Psychological Elements of How Individuals Receive Information – Can You Shift Their Thinking?

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Research Introduction

Behavioral Economics

Combines elements from psychology and economics to understand personal and interpersonal factors influencing consumer decisions.

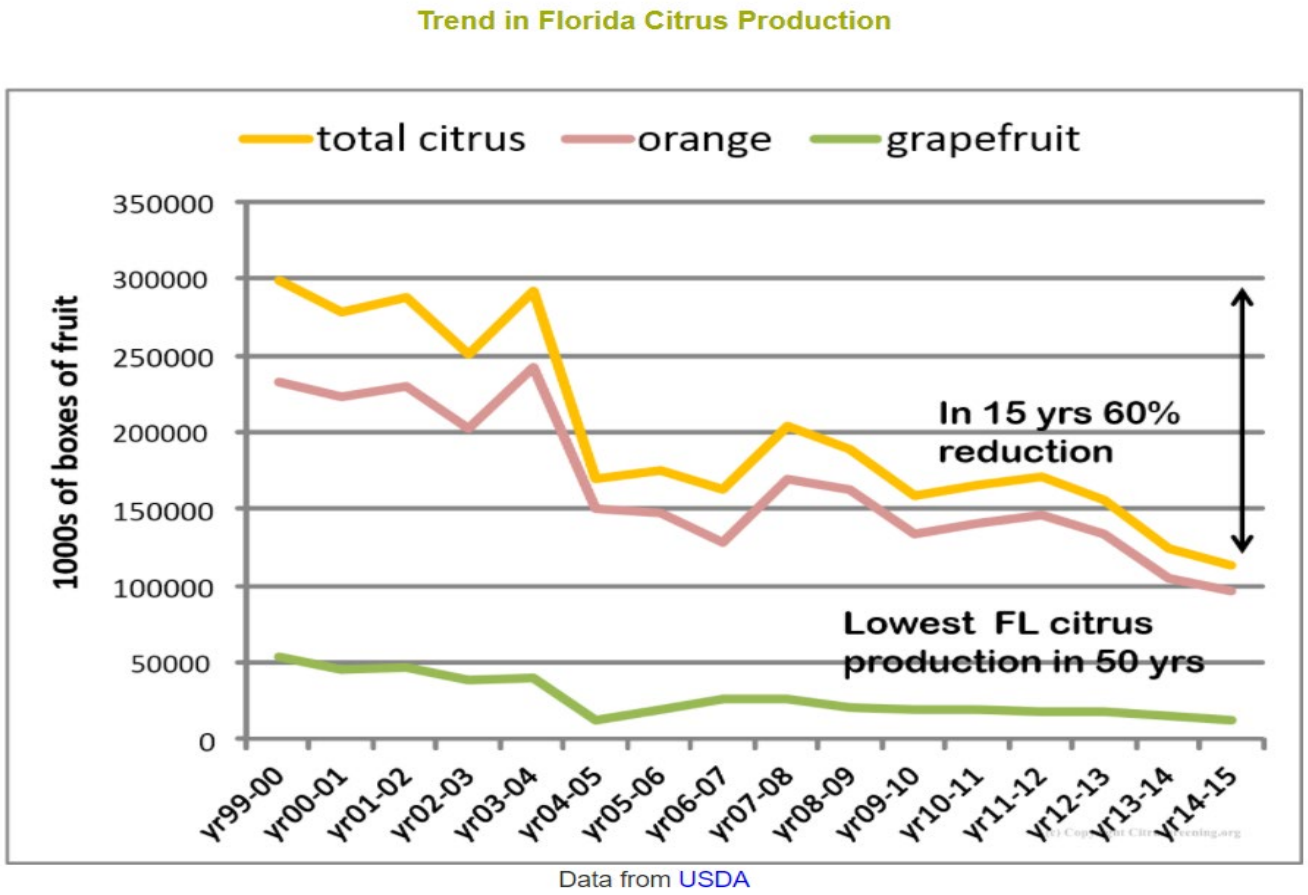
Neuro-Economics

Combines additional insights from neuroscience to delve into the neurobehavioral mechanisms responsible for individual decisions and reactions.

Examples of Previous Work

1. Fine-tuning willingness-to-pay estimates in second price auctions
2. Incorporating biometric data in models of consumer choice
3. Nudging higher responsiveness to prevention practices during COVID-19
4. Demand for healthy snacks in US varies by product, health benefit, and color
5. Consumer awareness of country-of-origin labeling
6. Influence of health and environmental information on consumer preferences for goat meat
7. The role of political framing in information provision to promote preferences for local foods
8. Beef: It's what's for dinner, with a bit of seaweed for sustainability

Background


Trend in Florida Citrus Production
total citrus
orange
grapefruit
1000s of boxes of fruit
350000
300000
250000
200000
150000
100000
50000
0
In 15 yrs 60% reduction
Lowest FL citrus production in 50 yrs
yr99-00
yr00-01
yr01-02
yr02-03
yr03-04
yr04-05
yr05-06
yr06-07
yr07-08
yr08-09
yr09-10
yr10-11
yr11-12
yr12-13
yr13-14
yr14-15
Data from USDA

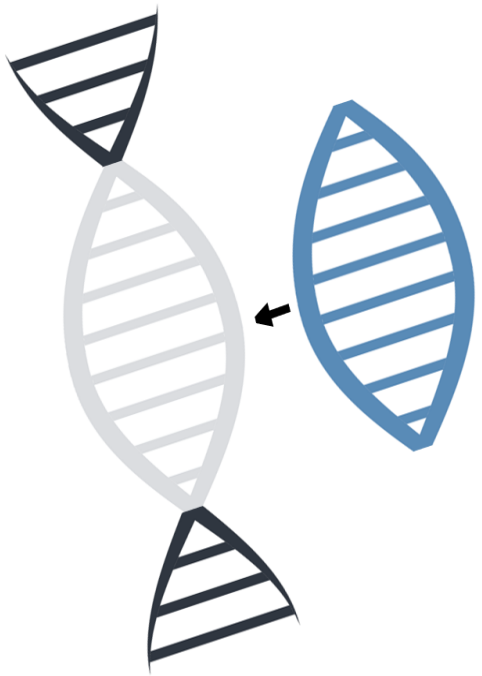

UGA0656076

Background Cont.

- Gene-editing identified to have promising applications in providing solutions for major agricultural challenges

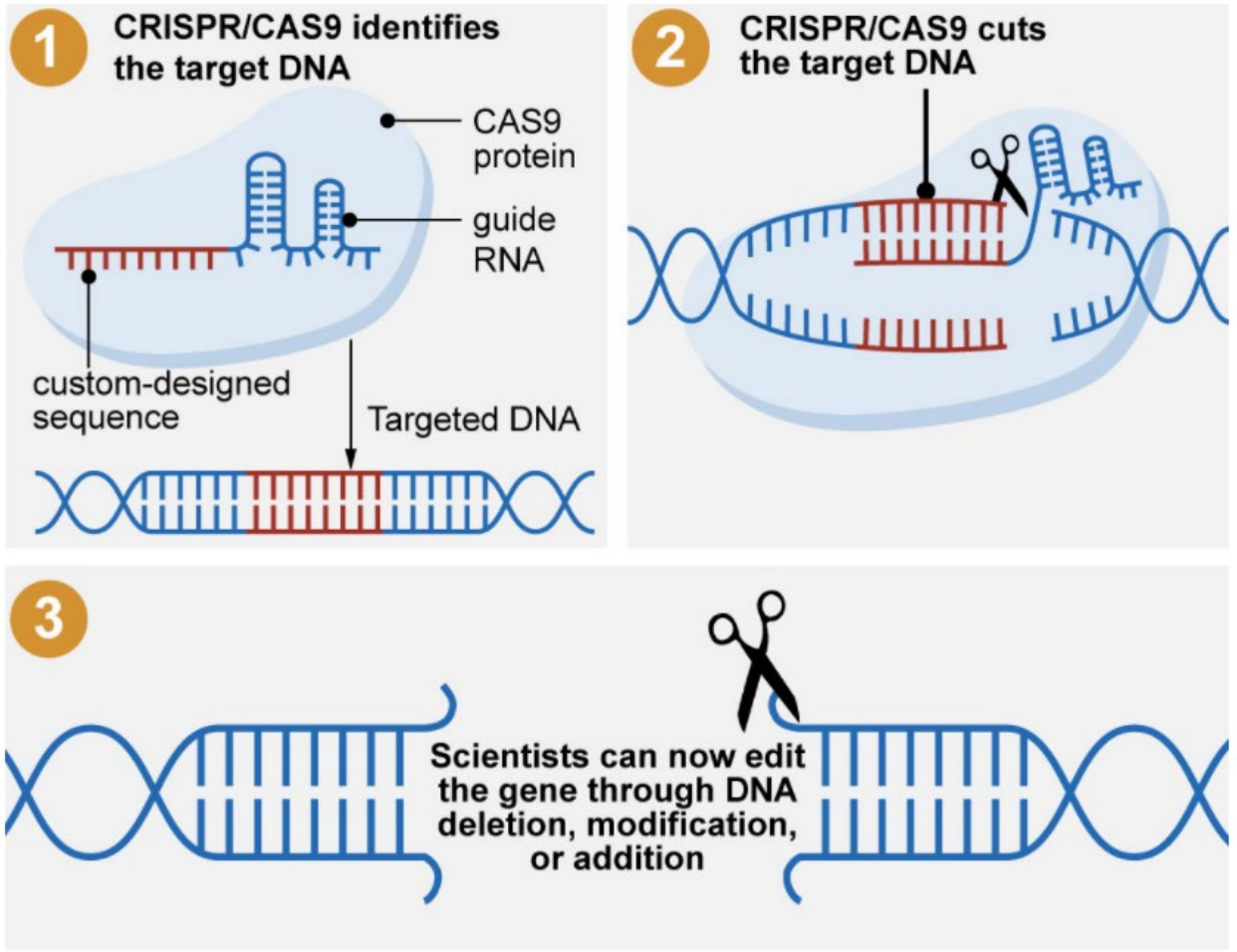
GMOs

Technique: a foreign gene is inserted into the DNA strand.



CRSPR gene editing

Technique: gene is cut and its DNA is modified.



Background Cont.

Combating HLB with gene editing

Identification of HLB Susceptibility Genes in a Citrus Population Generated using Multiplexed CRISPR/Cas9 Gene Editing

Yale USDA

Objectives

1. The influence of psychological/behavioral traits on consumer acceptance of gene editing in orange juice

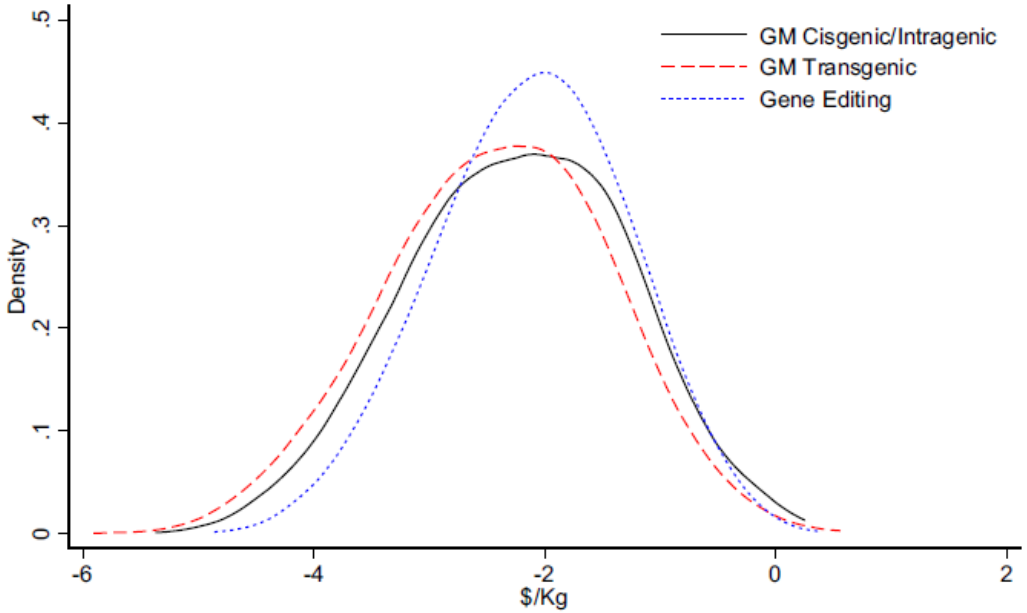
2. The effects of information framing on consumer preferences for CRISPR

3. The effects of misinformation interventions on consumer acceptance of food biotechnology

Consumer Preferences for Gene editing: The Influence of Risk and Behavioral Traits

Motivation

- Thin GE literature so far show potential for higher acceptance than GMO



Distribution of individual WTP for breeding technologies

Source: Muringai et al., (2019)

Motivation Cont.

- Focus has been on
  - Influence of information (Caputo et al., 2021)
  - Food safety perceptions (Uddin et al., 2021)
  - Aversion to novel technology (Ortega et al., 2022)
  - Beliefs (Caputo et al., 2021)

- This study focuses on
  - Investigating WTP for GE orange juice
  - Exploring the influence of risk preference/perception, time preference and ambiguity tolerance on WTP

Materials and Methods

- Data collection
  - Online survey of 1796 U.S orange juice consumers
    - Risk preference and perception
      - BSS Scale
      - Risk perception scale
    - Ambiguity tolerance
      - MSTAT-II scale
    - Time preference
      - CFC scale

Materials and Methods Cont.

Choice experiment parameters

Attributes	Number of levels	Levels
Price ($/52-59oz pack)	4	$3.00, $3.75, $4.50, $5.25
Consistency	2	With pulp, Without pulp
Origin	2	Florida, Imported
Method	3	Conventional, GMO, CRISPR

Example choice set

	Option A	Option B	Option C	Option D
Consistency	With pulp	No pulp	No pulp	I will not choose any option
Origin	FL	FL	Imported	
Method	CRISPR	Conventional	GMO	
Price	$3.75	$3.00	$4.50	

Results

Mixed Logit Model Results

	Coefficient	WTP
Means		
Price	-0.311*** (0.014)	
None	-1.639*** (0.066)	
No pulp	0.351*** (0.026)	$1.13
Florida	0.752*** (0.026)	$2.42
Genetic editing (CRISPR)	-0.525*** (0.028)	-$1.69
Genetic modification	-0.923*** (0.037)	-$2.97
Standard deviations		
No pulp	1.339*** (0.042)	
Florida	0.814*** (0.041)	
Genetic editing (CRISPR)	0.664*** (0.048)	
Genetic modification	1.014*** (0.054)	

Results Cont.

Linear Regression Results

Dependent variable – Individual WTP estimates for gene-editing	Coefficients
Intercept	-0.505* (0.300)
Ambiguity tolerance	-0.084** (0.040)
Risk perception	-0.184*** (0.036)
Risk preference (risk seeking)	0.036*** (0.012)
GE familiarity	0.007 (0.025)
Time preference (future-oriented)	-0.069* (0.041)
Objective knowledge	-0.080 (0.075)
Opinion about biotechnology benefits	0.136** (0.060)
General trust	0.011 (0.038)
Demographics	Yes

Results Cont.

Latent Class Analysis

	Class 1 (Florida OJ seekers)	Class 2 (No-pulp consumers)	Class 3 (Price insensitive shoppers)	Class 4 (Habitual OJ purchasers)
Price	-0.455*** (0.052)	-1.072*** (0.066)	0.331*** (0.024)	-0.922*** (0.040)
No product	1.110*** (0.241)	-2.697*** (0.310)	-0.845*** (0.147)	-5.456*** (0.175)
No pulp	1.541*** (0.116)	3.885*** (0.230)	-0.047 (0.038)	-0.660*** (0.056)
Florida	2.346*** (0.110)	0.089 (0.125)	0.359*** (0.039)	1.169*** (0.067)
Genetic editing (CRISPR)	-0.964*** (0.085)	-0.334*** (0.113)	-0.074* (0.044)	-1.330*** (0.076)
Genetic modification	-2.002*** (0.129)	-0.665*** (0.130)	-0.240*** (0.046)	-1.154*** (0.070)
Class share	0.216	0.168	0.323	0.294

Discussion/Conclusion

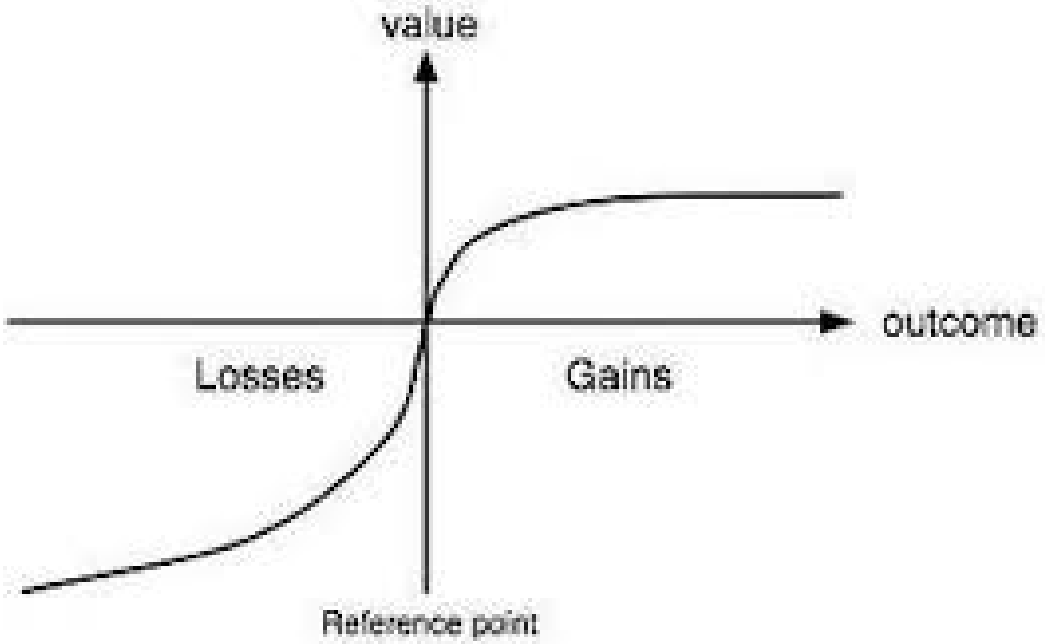
- Strong demand for FL orange juice encouraging for FL citrus industry
- CRISPR products have potential to perform better in the marketplace than GM products
- Various behavioral and demographic characteristics correlated with WTP
- Four distinct groups with significant differences in preferences
- Compared to *Habitual OJ Purchasers* (reference class);
- *Florida OJ seekers* - older, female, more risk averse, higher tolerance for ambiguity

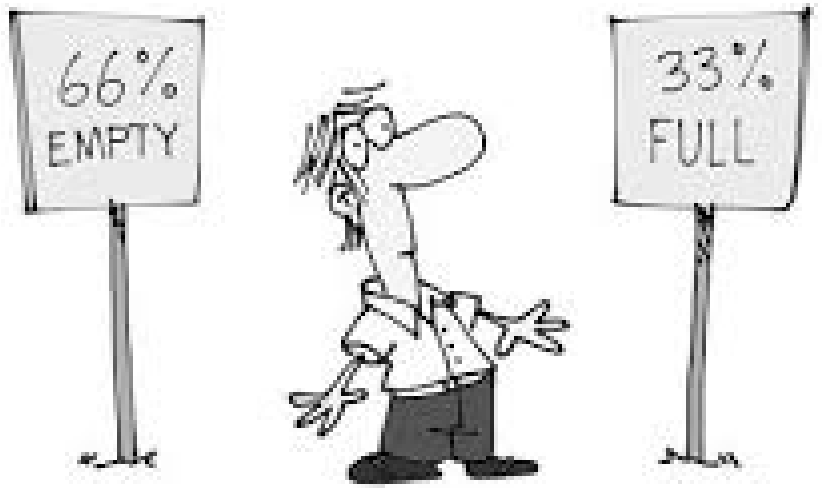
Discussion/Conclusion

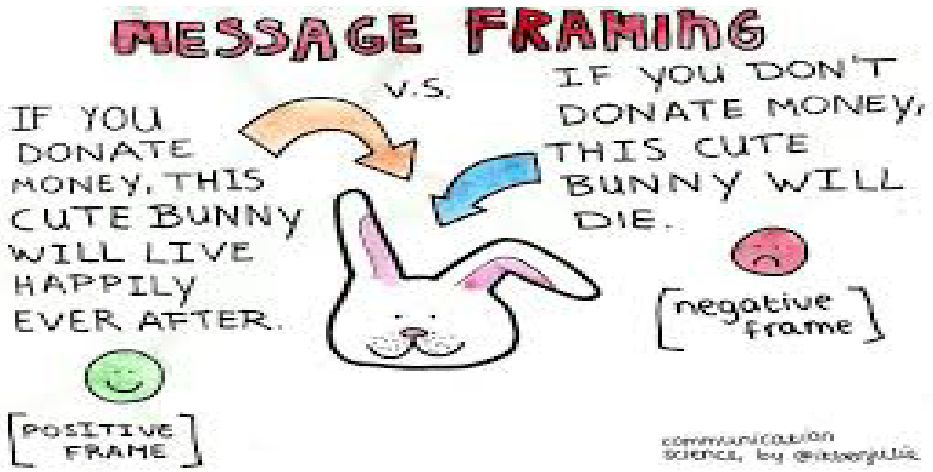
- *No-Pulp Consumers* - less familiar with GE, younger, female and less concerned about OJ health benefits
- *Price-Insensitive shoppers* - higher household income, pay attention to OJ health benefits, risk-seeking, familiar with GE, younger
- Results useful for targeted educational campaigns

The Influence of Framing Effects on Consumer Preferences for Gene Editing

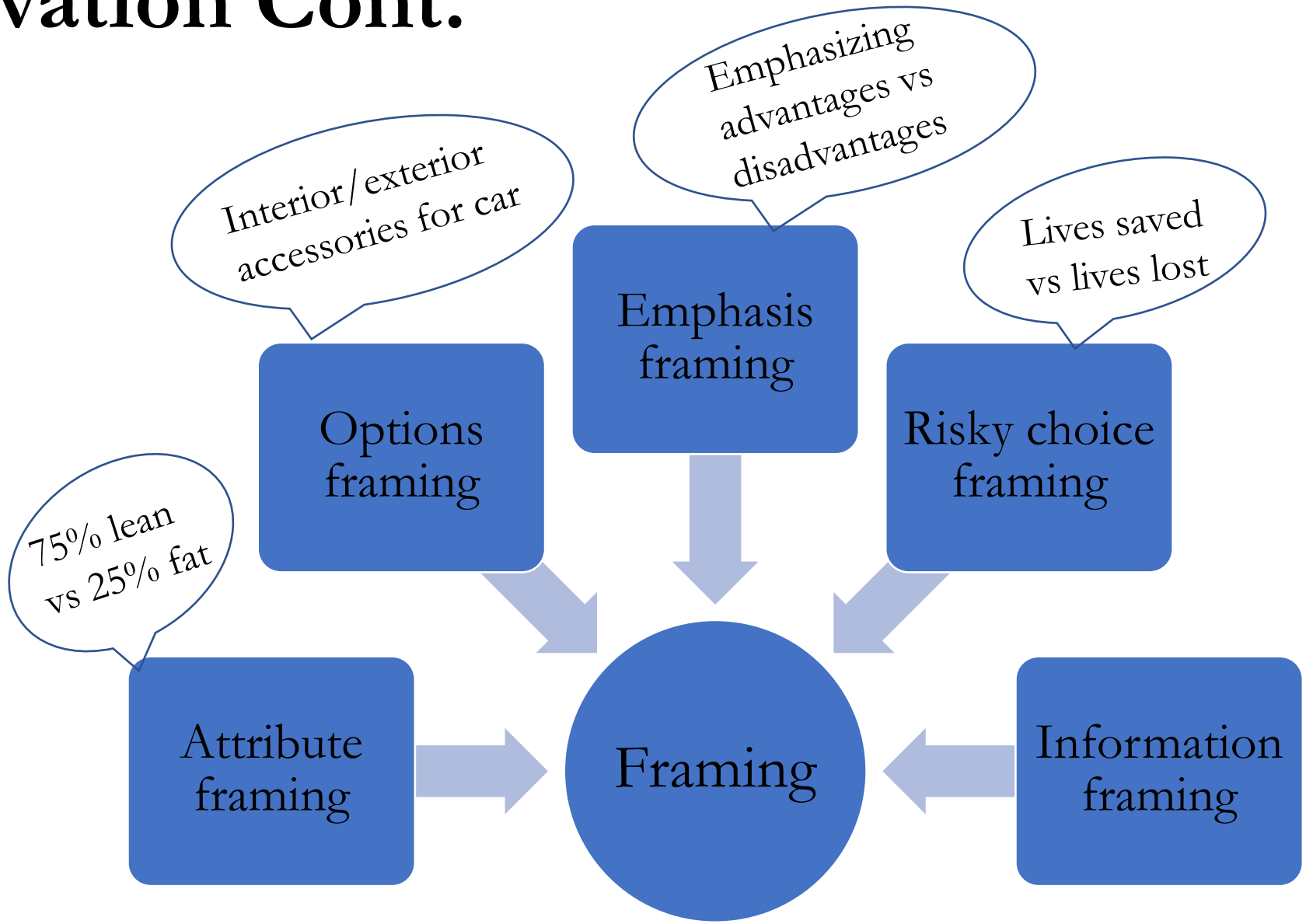
Motivation


value
outcome
Losses
Gains
Reference point


66% EMPTY
33% FULL


MESSAGE FRAMING
V.S.
IF YOU DONATE MONEY, THIS CUTE BUNNY WILL LIVE HAPPILY EVER AFTER.
IF YOU DON'T DONATE MONEY, THIS CUTE BUNNY WILL DIE.
[POSITIVE FRAME]
[negative frame]

Motivation Cont.



Motivation Cont.

- Previous info treatments in CRISPR studies
  - Benefits, primary beneficiaries, description of methods, format of info, etc (Colson et al., 2011; Caputo et al., 2020; Gotz et al., 2022; Hu et al., 2022; Shew et al., 2018)
  - Results show improvement in attitudes, dependent on type of info
- Which message frames are most effective in boosting CRISPR acceptance?
- Previous positive/negative info studies in food biotechnology (Anand et al., 2007; Colson et al., 2011; Depositario et al., 2009; Weir et al., 2021).
  - Positive info = benefits, negative info = risks

Objectives

- This study frames CRISPR benefits positively or negatively without changing meaning
  - Message is identical in both frames
- This study focuses on
  - Investigating consumers' preference and willingness-to-pay (WTP) for CRISPR orange juice
  - Analyzing the impacts of information framing on WTP

Methodology

Data collection

- Online survey (n=1929)
- Survey content
  - Orange juice consumption
  - Information frames
  - Valuation of orange juice products
  - Behavioral questions
  - Demographics
- Treatments – Control (no info), Positive frame, Negative frame

Methodology (Cont.)

- Positive frame

Please read through the following information carefully

CRISPR biotechnology - Food biotechnology is an umbrella term covering a variety of processes to develop new or improved food products. CRISPR is a food biotechnology method that acts like a scissors to cut and edit existing DNA within a plant.

Some of the benefits of this technology are:

1. CRISPR can increase food production, thereby reducing world hunger.
2. CRISPR can reduce the need for the application of pesticides and other agro-chemicals.
3. CRISPR can significantly increase the quality and attractiveness of food products
4. CRISPR can provide a solution to incurable diseases, thereby reducing the financial burdens on farmers

Methodology (Cont.)

- Negative frame

Please read through the following information carefully

CRISPR biotechnology - Food biotechnology is an umbrella term covering a variety of processes to develop new or improved food products. CRISPR is a food biotechnology method that acts like a scissors to cut and edit existing DNA within a plant.

Some of the disadvantages of not using this technology are:

1. Not using CRISPR can result in continued shortage of food, especially for people that need it the most
2. Not using CRISPR can result in more application of pesticides and other agro-chemicals, leading to further degradation of the environment
3. Not using CRISPR can lead to significant reductions in the quality of food products
4. Not using CRISPR can lead to worsening of plant diseases, thereby significantly increasing financial burdens on farmers

Methodology (Cont.)

Choice experiment parameters

Attributes	Number of levels	Levels
Price ($/52-59oz pack)	4	$3.00, $3.75, $4.50, $5.25
Consistency	2	With pulp, Without pulp
Origin	3	Florida, California, Imported
Method	2	Conventional, CRISPR

Example choice set

	Option A	Option B	Option C	Option D
Consistency	With pulp	No pulp	No pulp	I will not choose any option
Origin	FL	FL	Imported	
Method	CRISPR	Conventional	GMO	
Price	$3.75	$3.00	$4.50	

Results (Cont.)

Comparisons of WTP Between Treatments

	Control (n=654)	Positive group (n=620)	Negative group (n=655)	Positive vs Control$^{\Psi}$	Negative vs Control$^{\Psi}$	Positive vs Negative$^{\Psi}$
				p value	p value	p value
No pulp	$1.15 [0.99, 1.30]	$0.65 [0.51, 0.79]	$1.10 [0.94, 1.28]	0.999	0.652	0.999
Florida	$1.44 [1.27, 1.60]	$1.17 [0.99, 1.33]	$1.49 [1.29, 1.69]	0.988	0.328	0.993
California	$1.06 [0.89, 1.20]	$1.02 [0.86, 1.16]	$1.17 [0.97, 1.34]	0.622	0.194	0.874
CRISPR	-$0.65 [-0.78, -0.49]	-$0.30 [-0.44, -0.16]	-$0.50 [-0.66, -0.33]	0.000	0.095	0.034

Results (Cont.)

Linear Regression Results

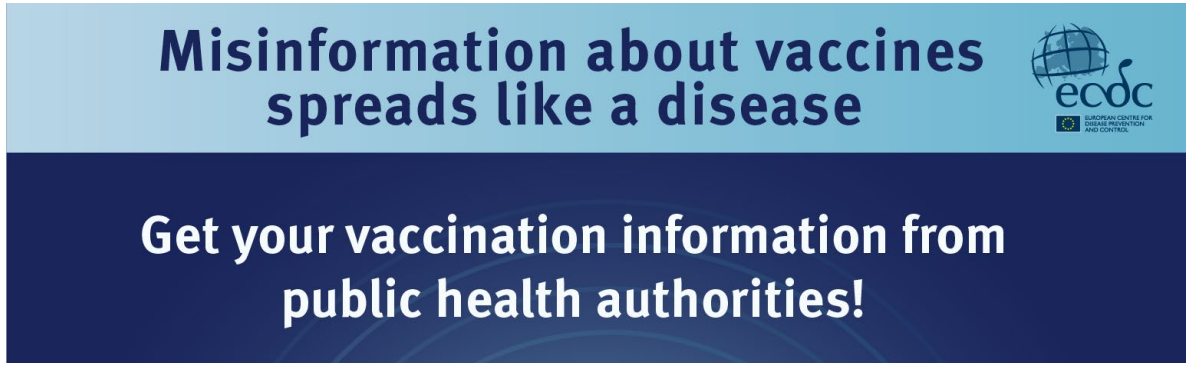
Explanatory variables	Dependent variable = Willingness to pay for CRISPR attribute Coefficients
Intercept	-0.958*** (0.264)
Positive frame group	0.193** (0.088)
Negative frame group	0.134 (0.089)
Perceived importance of production method attribute to choice	-0.296*** (0.031)
Openness to Technology	0.343*** (0.055)
Identification as Foodie	0.132*** (0.049)
Subjective knowledge of CRISPR	0.131*** (0.035)
Objective knowledge of CRISPR	-0.142 (0.091)
Opinion about CRISPR benefits	0.309*** (0.079)
Demographics	Yes

Main take-aways

- Educational campaigns significantly influence WTP
- Positive framing is more effective than negative framing
  - Can be an effective nudge in food marketing
- Technology-friendly individuals and those that identify as 'foodies' are more likely to accept CRISPR
- Familiarity with CRISPR and its benefits should be increased
- Educational and marketing campaigns should especially target older females

How Effective are Debunking Strategies? A Study on Misinformation in Food Biotechnology

Motivation



Misinformation, Fake News, and Political Propaganda

Become your own "fact checker"

The New York Times

A Genocide Incited on Facebook, With Posts From Myanmar's Military

Motivation Cont.

The Atlantic

POLITICS | BUSINESS | TECH | ENTERTAINMENT | HEALTH | EDUCATION | SEXES

JUST IN Caffeine 'Addiction': A Tortured Love EVEN

The Devastation of Super-Typhoon Haiyan

By Alan Taylor

Should Food Stamps Buy Soda?

By Olga Khazan

The Very Real Danger of Genetically Modified Foods

ARI LEVAUX | JAN 9 2012, 7:57 AM ET

New research shows that when we eat we're consuming more than just vitamins and protein. Our bodies are absorbing information, or microRNA.

Motivation Cont.

- Corrective messages to combat misinformation
  - Effectiveness varies across context
- Information communication to fight GM safety misconceptions
  - Studies have focused mainly on info about benefits, potential risks (Colson & Huffman, 2011; Depositario et al., 2009; Rousu et al., 2002; Valente & Chaves, 2018; Weir et al., 2021)
- Incorporating misinformation interventions is important
- This study investigates
  - The impact of various debunking interventions on consumers' perception of GM safety
  - How these interventions affect consumers' WTP for non-GM label

Methodology

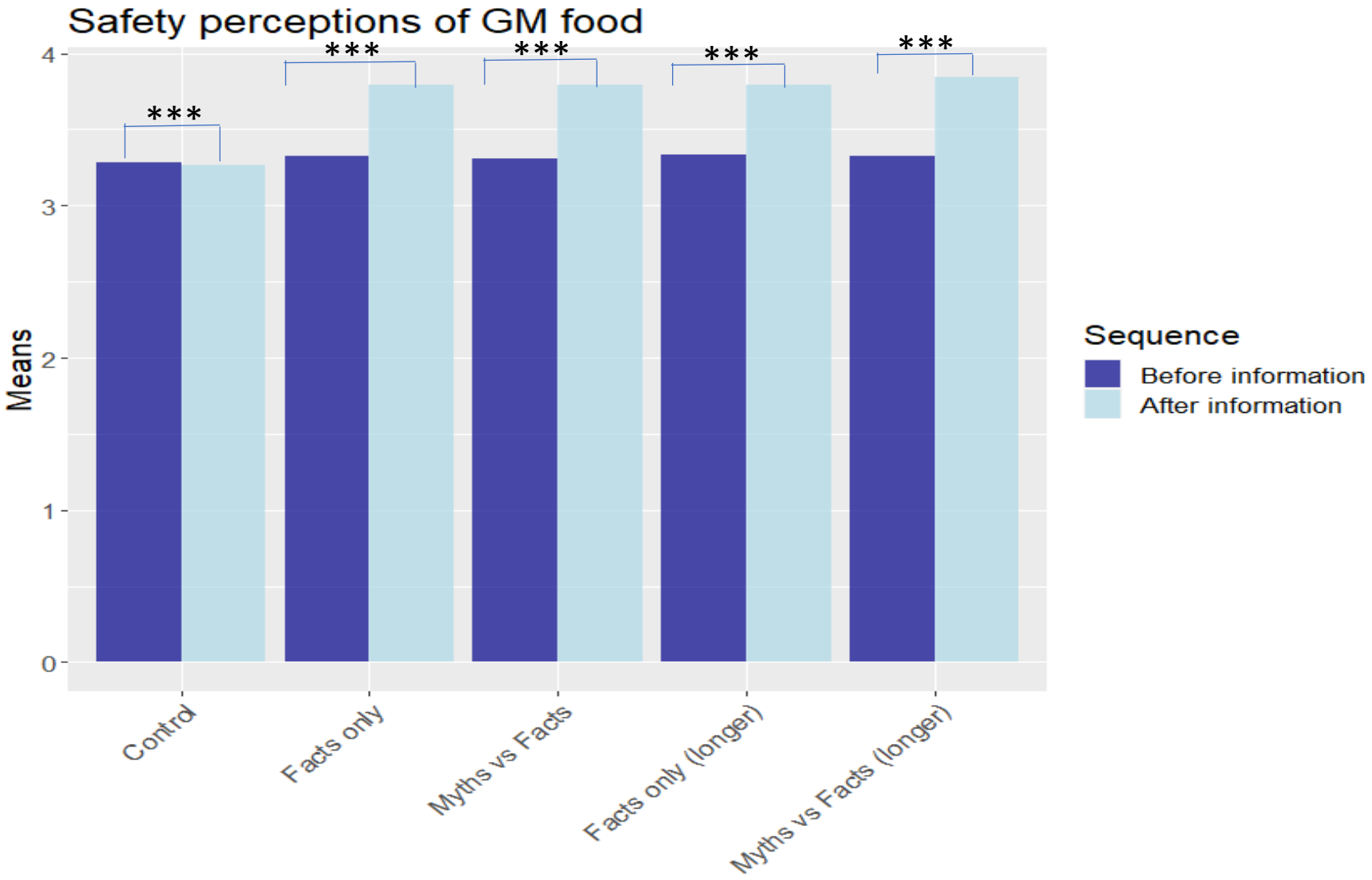
- Online survey of 1799 U.S orange juice consumers
- Respondents randomized into 1 of 5 treatment groups
  - Control (no information)
  - Facts
  - Myths vs Facts
  - Facts (longer)
  - Myths vs Facts (longer)

Methodology Cont.

Choice experiment parameters

Attributes	Number of levels	Levels
Price ($/52-59oz pack)	4	$3.00, $3.75, $4.50, $5.25
Pulp	2	With pulp, Without pulp
Made in USA	2	Present, Absent
Non-GMO	2	Present, Absent

Results


Safety perceptions of GM food
Means
4
3
2
1
0
***
***
***
***
***
Contrd
Facts only
Myths vs Facts
Facts only (longer)
Myths vs Facts (longer)
Sequence
Before information
After information

Results Cont.

Comparison of WTP Between Treatments

	Control group	Facts Only group	Myths vs Facts group	Facts only (longer version) group	Myths vs Facts (longer version) group
Pulp	-$1.17 [-1.41, -0.97]	-$1.33 [-1.52, -1.13]	-$1.54 [-1.79, -1.28]	-$1.48 [-1.71, -1.23]	-$1.49 [-1.75, -1.26]
Made-in-USA	$1.05 [0.88, 1.23]	$0.69 [0.51, 0.84]	$1.20 [1.02, 1.39]	$1.17 [0.99, 1.34]	$1.02 [0.84, 1.21]
Non-GMO	$0.60 [0.43, 0.78]	$0.25 [0.12, 0.40]	$0.39 [0.20, 0.59]	$0.33 [0.17, 0.51]	$0.35 [0.18, 0.54]
Comparison with control$^{\psi}$					
		p-value	p-value	p-value	p-value
Pulp		0.83	0.98	0.97	0.97
Made-in-USA		0.99	0.15	0.20	0.60
Non-GMO		0.99	0.94	0.98	0.97

Results Cont.

Myth Perception Sub-Group Analysis

	Group 1 (Disagree with GM myths) N=714	Group 2 (Neutral to GM myths) N=324	Group 3 (Agree with GM myths) N=761
Price	-0.83*** (0.03)	-0.70*** (0.04)	-0.37*** (0.02)
None	-3.95*** (0.13)	-3.48*** (0.18)	-2.27*** (0.11)
Pulp	-1.07*** (0.05)	-1.12*** (0.08)	-0.49*** (0.04)
Made-in-USA	0.78*** (0.04)	0.56*** (0.06)	0.50*** (0.03)
Non-GMO	0.17** (0.08)	0.20* (0.12)	0.44*** (0.08)
Non-GMO*Facts only	0.10 (0.11)	-0.22 (0.18)	-0.21** (0.10)
Non-GMO*Myth vs Facts	0.05 (0.11)	0.04 (0.16)	-0.28*** (0.11)
Non-GMO*Facts only (longer version)	0.02 (0.12)	-0.20 (0.17)	-0.10 (0.10)
Non-GMO*Myth vs Facts (longer version)	0.03 (0.12)	-0.04 (0.17)	-0.21** (0.10)
Note - *p < .1, **p < .05, ***p < .01. Numbers in parenthesis are standard errors			

Results Cont.

Political Affiliation Sub-Group Analysis

	Group 1 (Republicans) N=527	Group 2 (Democrats) N=757	Group 3 (Independent/Others) N=515
Price	-0.71*** (0.03)	-0.45*** (0.02)	-0.74*** (0.03)
None	-3.46*** (0.15)	-2.66*** (0.11)	-3.49*** (0.15)
Pulp	-0.89*** (0.06)	-0.71*** (0.05)	-0.96*** (0.06)
Made-in-USA	0.80*** (0.05)	0.47*** (0.03)	0.64*** (0.05)
Non-GMO	0.37*** (0.09)	0.37*** (0.07)	0.06 (0.05)
Non-GMO*Facts only	-0.15 (0.13)	-0.20** (0.10)	0.27** (0.14)
Non-GMO*Myth vs Facts	-0.14 (0.14)	-0.24** (0.10)	0.23* (0.14)
Non-GMO*Facts only (longer version)	-0.10 (0.13)	-0.13 (0.21)	0.07 (0.14)
Non-GMO*Myth vs Facts (longer version)	-0.15 (0.13)	-0.31*** (0.10)	0.39*** (0.14)

Main Take-aways

- Misinformation interventions can
  - Improve GM safety perceptions
  - Influence purchase behavior
  - Be affected by attitudinal variables
- Important implications for stakeholders
  - Formats can be used to target safety concerns in education programs
  - Different strategies for different consumer groups
  - Value of relevant scientific information in overcoming biotechnology misconceptions

Conclusion

- In general, there is hope for improving consumers' acceptance of biotechnology
- Food biotechnology stakeholders will find the factors highlighted in this study useful when designing programs to improve acceptance

Thank you! Any questions?