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Profitability in Marketing Bred Heifers in Alabama

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Alabama Cattle Production

- Beef cattle sales: \$450 million in 2016
 - 2nd in AL agricultural receipts (#1 is poultry)
 - 31st in U.S.
- 12th in U.S. for % of farms with beef cattle
 - 41% of total farm operations in AL
 - 87% of AL cattle operations have <50 head
- Many small cow-calf operations
 - Sell to stocker or feedlots in Midwest

Motivation

- Extension agents and specialists objectives:
 - Create opportunities and education to increase profitability for cattle producers in AL
- 1999: ACES began hosting the Herdbuilder Replacement Female Sale
 - Partnership with producers
 - Goal: Create value-added for heifers in comparison to steers in their cohort
 - Annual event with biennial training
- 2017 training: What characteristics add value when marketing bred heifers?

Literature

- Many studies use Hedonic models to explain value of cattle characteristics
 - **Feeder cattle:** Coatney, Menkhaus, and Schmitz (1996), Williams et al. (2012), Zimmerman et al. (2012), Schulz, Dhuyvetter, and Doran (2015), Blank, Saitone and Sexton (2016), Mallory et al. (2016) many more
 - **Bulls:** Dhuyvetter et al. (1996), Vestal et al. (2013)
 - **Cow-Calf Pairs:** Parcell, Schroeder, Hiner (1995)
 - **Bred cows:** Mitchell, Peel and Brorsen (2017)

Bred Heifer Sales Data

- 2008-2017 data from annual Herdbuilder Replacement Female Sale
 - Every August in Uniontown, AL
- Unbalanced panel:
 - 749 pens of 3-5 bred heifers
 - 61 producers
- Dataset provides additions to literature:
 - Relatively disaggregated data
 - Additional positives: No spatial, seasonal, or age effects to account for
 - Can explore producer reputation effects (Maybe?)
 - Many unknowns for buyer: first calf, no contractual guarantees

Individual Heifer Characteristics

- Sale Order
- Breed Code (Ex: SSSS, AAAS)
- Color
- Calving Range (Ex: Oct. 20-Jan. 15)
- Breeding: Artificial Insemination (AI) vs Conventional
- Per Heifer Price
 - Same for all heifers in pen so need to aggregate

Aggregate Pen Characteristics

- Same across heifers in pen: Sale Order, Breeding AI vs Conv., Per Heifer Price
- Calving Range:
 - Range: Average number of days
 - Months until beginning of calving range: Average for pen
- Pen color:
 - Black vs. non-black
 - Non-black: $\leq 50\%$ black heifers
 - Same vs. Mixed

Aggregate Pen Characteristics

- Breed Influence:
 - $>0\%$ in pen
 - Hereford, Brahman, Simmental, Angus
- (Somewhat) Specific Breed Mixes:
 - 50% Hereford, 50% Brahman
 - $\geq 75\%$ Brangus
 - $\geq 75\%$ Angus
 - $\geq 75\%$ Simmental
 - $\geq 75\%$ Angus with Simmental Influence
 - $\geq 75\%$ Simmental with Angus Influence

Summary Statistics

N=749, Years 2008-2017

Statistic	Mean	St. Dev.	Min	Max
Pen Average Price/Heifer	1,831.66	683.91	800	4,600
Breeding: Conventional (1) vs A.I. (0)	0.79	0.41	0	1
Calving Range (# Days)	85.04	17.34	24	153
Months Until Calving Begins	2.26	1.43	1	8
Sale Order	38.36	22.50	1	96
Pen Color: Same (1) vs. Mixed (0)	0.76	0.43	0	1
Color: Non-Black	0.14	0.34	0	1
50 Heref/50 Brahm	0.03	0.18	0	1
Brahman Influence	0.19	0.39	0	1
75+Brangus	0.06	0.24	0	1
75+ Angus	0.13	0.34	0	1
75+ Simmental	0.05	0.22	0	1
Angus Influence	0.83	0.38	0	1
Simmental Influence	0.59	0.49	0	1
Hereford Influence	0.10	0.30	0	1
75+ Angus x Simm Inf.	0.03	0.16	0	1
75 Simm x Angus Inf.	0.03	0.18	0	1

Empirical Model

- Hedonic model
 - Ladd and Martin (1976): Input price=Sum of money value of input's characteristics
 - Assumption: Supply is perfectly inelastic
 - Reasonable for a given sale

$$Price_{ikt} = \beta_0 + \sum_j \beta_j x_{ikjt} + YearFE + \epsilon_k + \lambda_{it}$$

- i =pen, k =producer, t =year, j =characteristic
- β_j : marginal value of j^{th} characteristic
- λ_{it} : iid random error
- ϵ_k : Errors correlated for each producer

Hypothesized Effects on Price

- Conventional breeding **discounted** to AI
 - Conventional less accurate
- Calving Range (# Days): **Negative**
- Months Until Calving Begins: **Negative**
 - Further out means more inputs before calf (Mitchell, Peel and Brorsen, 2017)
- Sale Order: **Negative**
 - Sale order roughly approximates quality
- Pen Same Color receives **premium** compared with Mixed
- Color: Non-Black **discounted** to Black (Mitchell, Peel and Brorsen, 2017)

Hypothesized Breed Effects on Price

- Brahman Influence: ???
 - Feeder cattle Brahman influence receives discount (Williams et al, 2012; Coatney et al.,1996)
 - Tolerance to heat and endophyte-infected fescue increases value to Southeast producers
- Hereford Influence: **Discount** (Parcell et al.,1995)
- 50% Hereford/50% Brahman: **Premium**
 - Tigerstripe, heat tolerance increases value

Hypothesized Breed Effects on Price

- 75+ Angus: Premium (Parcell et al., 1995)
- 75+ Brangus: Premium
 - Heat tolerance combined with Angus
- 75+ Simmental: Premium
- 75+ Simmental x Angus, 75+ Angus x Simm: Premium
 - Premiums for European Crosses (Coatney et al., 1996; Hawkes et al., 2008)

Results

Bred Heifer Hedonic Price Model with Producer Cluster-Robust Errors

	Dependent Variable: Average Price/Heifer		
	(1)	(2)	(3)
Conventional Breeding	-160.90*** (46.33)	-162.79*** (46.79)	-51.59 (36.42)
Calving Range (# Days)	-1.91** (0.79)	-1.86** (0.81)	-1.30 (0.92)
Months Until Calving Begins	-79.17*** (13.62)	-78.79*** (13.66)	-61.18*** (12.13)
Sale Order	-1.87*** (0.49)	-1.90*** (0.48)	-1.42*** (0.49)
Pen Same Color	18.26 (16.63)		
Color: Non-Black	20.52 (22.01)		
50 Heref/50 Brahm	225.65** (88.21)	247.09*** (54.16)	242.65*** (35.90)
Brahman Inf.	-26.87 (27.63)		
75+Brangus	91.75** (37.52)	78.77** (33.57)	72.43* (43.68)
75+ Angus	-121.34*** (38.70)	-120.06*** (37.46)	-53.82 (40.32)
75+ Simmental	-68.98 (52.26)	-69.47 (51.99)	-74.28** (30.52)
Hereford	26.93 (49.24)		
75+ Angus x Simm Inf.	111.94*** (43.32)	113.26*** (43.11)	20.17 (53.29)
75+ Simm x Angus Inf.	188.07** (77.35)	192.48** (77.60)	231.22*** (66.39)
Constant	1,735.04*** (86.48)	1,748.08*** (86.67)	1,456.51*** (114.33)
Year FE	Yes	Yes	Yes
Producer FE	No	No	Yes
R ²	0.88	0.88	0.9
Adjusted R ²	0.87	0.88	0.9

Note:

* p<0.1; ** p<0.05; *** p<0.01

Significant Effects on Avg Price/Heifer

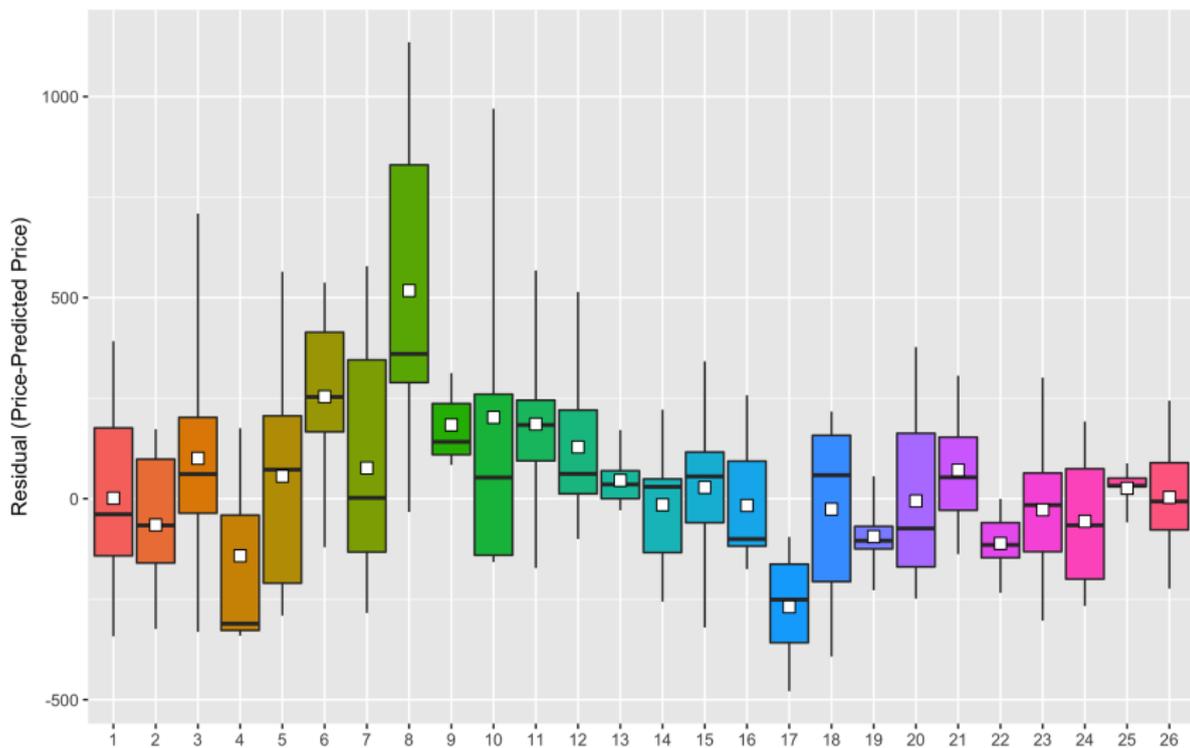
- Conventional breeding to AI: **-\$163**
- Calving Range (# Days): **-\$2**
- Months Until Calving Begins: **-\$79**
- Sale Order: **-\$2**
- 50% Hereford/50% Brahman: **\$247**
- 75+ Angus: **-\$120**
 - 75+ Angus x Simm: **-\$7**
 - Surprising?
- 75+ Brangus: **\$79**
- 75+ Simmental x Angus: **\$123**
- No statistically significant effect: Pen Same Color vs. Mixed, Color: Non-Black vs. Black, Brahman Influence, Hereford Influence, 75+Simmental

Reputation Effects

Producers selling 2+ years

Producer 1	104.56** (43.76)	Producer 16	80.85 (72.13)
Producer 2	32.68 (45.33)	Producer 17	-233.14*** (44.88)
Producer 3	266.56*** (46.14)	Producer 18	49.50 (42.12)
Producer 4	-47.89 (66.61)	Producer 19	-6.48 (43.56)
Producer 5	91.09* (47.52)	Producer 20	78.97 (54.55)
Producer 6	373.29*** (43.65)	Producer 21	227.11*** (59.66)
Producer 7	309.98*** (60.06)	Producer 22	-36.67 (63.96)
Producer 8	746.95*** (55.28)	Producer 23	81.53** (41.29)
Producer 9	258.99*** (41.56)	Producer 24	127.81*** (46.81)
Producer 10	414.46*** (60.59)	Producer 25	132.45 (105.95)
Producer 11	256.02*** (45.95)	Producer 26	65.44 (54.21)
Producer 12	206.97*** (38.66)		
Producer 13	158.47*** (41.77)		
Producer 14	58.93 (37.47)		
Producer 15	175.50*** (43.70)		

Residual 95% CI Box Plots by Producer



Conclusions and Future Work

- Limiting calving range: effective in getting higher prices
 - AI valued significantly higher than conventional
- Tolerance to heat and/or endophyte-infected fescue seems to play a big role in this market compared with others
 - Brahman mixes receive premiums comparable or higher than Angus/Simm mixes
- Evidence of reputation effects
 - Could be additional breed effects?
 - Further investigation is necessary
- Find better methods for capturing breed effects?

Questions? Comments?

Thank you!

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Significant Characteristics of Bred Cows

- Mitchell, Peel and Brorsen (2017) finding the following effects of characteristics on bred cow price:
 - Age: Negative
 - Weight: Positive but diminishing
 - Months bred: Positive
 - Highest premiums 8-month bred
 - Color: Black receives premium
 - Quality: Premiums for higher quality
 - Spatial and Seasonal differences
- USDA AMS bred cow reports
 - Aggregation across lots