Popular Impact: Public Opinion and Planetary Defense Planning

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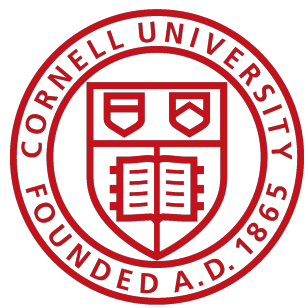


Joint work with Adi Rao, Erika Kristen Palmer, and Sarah Kreps

Motivation

What is the public's role in planetary defense?

- Previous research views the public as reactive, with little influence on planning.
  - Disaster Response: Managing public response to an actual crisis.
  - Educational Outreach: Informing the public about impact risks and planetary defense policies.
- Planners have limited information on how the public will engage with ongoing and future policies.

Puzzle

- Previous data paints a mixed picture of the public's risk assessment and matching policy preferences.
  - Survey research shows the public places asteroid impacts as nearly last in likelihood (Friedman 2018).
  - Other survey research has seen the public place planetary defense as a high priority (Funk and Strauss 2018).

Argument

- The public's preferences can be modeled as an expected utility function.
  - Expected Utility = Probability(Value of Risk Mitigated) -Cost of Mitigation + Secondary Costs/Benefits.

- Public opinion is sensitive to different types of information:
  - Probability of a disaster.
  - Effectiveness of risk mitigation methods.
  - The side-benefits and costs of investment into these methods.

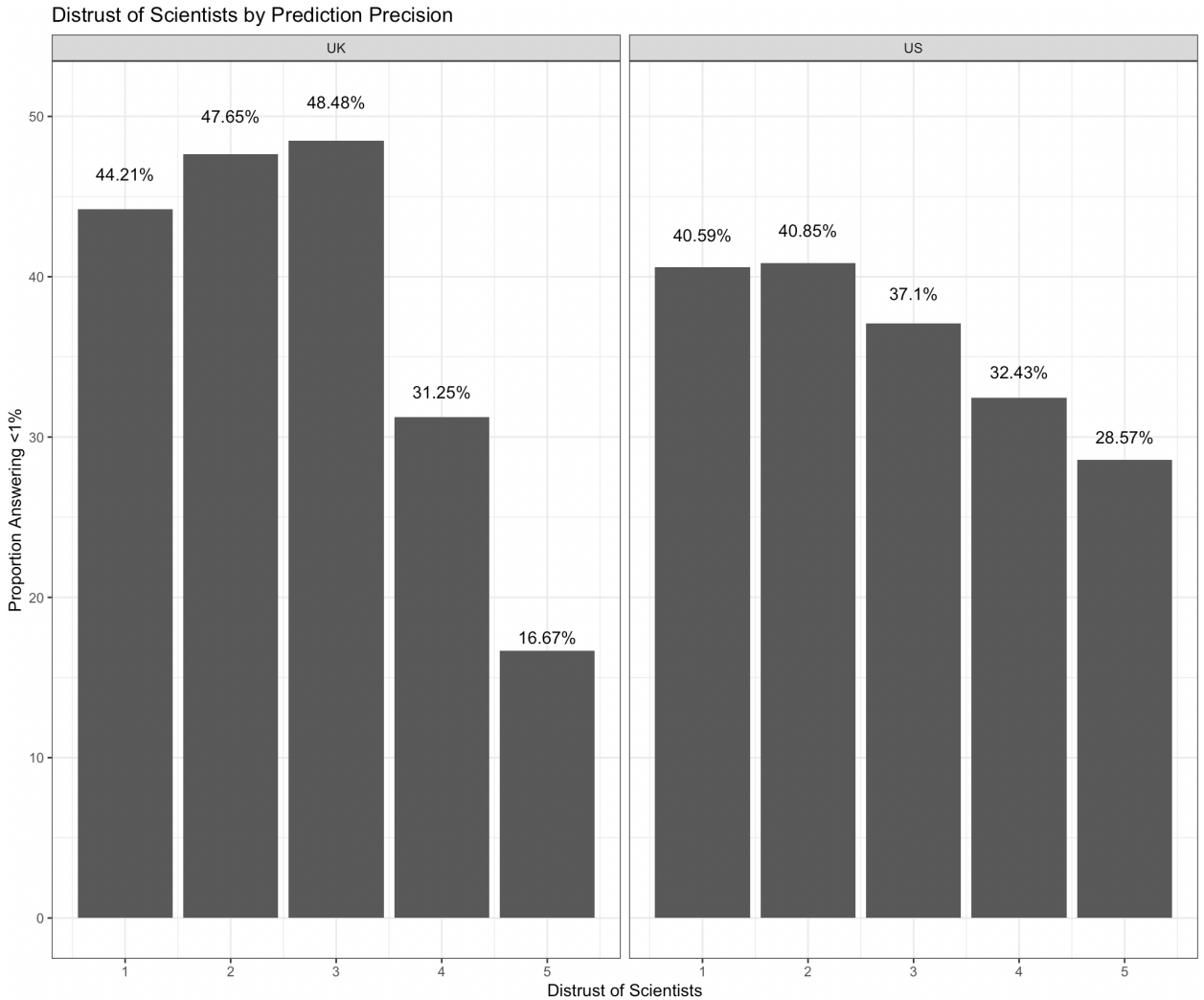
Research Methods

International Planetary Defense Survey

- Sample: N = 2,997, US and UK.
- Non-experimental Exploratory Analysis.
  - Rank sources of information about planetary defense; provide estimate of the likelihood of asteroid impact.
    - Sources: Domestic Head of State, Foreign Head of State, UN Secretary General, Scientists and Researchers, and Private Space Companies.
- Two Experiments:
  - Conjoint experiment: varies technical, political, and temporal components of hypothetical planetary defense missions.
  - Survey vignette experiment: varies economic, political, and security side-benefits or opportunity costs of investment into planetary defense.

Results: Trust and Risk Perceptions

- As trust in scientists decreases, perception of asteroid impact increases.

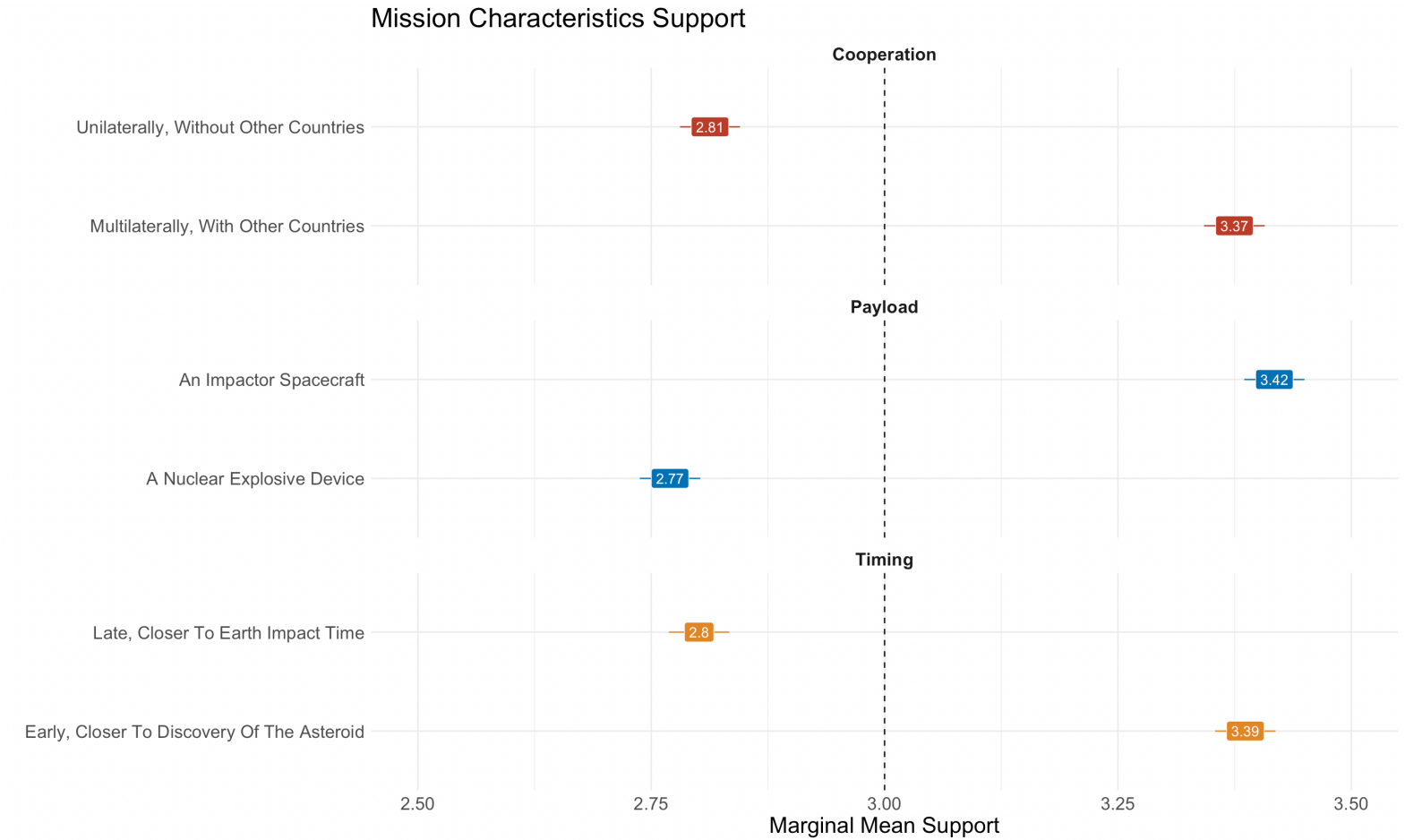


Results: Trust and Risk Perceptions

	Dependent variable:				
	Asteroid Disaster Probability	Support		Budget Change	
	(Ordered Logistic)	*(OLS)*		*(OLS; robustness)*	
	(1)	(2)	(3)	(4)	(5)
Distrust of Scientists	0.130***		-0.013		0.099
	(0.048)		(0.019)		(0.213)
Asteroid Disaster Probability		0.077***		0.533***	
		(0.011)		(0.131)	
Conservatism	0.091***	-0.025**	-0.019	0.543***	0.565***
	(0.034)	(0.013)	(0.013)	(0.148)	(0.150)
Male	-1.031***	0.169***	0.123***	-0.942***	-1.255***
	(0.072)	(0.028)	(0.027)	(0.321)	(0.313)
White	-0.459***	0.007	-0.015	-0.034	-0.169
	(0.091)	(0.036)	(0.036)	(0.412)	(0.412)
Age	-0.004*	-0.003***	-0.003***	-0.045***	-0.046***
	(0.002)	(0.001)	(0.001)	(0.010)	(0.010)
Income	-0.015	-0.002	-0.003	-0.082	-0.088
	(0.012)	(0.005)	(0.005)	(0.054)	(0.054)
Education	-0.133***	-0.001	-0.007	-0.053	-0.090
	(0.025)	(0.010)	(0.010)	(0.111)	(0.111)
Reputation	0.213***	0.083***	0.091***	0.378***	0.440***
	(0.032)	(0.012)	(0.012)	(0.142)	(0.142)
Space Priority	0.290***	0.313***	0.325***	0.192	0.282*
	(0.036)	(0.014)	(0.014)	(0.158)	(0.157)
US Sample	0.020	0.034	0.038	-0.407	-0.401
	(0.074)	(0.029)	(0.029)	(0.328)	(0.330)
Constant		1.747***	1.907***	1.610	2.486**
		(0.087)	(0.088)	(0.998)	(1.005)
Observations	2,971	2,971	2,971	2,971	2,971
R^2		0.249	0.237	0.027	0.021
Adjusted R^2		0.246	0.235	0.024	0.018
Residual Std. Error (df = 2960)		0.727	0.733	8.354	8.377
F Statistic (df = 10; 2960)		98.082***	92.081***	8.166***	6.488***
Note:					*p**p***p<0.01

Results: Mission Preferences

- Respondents prefer multilateral, early launch, kinetic impactor missions.
- Active dislike of acting unilaterally, utilizing nuclear explosives, or launching later.



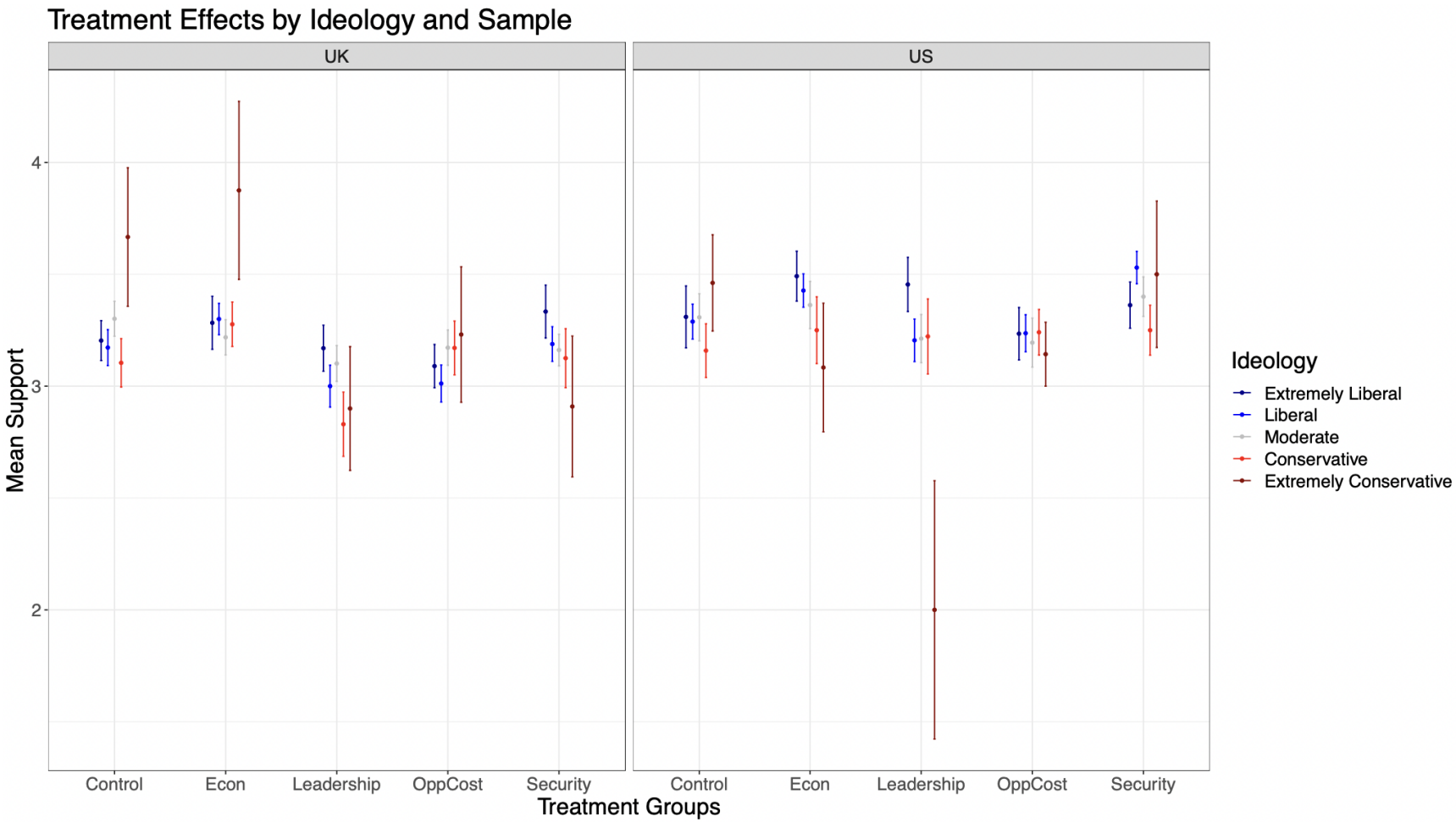
Results: Mission Preferences

	DV = Support
(Intercept)	3.991***
	(0.023)
Cooperation = Unilaterally, without other countries	-0.562***
	(0.025)
Payload = A nuclear explosive device	-0.647***
	(0.027)
Timing = Late, closer to earth impact time	-0.585***
	(0.026)
Num.Obs.	8913
R2	0.179
R2 Adj.	0.179
RMSE	1.10
Std.Errors	by: id

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001 *Note: we represent a larger* N *given each observation is presented three randomized conjoint selections.*

Results: Supplemental Benefits

- Economic development and dual-use security applications correlate with modest increases in support for higher investment.



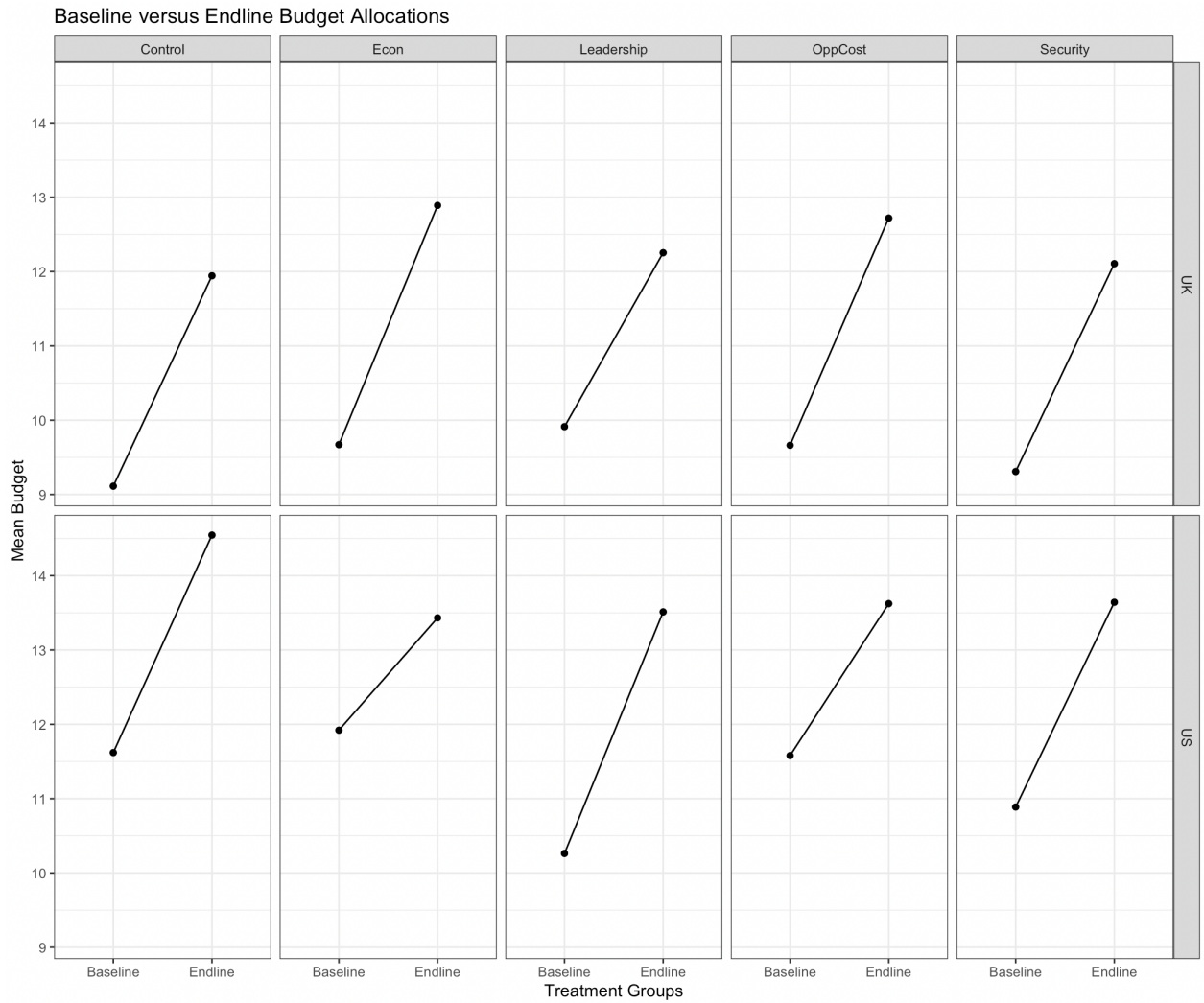
Results: Supplemental Benefits

	Treatments	With Demographics	With Space-relevant Controls
(Intercept)	3.179***	3.281***	1.915***
	(0.038)	(0.084)	(0.090)
Economic	0.083+	0.095*	0.140***
	(0.048)	(0.047)	(0.042)
Leadership	-0.112*	-0.118*	-0.054
	(0.049)	(0.049)	(0.043)
Opp. Cost	-0.082+	-0.094+	-0.029
	(0.049)	(0.048)	(0.043)
Security	0.054	0.060	0.093*
	(0.048)	(0.048)	(0.042)
US Sample	0.141***	0.148***	0.031
	(0.031)	(0.032)	(0.029)
Male		0.218***	0.105***
		(0.031)	(0.028)
White		0.047	-0.028
		(0.040)	(0.036)
Age		-0.003**	-0.004***
		(0.001)	(0.001)
Income		-0.002	-0.002
		(0.005)	(0.005)
Education		-0.009	-0.012
		(0.011)	(0.010)
Party		-0.033*	-0.017
		(0.015)	(0.013)
Reputation			0.093***
			(0.012)
DART			0.149***
			(0.031)
Space Priority			0.314***
			(0.014)
Num.Obs.	2971	2971	2971
R2	0.015	0.037	0.251
R2 Adj.	0.014	0.034	0.247
AIC	7345.0	7289.9	6551.5
BIC	7387.0	7367.9	6647.4
Log.Lik.	-3665.516	-3631.971	-3259.728
F	9.246	10.434	70.650
RMSE	0.83	0.82	0.72

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Results: Budget Change

- Respondents allocate an average of 3 percent more to planetary defense at the end of the survey.



Conclusions

- The public supports investment in planetary defense despite it being a "Black Swan" event.
- The public has strong preferences for the characteristics of a deflection mission.
- Budget allocations increase with information, so education and informational outreach can enhance public support.

Thank you!

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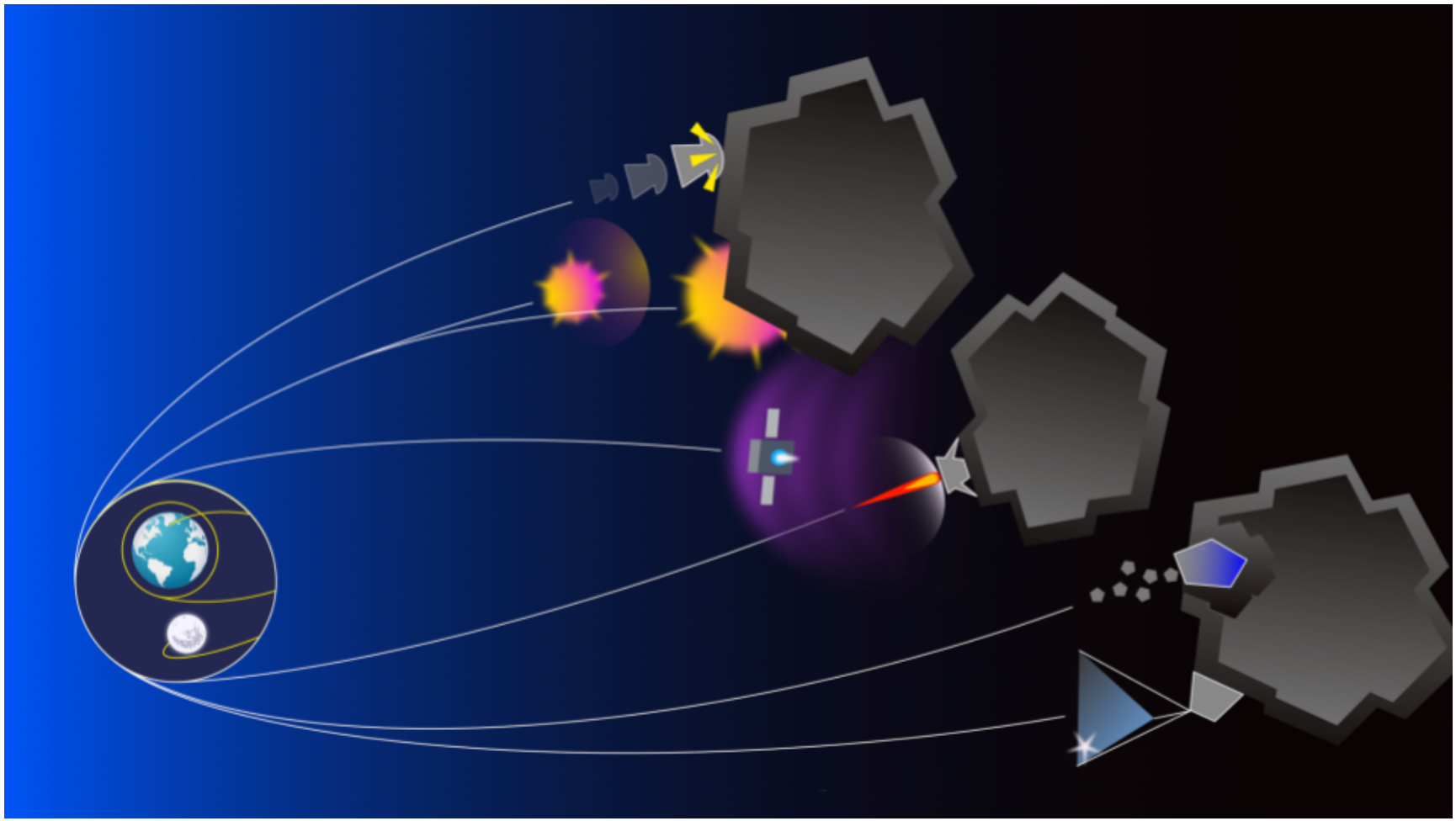
Questions?



References

Priorities for preventive action: Explaining Americans' divergent reactions to 100 public risks.

Friedman, Jeffrey A.

American Journal of Political Science 63.1, 2019.

Majority of Americans believe it is essential that the US remain a global leader in space.

Cary Funk and Mark Strauss.

Pew Research Center, 2018.