Producers Valuation of Feeder Cattle Characteristics

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David Anderson

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Jacksonville, FL
Feeder Cattle

- Young steers, heifers and bulls to be placed in a feedlot, where they are fattened prior to slaughter.

- Purchased at live auction markets

- Price is determined by observable characteristics:
  - Premiums: European breeds, color
  - Discounts: Horns, sex
Hedonic Price

- Feeder cattle price: $ r(z) = r(z_1, ..., z_m) $

- The effect of cattle characteristics on market prices has been extensively studied:
  - Schroeder et al., 1988
  - Schulz et al., 2015
  - Zimmerman et al., 2012

- Prices reveal nothing about producers’ valuations or structural demands.
Price vs. Preferences

$r(z_1, z_2^*, ..., z_m^*)$

Adapted: Rosen, 1974
Price vs. Preferences

Adapted: Rosen, 1974
Objectives

- Estimate the underlying valuation functions behind observed prices.
- Develop better marketing, management and educational programs for feeder cattle producers.
Outline

- Motivations
- Theoretical Framework
- Data
- Model Estimation
- Preliminary Results
Theoretical Framework
Theoretical Model

- Two input types:
  - Heterogeneous: Feeder cattle
  - Homogenous: Composite

- Output quality is a function of the quantity and quality of the inputs used.
  - $q \leq \Gamma(X, z, \lambda)$ (quality constraint)
  - $p(q) = p(q_1, ..., q_k)$ (price)

- Objective of producers (buyers) is to maximize profit:
  $$\max_{q,z} \pi = p(q) - c(r, z, q, \lambda)$$
• Producers’ valuation of heterogeneous input \( (z) \):
  \[
  WTP = \theta(z; \pi, q, \lambda)
  \]
  \[
  \pi = p(q) - c(\theta, z, q, \lambda)
  \]

• Optimal choice of \( q \) and \( z \):
  \[
  p_i(q) = \frac{\partial c}{\partial q_i} = c_{q_i}, \quad i = 1, \ldots, k
  \]
  \[
  z_i = -\frac{\partial c}{\partial z_i} = -c_{z_i}, \quad i = 1, \ldots, m
  \]

• Thus, profit is maximized when
  \[
  \theta(z^*; \pi^*, q^*, \lambda) = r(z^*)
  \]
  \[
  \theta_{z_i}(z^*; \pi^*, q^*, \lambda) = r_i(z^*), \quad i = 1, \ldots, m
  \]
Data
Data Collection

  - County Extension Agents
  - Standardized data collection process
  - Individual animals rather than lots

- Gathered information includes
  - Price
  - Color
  - Sex
  - Frame size
  - Fill
  - Body condition
  - Muscle score
  - Brahman influence
  - Dehorn status
  - Weight
  - Date
## Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Proportion (%)</th>
<th>Variable</th>
<th>Proportion (%)</th>
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Data Considerations

- Cattle attributes:
  - Continuous: Weight
  - Discrete (S levels): Color – black, white, spots, etc.,

- Hedonic literature is based on continuous attributes.
  - Profit maximization implies: $\theta_{z_j} = r_j$
  - No FOC for discrete attributes

- The true valuation of discrete characteristics is not directly observed
  - Revealed preference choices imply: $\theta_{z_{ks}} \geq r_{ks}$
Model Estimation
1. Hedonic Price

- Hedonic price function: \( r(z) = r(z_1, \ldots, z_m) \)
  - Random Effects: \( r(z) = z'\beta + z'\gamma \)

- Marginal implicit prices
  - Continuous: \( \frac{\partial r}{\partial z_i} \)
  - Discrete: \( r(z|z_{ks} = 1) - r(z|z_{ks} = 0) \)

- The hedonic price is estimated for each auction location to avoid potential identification problems (Brown and Rosen, 1982).

- Marginal prices are inferred for each observation (\( \hat{r}_i \)).
2. Producers’ Valuation

- Theory: \( r_i = \theta_{z_i} = -c_{z_i} \)

- A functional cost function could be used to estimate \( \theta_{z_i} \)
  - Theoretical properties of \( c(r, z, q, \lambda) \)?
  - \(-c_{z_i} \approx V_{z_i} + u_i\)
  - \( V_{z_i} = f(r, z, q, \lambda) = f(x; \alpha) \)

- Marginal valuation functions
  - Continuous: \( \hat{r}_i = x'\alpha + u_i \)
  - Discrete: \( \hat{r}_{ks} \leq x'\alpha + u_{ks} \)
Preliminary Results
## Price Differentials

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Future Work

- Estimate valuation function:
  - $V_{zi} = f(r, z, q, \lambda)$
  - Input price: *hedonic price, corn futures*
  - Quality: *feeder cattle attributes*
  - Production parameters: *location, time*

- Develop educational programs for feeder cattle producers
  - Identify buyer preferences
  - Price vs. valuation
Thank you!

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