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Asymmetric Information in Defense Acquisition:

Bid Protests and Containment Strategies

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Why Information Asymmetries and Bid Protests?

- Information Aggregation
  - Information decentralized across DoD and contractors
  - DoD should gather and aggregate information
    - Update preferences – FEAR OF PROTESTS
- Information Revelation
  - DoD has good *a priori* information
  - DoD should reveal its information to the contractors
    - Update preferences – FEAR OF PROTESTS

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Objectives

- Examine asymmetric information in defense procurement
  - Scenario 1: DoD's possess imperfect information; information is decentralized across contractors
  - Scenario 2: Information is centralized within DoD; DoD decides what to distribute across contractors
- Model asymmetric information environments and characterize implications
  - Iterated Information Aggregation Auction (I^2A^2) Mechanism
  - Centralized Information Multi-attribute Contracting Model
- Examine implications of the asymmetric information models for bid protests relative to alternative containment strategies

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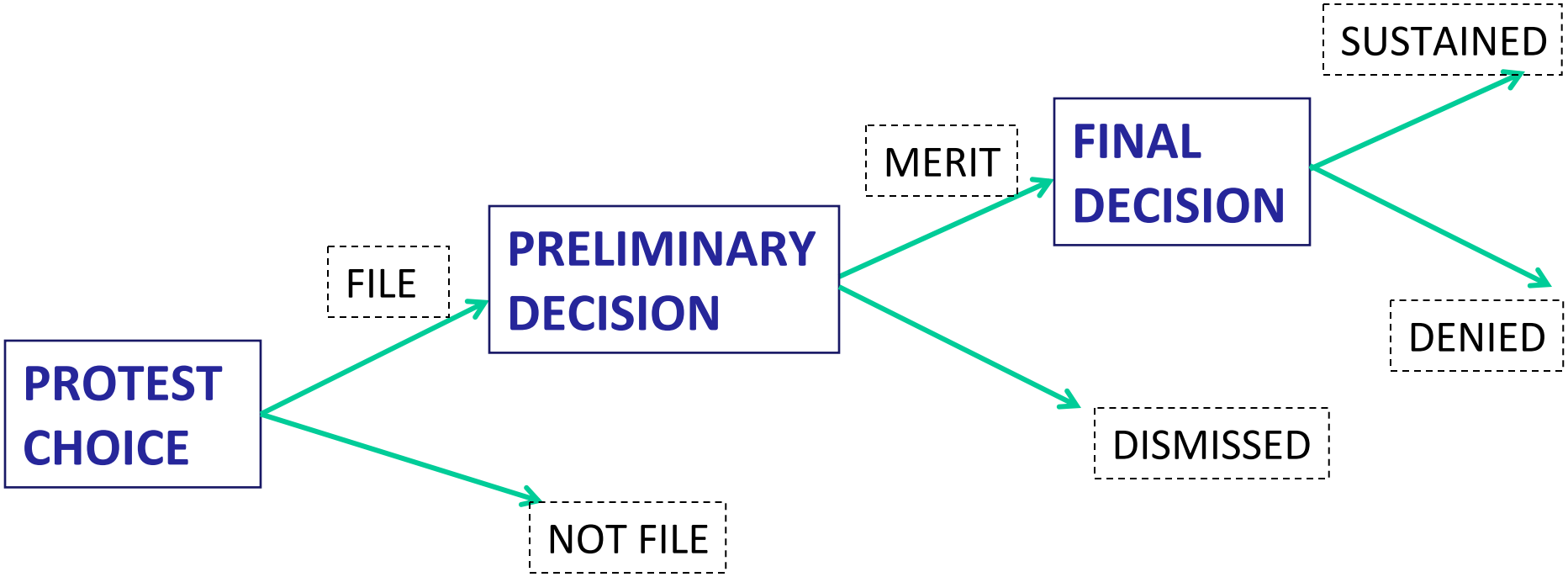
BID PROTEST PROCESS



- Probability (Merit)
- Probability (Sustained/Merit)

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Vendor (Agent) Protest Choice Problem

- Profit from Protest
  = Expected Benefits – Expected Costs
- Expected Benefits
  = Prob (merit)*Prob (Sustained/Merit)*
  Contract Revenues
- Expected Costs
  = Search & Information + Legal + Reputation
  + Opportunity Costs

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DoD (Principal) Governance Mechanisms

- Reduce Profit from Protest
  - Expected Benefits – Expected Costs
- Reduce Expected Benefits
  - Lower Probability (Merit) and Probability (Sustained)
  - Reduce Revenues
- Increase Expected Costs
  - Raise: Search & Information, Legal, Reputation, Opportunity Costs

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Increase Expected Costs

- Raise: Search & Information, Legal, Reputation, Opportunity Costs
  - Charge a protest fee that reflects DoD's transaction costs from a protest
    - Schedule delays; lapse in performance coverage; program cost overruns, etc.
  - Adopt UK court's principle that loser pays…
    - Unsuccessful protestors pay court costs and compensation

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Reduce Expected Benefits

- Lower Probability Merit and Sustained
  - Carefully document decision process
  - Better educate procurement teams
  - Specify desired characteristics/attributes but not weights
  - Solicit GAO "Seal of Approval"
- Reduce Revenues
  - Provide more chances to win contract
    - Unbundle complex integrated contracts
    - Shared awards; variable shares based on proposal evaluation
  - Firms earn reputation of being protestors

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Risks of Limiting Protests

- Bidders may raise their prices/bids to compensate
- Bidders may lower quality/performance/schedule outcomes to compensate
- Bidders may drop out reducing competition
- Reduces Transparency and Accountability of Acquisition Process
- Risk Trade-off : Performance, Cost & Schedule

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LOGCAP IV – Evaluation

- Awards based on best value to the government, considering the evaluation factors of management, past performance, technical (scenario) &cost/price
- Management evaluation "moderately" more important than past performance & technical factors
- Past performance & technical factors "moderately" more important than final cost/price estimates.

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Asymmetric Information in Defense Procurement

- DoD is uncertain about relevant attribute weights
  - Contractors have better tradeoff information
  - Incentive to sway DoD's preferences in their favor
  - DoD wants to aggregate decentralized trade-off information
- DoD has *a priori* preferences over relevant weights
  - DoD doesn't specify (all) weights to avoid contractor protests
    - Contractors face a lower probability of winning a protest
  - Disguising preferences compromises the quality of the proposals DoD receives

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DoD Uncertain About Attribute Weights

- True value of procured product/service depends on:
  - Performance along various attributes (A_1, A_2, A_3, …)
    - Aircraft example: Speed, maneuverability, range, reliability, etc.
  - Relative importance/weighting of each attribute (α_1, α_2, α_3, …)
    - Information about appropriate weights incomplete, diffuse, and private

  $\Rightarrow$ Value = $\alpha_1 A_1 + \alpha_2 A_1 + \alpha_3 A_1 + \ldots - P$
- *Ex ante* information (before bids or announcements):
  - DoD and contractors have incomplete and independent information about optimal attribute weighting
    - Precision of information reflected in number of "draws from an urn"
    - DoD may have more, less, or same precision as any contractor
  - Each contractor knows its own cost function

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Binomial Distribution

- Binomial Distribution
  - Actual Weight= .6
  - 68% of random observations within one standard deviation of mean

Draws	2	4	6	8	10	15	20
1 STD	±.346	±.245	±.200	±.173	±.155	±.126	±.110
+ 1 STD	0.946	0.845	0.800	0.773	0.755	0.726	0.710
-1 STD	0.254	0.355	0.400	0.427	0.445	0.474	0.490

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Single Auction Alternatives

1) **Publish** (*optional*)**:** DoD publishes its own estimates of weights
2) **Auction:** Each contractor submits bid based on own estimates and (perhaps) DoD estimates of weights
3) **Update** (*optional*)**:** DoD updates its own estimates of weights based on contractor bids
4) **Award:** Winning contractor selected based on (possibly) updated weights

Two optional stages create four single auction variations:

- No Publish, No Update
- No Publish, Update
- Publish, No Update
- Publish, Update

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I^2A^2: Iterated Information Aggregation Auction

1) **Initial auction:** Each contractor submits bid (M_1, M_2, M_3, …, P) based on own estimates of weights (α_1, α_2, α_3, …)
2) **Update:** DoD updates its estimates of appropriate weights based on contractor bids and announces new estimates
3) **Elimination:** Contractors with least value initial bids (according to updated weights) are eliminated
4) **Final auction:** Each remaining contractor submits a new bid based on updated weights
5) **Award:** Winning contractor selected based on updated weights

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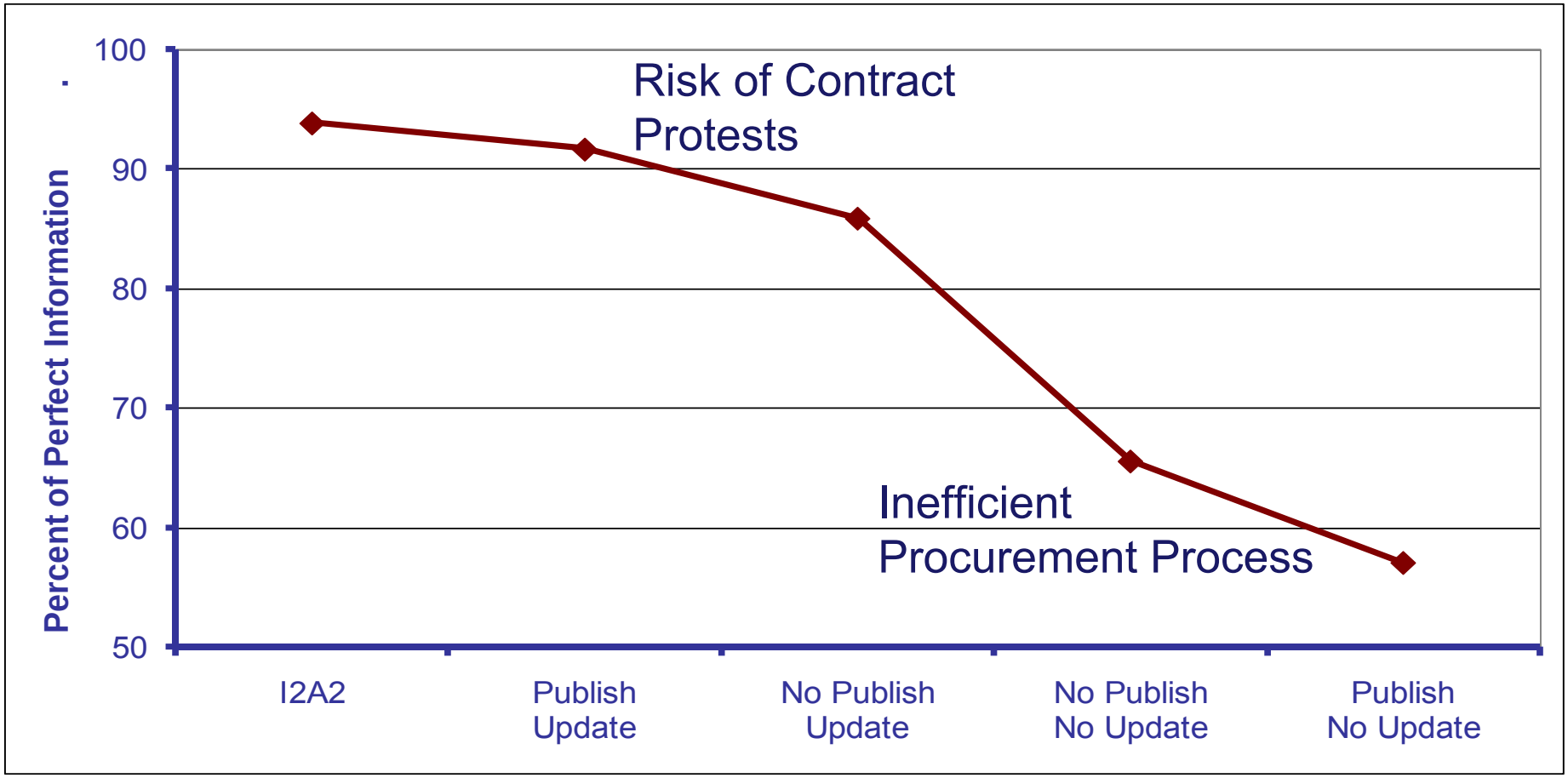
Mean Simulation Results



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Implications

- Procurement mechanisms can be designed that:
  - Create incentives for actors to **truthfully reveal** information
  - **Efficiently aggregate** diverse and often conflicting information
  - **Identify optimal choices** based on aggregated information
- Updating requirements and evaluation criteria significantly increases DoD's value
  - Carefully designing how we procure can help determine what to procure, from whom and at what price

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A Priori DoD Preferences – Weights Specified(?)

- True value of procured product/service depends on:
  - Performance along ten attributes (A_1, A_2, A_3, … , A_{10})
    - Aircraft example: Speed, maneuverability, range, reliability, etc.
  - Relative importance/weighting of each attribute (α_1, α_2, α_3, … , α_{10})
    - DoD has *a priori* values for attribute weights
    - Contractor information about appropriate weights **incomplete**

  $\Rightarrow$ Value = $\alpha_1 A_1 + \alpha_2 A_2 + \alpha_3 A_3 + \ \ldots + \alpha_{10} A_{10} - P$
- DoD reveals weights for some/all attributes
  - Withholds information to avoid protests

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Monte Carlo Simulation Model

- DoD announces 0 – 10 attribute weights
  - 0% info; 10% info; …; 100% info (11 cases)
- Contractors choose product attributes (2, 4, 6, 8, 10 firms)
  - Imperfectly informed for unannounced attributes
    - Draws from an urn (2, 4, 6, 8, 10, 15, 20)
  - Contractors know their (random) cost functions
    - $P_j = C_j = a_{1j}A_{1j} + a_{2j}A_{2j} + \ldots + a_{10j}A_{10j}$
    - Choose $A_{1j}, \ldots A_{10j}$ to maximize: $\alpha_{1j}A_{1j} + \ldots + \alpha_{10j}A_{10j} - P_j$
- DoD chooses contractor maximizing DoD value
  - Pays to capture value of first excluded contractor

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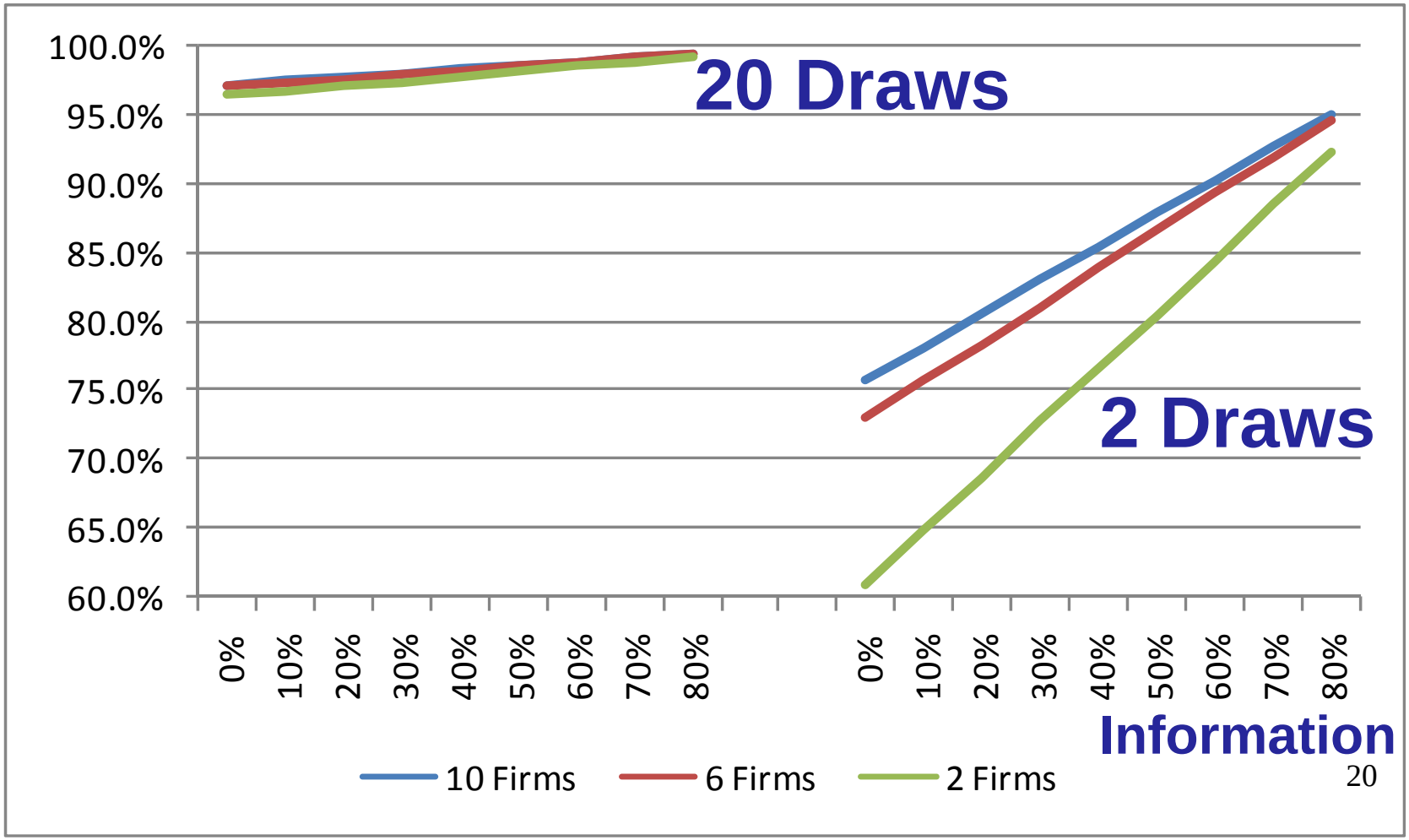
DoD Surplus-% of Perfect Revelation



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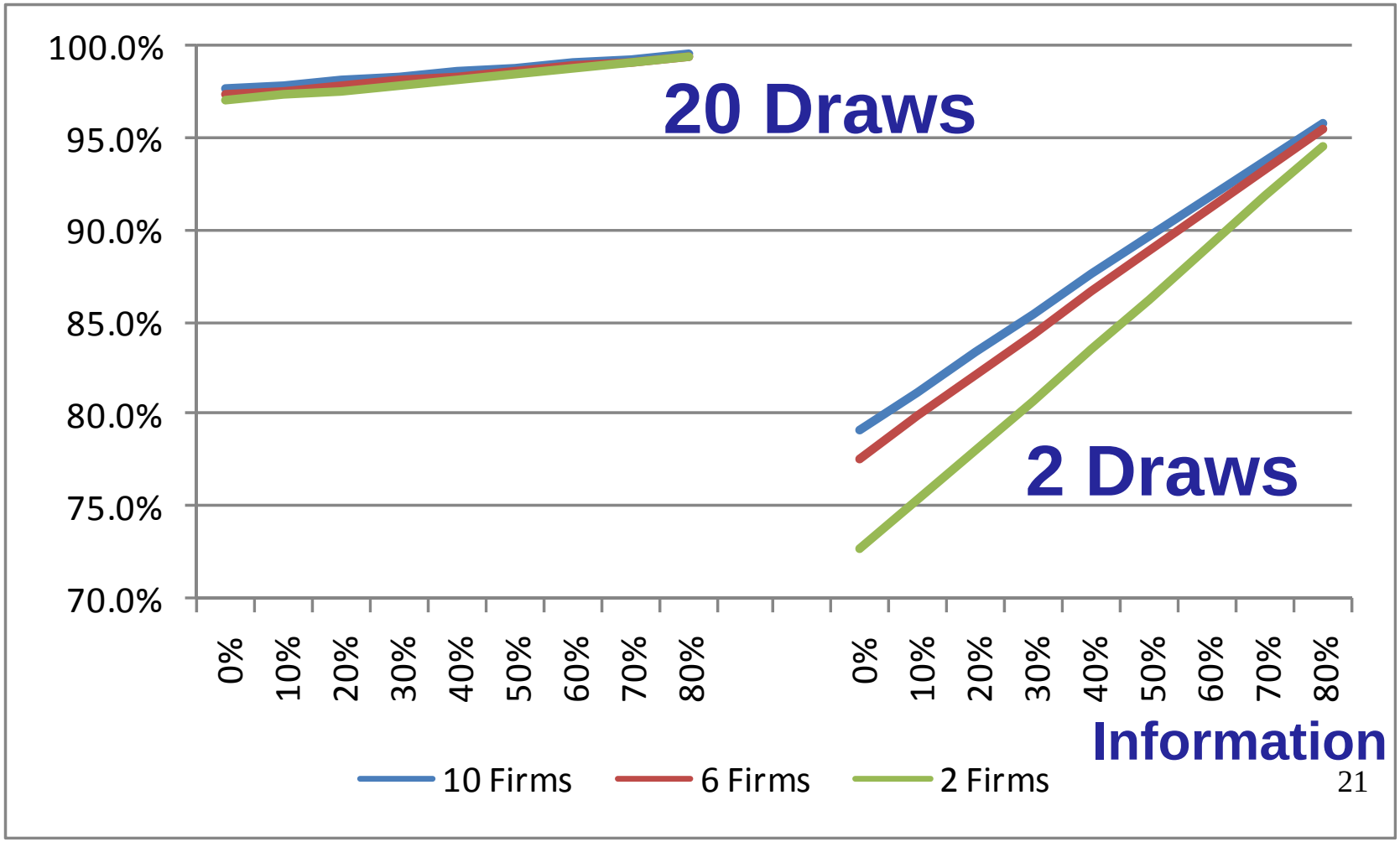
Total Surplus-% of Perfect Revelation



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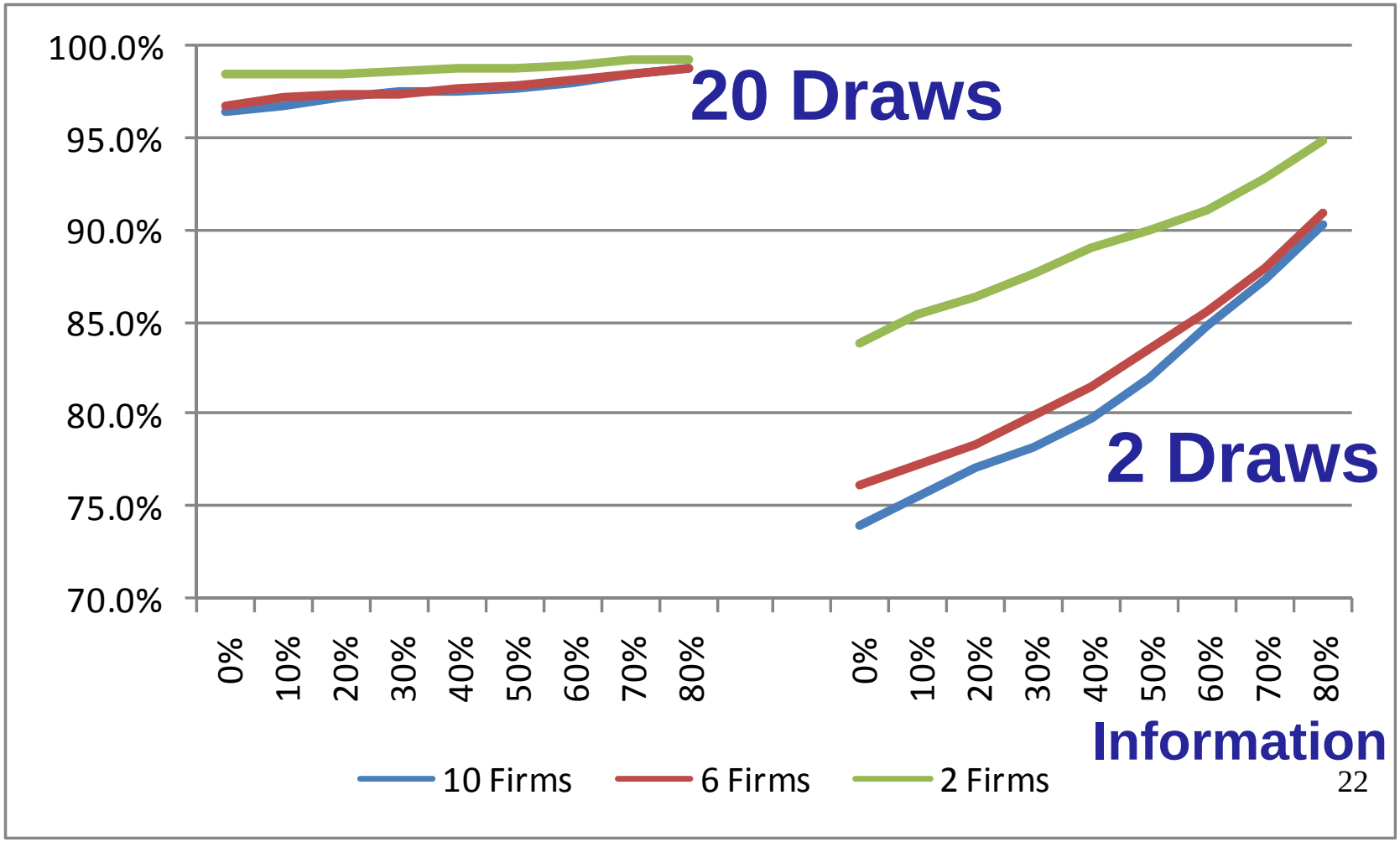
Consistency in Contractor Selection



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Implications

- If DoD doesn't know *a priori* preferences
  - Aggregate information across contractors to improve efficiency
- If DoD knows but doesn't reveal *a priori* preferences,
  - Reduces DoD surplus value
  - DoD may reject preferred contractor
  - Creates uncertainty
    - Reduces expected value of contract protest

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Future Research

- Combine decentralized information and revelation models
  - DoD's a priori knowledge varies across attributes
  - Revealed preferences can not be updated
- Model tradeoff between expected value of protest and DoD inefficiency
- Compare to alternative mechanisms to address contract protests
  - Split contracts with split based on relative value