

# **Asymmetric Information in Defense Acquisition:**

*Bid Protests and Containment Strategies*

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| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                           | Form Approved<br>OMB No. 0704-0188                  |                                 |
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# Why Information Asymmetries and Bid Protests?

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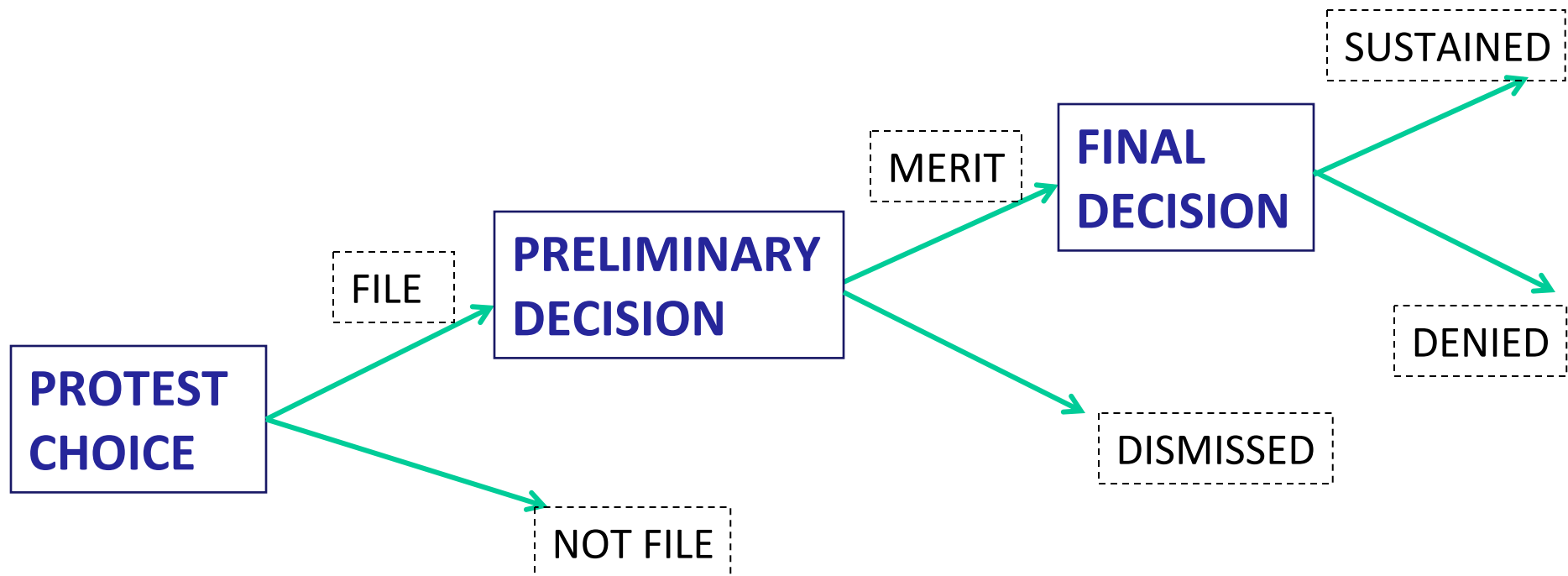
- Information Aggregation
  - Information decentralized across DoD and contractors
  - DoD should gather and aggregate information
    - Update preferences – FEAR OF PROTESTS
- Information Revelation
  - DoD has good *a priori* information
  - DoD should reveal its information to the contractors
   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

# Objectives

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- 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<sup>2</sup>A<sup>2</sup>) Mechanism
  - Centralized Information Multi-attribute Contracting Model
- Examine implications of the asymmetric information models for bid protests relative to alternative containment strategies

# BID PROTEST PROCESS



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

# Vendor (Agent) Protest Choice Problem

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

# DoD (Principal) Governance Mechanisms

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- 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

# Increase Expected Costs

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- 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



# Reduce Expected Benefits

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- 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

# Risks of Limiting Protests

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- 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

## LOGCAP IV – Evaluation

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- 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.

# Asymmetric Information in Defense Procurement

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- 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

# DoD Uncertain About Attribute Weights

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- True value of procured product/service depends on:
  - Performance along various attributes ( $A_1, A_2, A_3, \dots$ )
    - Aircraft example: Speed, maneuverability, range, reliability, etc.
  - Relative importance/weighting of each attribute ( $\alpha_1, \alpha_2, \alpha_3, \dots$ )
    - Information about appropriate weights incomplete, diffuse, and private

$\Rightarrow \text{Value} = \alpha_1 A_1 + \alpha_2 A_1 + \alpha_3 A_1 + \dots - P$
- *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

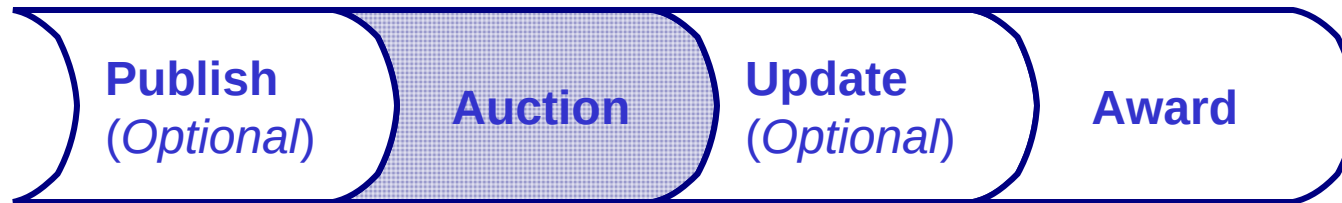
# Binomial Distribution

- 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 |

# Single Auction Alternatives

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- 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

# I<sup>2</sup>A<sup>2</sup>: Iterated Information Aggregation Auction

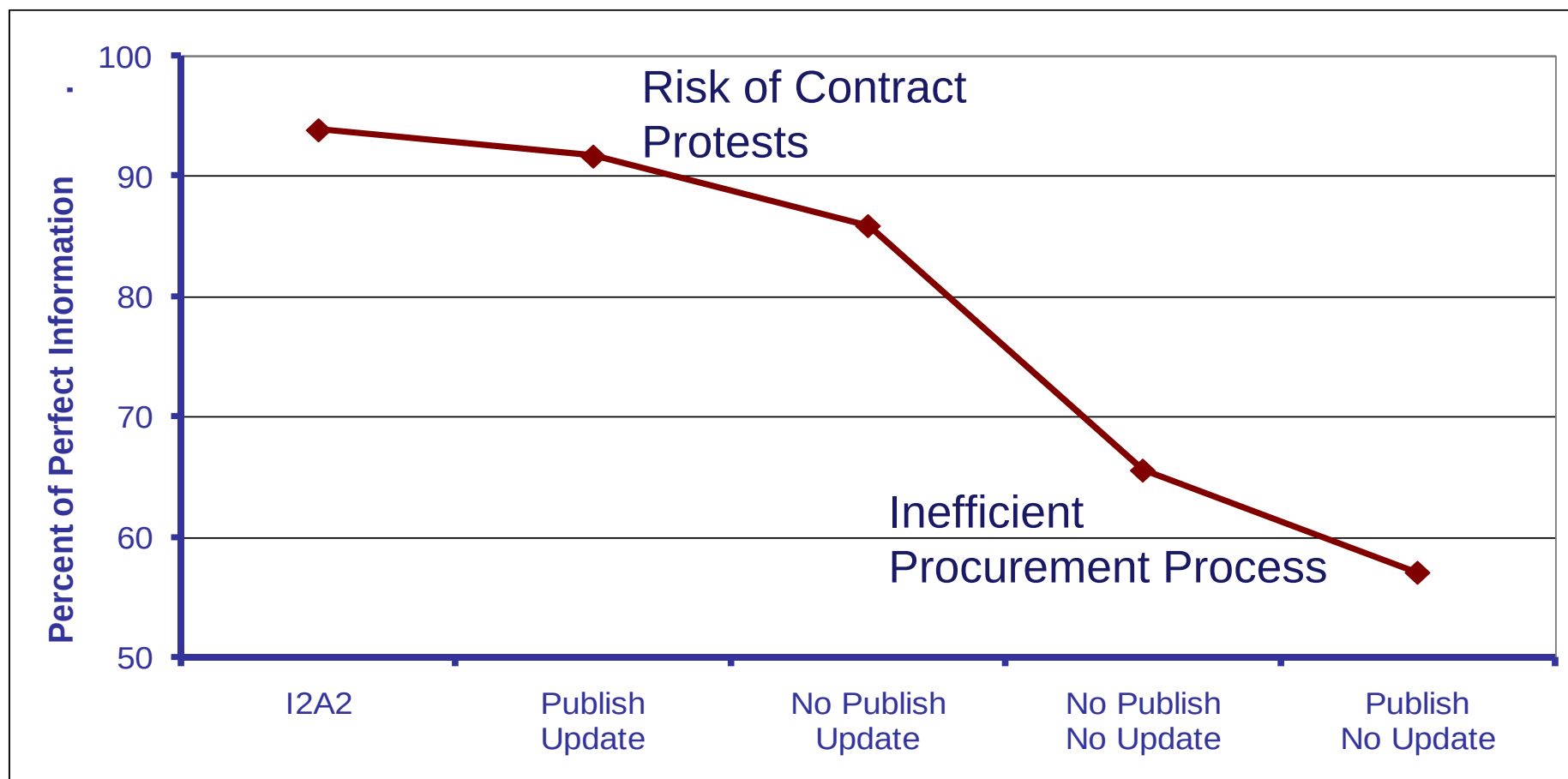
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- 1) **Initial auction:** Each contractor submits bid ( $M_1, M_2, M_3, \dots, P$ ) based on own estimates of weights ( $\alpha_1, \alpha_2, \alpha_3, \dots$ )
- 2) **Update:** DoD updates its estimates of appropriate weights based on contractor bids 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



# Mean Simulation Results



# Implications

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- 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

## *A Priori* DoD Preferences – Weights Specified(?)

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- True value of procured product/service depends on:
  - Performance along ten attributes ( $A_1, A_2, A_3, \dots, A_{10}$ )
    - Aircraft example: Speed, maneuverability, range, reliability, etc.
  - Relative importance/weighting of each attribute ( $\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_{10}$ )
    - DoD has *a priori* values for attribute weights
    - Contractor information about appropriate weights **incomplete**

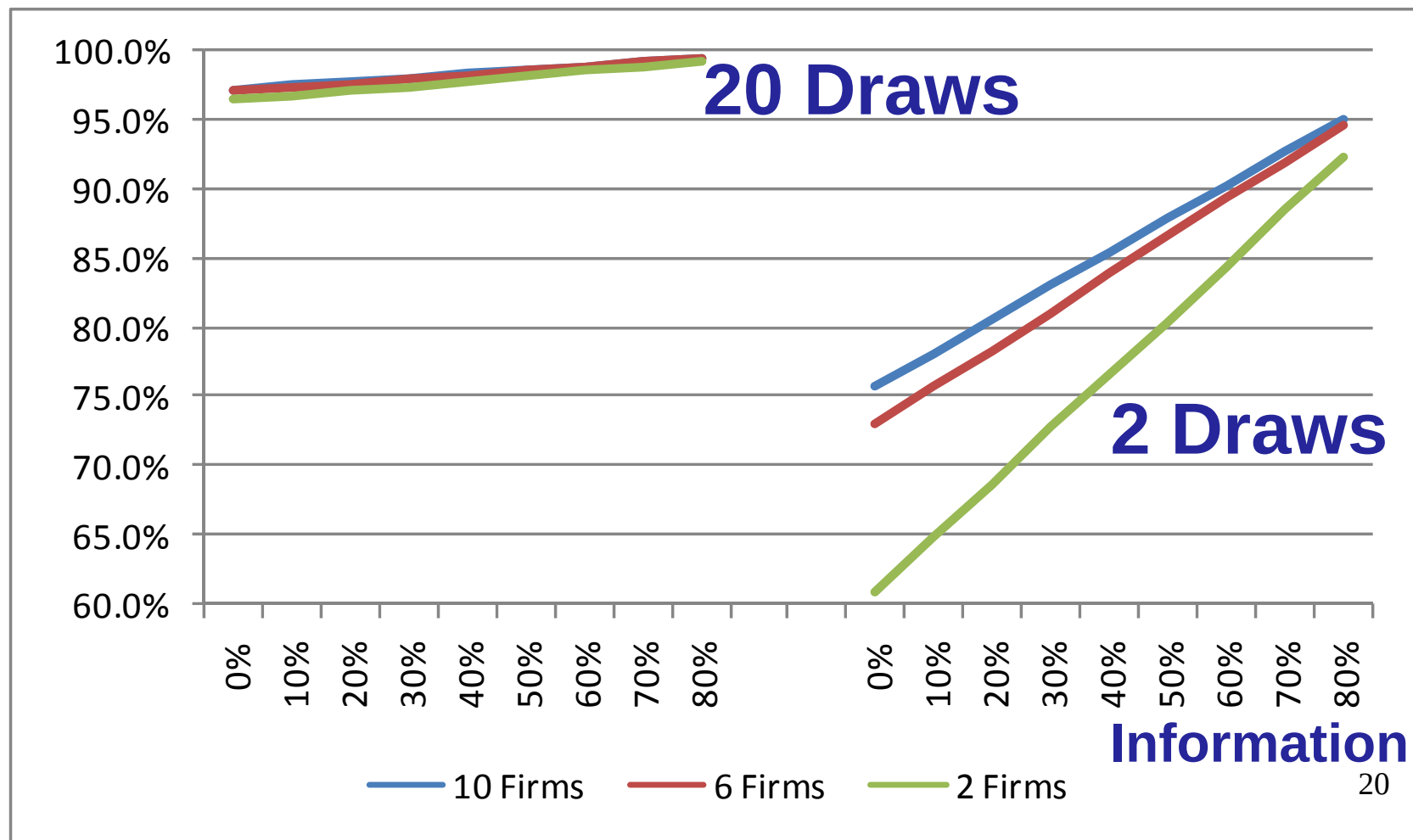
$\Rightarrow \text{Value} = \alpha_1 A_1 + \alpha_2 A_2 + \alpha_3 A_3 + \dots + \alpha_{10} A_{10} - P$
- DoD reveals weights for some/all attributes
  - Withholds information to avoid protests

# *Monte Carlo Simulation Model*

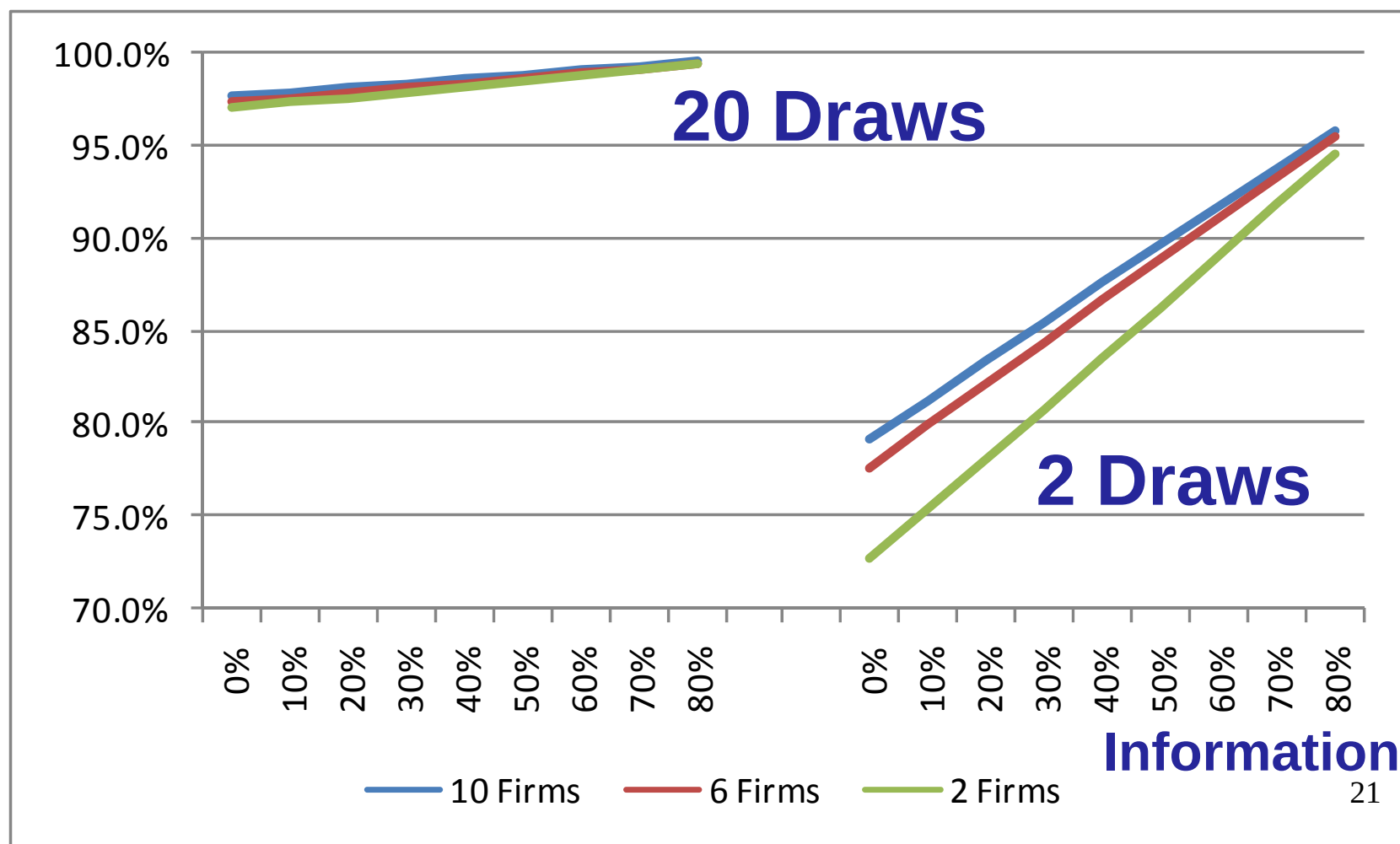
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- DoD announces 0 – 10 attribute weights
  - 0% info; 10% info; ...; 100% info (11 cases)
- Contractors choose product attributes (2, 4, 6, 8, 10 firms)
  - Imperfectly informed for unannounced attributes
    - Draws from an urn (2, 4, 6, 8, 10, 15,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

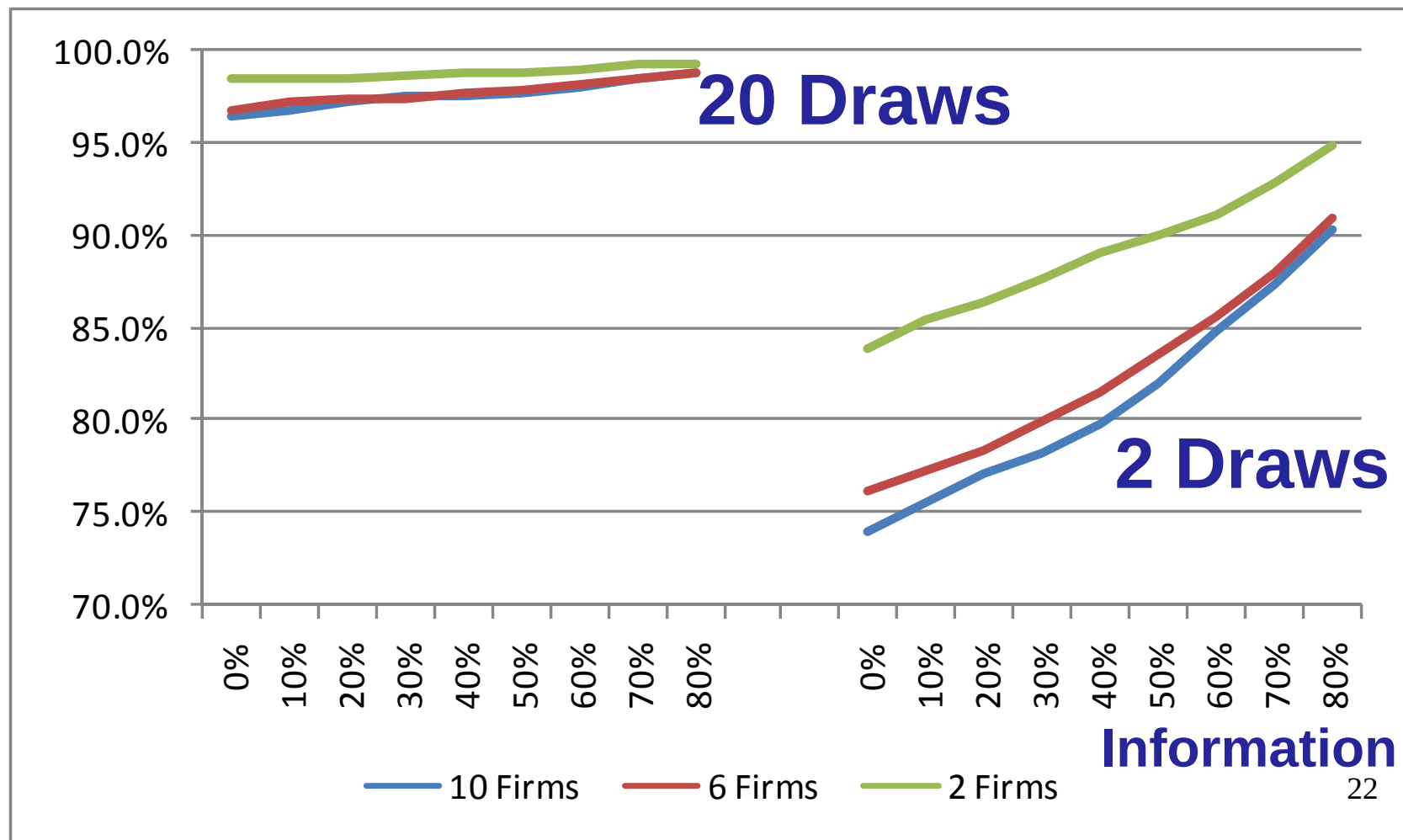
# DoD Surplus-% of Perfect Revelation



# Total Surplus-% of Perfect Revelation



# Consistency in Contractor Selection



# Implications

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- 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



# Future Research

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- 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