
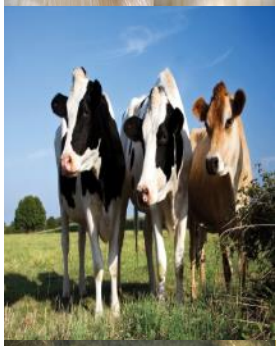


Animal Health Economics

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Tuskegee University

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Outline

- Introduction
- Economics to Consider
- Animal Production and Trade
- Empirical Research Examples
- Decision Optimization
- Final Discussion

Animal disease can be an…

- Animal health problem
- Human health problem
- Production problem
- Economic problem

Infectious Animal Diseases

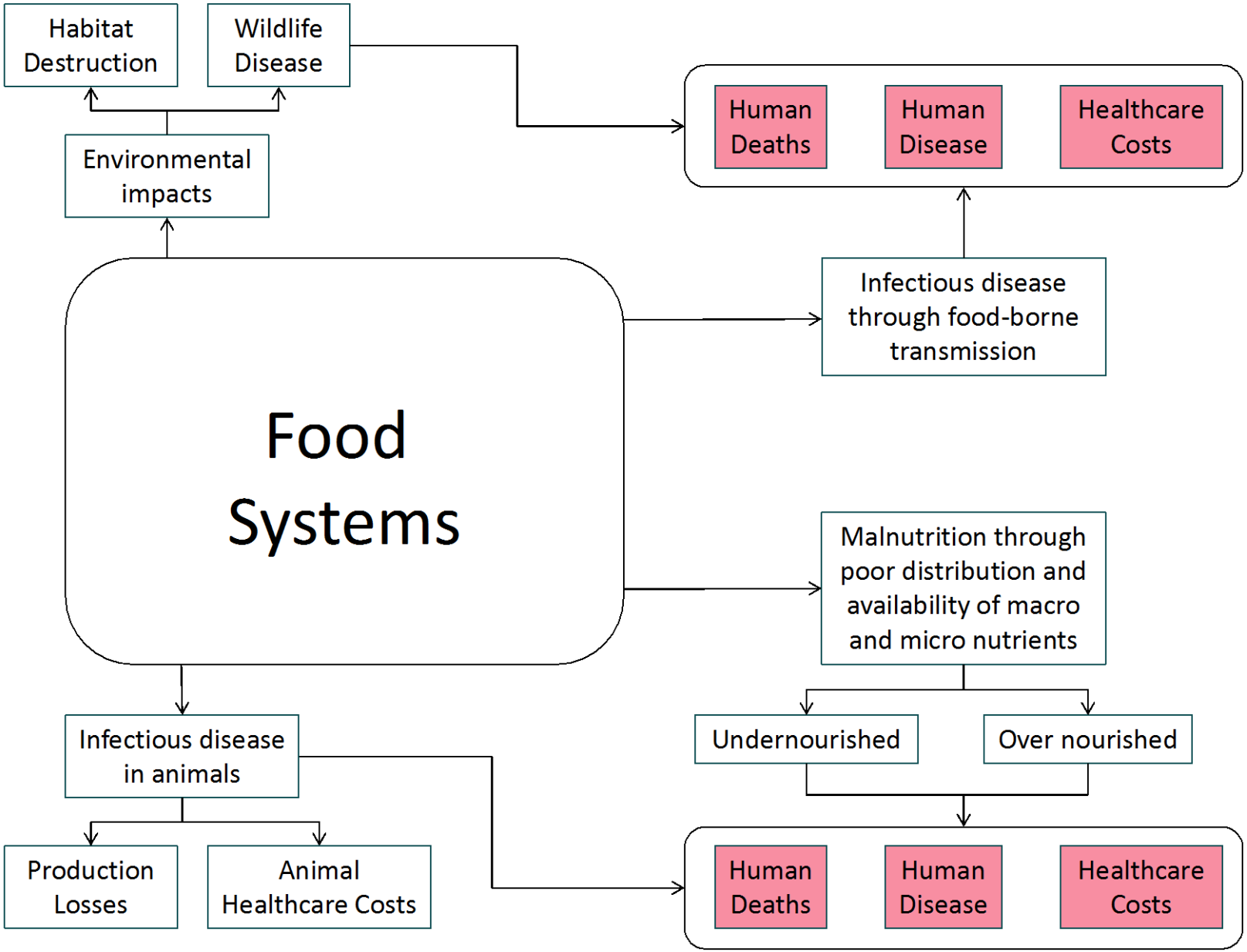
- Almost 60 percent of known human pathogens are of animal origin (Woolhouse and Gaunt, 2007)

- On average, a new disease has emerged or re-emerged each year over the past several decades with 75 percent of these being zoonotic (King, 2004)

- Between 1940 and 2004, found that of 60 percent of EIDs in the United States were zoonotic, with 72 percent originating in wildlife (Jones et al., 2008)

Infectious Diseases

- Increasing disease prevalence driven by:
  - Agricultural and food systems
    - Spatial livestock production, mixed biosecurity, trade
  - Ecosystems
    - Land use and climate change
  - Human living environment
    - Population, standard of living, travel

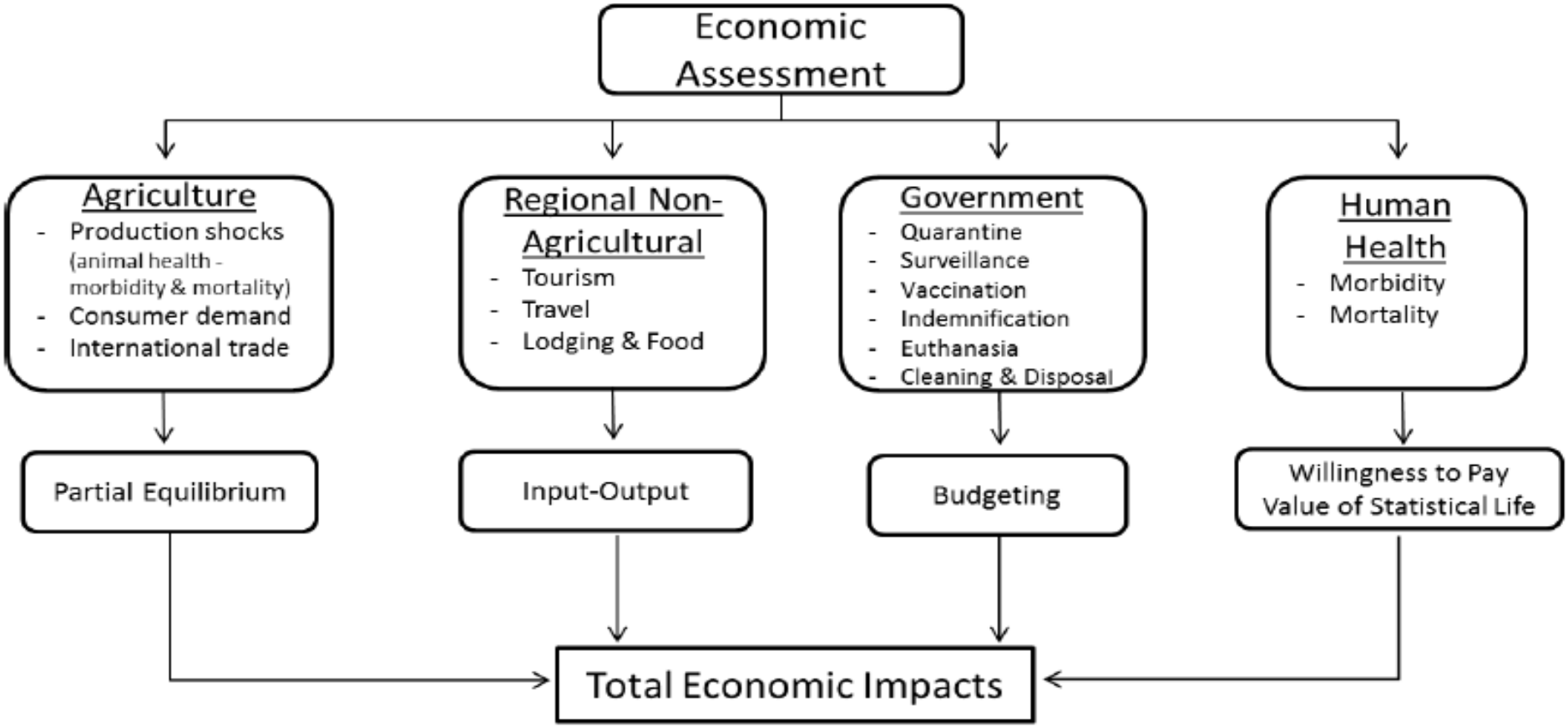


Source: Rushton, 2012

Economic-Health Tradeoff

- As veterinarians, your prerogative is animal health
  - If there is a control measure, it should be used
- Producers decides optimal control based on:
  - Time
  - Cost
  - Effectiveness of treatment

Economic Assessments



Source: Pendell et al. (2014)

ECONOMICS OF ANIMAL AGRICULTURE

What is Economics?

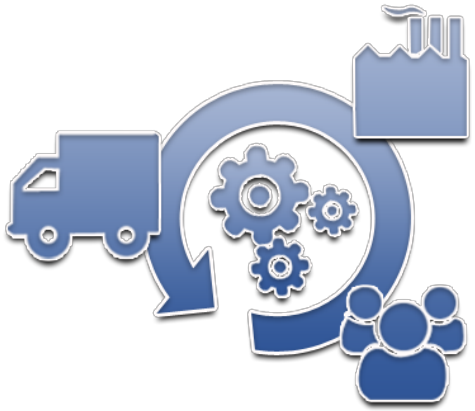
- Simplest definition: The study of the allocation of scare resources
- Animal health economics is concerned with allocation of resources to:
  - Inform disease prevention measures
  - Combat disease
  - Minimize disease impacts

Valuing Direct Costs

- Direct Costs: Costs directly accounted to the payer
  - Drug and vaccine costs
  - Labor costs
  - Disease control measure costs

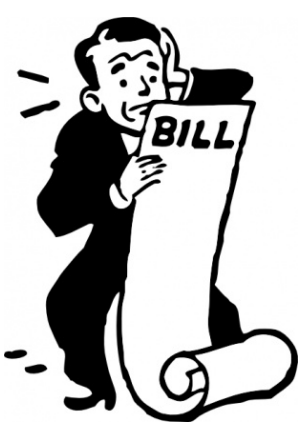
Valuing Indirect Costs

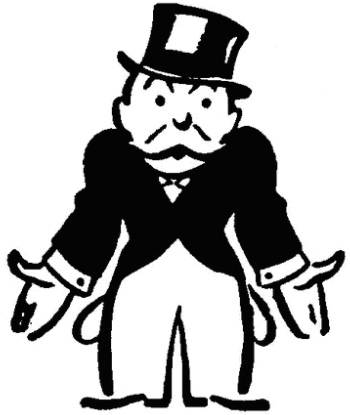
- Indirect Costs: Costs not directly accounted to the payer
  - Supply chain impacts
  - Consumer price changes
  - Trade changes
  - Impacts on animal and human health



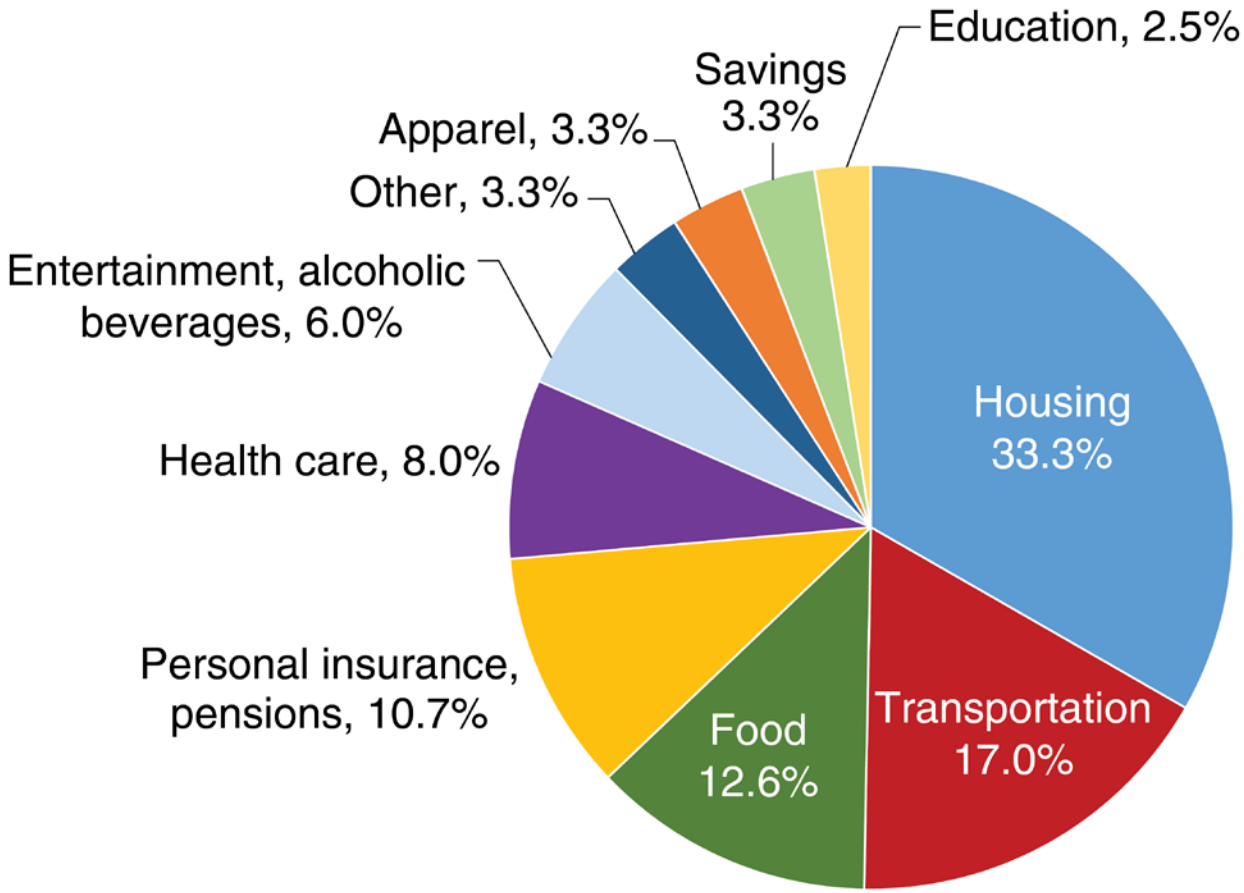
Who Pays These Costs?

- Producers
- Government: Local, State, and Federal
- Domestic Consumers
- International Consumers





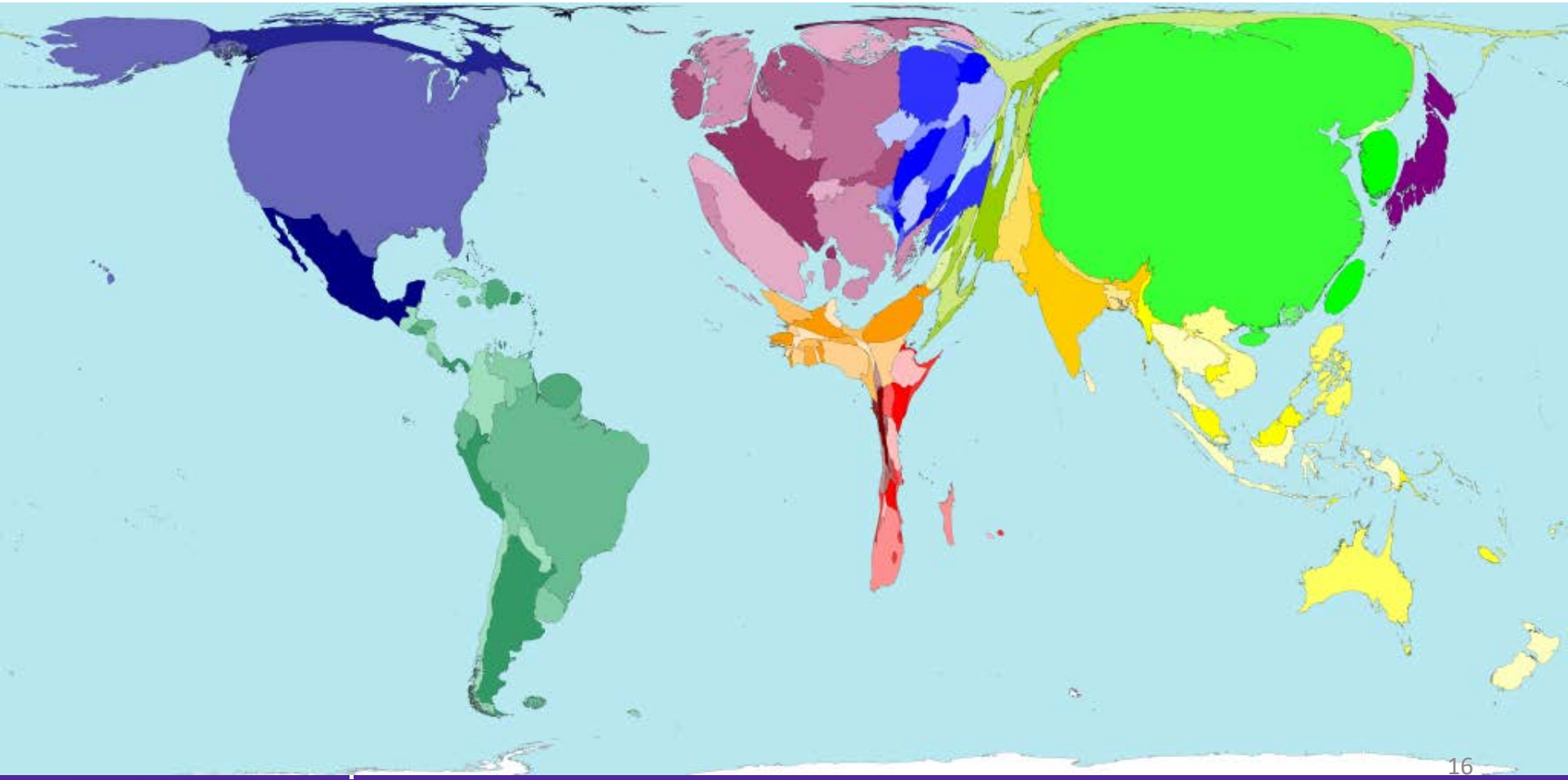
Share of U.S. household consumer expenditures by major categories, 2014



Note: "Other" includes personal care products, tobacco, and miscellaneous expenditures.
Source: USDA, Economic Research Service using data from U.S. Bureau of Labor Statistics, Consumer Expenditure Survey, 2014.

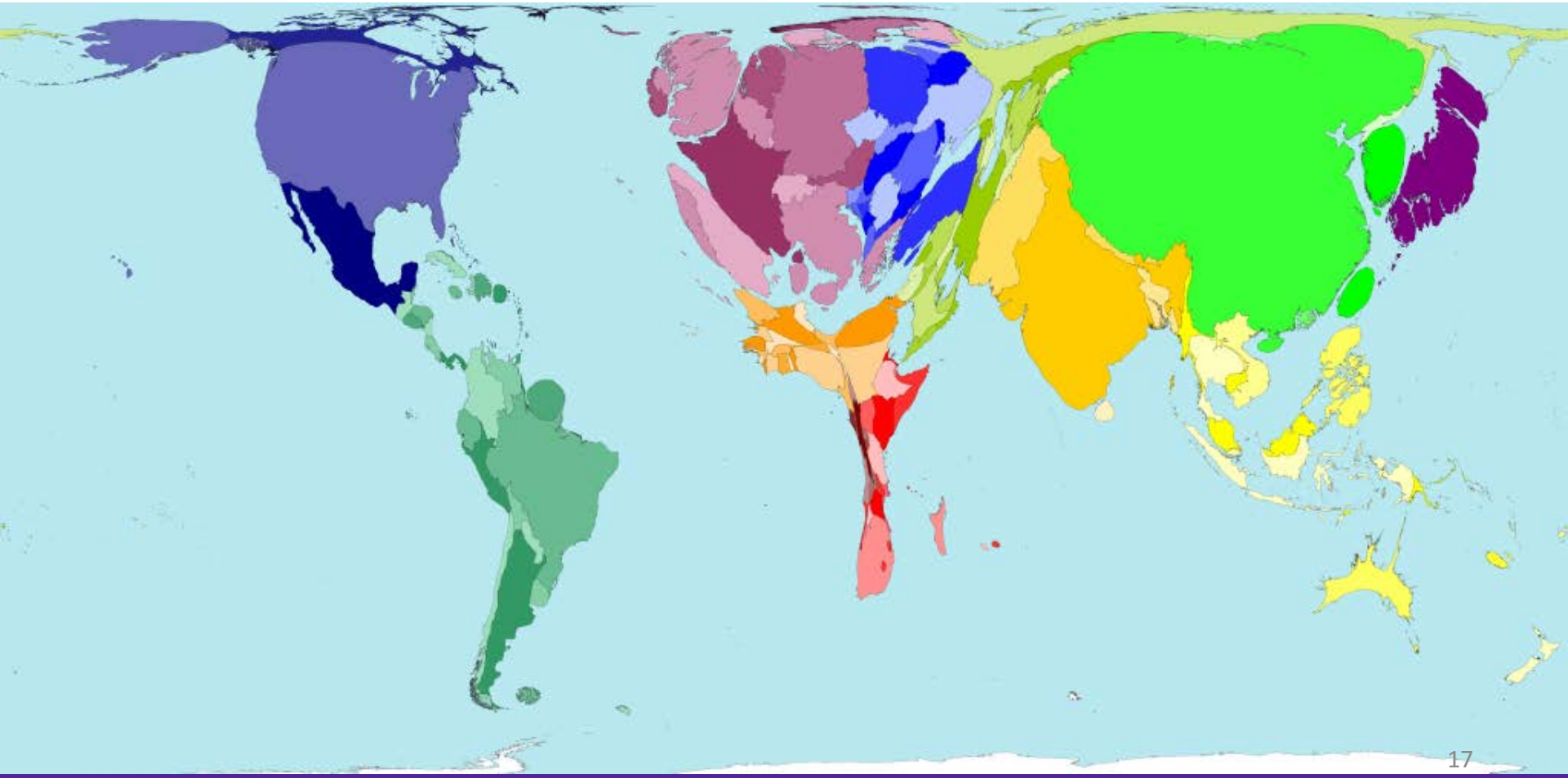
ANIMAL PRODUCTION AND TRADE

Proportion of Global Meat Production



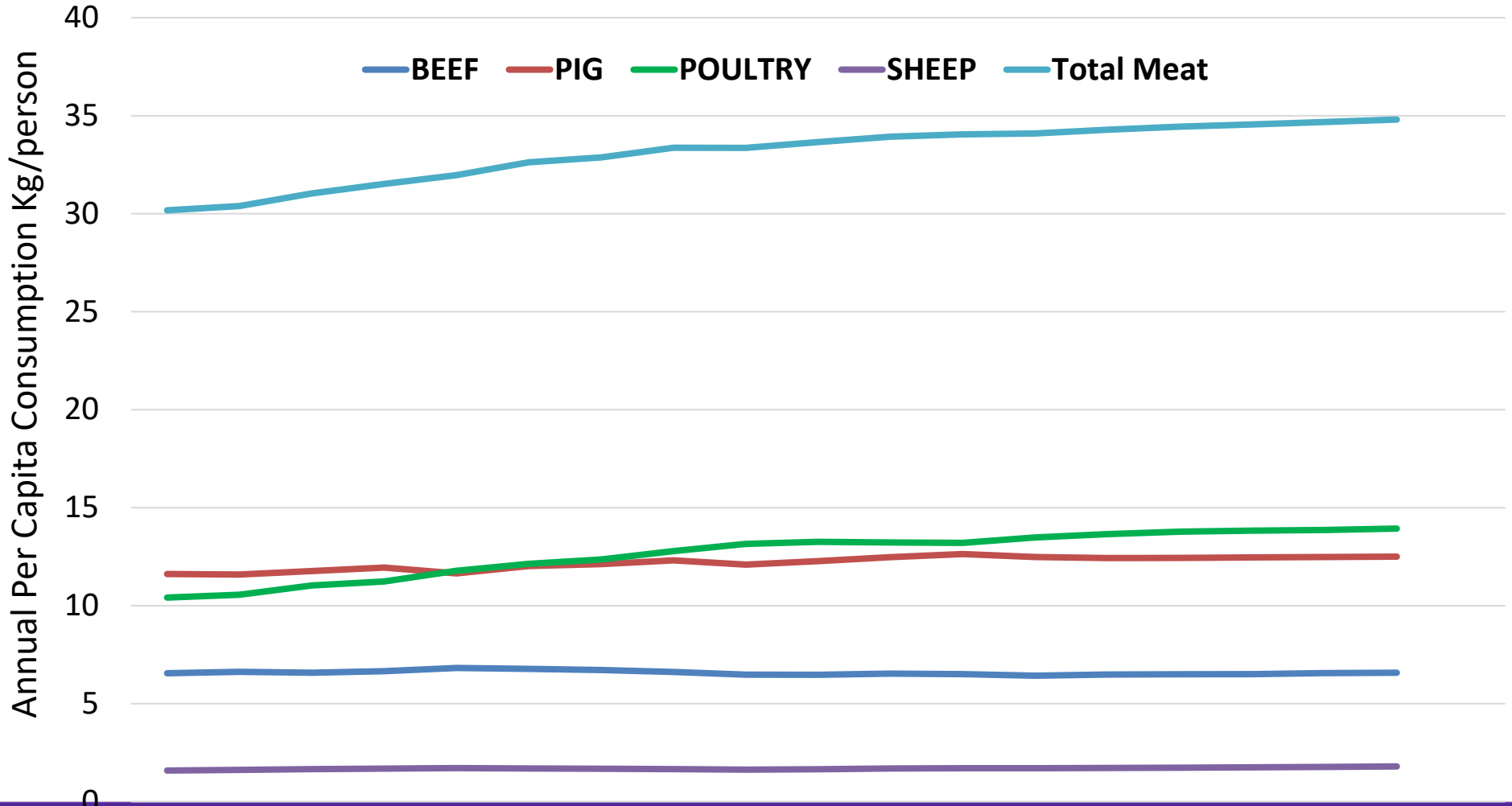
Source: Worldmapper, 2016. http://www.worldmapper.org/display.php?selected=125

Proportion of Global Meat Consumption



Source: Worldmapper, 2016. http://www.worldmapper.org/display.php?selected=125

Global Annual Per Capita Meat Consumption

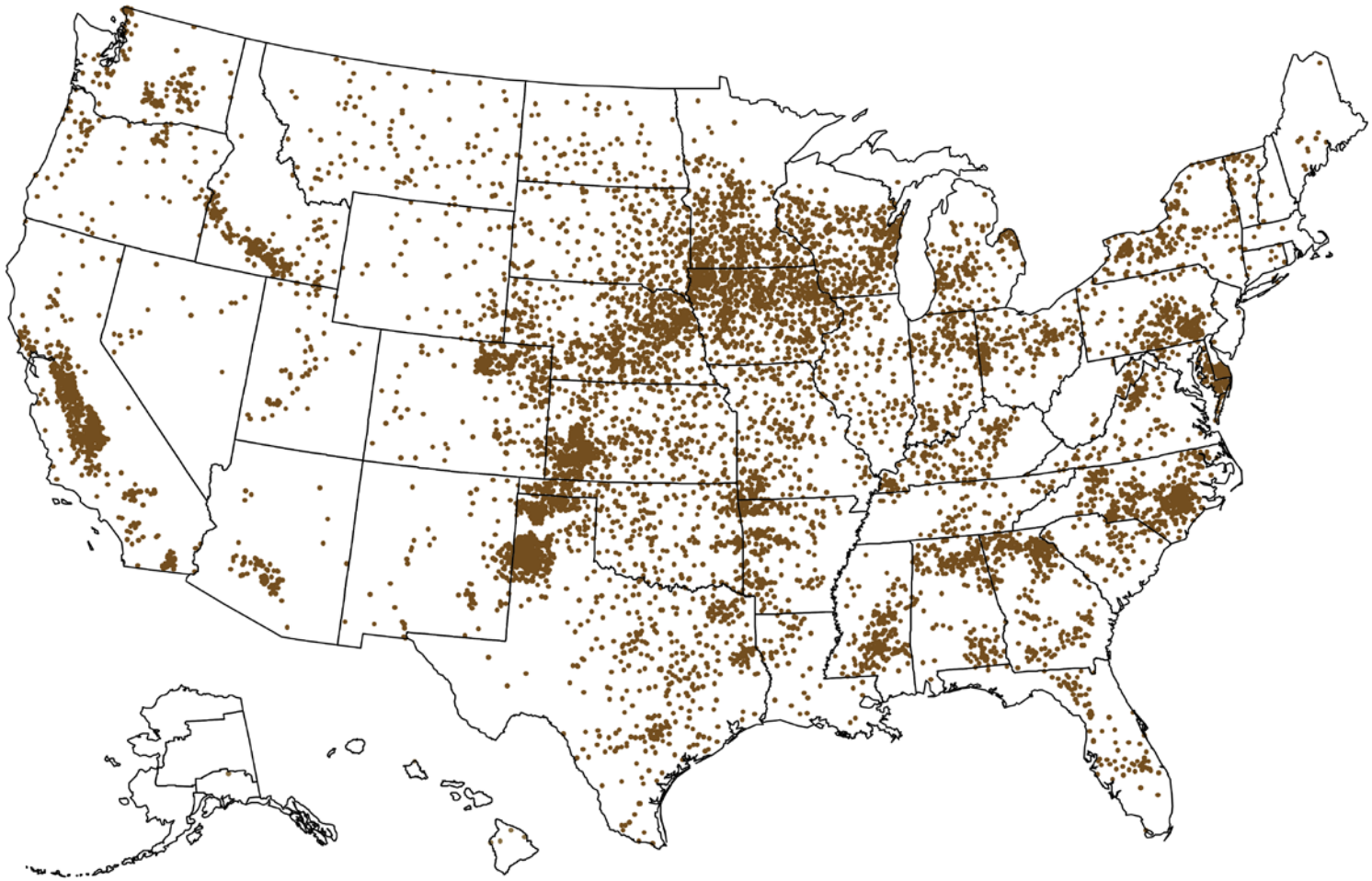


Source: OECD Per Capita Meat Consumption, 2016

U.S. Animal Production

- United States a net exporter
- Value of exports often exceed $100 billion per year
- Member of World Trade Organization (WTO)
  - Part of the sanitary and phytosanitary (SPS) agreement
  - Trade measures encouraged to use international standards
  - Further reading: Zepeda et al. (2005)

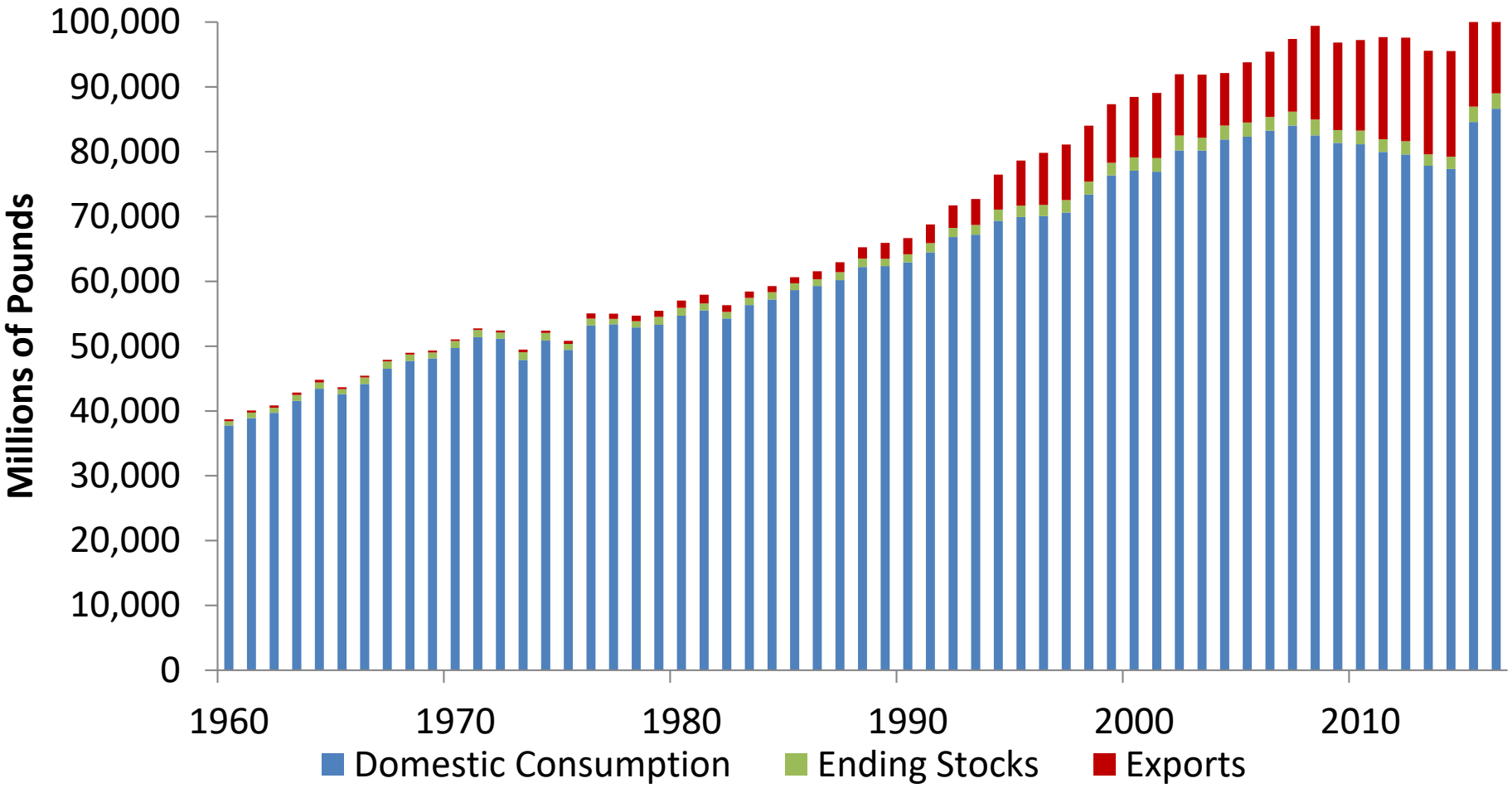
Market value of livestock, poultry, and their products sold in 2012



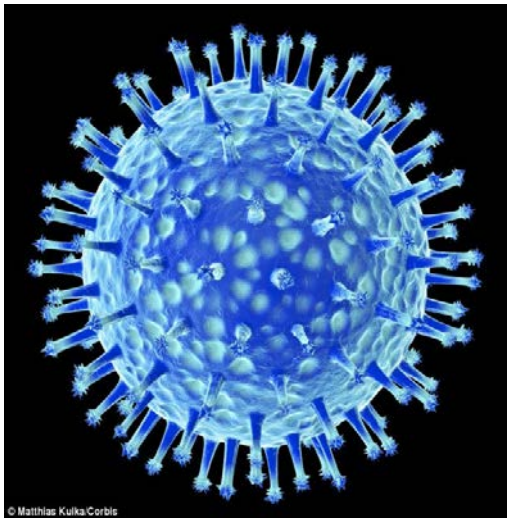
1 dot = $20 million

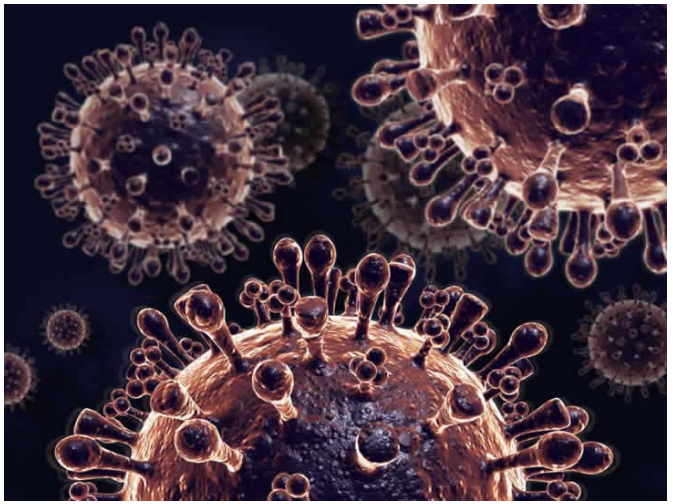
Source: USDA, Economic Research Service using data from USDA, National Agricultural Statistics Service, 2012 Census of Agriculture.

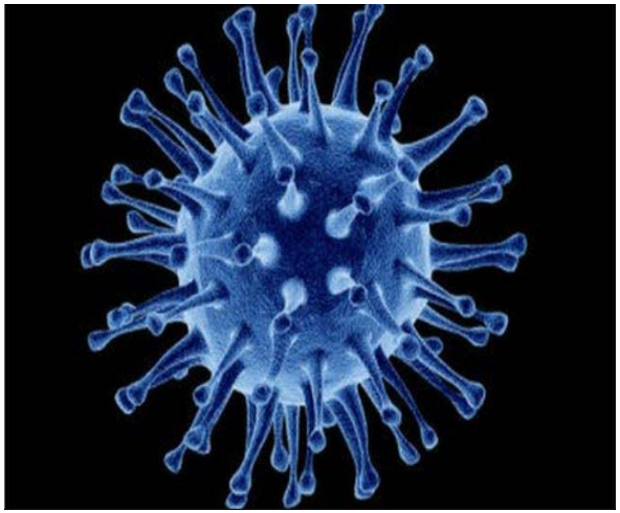
U.S. Red Meat and Poultry Utilization



Source: USDA- World Agriculture Supply and Demand Estimates, 2016





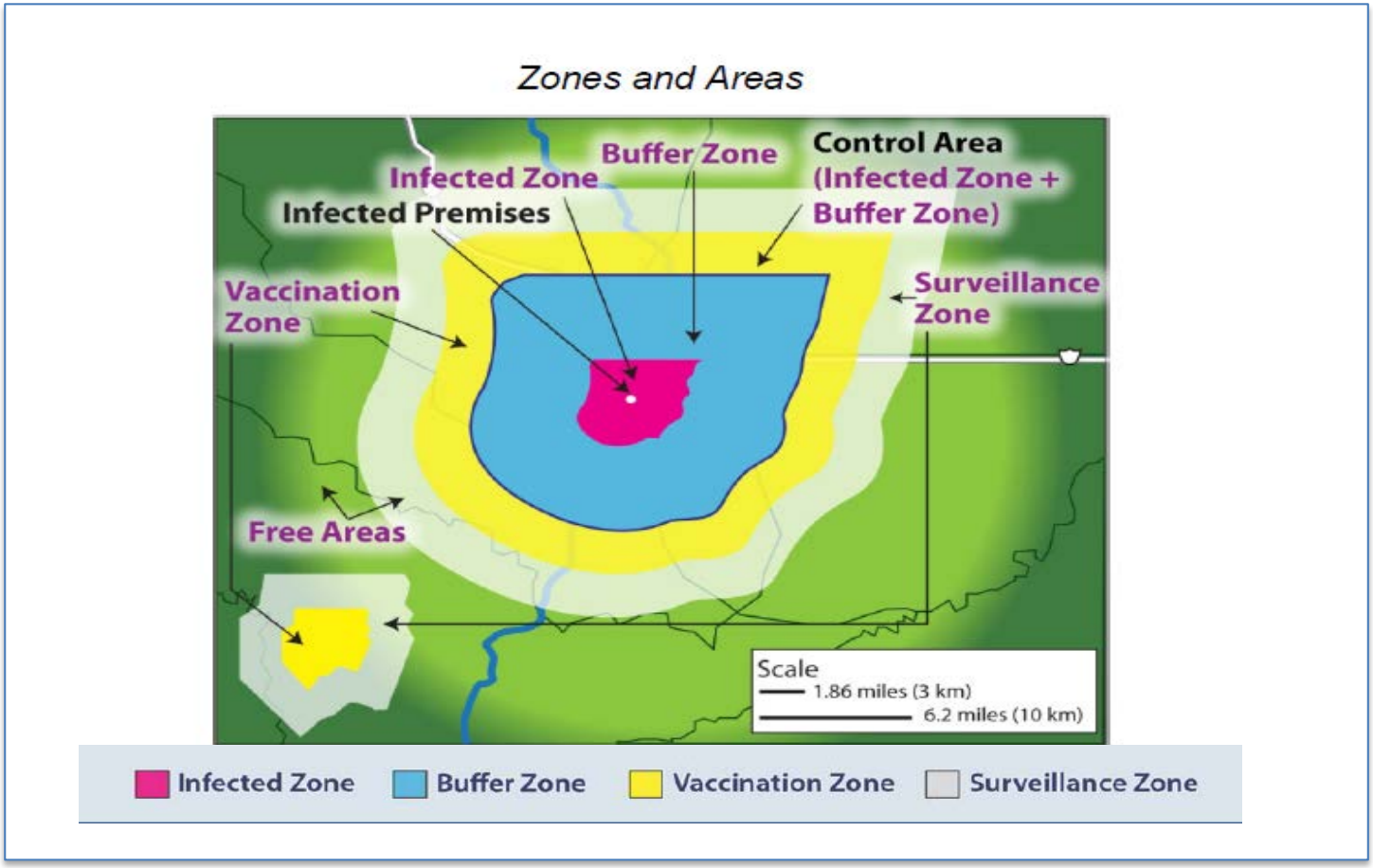


EMPIRICAL EXAMPLES OF HIGHLY PATHOGENIC AVIAN INFLUENZA

Poultry Business Continuity

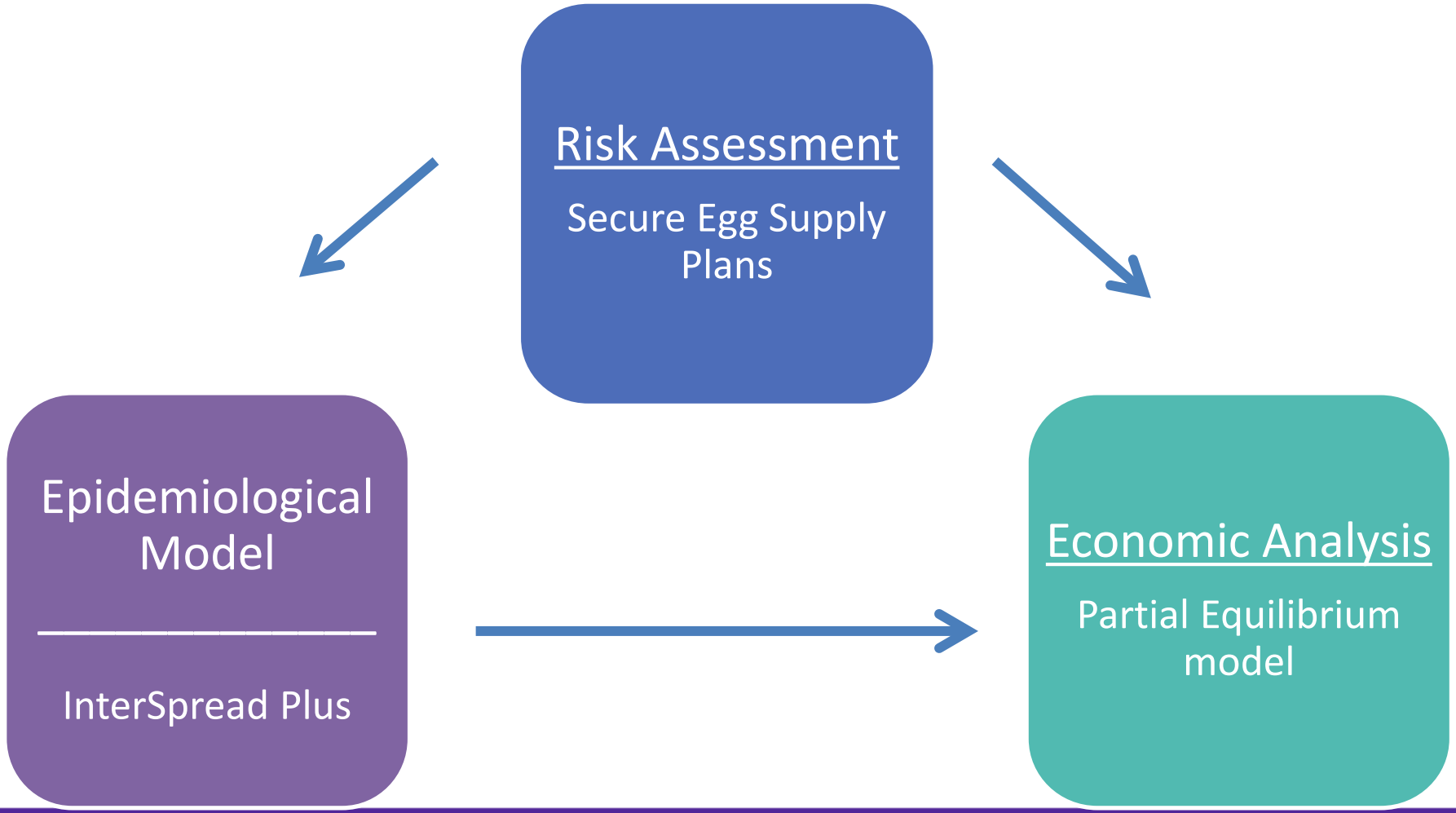
- Effect of business continuity on U.S. market
- Integrated epidemiological and economic model
- Model effects of a hypothetical highly pathogenic avian influenza (HPAI) outbreak

Business Continuity: Control Areas

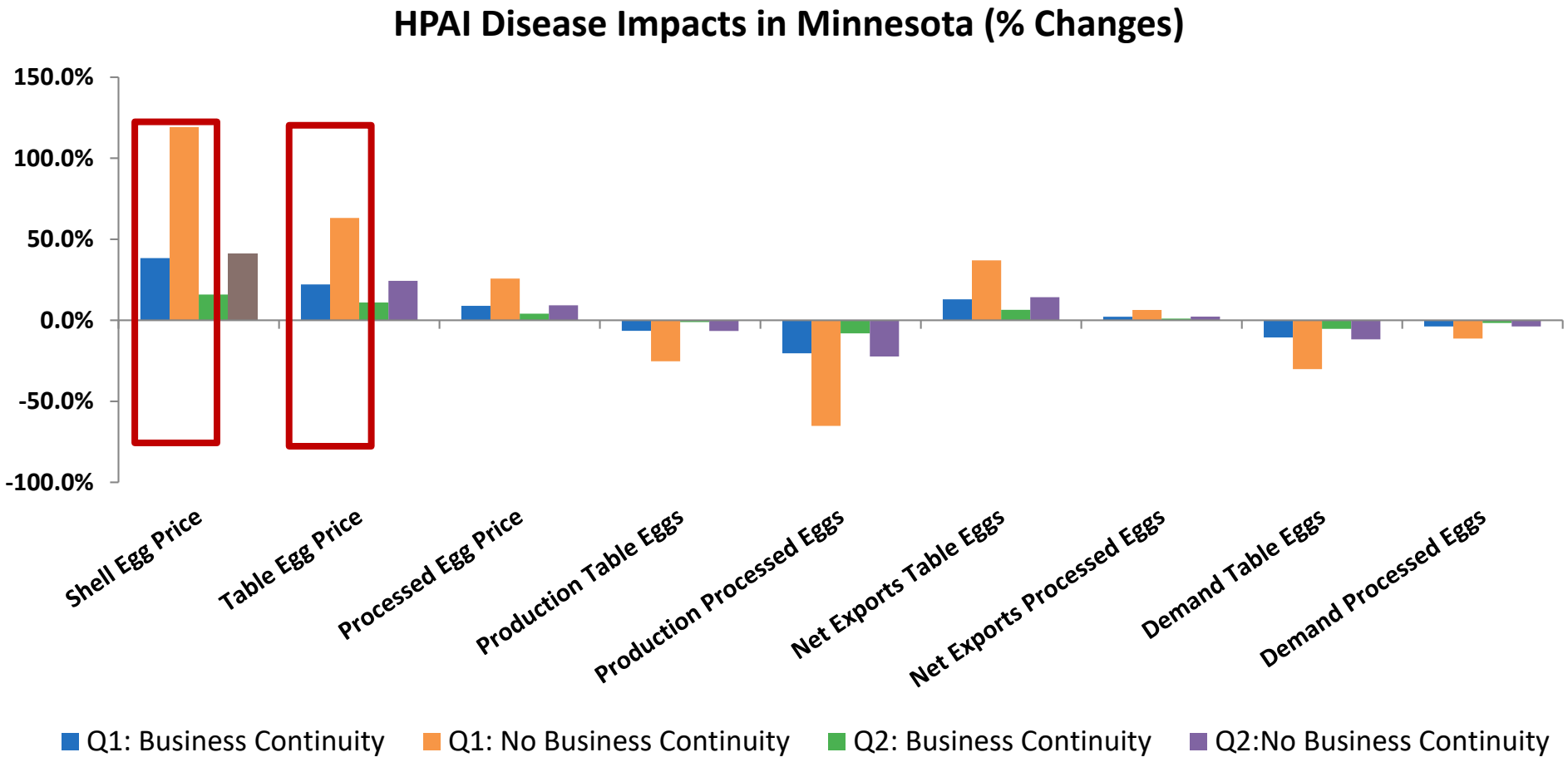


Source: United States Department of Agriculture: Animal and Plant Health Inspection Service. *Highly Pathogenic Avian Influenza Response Plan, The Red Book*. September 2012

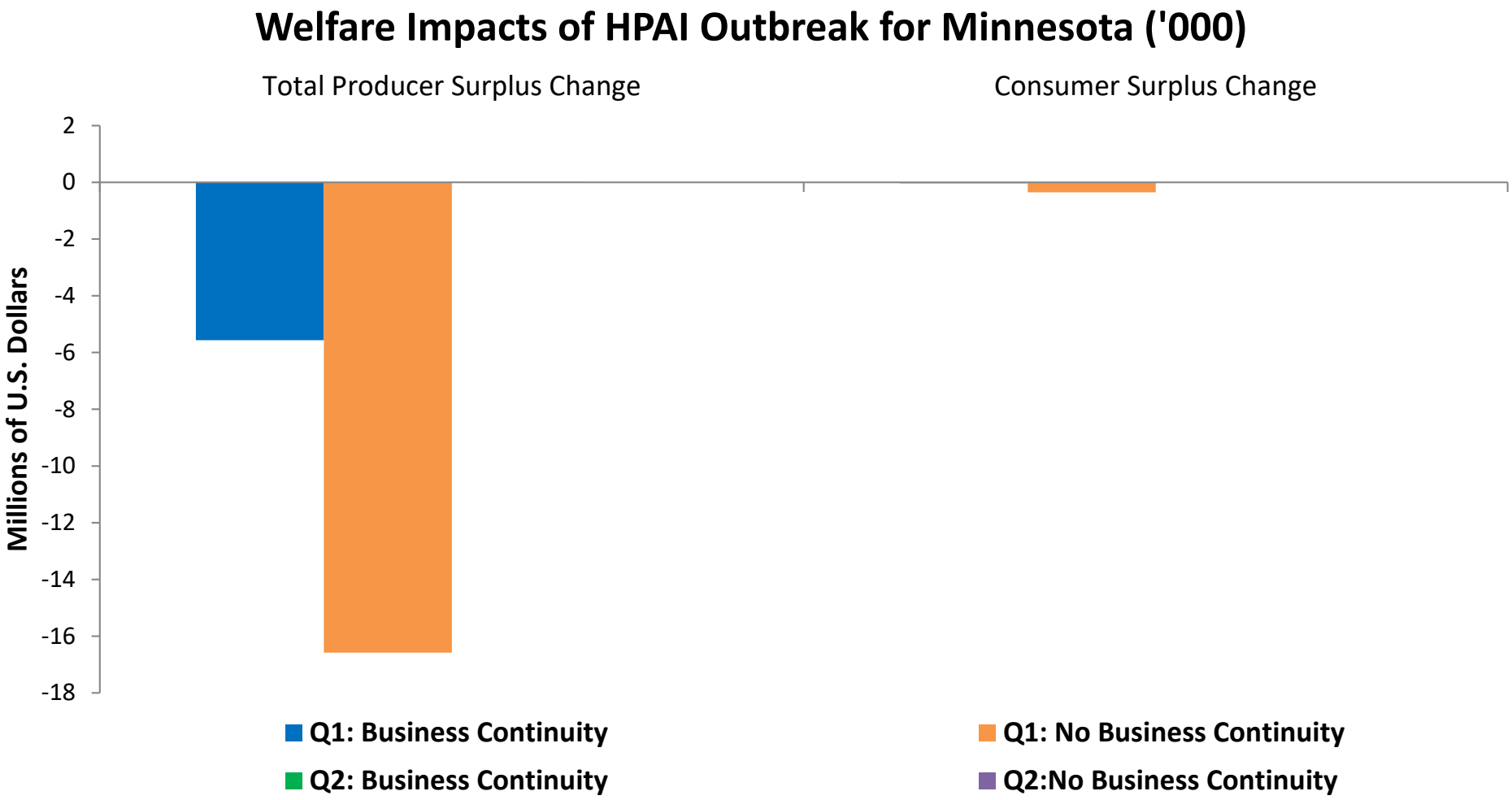
Methodology Overview



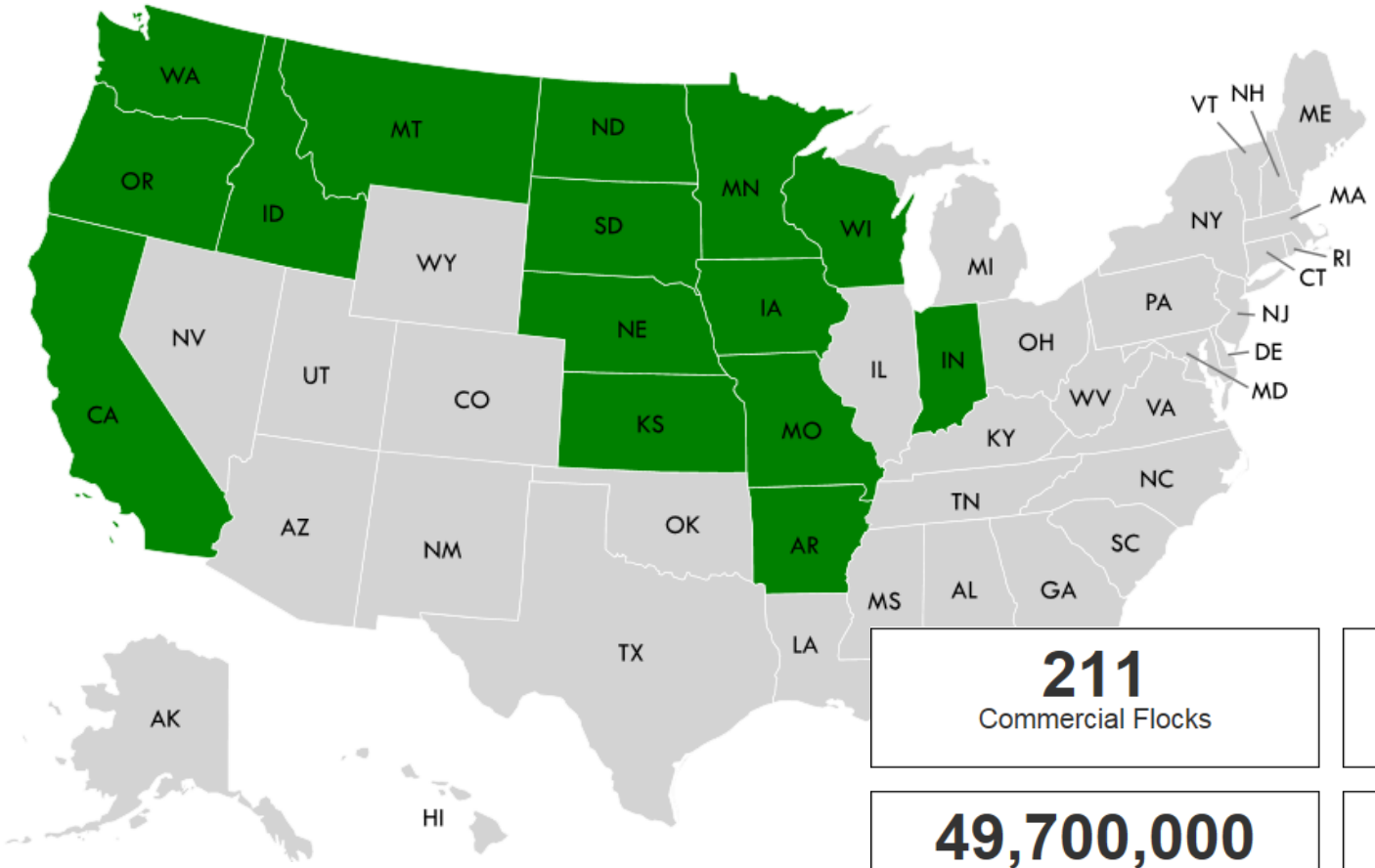
Results


HPAI Disease Impacts in Minnesota (% Changes)
150.0%
100.0%
50.0%
0.0%
-50.0%
-100.0%
Shell Egg Price
Table Egg Price
Processed Egg Price
Production Table Eggs
Production Processed Eggs
Net Exports Table Eggs
Net Exports Processed Eggs
Demand Table Eggs
Demand Processed Eggs
Q1: Business Continuity
Q1: No Business Continuity
Q2: Business Continuity
Q2:No Business Continuity

Results: Welfare



Highly Pathogenic Avian Influenza



211
Commercial Flocks

21
Backyard Flocks

49,700,000
Birds Affected

6/17/15
Last Detection Reported

Poultry Trade Example

- 2014-2015 HPAI in U.S. poultry
- Changes in trade composition and quantity
- Regionalized importer trade response
  - Disease status had to be established for all regions
  - Control program to be in places
  - National and state level coordination

Results

	Aggregated Products Aggregated Ban	Aggregated Products Types of Bans
Aggregate Poultry Trade Ban	-99.37***	
	(0.13)	
National Poultry Trade Ban		-100.00***
		(0.16)
State Poultry Trade Ban		-34.95***
		(0.13)
Country Poultry Trade Ban		16.18
		(0.15)
Observations	13,380	13,380
Number of ID	345	345

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

DECISION OPTIMIZATION

Economic Concepts in Decision Making

- Opportunity Costs
  - The forgone value of the choice(s) not taken
- Marginal Benefits/Costs
  - Benefits/costs associated with an additional unit of activity or good
- Understanding Value of Money
  - Discounting future revenue/costs to present day worth

Reactive vs. Proactive Approaches

Investment in Prevention

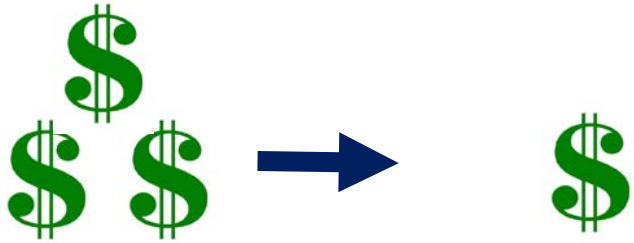
Costs of an Outbreak

Reactive

"Find a Cure"

Proactive

"Prevention"



Net Present Value (NPV)

- Estimating the present value today of some future amount accounting for the discount rate (r)

$$\textbf{NPV= Future Value} \div (1+r)^t$$

Example:

Future cost of a disease at time T = $1,000

Discount rate: r = 4%

Time T= 3 years

$$NPV = \$1{,}000/ (1.04)^3 = \$889$$

The present cost of a future disease is $889 in this example.

Methods for Decision Optimization

- Cost-minimization analysis
- Cost-benefit analysis
- Cost-effectiveness analysis
- Cost-utility analysis

Cost-Minimization Analysis

- Only compare direct monetary costs associated with decisions
- Choose the minimum cost alternative

Minimize C – MB

Where: C = Decision costs

MB = Decision Monetary Benefits

Cost-Benefit Analysis (CBA)

- Uses benefit-cost ratio that expresses the monetary benefits of a decision to the costs of that decision
  - Value of animals not infected due to vaccination
  - Value of farm production due to disease avoidance
- Choose the highest benefit-cost ratio

Maximize BC Ratio = MB / C

Where: C = Costs of decision

MB = Monetary Benefits

Cost-Effectiveness Analysis (CEA)

- Uses cost- effectiveness ratio that expresses the non-monetary health benefits of a decision
  - # of infected animals
  - # of days farm not in production
- Used in fields where not appropriate to monetize benefit
  - E.g., value of life or quality of life

Cost-Effectiveness Analysis (CEA)

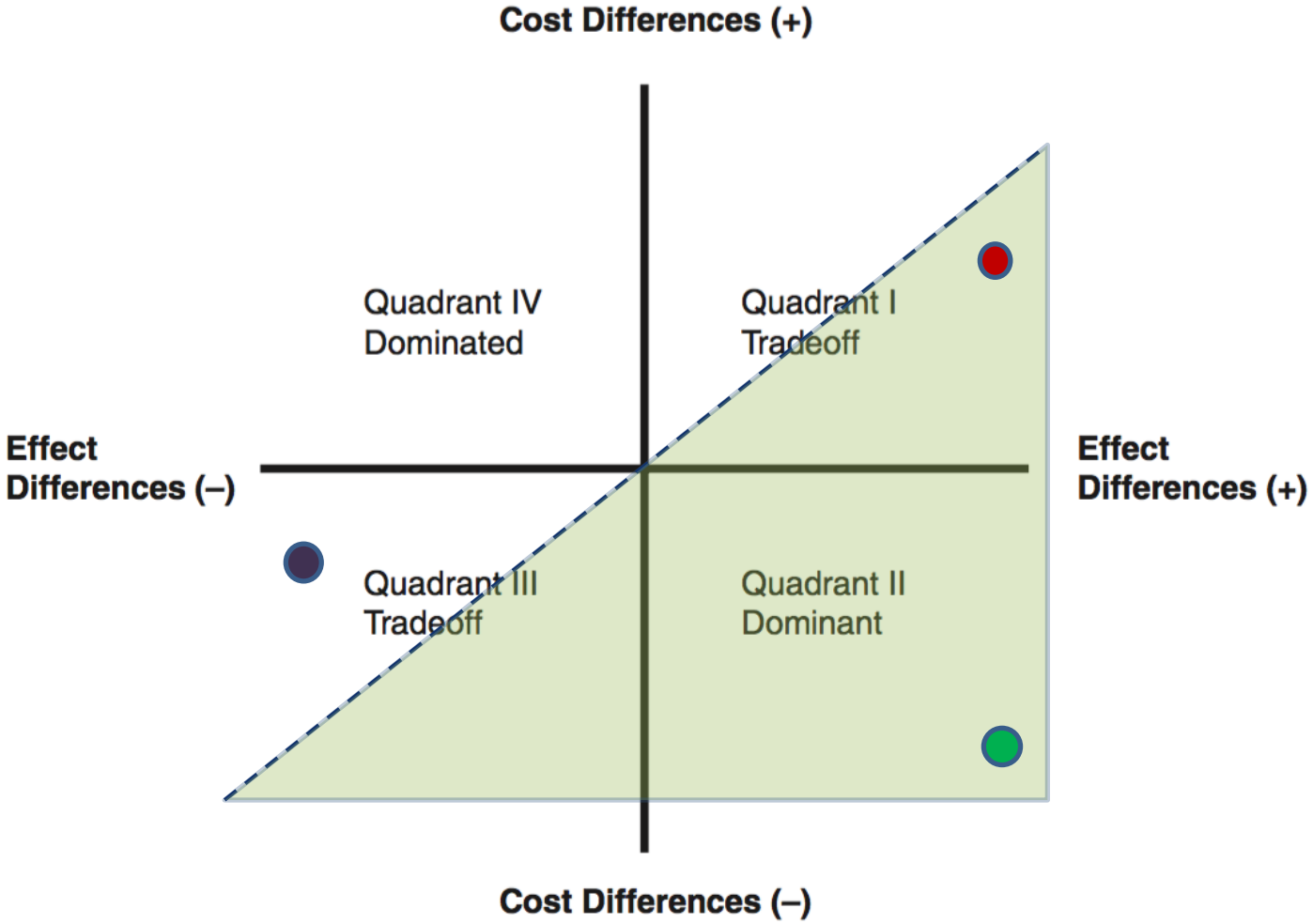
- Use CE Ratio to compare alternative decisions

CE Ratio = C / NMB

Where: C = Costs of Decision

NMB = Non-Monetary Benefits

CEA Tradeoff Grid



Cost-Utility Analysis (CUA)

- Uses cost-utility ratio that expresses the benefits as weighted utility (QALY) of a decision
- Special case of CEA, but includes societal preferences
- Used in health technology assessments
- Quality- adjusted life years (QALY)

  = Time in health state * Utility
- Where utility is person specific: Perfect Health =1; Death =0

Cost-Utility Analysis (CUA) Cont.

- Like CEA use grid to compare CU ratios

CU Ratio = C / NMB

Where: C = Costs of Decision

NMB = Non-Monetary Benefits

FINAL RECAP

Recap

- Animal diseases can have great negative economic impact
- Trade is an important component of U.S. production
- Producers make decisions based on a myriad of factors, which should be considered
- CBA, CEA, and CUA are all tools that can be used in decision making

Thank you for your attention. Are there any questions?

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