

# ***Economics of Technology Acceptance and Agricultural Producer Self-Regulation Assessment***

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# Situational Background

- Growing tension and interest around technology
  - Social challenge of feeding growing population, improving food safety, etc.
  - Growing interest in how food is produced
  - Increasing flow, speed, & reach of information from a range of sources
  - Globalizing supply chains & vertically connected relationships



# Classical View on Benefits of Technology

- Lusk, 2013 *Animal Frontiers* (pg 21):
  - R&D reduces the marginal cost of food production, which shifts the supply curve outward and to the right, resulting in lower-priced, more widely available food.
  - Consumers benefit as they receive more food at a lower price.
  - Producers who are early adopters are also certain to benefit.
    - **While appropriate for textbook discussions, things are more complicated today in U.S. food & ag complex...**



# Technology Feasibility vs. Acceptance

- The Center For Food Integrity (@foodintegrity) tweeted on Wed, Sep 04, 2013:

“Science tells us if we can do something.

**(supply side – technical feasibility)**

Society tells us if we should do it.”

**(demand side – societal acceptance)**

- ***‘Science working’ is necessary but no longer sufficient for technology use...***



# Technology Feasibility vs. Acceptance

- Consider host of examples in meat & livestock realm:
  - Partial disadoption
    - rbST, beta-agonists, LFTB
  - Limited adoption to-date
    - Irradiation of meat, immunocastration
  - Ongoing calls for bans/restrictions
    - growth hormones, GM-seed



# Why Does this Matter?

- Direct/common reasons:
  - See classical view summarized by Lusk, 2013
  - Consumer and industry welfare of resulting bans/regulations is well established
  - Given controversy, more economic rationale is needed
- Indirect/unintended consequences:
  - Reduced R&D investment?
  - Shifts in global comparative advantage?
  - Increased scrutiny & conflict within industry given product differentiation & target marketing incentives



# My Goal Here Today

- Raise awareness & facilitate broad discussion
- Outline open questions and ongoing work
- **Motivate bright minds to add economic insight to complex and important situation**



# Existing Literature Threads

- Production costs impacts
  - Including mountains of non-economic studies
    - Gives us critical “supply side” information
- Consumer WTP & acceptance
  - Related work on value of labels, regulations, and bans
    - Gives us critical “demand side” information
- Minimum Quality Standards
  - Commonly marketing order &/or coop applications
- Self-regulation in Environmental Econ. lit
  - Little in commercial food & agriculture arena





# Individual Firm/Producers vs. Industry

- E.coli vaccine (working paper w/ Schroeder)
  - Implemented at feedyard, possible packer benefit
  - Social value of food safety improvement vs. AW impact
    - Fits with economic externality literature
- Animal ID & Export Maintenance (Pendell et al. 13)
  - Small loss of exports = PS of ID adoption
    - To experience trade benefits, a significant portion of animals likely need to be enrolled in accepted/desired system(s)
    - Adoption starts at cow-calf level, partial view of benefits
      - Less of an externality story...



# Customer vs. Consumer

- Typically think of Consumer WTP & Acceptance
- Derived demands also encompass Customer WTP & acceptance
- Consider Feedlot Situation:
  - Consumer: Retail product purchaser
  - Customer: Live animal purchaser (packer)
    - Fed cattle derived demand encompasses both

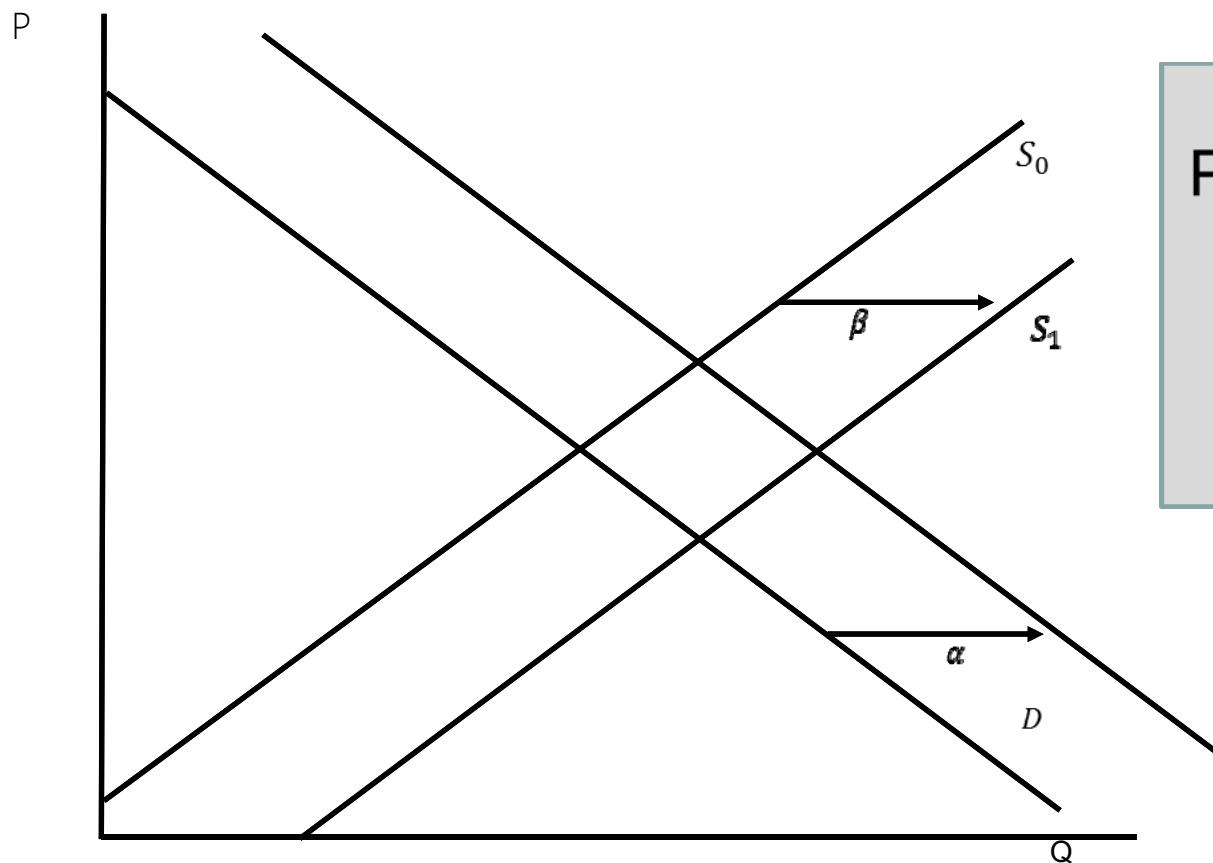


# Current Work (w/ Nathan Hendricks)

- Role of Self-Regulation
  - Separate from classic externality assessment
  - Demonstrate conditions (based on producer surplus) for industry self-regulation to be rational
- Plan to start w/ simple EDM & expand to multiple level case
  - Technology at feedlot level w/ cow-calf, packer, and retail level consideration in beef industry PS
- May also compare real options & sequential bargaining approaches



# Current Work (w/ Nathan Hendricks)



Production Shock:  $\beta$   
 Supply Elast:  $\varepsilon$   
 Demand Shock:  $\alpha$   
 Demand Elast:  $\eta$

$$d\ln Q = \frac{\varepsilon\alpha - \eta\beta}{\varepsilon - \eta}$$

$$d\ln P = \frac{\alpha - \beta}{\varepsilon - \eta}$$

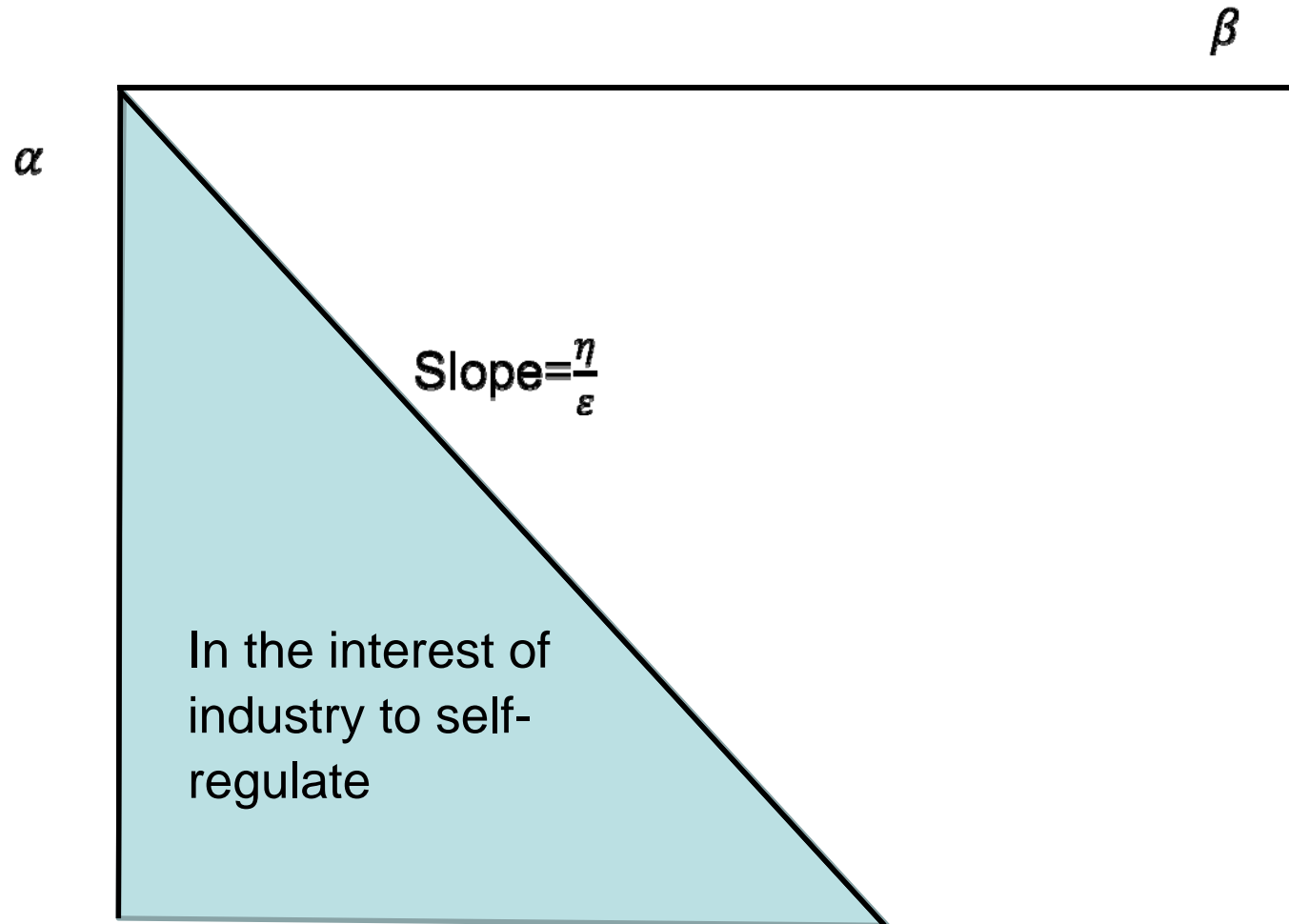
$$\Delta PS = P^0 Q^0 \left( d\ln P + \frac{\beta}{\varepsilon} \right) \left( 1 + \frac{1}{2} d\ln Q \right)$$

## Current Work (w/ Nathan Hendricks)

- Producers would choose to ban the practice or self regulate if  $\Delta PS < 0$
- Use  $\Delta PS = 0$  condition & solve for  $\alpha$  (demand shock) as a function of  $\beta$  (supply shock)
  - Identify demand shock required to offset the gains from a given production shock
- Necessary (but not sufficient) condition for self-regulation:  $\alpha < \frac{\eta}{\varepsilon} \beta$ 
  - $\eta$  is demand elasticity;  $\varepsilon$  is supply elasticity



# Current Work (w/ Nathan Hendricks)



# Current Work (w/ Nathan Hendricks)

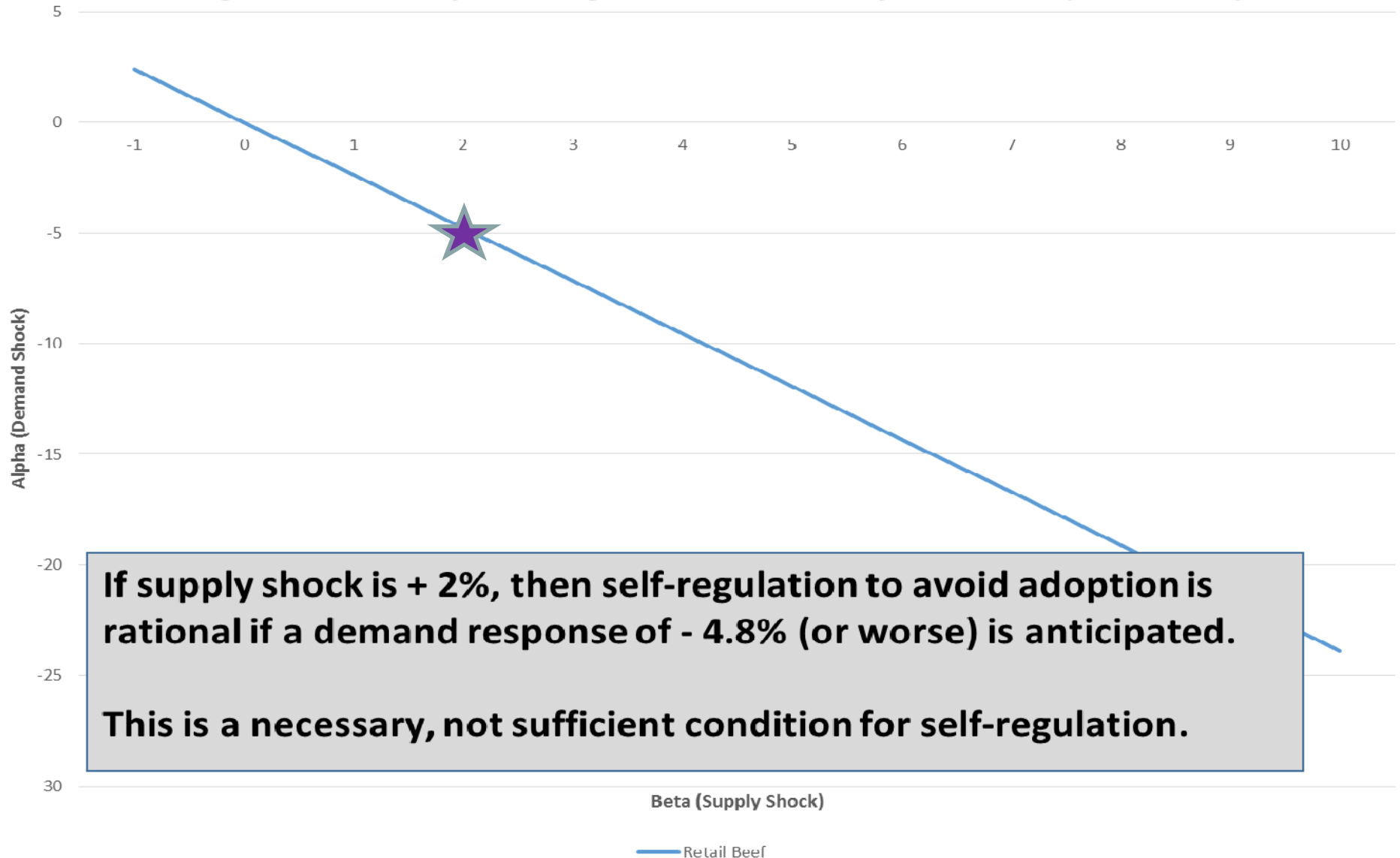
**Table A.1. Elasticity Estimates (Pendell et al., 2010)**

Definition	Short-Run Estimate	Long-Run Estimate
Own-price elasticity of demand for retail beef	-0.86	-1.17
Own-price elasticity of supply for retail beef	0.36	4.62
Own-price elasticity of demand for wholesale beef	-0.58	-0.94
Own-price elasticity of supply for wholesale beef	0.28	3.43
Own-price elasticity of demand for slaughter cattle	-0.40	-0.53
Own-price elasticity of supply for slaughter cattle	0.26	3.24
Own-price elasticity of demand for feeder cattle	-0.14	-0.75
Own-price elasticity of supply for feeder cattle	0.22	2.82



# Current Work (w/ Nathan Hendricks)

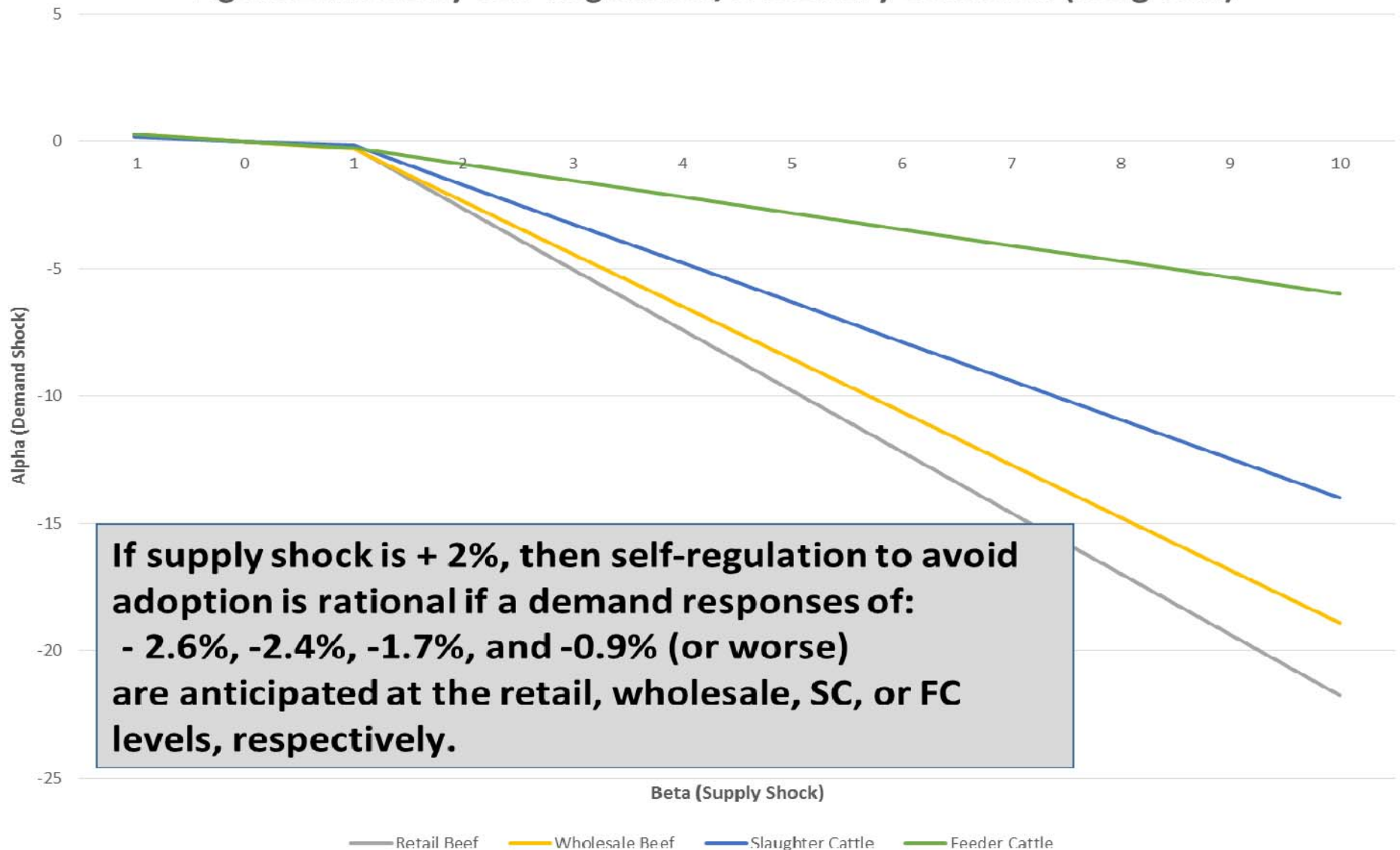
Figure 1. Industry Self-Regulation, Necessary Condition (Short-Run)





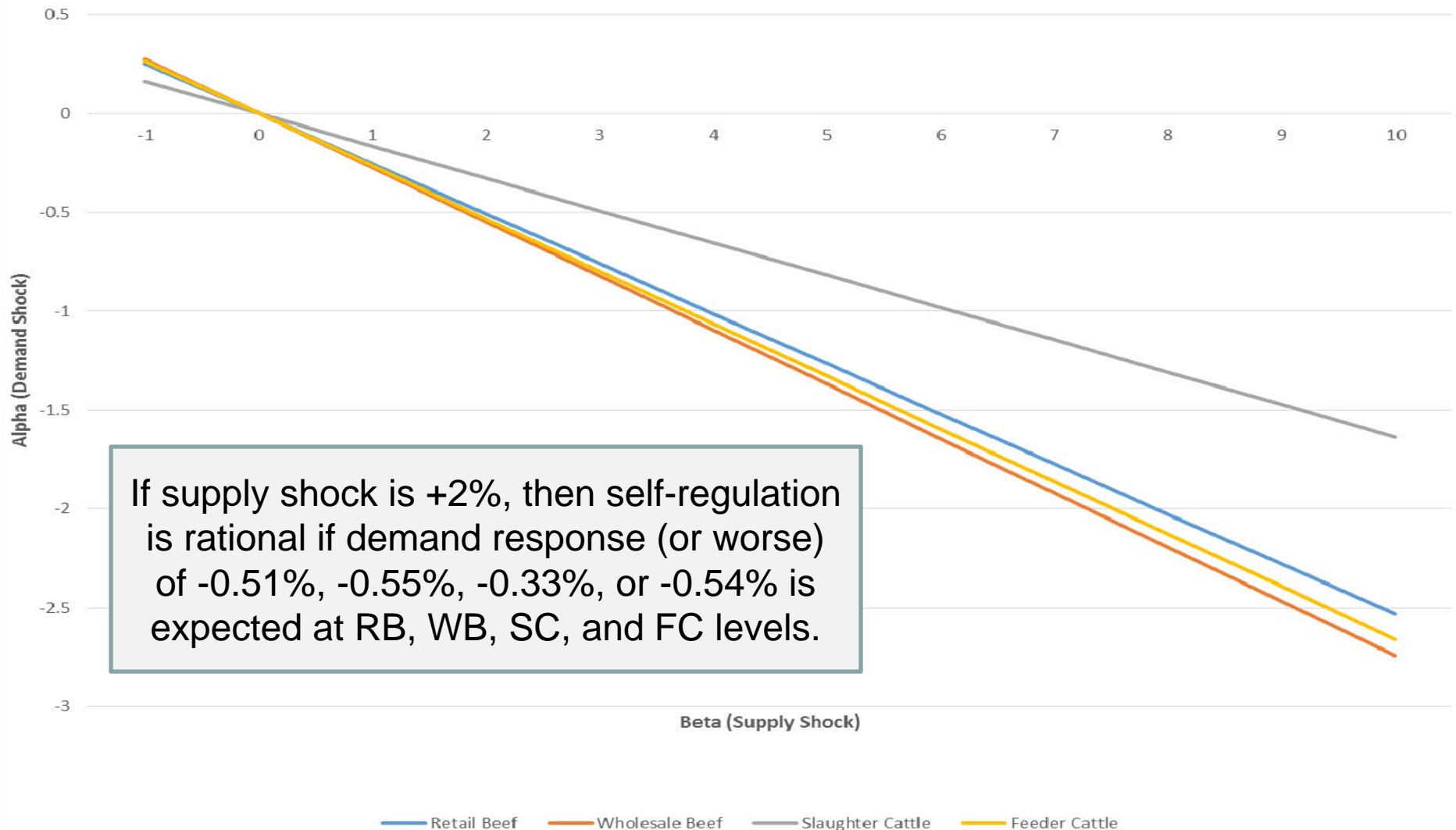
# Current Work (w/ Nathan Hendricks)

Figure 2. Industry Self-Regulation, Necessary Condition (Long-Run)



# Current Work (w/ Nathan Hendricks)

Figure 2. Industry Self-Regulation, Necessary Condition (Long-Run, 4 - levels)



# Questions

- Is PS from EDM useful threshold for accept/adopt decisions?
  - What about brand image, litigation costs, etc.?
    - Unlikely to be in base necessary condition ( $\alpha < \frac{\eta}{\varepsilon} \beta$ )
  - What about a real options approach?
- What about reversible (variable costs only) vs. irreversible (fixed cost impacting) situations?
  - E.coli vaccine vs. gestation stall discussions



# Questions

- What about issues involving ballot initiatives and related “threats?”
  - Gestation stalls and laying hen cages
- What about issues where the government is asking industry for self-regulation?
  - Pharmaceutical company reduction or limits on antibiotics sales



# Tonsor's View on Industry Fit

- Industry could utilize corresponding decision aides
- Suggestion to producers considering new tech:
  1. Get informed. Seek information from many sources with the goal of educating yourself on a specific topic.
  2. Verify proof of concept. Determine feasibility in real-world applications by finding examples where a product or method has been used.
  3. Consider the “no adoption” cost. Look at the competitive landscape to understand whether the cost of not adopting puts you at a disadvantage.
  4. Communicate. Keep customers informed when implementing a new technology to obtain agreement and buy-in.
  5. Understand your business and assess your risk tolerance. Are you generally willing to accept risk in return for expected higher returns, are you more interested in short-term or long-term impacts, and are you flexible about making production changes?



# Tonsor's Overall Take

- Given social challenges we need to continue pursuit of new & improved technologies
  - Communication is critical
  - Recognizing “grayness” (not black & white) is key
- Economics of acceptance & adoption are complex
- I wish “KISS” applied but it doesn’t...
- Much work remains...



More information available at:



This presentation will be available in PDF format at:

<http://www.agmanager.info/about/contributors/individual/tonsor.asp>

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