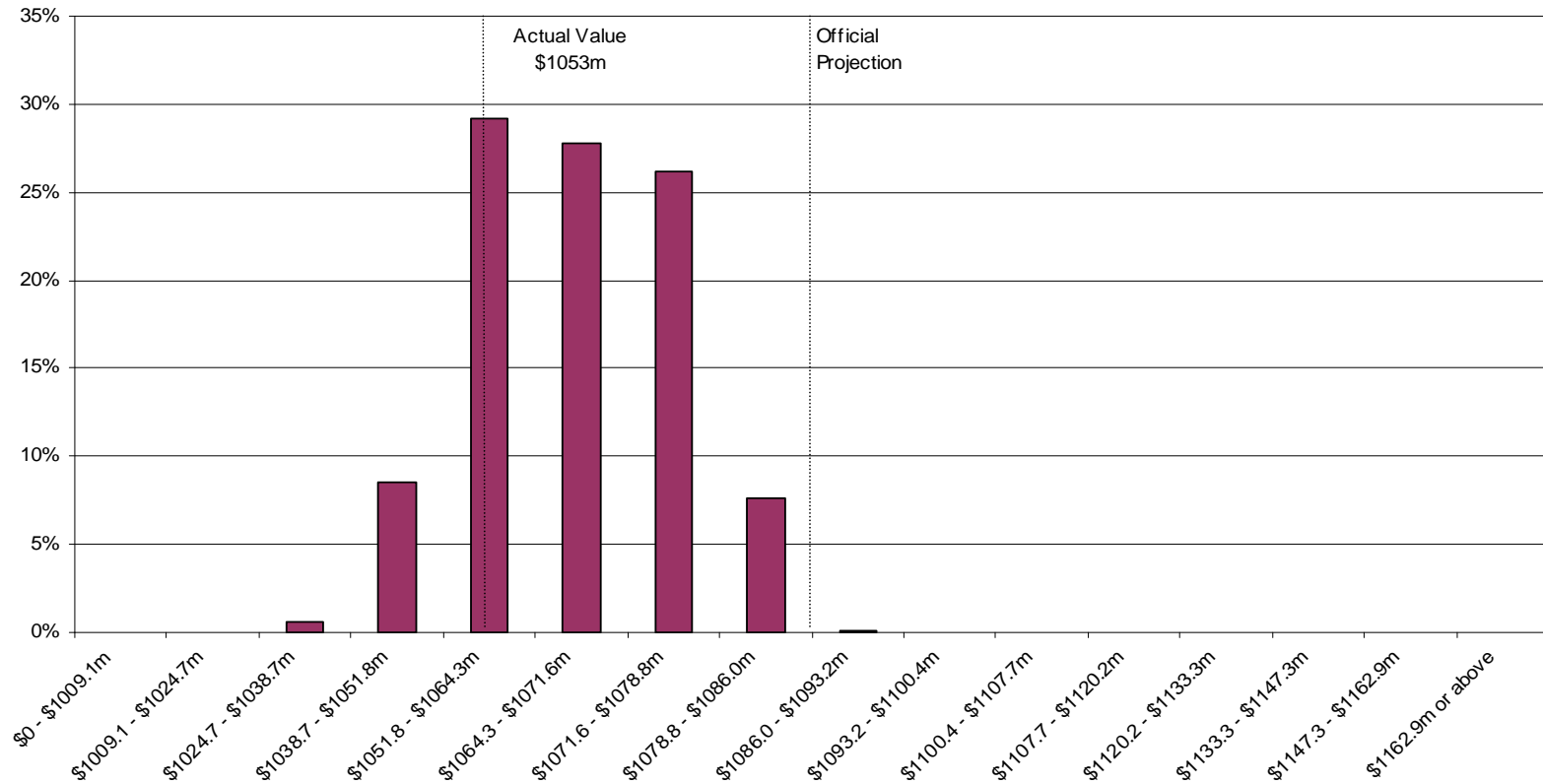
$$P(s | I) = \frac{p_{s_1} p_{s_2} \cdots p_{s_N}}{\sum_{\forall s} p_{s_1} p_{s_2} \cdots p_{s_N}}$$

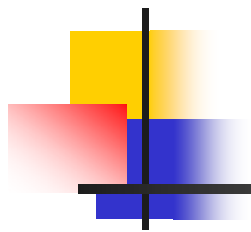
Dealing with Risks Attitudes: A Two-Stage Mechanism



Real World Application

Implied Probabilities of Revenue Bins, September 2003





i n v e n t



Supplementary



Behavioral Economics – Predict Human Economic Behavior

- Traditional Economic Theory
 - Rational, selfish, optimizing agents
- Individual Behavior
 - Risk attitudes
 - Loss aversion
 - Bounded rationality: making mistakes and heuristics
- Social Preferences
 - “Emotional algorithm”
 - Trust, status, fairness, altruism, reciprocity, group effect,
- Behavioral Anticipation
 - Reputation
 - Information sharing & trust



Wind Tunnel for Business – Creating Your Own Business Intelligence

Experimental economics methodologies

- Simulation of complicated business/econ environment
- Human subjects with incentives controlled with money
- Deal with economics with real human responses
- HPL has first industrial experimental econ lab
- HPL has unique software, IP and publications

Applications

- Supply Chain Contracting
- Economic Mechanism Design
 - Decision Insurance
 - Information Aggregation

Why does it work?

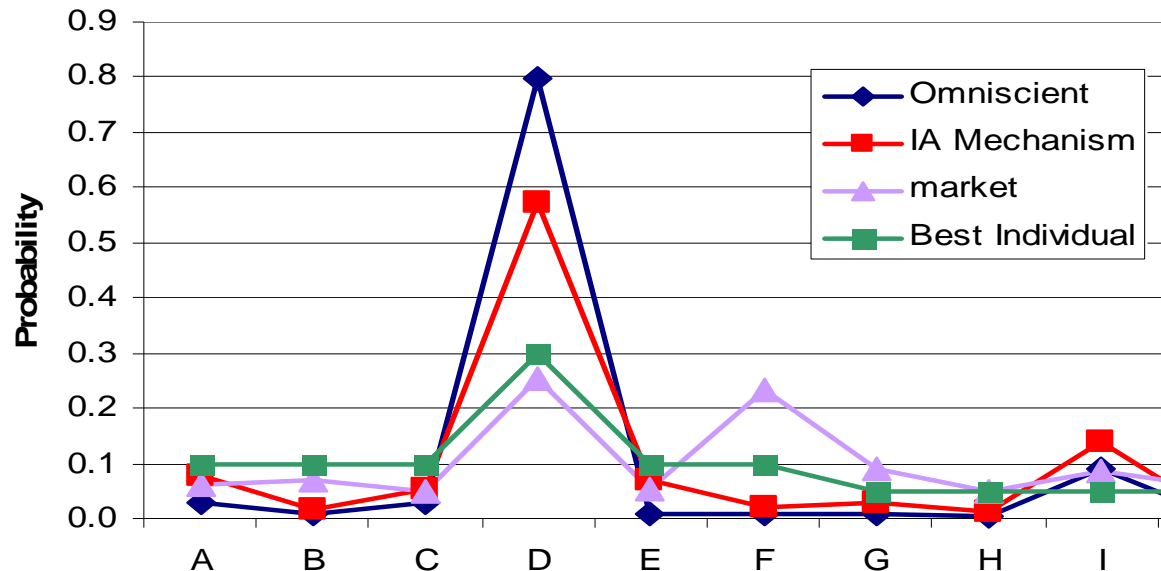
- Economics forces drive same behavior
- Test gaming behavior, not domain knowledge
- Repeatable
- Validation with real world data

What is business value and benefits?

- Low cost
- Low risk
- Isolate cause and effect
- Repeatable results

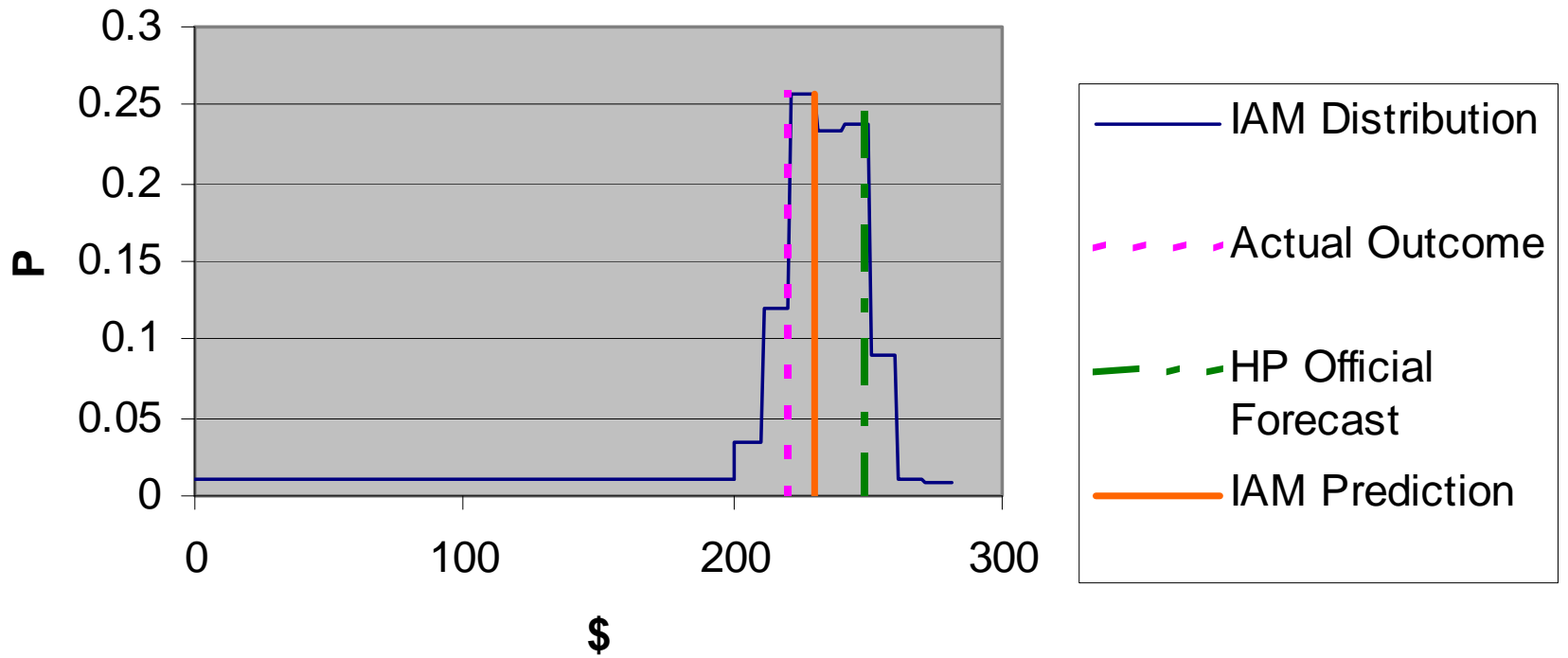
Performance Beat Several other Mechanisms

Comparison To All Information Probability



Experiment 4, Period 17

Event 2



Results

		Abs % Errors of IAM Predictions						
		Last Interval Ignored			Last Interval Mass at Lower Bound			
Event	Absolute % errors of HP forecasts	Average last 60% trade	Average last 50% trade	Average last 40% trade	Average last 60% trade	Average last 50% trade	Average last 40% trade	
2	13.18%	4.61%	4.57%	4.68%	5.63%	5.68%	5.80%	
3	59.55%	57.48%	55.72%	54.60%	59.25%	57.46%	56.32%	
4	8.64%	7.84%	8.15%	8.52%	6.45%	6.77%	7.13%	
5	32.08%	30.93%	31.57%	31.83%	29.74%	30.33%	30.48%	
6	29.69%	24.23%	24.54%	25.30%	22.94%	23.22%	23.93%	
7	4.10%	7.33%	7.02%	6.71%	5.35%	4.91%	4.55%	
8	0.11%	2.00%	2.35%	1.83%	1.53%	1.39%	1.00%	
9	28.31%	23.85%	24.85%	24.39%	17.55%	17.32%	16.54%	
T-test P-value		0.079	0.084	0.071	0.034	0.026	0.022	

Real World Application

Implied Probabilities of Operating Profit Bins, September 2003

