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## **The Trans-Pacific Partnership and Japan's Agricultural Trade**

**Manhong Zhu**

*Selected Paper prepared for presentation at the International Agricultural Trade Research Consortium's (IATRC's) 2016 Annual Meeting: Climate Change and International Agricultural Trade in the Aftermath of COP21, December 11-13, 2016, Scottsdale, AZ.*

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# **The Trans-Pacific Partnership and Japan's Agricultural Trade**

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# Three Essays of My Dissertation

- 1) The Trans-Pacific Partnership, GMOs, and Japan's agricultural trade
- 2) Japan's beef demand analysis: What is in it for U.S. beef producers?

*Current working paper—Beef: freer trade in the context of Japan's domestic producer subsidies?*

- 3) A signaling game in the controversy over genetically engineered foods

**A Signaling Game in the  
Controversy over Genetically  
Engineered Foods**

# Introduction

- Scientific facts
  - The majority of the scientific community agrees that Genetically Engineered (GE) foods are safe
- Issue
  - Consumer sentiment towards GE foods is generally negative (Pew Research Center, 2015)
- Hypothesis
  - Special interest groups who are opposed to Genetic Engineering technology (anti-GE) **have a strategic incentive** to spin facts about the safety of GE foods
- Research methodology and findings
  - Game theoretical approach — signaling game
  - Consumers' attitudes on GE foods — messages and inspection costs
  - Anti-GE special interest groups will always spin facts when **the truth is inconvenient**

# Background

- Anti-GE special interest groups have been promoting mandatory “GMO” labeling.
- Anti-GE special interest groups inform consumers of the potential health risks related to GE foods
- Pro-GE special interest groups fear these labels can be costly and misleading
- Are the anti-GE special interest groups purposely misinforming or misleading the general public?

# Motivations

- We need enough and affordable food to feed a growing world population. The United Nation warns world must produce 60% more food by 2050 to avoid mass unrest.
- The science community has proven that GE foods are as safe as their conventional counterparts, but consumers' sentiment towards GE foods is generally negative
- Too much regulation (GMO labeling) makes the technology more expensive, making it harder for small, independent companies to produce it and small farmers to gain access to it.
- (Americans and Europeans can afford expensive organic foods, but there are people, especially in developing countries, who are still starving but can't get cheaper GE foods.)



# Anti-GE Groups and Organizations

Goal: Educate the public about the concerns and dangers of GMOs.







### Nutrition Facts

Serv Size 2 Tbsp (32g)  
 Servings: About 14  
**Calories 190**  
 Calories from Fat 140

Amount/Serving	% DV*	Amount/Serving	% DV*
<b>Total Fat</b> 15g	<b>23%</b>	<b>Sodium</b> 140mg	<b>6%</b>
Sat Fat 3g	<b>15%</b>	<b>Total Carb</b> 8g	<b>3%</b>
Trans Fat 0g		Dietary Fiber 2g	<b>8%</b>
Polyunsat Fat 1g		Sugars 3g	
Monounsat Fat 12g		<b>Protein</b> 7g	
<b>Cholesterol</b> 0mg <b>0%</b>			
Iron 4%	Vitamin E 10%	Thiamin 8%	
Niacin 20%	Folate 15%		

\*Percent Daily Values (DV) are based on a 2,000 calorie diet.

Not a significant source of vitamin A, vitamin C and calcium.

**INGREDIENTS:** PEANUT BUTTER (PEANUTS, DRIED CANE SYRUP, SALT, MOLASSES), NATURAL OILS (PALM FRUIT AND FLAXSEED OILS).  
**CONTAINS: PEANUTS.**

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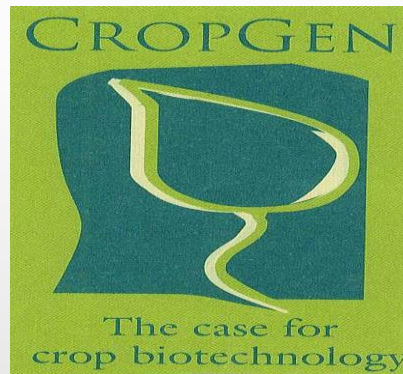
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# Pro-GE Groups and Organizations

Educate the public on biotechnology and communicate the benefits of biotech







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The University of Florida's Monsanto Shill

**THE BRAIN**  
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This is where the soul darkens and evil grows

**THE EARS**  
This is where audible information is filtered to remove scientific facts and favor GMO lies

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# What Have Consumers Learned?

(Source: Jimmy Kimmel)



# Previous Literature

- **Consumer attitudes towards GE foods can be impacted by**
  - **Media bias**
    - News coverage is generally negative towards GE technology (e.g. McClusky, Kalaitzandonakes, and Swinnen, 2015)
  - **In-group bias**
    - We often adopt our beliefs from those we know and trust (e.g., Brewer, 2011; Cohen, 2003; Mackie et al., 1990)
  - **Confirmation bias**
    - Assimilation of scientific information is dependent on prior beliefs (e.g., McFadden and Lusk, 2015)

# Objectives and Methodology

- Objectives

- Model the strategic interactions
- Find the optimal strategy profile

- Methodology

- A signaling game model (e.g., Bullock, 2015; Gentzkow and Shapiro, 2006)
- Modify and extend Bullock's model (2015)

# Model Settings

- Players: Nature; Special Interest Group (SIG); consumer (Lucy)
- Sequence of the game

- **Nature** determines the truth
- **SIG** observes Nature's action
- **SIG** makes a signal
- **The consumer** observes SIG's signal and updates her beliefs
- **Consumer** chooses whether to inspect
- If the **consumer** inspects, she learns the truth
- If the **consumer** does not inspect, she chooses whether to buy the GE food with some probability



# Model Settings

- Payoffs:

- **Anti-GE SIG:**  $\begin{cases} a & \text{if Lucy does not buy the GE food} \\ 0 & \text{if Lucy buys the GE food} \end{cases}$ , and incur spin cost  $c'_s$  (or  $\bar{c}_s$ ) if spin facts

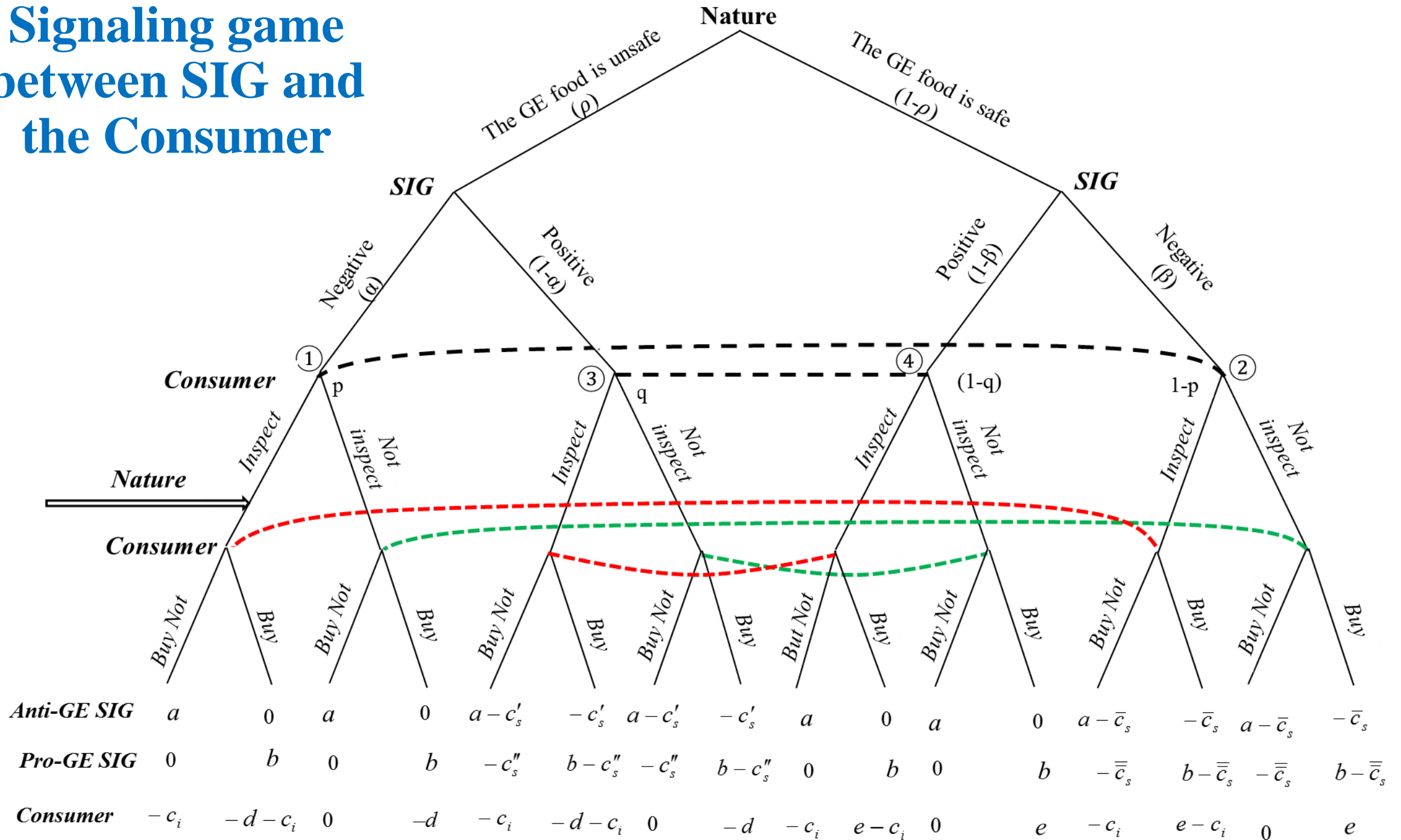
- **Pro-GE SIG:**  $\begin{cases} b & \text{if Lucy buys the GE food} \\ 0 & \text{if Lucy does not buy the GE food} \end{cases}$ , and incur spin cost  $c''_s$  (or  $\bar{\bar{c}}_s$ ) if spin facts

- **Consumer:**  $\begin{cases} -d & \text{if buys when "it is unsafe"} \\ e & \text{if buy when "it is safe"} \\ 0 & \text{if not buy} \end{cases}$ , and incur inspect cost  $c_i$  if inspect

$$c_i = f(\theta) \text{ where } \theta = \frac{\sigma_T^2}{\sigma_T^2 + \sigma_F^2}. \quad \theta : \text{signal extraction factor in the regression Truth} = \theta(\text{True} + \text{False}) + \mu$$

*Note:* 1 is the normalized maximum gain, and -1 is the normalized maximum loss.

# Signaling game between SIG and the Consumer



# Model Assumptions

- Assumptions:
  - SIG has private information of the truth
  - Consumer's initial belief,  $\rho$
  - If the consumer inspects, she will find the truth from Nature (Anand et al. 2007);
  - Otherwise, she makes random purchase decisions with the following probabilities:

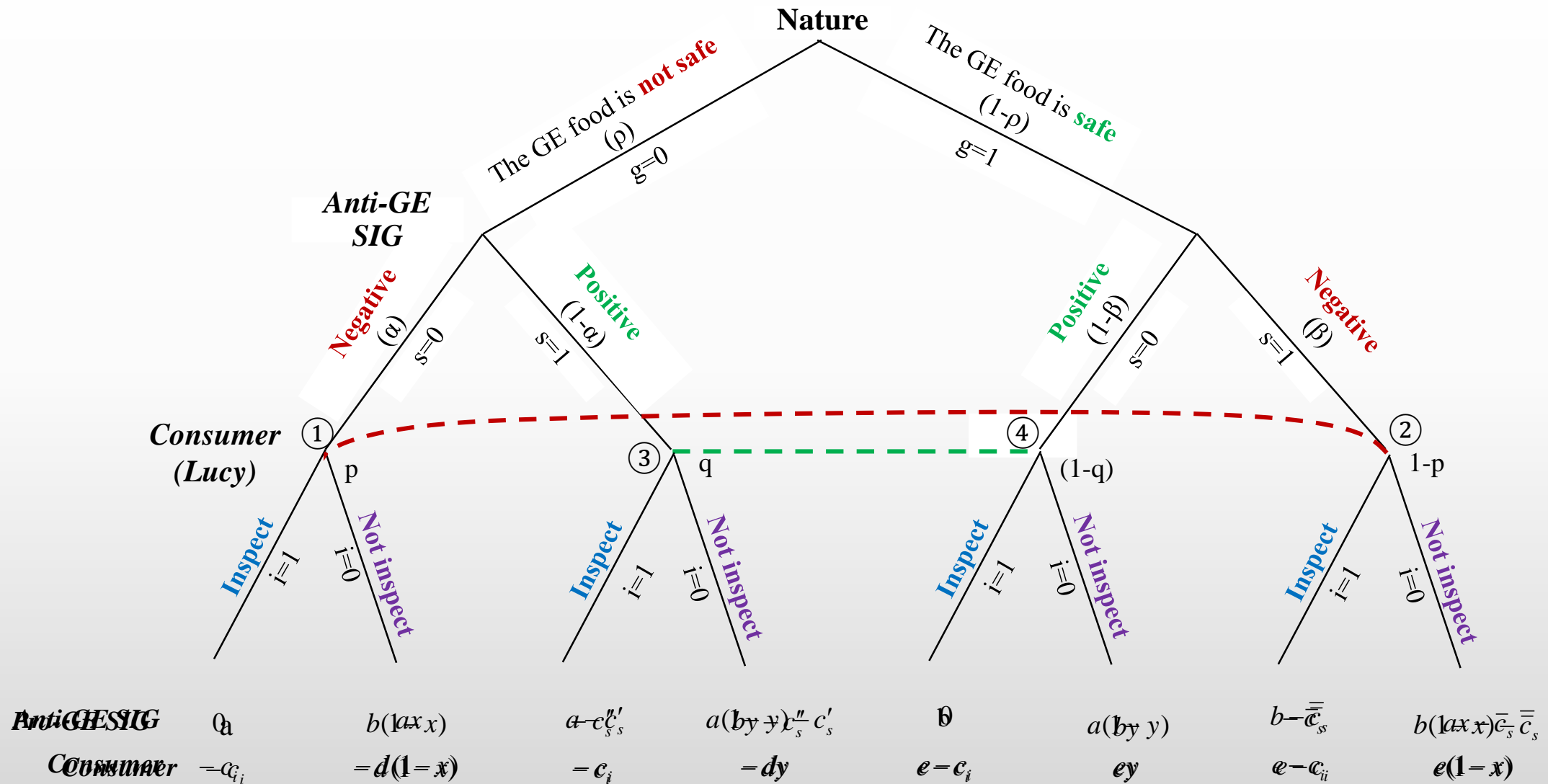
$$\Pr(\textit{not} \text{ buy if negative} ) = x$$

$$\Pr(\text{ buy if negative} ) = 1 - x$$

$$\Pr(\text{ buy if positive} ) = y$$

$$\Pr(\textit{not} \text{ buy if positive} ) = 1 - y$$

# Special Interest Group and Consumer



# The Game between SIG and Consumer

- Perfect Bayesian Nash Equilibrium (PBNE):

$l$  is the consumer's strategy; and  $s$  is SIG's strategy

$$\text{Consumer : } \left. \begin{array}{l} \textit{Max EP}(l) \\ \textit{s.t. } s; \end{array} \right\} \Rightarrow l^* \text{ (Consumer's best response)}$$

$$\text{SIG : } \left. \begin{array}{l} \textit{Max EP}(s) \\ \textit{s.t. } l^*; \end{array} \right\} \Rightarrow s = s^* ? \text{ (Check if } s \text{ is optimal)}$$

Note : EP denotes the expected payoff

# Propositions: SIGs reveal information truthfully; Consumers update their beliefs

(1) If  $c_i < \min[d(1 - x), e(1 - y)]$

**Consumer** always inspects,  
**Both SIGs** don't spin.

(2) If  $c_i > \max(d(1 - x), e(1 - y))$ ,

**Consumer** does not inspect;

**both SIGs** will reveal their information truthfully *only if*

- **Anti-GE SIGs:**  $c'_s > a(1 - x - y)$  when  $0 < (x + y) \leq 1$  or  $\bar{c}_s > a(x + y - 1)$  when  $1 < (x + y) \leq 2$
- **Pro-GE SIGs:**  $\bar{\bar{c}}_s > b(1 - x - y)$  when  $0 < (x + y) \leq 1$  or  $c''_s > b(x + y - 1)$  when  $1 < (x + y) \leq 2$

# Propositions: SIGs reveal information truthfully; Consumers update their beliefs

(3)  $e(1 - y) < c_i < d(1 - x)$ :

**Consumer** inspects negative but not positive;

**Anti-GE groups** reveal their information truthfully surely;

**Pro-GE groups** will do so only if  $c_s'' > b$  and  $\bar{c}_s > b(1 - y)$ .

(4)  $d(1 - x) < c_i < e(1 - y)$ :

**Consumer** inspects positive but not negative;

**Pro-GE groups** reveal their information truthfully;

**Anti-GE groups** will do so only if  $c_s' > a(1 - x)$  and  $\bar{c}_s > ax$ .

# Propositions: SIG always behaves in their best interest; consumers use their prior beliefs

$$(1) (d\rho + (e - e\rho - d\rho)x) < c_i < (e(1 - \rho) - (e - e\rho - d\rho)y)$$

**Consumer** inspects positive but not negative

**Anti-GE SIGs** always negative ( $c'_s > a(1 - x)$  &  $\bar{c}_s < ax$ );

**Pro-GE SIGs** always positive 

$$(2) e(1 - \rho) - (e - e\rho - d\rho)y) < c_i < (d\rho + (e - e\rho - d\rho)x$$

**Consumer** inspects negative but not positive

**Anti-GE SIGs** always negative 

**Pro-GE SIGs** always positive ( $\bar{c}_s < a(x + y - 1)$  &  $c''_s < b(x + y - 1)$ )



# Propositions: SIG always behaves in their best interest; consumers use their prior beliefs

$$(3) c_i > \max[ d\rho + (e - e\rho - d\rho)x, e(1 - \rho) - (e - e\rho - d\rho)y];$$

**Consumer:** no inspection

**Both groups** will spin facts in their best interests as long as

$$\bar{c}_s < a(x + y - 1) \text{ for anti-GE groups and}$$
$$c_s'' < b(x + y - 1) \text{ for pro-GE groups.}$$

# Conclusions and Implications

- Anti-GE SIGs face lower risks of spinning facts
- Keeping silent is probably the best they can do
- Consumers may not make better decisions with more information
  - Excess information
    - Consumers are “rationally ignorant” (McCluskey and Swinnen, 2004);
    - Signal extraction

# Implications

- GMO labeling can be used as a negative message by anti-GE special interest groups
- Interdisciplinary collaboration to interpret scientific evidence
- More competitive grants for plausible alternative hypothesis

Thank you!