


Dairy Economics –
Factors affecting profitability
(and a couple custom analytics projects)

Kevin Dhuyvetter, PhD
 Technical Consultant, Elanco


Balchem Real Science Exchange Webinar
 March 5, 2024



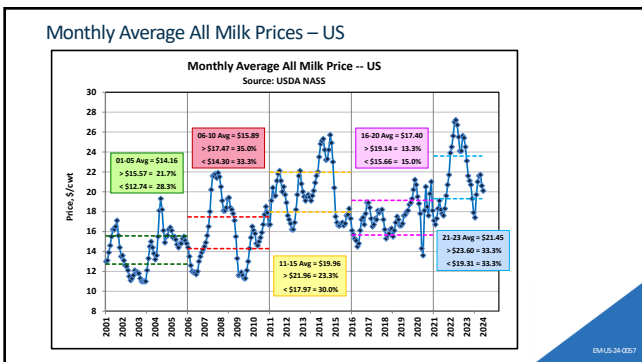

1

A few important economic concepts...

- Variable vs. fixed costs
 (economies of size (scale) is related to fixed cost)
- Short run vs. long run
- Cash vs. economic costs (P&I pmt vs depreciation)
- Price = cost (implies profit = \$0)
 (on average, in the long run, in competitive industries)
- Marginal revenue > marginal cost
 (decision rule for profit maximization)
- Partial budget vs. whole-farm analysis
- Time value of money
- Comparative advantage, revealed preference, time & wealth

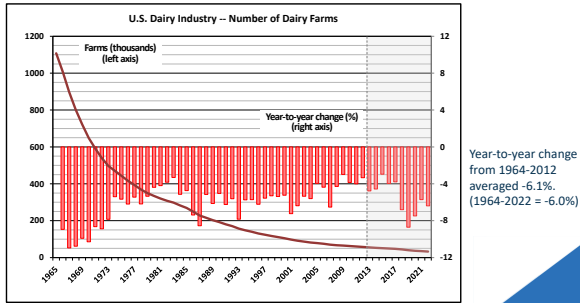


2



3

Number of dairies has been declining for long time...



8

Economic concepts with actual data

Examples of historical dairy returns



9

Historical returns to dairy operations

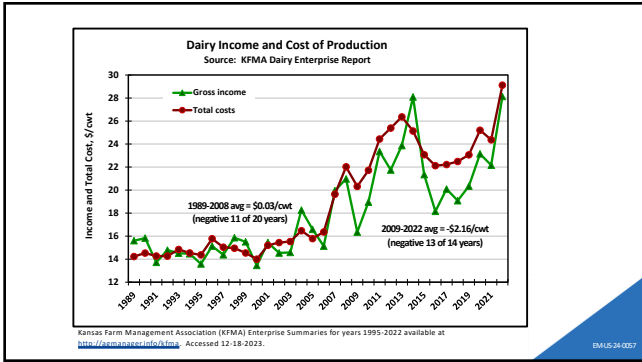
2002 Data - Kansas	Kansas Farm Management Association Annual Report 2002											
Item	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Total Assets	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Total Liabilities	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Equity	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Total Revenue	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Total Expenses	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000	800,000
Total Profit	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000

Annual Dairy Enterprise Reports covering the years 1989 to 2022.

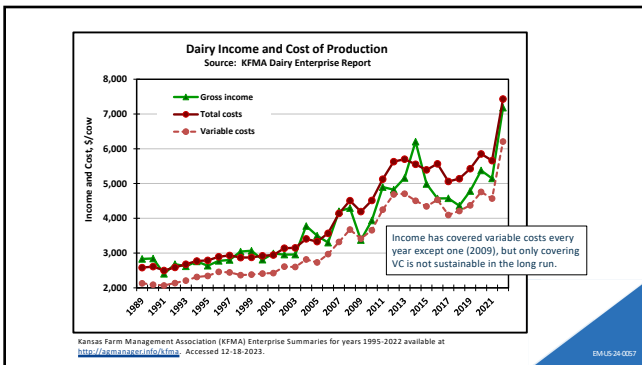
Reports from 1995-2022 are available at <https://www.asmanager.info/kfma/kfma-enterprise-reports>



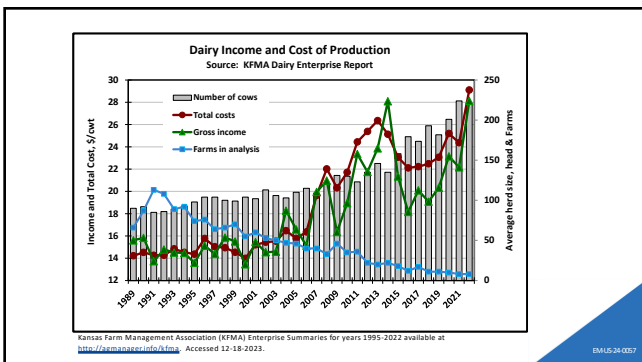
10



11



12



13

Historical returns to dairy operations from multiple sources

Examined historical data from multiple sources (accounting firms, universities, state agency) and time periods to look at key metrics of high profit versus average dairies.

EMUS-36-0257

14

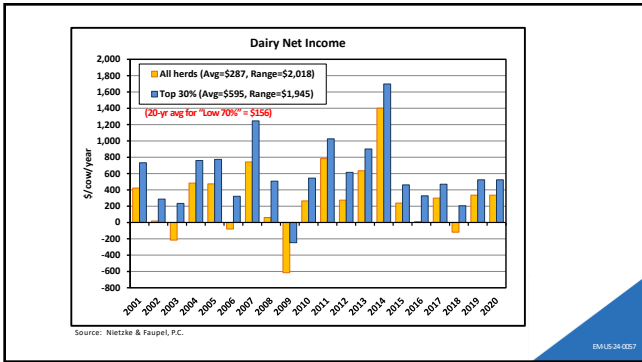
Historical returns to dairy operations

Annual reports covering years 2001-2020

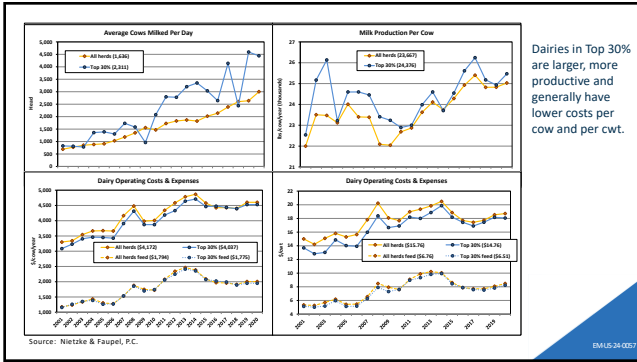
Top 30% vs Average (by year)

EMUS-36-0257

18



19



20

Summary of Key Indicators from Various Dairy Data Sources

Source	Group	Region	Years
Cornell ¹	All herds	NY	1999-16
	Top 25%	NY	1999-16
Difference			
NIFA, P.C. ²	All herds	Midwest	2003-20
	Top 35%	Midwest	2003-20
Difference			
CDFA ³	Sm/Med/eng	CA	2006-17
	Large	CA	2006-17
Difference			
KSUP ⁴	All herds	KS	2005-10
	Top 33%	KS	2005-10
Difference			
G, M and Co ⁵	All herds	CA	2003-20
	Top 25%	CA	2003-20
Difference			
G, M and Co ⁶	All herds	ID	2003-18
	Top 25%	CA	2003-18
Difference			
G, M and Co ⁷	All herds	TX	2003-20
	Top 25%	TX	2003-20
Difference			
FINBIN ⁸	All herds	MN/WI	2003-20
	Top 20%	MN/WI	2003-20
Difference			

Source: Dairy Farm Business Composites, New York Legume Herds, 200 Cows or Larger (various years); Department of Agricultural, Resource, and Management Sciences, College of Agriculture and Life Sciences, Cornell University, Ithaca, New York
¹ Cornell University
² NIFA, P.C.
³ California Department of Food and Agriculture (CDFA)
⁴ Department of Dairy, Kansas Veterinary Diagnostic Laboratory, University of Kansas Veterinary Management Association Dairy Enterprise Data
⁵ University of California Department of Agricultural Economics Report, August 2011
⁶ Personal communication with former of Genesis, Muller and Co., Ltd.
⁷ Personal communication with former of Genesis, Muller and Co., Ltd.
⁸ FINBIN website. Accessed Report for Dairy Cows, Milk and Milk Components, Years 1999-2018. Various Profitability Groups. <https://www.finbin.com/finbin/Default.aspx> accessed 12/23/21.

21

Summary of Key Indicators from Various Dairy Data Sources

Source	Group	Region	Years	S/cow/yr	Range	Herd size	Milk/cow	Cost/cow	Feed/cow	Cost/cwt	Feed/cwt	Milk price	Cost
Cornell ¹	All herds	NY	1999-16	5643	\$1,264	810	68.7	\$1,374	\$1,574	\$13.77	\$6.49	\$17.83	\$1.83
	Top 25%	NY	1999-16	5985	\$2,070	866	67.0	\$1,090	\$1,029	\$12.38	\$6.10	\$17.47	\$1.25
Difference													
NIFA, P.C. ²	All herds	Midwest	2003-20	5287	\$1,218	1,056	79.3	\$4,177	\$1,905	\$15.29	\$6.76	\$15.27	\$1.25
	Top 35%	Midwest	2003-20	5600	\$1,945	2,111	79.0	\$4,041	\$1,782	\$14.76	\$6.53	\$15.39	\$1.45
Difference													
CDFA ³	Sm/Med/eng	CA	2006-17	5912	\$773	676	2.5	\$1,376	\$118	\$12.00	\$6.25	\$6.12	\$2.25
	Large	CA	2006-17	5252	\$2,175	2,586	75.3	\$1,834	\$2,180	\$15.13	\$9.67	\$16.16	\$1.61
Difference													
KSUP ⁴	All herds	KS	2005-10	5105	\$131	1,070	4.8	\$70	\$46	\$9.92	\$6.46	\$6.28	\$2.2
	Top 33%	KS	2005-10	5172	n/a	133	62.4	\$1,348	\$1,356	\$17.32	\$8.59	\$16.36	\$4.33
Difference													
G, M and Co ⁵	All herds	CA	2003-20	5216	\$1,261	1,077	79.3	\$1,366	\$1,894	\$13.29	\$6.12	\$15.68	\$1.25
	Top 25%	CA	2003-20	5517	\$1,985	2,700	71.7	\$1,205	\$1,812	\$14.27	\$6.05	\$15.80	\$1.25
Difference													
G, M and Co ⁶	All herds	ID	2003-18	5173	\$1,132	1,486	79.3	\$1,438	\$1,800	\$13.04	\$6.29	\$15.80	\$1.45
	Top 25%	ID	2003-18	5393	\$2,187	2,111	79.8	\$1,311	\$1,782	\$14.08	\$7.04	\$16.04	\$1.45
Difference													
G, M and Co ⁷	All herds	TX	2003-20	5226	\$1,211	2,061	87.4	\$1,617	\$1,728	\$16.51	\$6.30	\$15.95	\$1.25
	Top 25%	TX	2003-20	5524	\$2,289	2,379	89.1	\$1,264	\$1,685	\$13.20	\$7.81	\$17.00	\$1.25
Difference													
FINBIN ⁸	All herds	MN/WI	2003-20	5154	\$1,174	144	15.1	\$1,218	\$1,600	\$16.82	\$6.06	\$17.44	\$1.25
	Top 20%	MN/WI	2003-20	5869	\$1,296	142	19.0	\$1,089	\$1,548	\$14.31	\$7.26	\$18.49	\$1.25
Difference													

Source: Dairy Farm Business Composites, New York Legume Herds, 200 Cows or Larger (various years); Department of Agricultural, Resource, and Management Sciences, College of Agriculture and Life Sciences, Cornell University, Ithaca, New York
¹ Cornell University
² NIFA, P.C.
³ California Department of Food and Agriculture (CDFA)
⁴ Department of Dairy, Kansas Veterinary Diagnostic Laboratory, University of Kansas Veterinary Management Association Dairy Enterprise Data
⁵ University of California Department of Agricultural Economics Report, August 2011
⁶ Personal communication with former of Genesis, Muller and Co., Ltd.
⁷ Personal communication with former of Genesis, Muller and Co., Ltd.
⁸ FINBIN website. Accessed Report for Dairy Cows, Milk and Milk Components, Years 1999-2018. Various Profitability Groups. <https://www.finbin.com/finbin/Default.aspx> accessed 12/23/21.

22

Profit (simplified)

We typically assume that the goal of the operation is profit maximization.

EMUS-26-0057

26

Profit (simplified)

If we want to increase profit, how is that accomplished?

- 1) Increase revenue (↑) and/or decrease cost (↓)
- 2) Increase revenue (↑↑) by more than cost increase (↑)
- 3) Decrease revenue (↓) by less than cost decrease (↓↓)

These changes (increases or decreases) are referred to as "marginal" or "incremental" changes.

EMUS-26-0057

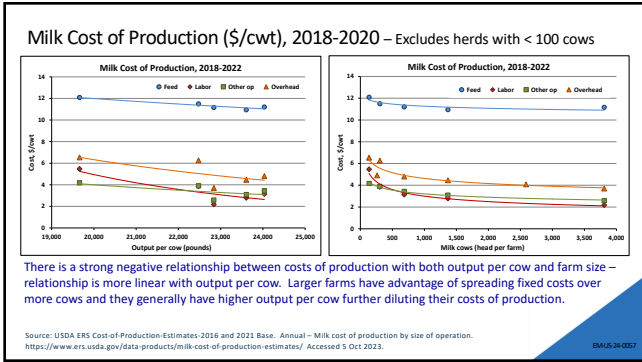
27

Incremental (more) milk

- Producing incremental (more) milk is typically a profitable decision for the individual dairy (not necessarily for the industry)
- Why?
 - Because in general, the value of the milk surpasses the incremental (marginal) cost
- How is this done?
 - 1) Adding cows
 - 2) Increasing the production from each existing cow
- Which is more beneficial? (answer varies depending upon dairy's constraints)

EMUS-26-0057

28




29

What is the cost of marginal / incremental milk?

- Feed and water (additional energy/nutrients required)
- Hauling, marketing, promotion, etc.
- Other???
- Depends upon what is driving the increased production:
 - Improved adherence to protocols / procedures
 - 2X vs 3X
 - Technology
 - Heat abatement / cow comfort
 - New/improved facilities

30

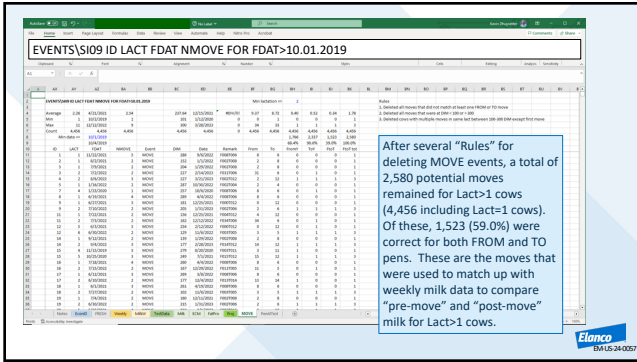
Evaluating the profitability of incremental milk



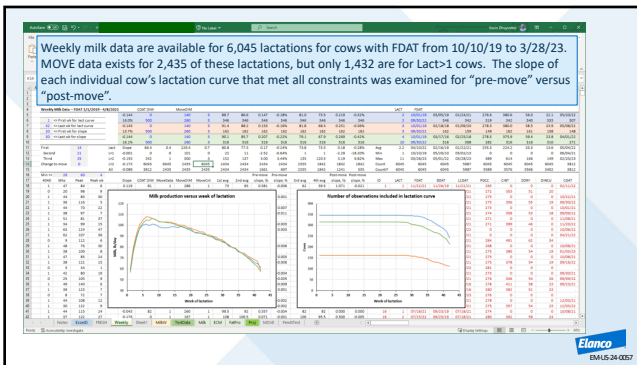
- When evaluating the impact of incremental milk, it is important to consider the costs relevant to the decision (i.e., marginal revenue versus marginal cost)
- Partial budgets can be used to look at the economics of incremental milk... (as well as other things...)

Elanco
EMUS-24-0027

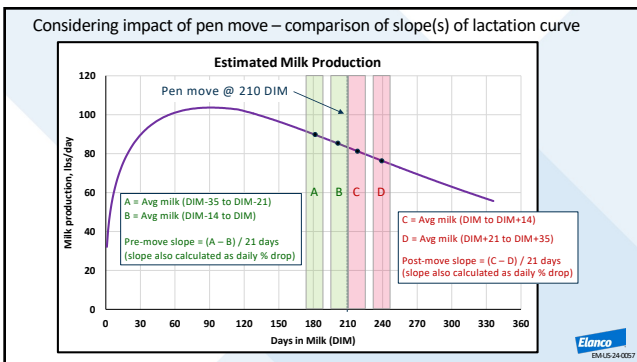
31



41



42



43

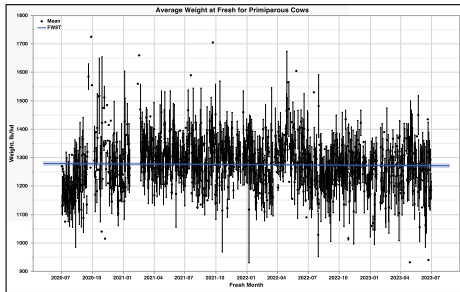
Issue (i.e., question that came to me)

- How is milk production in first lactation impacted by weight at calving?
- Does cow weight at calving have an impact on removal rate and reproduction in first lactation?

EMUS-23-002

51

Weight at calving over time – Lactation 1 (n=4,111)

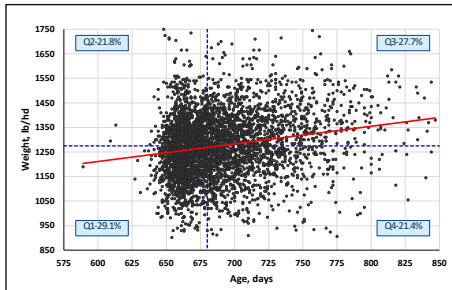


As would be expected, there is a lot of variation in cow weight, but mean over time has been relatively constant (slight decrease).

EMUS-23-002

52

Weight versus age at calving – Lactation 1 (n=4,133 ; FDAT = 7/1/20 – 6/30/23)



The majority of cows fall into the Q1 and Q3 quadrants, as would be expected with a positive relationship between age and weight, but there are still a lot of "outlier" cows.

Cows in Q4 are those we probably want to eliminate – they are older than average but weigh less than average.

EMUS-23-002

54

Multivariate statistical models (Lactation 1)

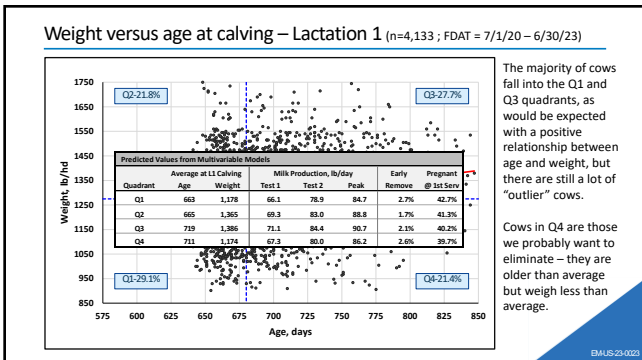
- Linear models – dependent variables
 - Milk
 - Milk1, Milk2, and Milk3
 - Milk at test (130-170 DIM)
 - Peak milk
- Logistic models – dependent variables
 - Removal in first 60 DIM (excluding sold for dairy)
 - First service outcome (Pregnant vs Open)

55

Multivariate statistical models (Lactation 1)

- Independent (explanatory) variables
 - Calf outcome (female, male, twin, other)
 - Calvings same week by parity
 - Age at L1 fresh, days (linear and squared)
 - Weight at fresh – L=1 (linear and squared)
 - Interaction between Age at L1 and Weight at fresh
 - Disease in first 30 DIM (Y|N) – Mastitis, Metritis, RP and DA
 - Month fresh
 - Year fresh (Year fresh is Aug-Jul)
 - Days in milk (DIM) (linear and squared)

56



57

Summary

- Weight of cow at calving is significantly related to milk production (much more important variable than age of cow)
- Considerable variation exists in weight of cow at calving that is not related to age (e.g., 400-500 pound range in weights at a given age)
- Identifying cows that are lighter than average but also older than average at calving is important to make progress on dairy
- Weighing cows at calving provides information that can be helpful for making management decisions – next step is to potentially to record/collect additional data to help explain weight variation in cows at calving

EMUS-23-002

58

Summary

- There is a wide range of profitability across dairies (variability across dairies at a point in time > than average across time)
 - Incremental milk is *often* profitable due to the dilution of fixed costs (i.e., marginal revenue > marginal costs)
 - Strategies for minimizing fixed costs per unit of output are:
 - 1) increase cows through facilities (add cows)
 - 2) increase production per cow (add milk/cow)
- Which is more profitable depends on an individual dairy's current situation and constraints
- Supply control/quotas impact the economics of incremental milk, but conclusions will depend on individual unique situations

EMUS-26-007

59

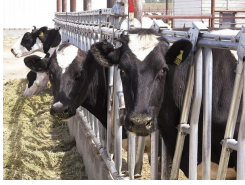
Summary

- Market variability (input and output prices) is high and likely will continue into the foreseeable future
- In commodity market, being low cost per unit of production is critical to business survival
- Inflation has increased cost of production significantly in the last several years
- Increased interest rates signal reduced leverage (all else equal)
- Are there things that might help offset some of these pressures? (e.g., beef x dairy, carbon markets, ???)

EMUS-26-007

60

Thank You



Kevin Dhuyvetter, Ph.D.
(785) 410-3244
kdhuyvetter@elanco.com



Elanco and the diagonal bar logo are trademarks of Elanco or its affiliates. Other product names are trademarks of their respective owner.
©2024 Elanco

EMUS-34-027
