Assessing Efficiency of U.S. Cow-Calf Operations:

Kansas

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US BEEF INDUSTRY

COW-CALF
& SEEDSTOCK

BACKGROUNDERS
& STOCKERS

SALE BARNS

FEEDYARDS

PACKERS

highly segmented

CONSOLIDATION

More than 105,000 cow-calf farms have been lost since 1997.

RETAINED OWNERSHIP
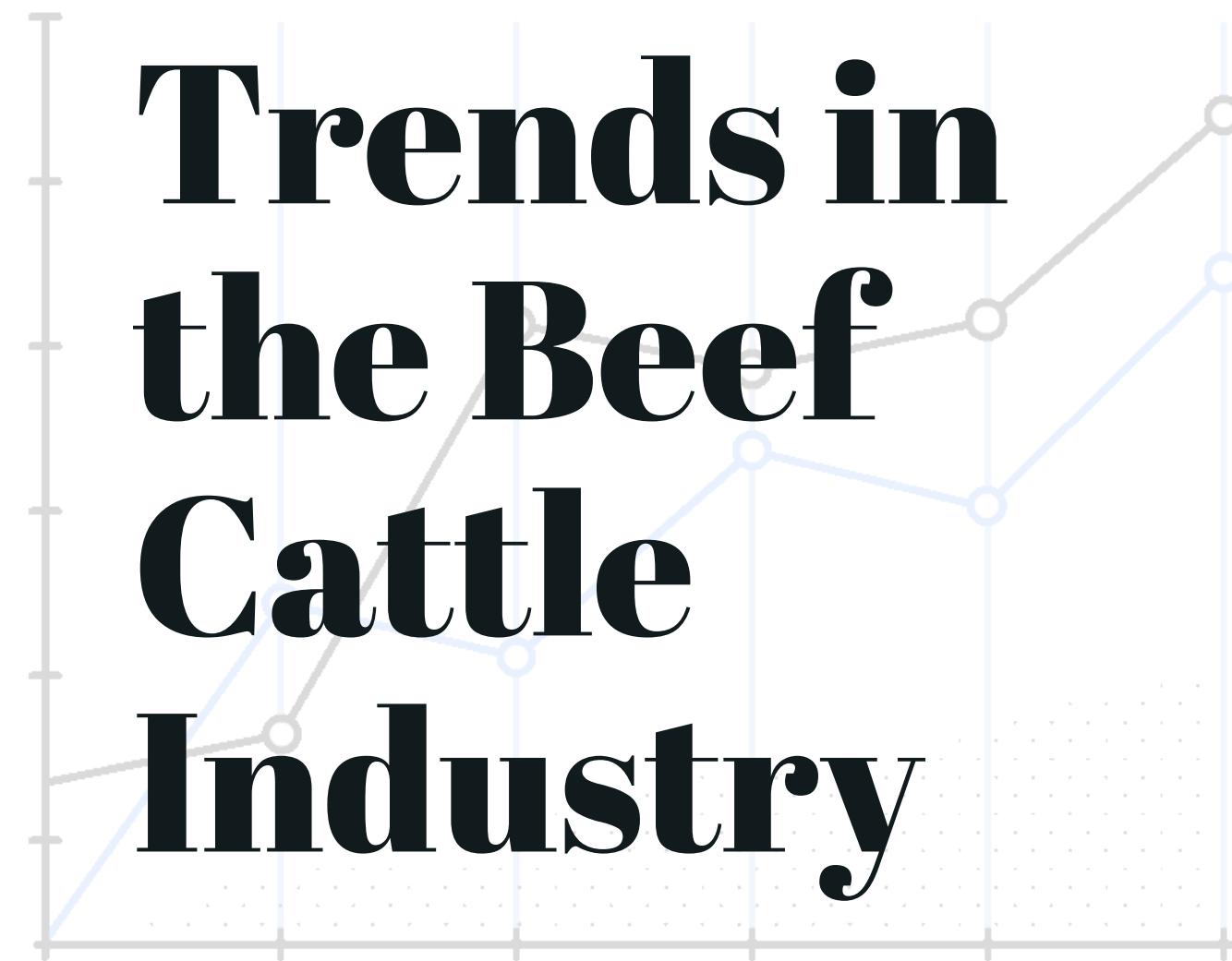
An increase of 10% in ownership retention since 2008.

INCREASED BACKGROUNDING

12% increase in use of backgrounding prior to marketing for cow-calf producers.
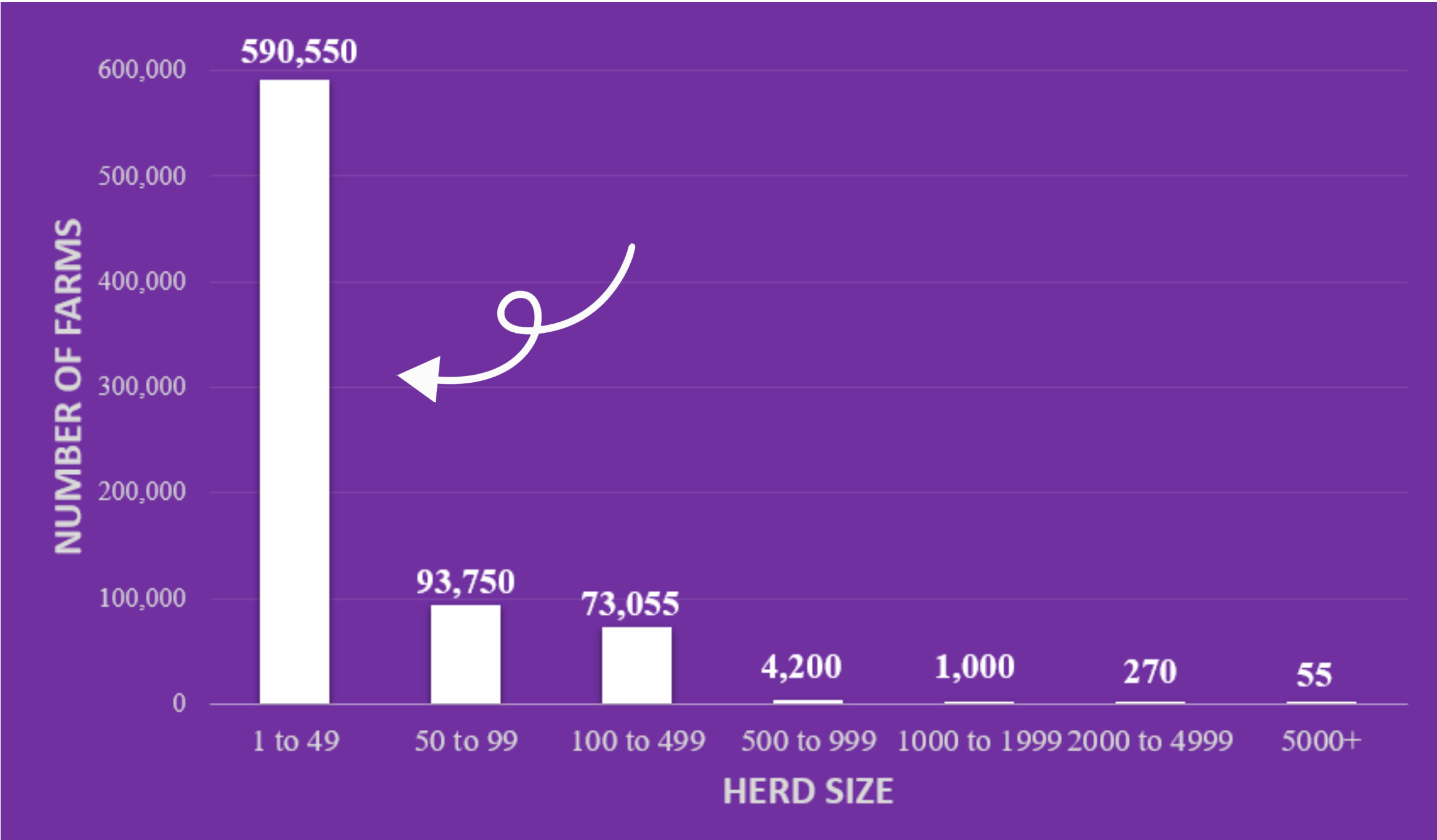
FEEDLOT MIGRATION

86% of feedlot production is located in the plains region.

Trends in the Beef Cattle Industry

USDA - ERS, 2017
Nehring, Peel, & Nulph 2009

Herd Size Over Time

An 8% increase in herd size over 44 years.

2018

43.5 head

1997

40.5 head

1974

40.3 head

USDA - ERS
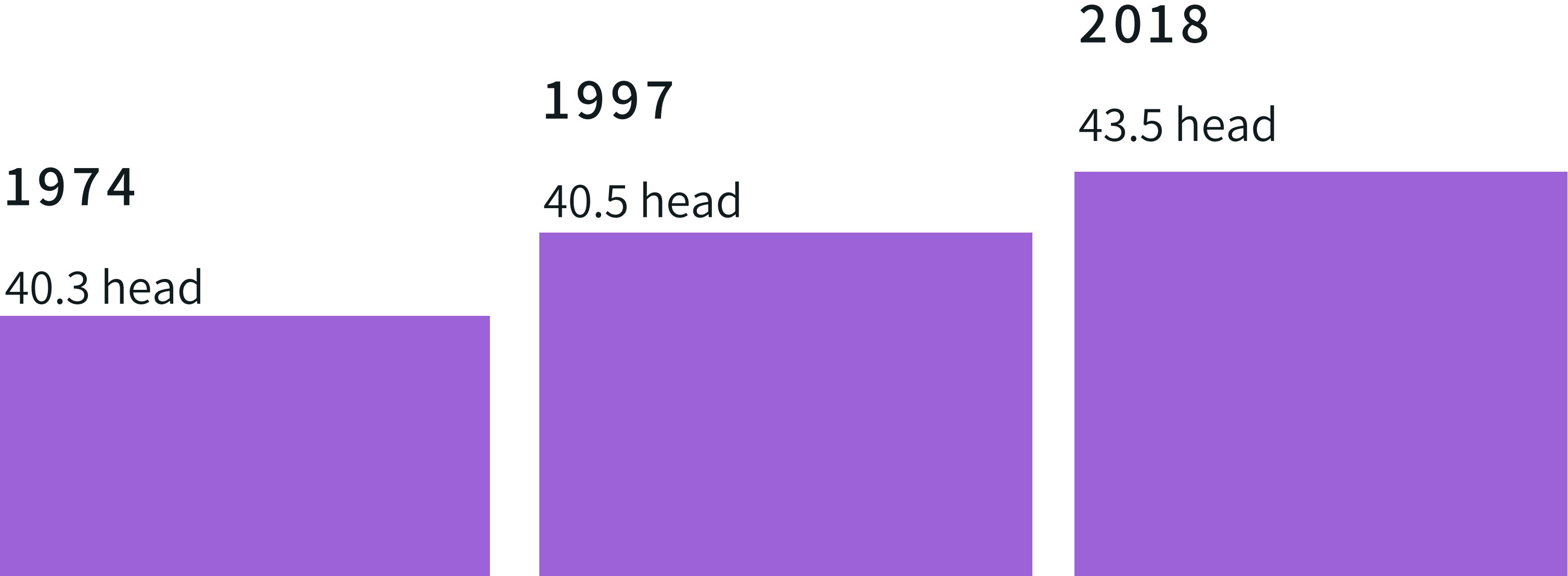
Returns to Management & Profitability
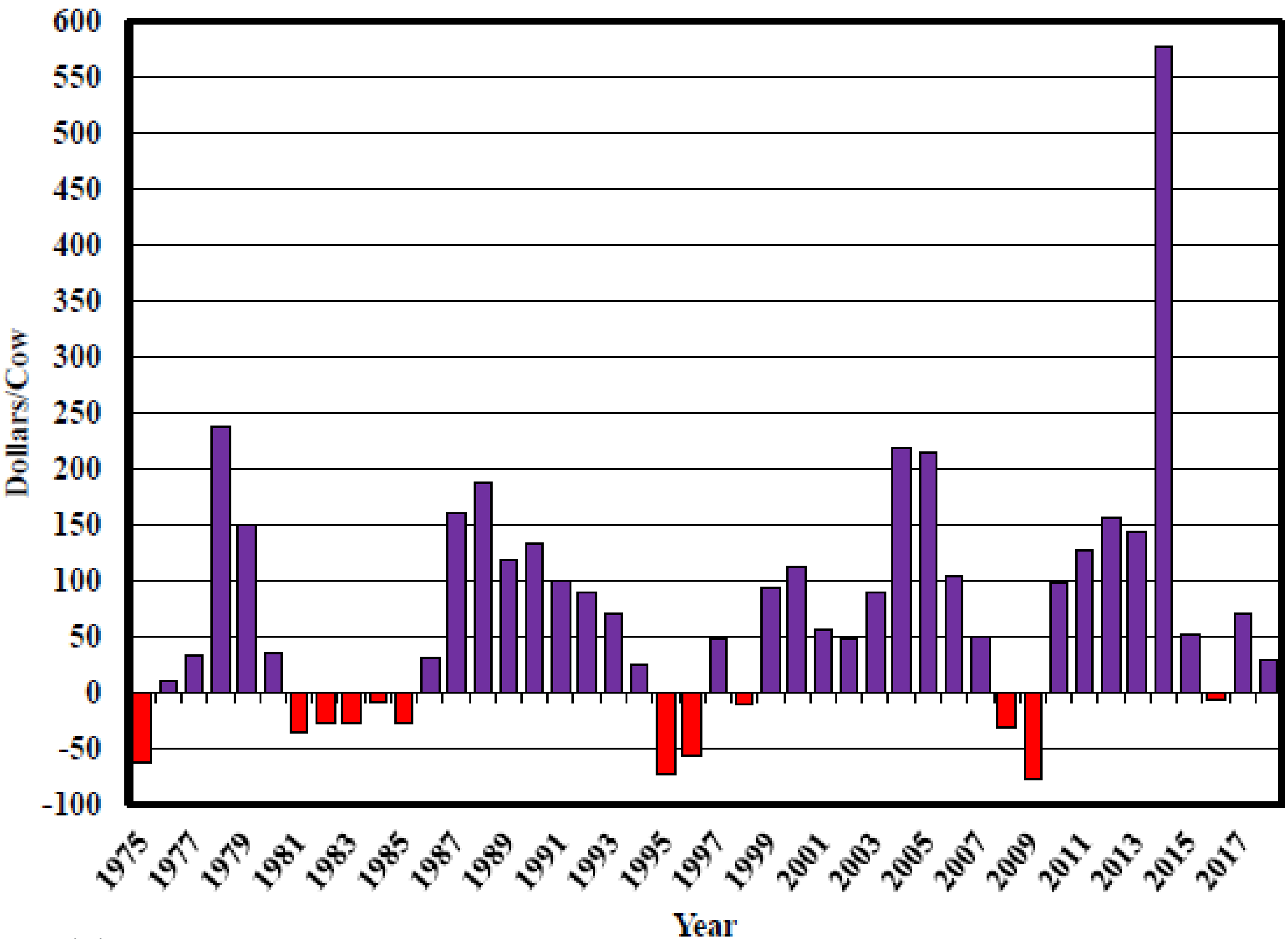
Given that profitability has been so variable over time, but herd size is not changing, what might be causing certain producers to be more efficient?

Objective

Estimate production efficiencies for Kansas Cow-Calf producers.

Identify characteristics of production (selling feeders vs selling calves) that might affect efficiency.

Determine if herd size affects efficiency.

Method & Data

KANSAS FARM MANAGEMENT ASSOCIATION

173 producers supplied data in 2018.

DATA ENVELOPMENT ANALYSIS

Non-Parametric approach to estimating efficiencies.
Does not require estimating a production function.

Data - KFMA

Descriptive Statistics – Kansas Farm Management Association:
2018 Cow Calf Production

	Producers Selling Calves (N=94)			Producers Selling Feeders (N=79)			Total (N=173)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Herd Size (hd)	120	12	560	157	21	399	137	12	560
Pasture Acres	1,162	30	6,600	1,362	49	4,258	1,253	30	6,600
Gross Income ($)	89,789	7,812	357,469	139,961	15,984	402,166	112,700	7,812	402,166
Labor ($)	19,437	1,835	143,422	25,562	2,598	70,446	22,234	1,835	143,422
Capital ($)	16,879	259	98,574	24,909	570	91,080	20,546	259	98,574
Feed ($)	56,844	3,565	247,669	88,602	8,068	297,520	71,346	3,565	297,520
Utilities/Fuel ($)	3,928	48	17,647	5,220	0	22,370	4,518	0	22,370
Veterinary ($)	4,036	0	36,002	7,172	0	25,522	5,468	0	36,002
Miscellaneous ($)	7,559	376	36,971	7,366	268	26,815	7,471	268	36,971

Method: Data Envelopment Analysis

This approach defines a non-parametric frontier and measures the efficiency of each unit relative to that frontier.

DEA uses linear programming to construct a frontier that envelops all observations and computes the relative Technical Efficiency of each farm included in the sample.

We use an output orientation with one output (Gross Income) and 6 Inputs.

We have two production systems in the data set: those that background and those that do not.

Method: Data Envelopment Analysis

Technical efficiency: the ability of a firm to either produce the highest level of output with a set input bundle and technology or to produce the current level of output with the lowest level of inputs

Allocative efficiency: evaluates if a firm is using the optimal bundle of inputs

Scale efficiency: compares a firm's current operational size with what is most efficient in terms of minimizing average cost

Inputs

HERD SIZE

LABOR

FEED & PASTURE EXPENSE

FARM UTILITIES & FUEL

VETERINARY EXPENSE
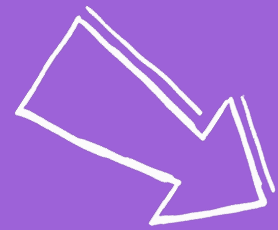
MISCELLANEOUS EXPENSES

Outputs

FARM INCOME

Technical Efficiency
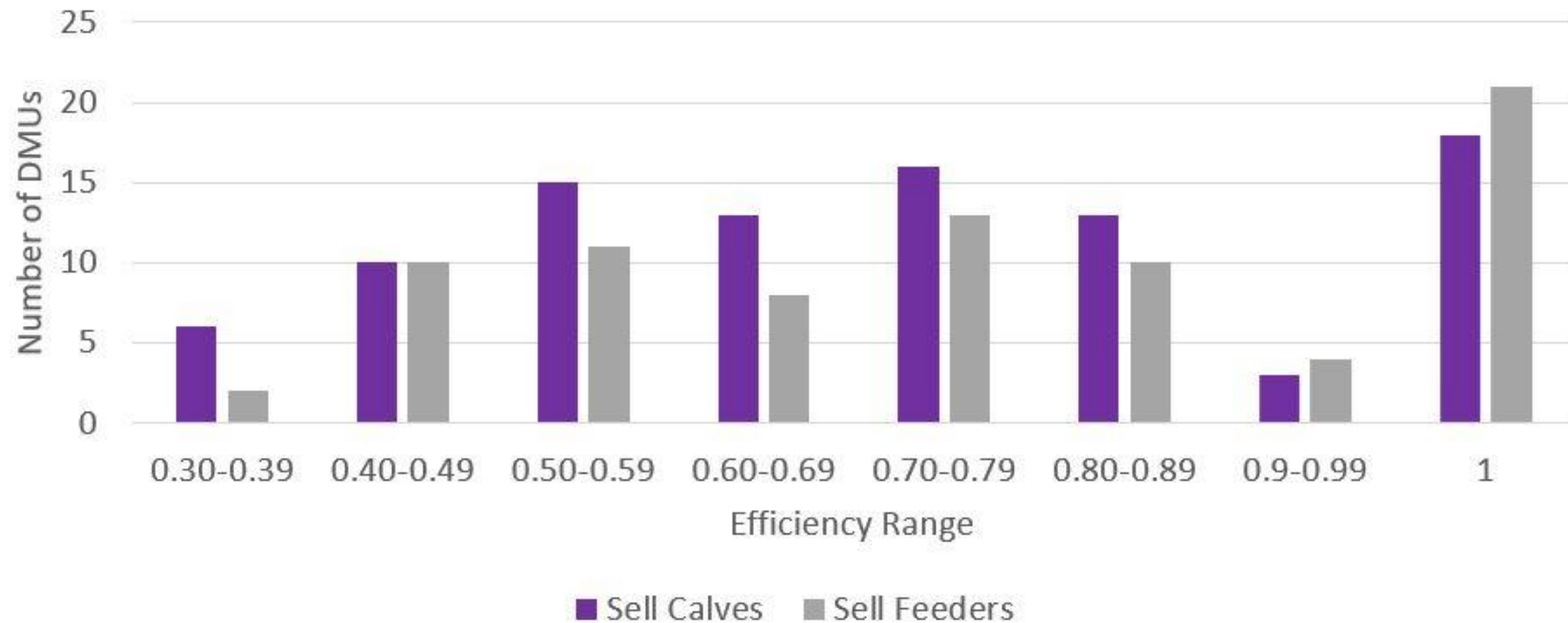
.712

SELLING CALVES

.754

SELLING FEEDERS

39 DMU'S WERE TECHNICALLY EFFICIENT (23%)

Technical Efficiency

KFMA Technical Efficiency Distribution
Cow-Calf Producers 2018, N=173

Bar chart: Number of DMUs (y-axis) vs Efficiency Range (x-axis)

Efficiency Range	Sell Calves	Sell Feeders
0.30-0.39	6	2
0.40-0.49	10	10
0.50-0.59	15	11
0.60-0.69	13	8
0.70-0.79	16	13
0.80-0.89	13	10
0.9-0.99	3	4
1	18	21

■ Sell Calves   ■ Sell Feeders

Allocative Efficiency

.700
SELLING CALVES

.710
SELLING FEEDERS

4 DMU'S WERE ALLOCATIVELY EFFICIENT (2%)

PRODUCTION ELASTICITY ESTIMATES

Production Parameter Estimates for Cow/Calf Producers in Kansas 2018			
	Selling Calves	Selling Feeders	Composite
Farm Income			
Herd Size	0.866**	0.907**	0.895**
Labor	0.014**	-0.150	-0.014
Feed	0.017**	0.132	0.046**
Utilities	-0.005**	0.050	-0.002
Vet	-0.048**	0.024	-0.054**
Misc.	0.174**	0.095	0.166**
Constant	5.667**	5.567**	5.709**
Inefficiency Variables			
0 to 120 cows			
121 cows to 300 cows	-0.142	23.267*	0.044
301 cows to 500 cows	-0.704	27.543**	-1.185*
501 cows to 1,000 cows	0.578**	-	-2.235**
Off Farm Income	4.794**	13.097	0.078
Significance: * p<0.05,** p<0.01			

Results & Discussion Summary
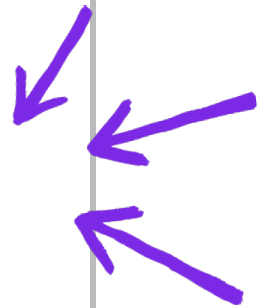
- OFF-FARM INCOME INCREASES INEFFICIENCY FOR PRODUCERS SELLING CALVES

- INCREASING HERD SIZE DECREASED INEFFICIENCY

- PRODUCERS THAT SELL CALVES ARE LESS TECHNICALLY EFFICIENT THAN PRODUCERS SELLING FEEDERS

Average Efficiancy Scores by Group - KFMA 2018			
Group	Scale	Allocative	Technical
Producers Selling Calves	0.878	0.700	0.712
Producers Selling Feeders	0.876	0.710	0.754
Composite	0.877	0.705	0.731

Future Research

PRODUCER CHARACTERISTICS

Identify other characteristics that may influence efficiencies (age, rented vs owned land, farm diversification).

PRODUCTION TECHNOLOGIES

Identify specific "technologies" that impact efficiencies (rotational grazing, AI, animal health).

UTILIZE ARMS DATA

Use DEA analysis on ARMS data to determine regional differences in production efficiency

THANK YOU

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