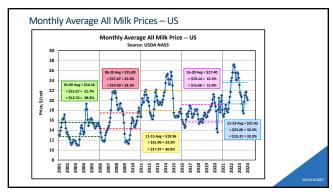
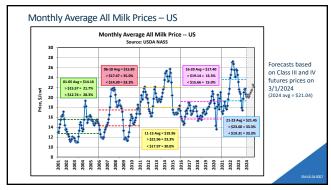


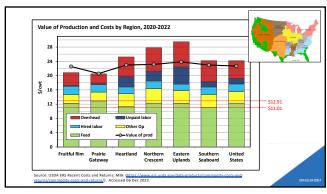
### A few important economic concepts...

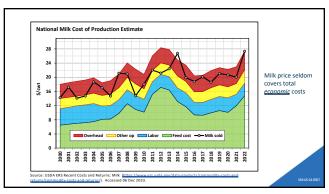
- Variable vs. fixed costs (economies of size (scale) is related to fixed cost)
- Short run vs. long run
- Cash vs. economic costs (P&I pmt vs depreciation)
- Price = cost (implies profit = \$0) (on average, in the long run, in competitive industries)
- Marginal revenue > marginal cost (decision rule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

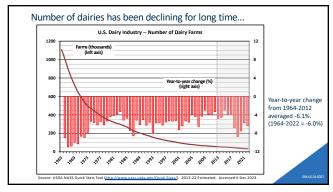
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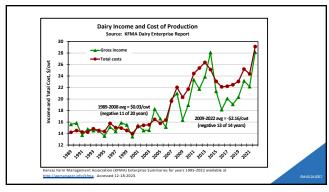


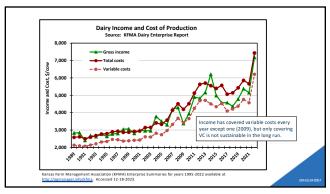


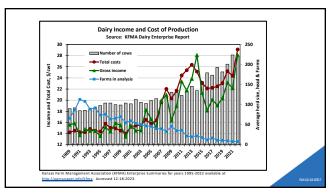


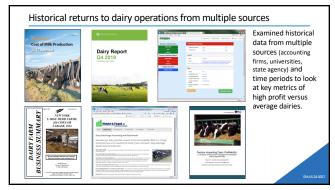
Econom	c concepts with actual data	
	Examples of historical dairy returns	

Annual Dairy Enterprise Reports covering years 1989 to 2022.  Reports from 1995-2022 are available at https://www.aemanaee/info/sfma/sfma-enterprise-re-  Reports from 1995-2022 are available at https://www.
Reports from 1995-2022 are available at https://www.aemanasec.info/hrms/hfma-enterprise-res
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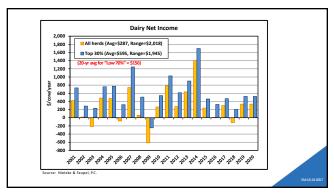


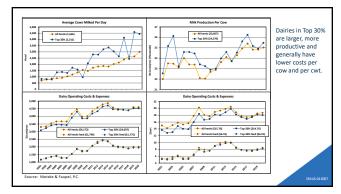












Dig var   Dig	ource	Group	Region	Years	
March   Color   Colo	Cornell <sup>3</sup>	All herds	NY	1999-16	
MAS P.C.   All houses   Services   2003-20	(18 yrs)	Top 20%	NY	1999-16	
Dig		Difference			
Collection   Col	N&F. P.C. <sup>2</sup>	All herds	Marea	2001-20	
Color   Colo	(20 yrs)	Top 30%	Marea	2001-20	
Clay		Difference			
Section   Sect	CDFA <sup>1</sup>	Sm/Med avg	CA	2006-17	
Section   Sect	(12 yrs)	Large	CA	2006-17	
Symbol   Top 125   St   200-130		Difference			
Object   O	KSU <sup>4</sup>	All herds	KS	2005-10	
(A, Mand CA) All hards (A, Mand CA) (A) (A) (A) (A) (A) (A) (A) (A) (A) (	(6 yrs)	Top 33%	KS	2005-10	
Degree   Top   T		Difference			
Marcia   M	S, M and Co <sup>s</sup>	All herds	CA	2001-20	
Option	(20 yrs)	Top 25%	CA	2001-20	
DE NY   No   201		Difference			
Observation   Continues   Co	G, M and Co <sup>5</sup>	All herds	ID	2001-18	
(5, M and CG) and hards: T2 200-30 (Delyn) Tay 25 15 T2 (Delyn) Tay 25 T2 (Delyn) Tay 2	(18 yrs)	Top 25%	ID	2001-18	
		Difference			
TORSION STATE OF THE PROPERTY	G, M and Co <sup>5</sup>	All herds	TX	2001-20	
Males   Male	(20 yrs)	Top 25%	TX	2001-20	
(20 ym.) Top 20% May/mil 2001-30  Top 2001-30  Top 2001-30  Top 3001-30  Top 3001-3		Difference			
Officerous  Source: Day's him beloves Growny, New York Lugar land Forms, 200 Cowes or Larger (purious years), Department of Agricultural, Resource, and Managerial Goscomics, College of Agricultura and Unit Sciences, Cornell University, 1994, New York Company Transformation of Agricultural and Unit Sciences, Cornell University, 1994, New York Company Transformation of Agricultural and Unit Sciences, Cornell University, 1994, New York Company Transformation of Agricultural and University of Agricultural and Unit Sciences, Cornell University, 1994, New York Company Transformation of Agricultural and University of Ag	FINBIN <sup>4</sup>	All herds	MN/WI	2001-20	
Source: Daily Sam Business Summary, New York Large Herd Forms, 200 Cours or Larger (various years), Department of Agricultural, Resource, and Managerial Economics, College of Agriculture and Life Sciences, Cornell University, 18hacs, New Yorkson, Control And Summarish Interesting Summa	(20 yrs)	Top 20%	MN/WI	2001-20	
Netter & Faunel P.C http://www.nfcsa.com/sericulture/dainy-advantage-accounting-and-benchmarks/					
Cultionis Department of Food and Agriculture (CDR) — https://www.cdb.cu.nov/doise/striange.gov/and/striange.					
		cation with partner of 0			rs 1999-2019. Various Profitability Groups, https://finbin.umn.edu/Lylench/Coty/Lylench/Index accessed 12/72/21.

	Group	Region	Years	\$/cow/yr	Range	Herd size	Milk/cow	Cost/cow	Feed/cow	Cost/cwt	Feed/cwt	Milk price	Cull
Cornell <sup>3</sup>	All herds	NY	1999-16	\$542	\$1,994	810	66.7	\$3,373	\$1,574	\$13.77	\$6.40	\$17.33	33.9%
(18 yrs)	Top 20%	NY	1999-16	\$985	\$2,070	856	67.9	\$3,090	\$1,529	\$12.38	\$6.10	\$17.47	32.2%
	Difference			\$443	\$76	57	1.2	-\$284	-\$45	-\$1.39	-\$0.30	\$0.14	-1.7%
N&F, P.C. <sup>2</sup>	All herds	Miarea	2001-20	\$289	\$2,018	1,636	76.5	\$4,177	\$1,800	\$15.76	\$6.76	\$15.27	37.2%
(20 yrs)	Top 30%	Miarea	2001-20	\$600	\$1,945	2,311	79.0	\$4,041	\$1,782	\$14.76	\$6.51	\$15.39	37.4%
	Difference			\$311	-\$73	676	2.5	-\$136	-\$18	-\$1.00	-\$0.25	\$0.12	0.2%
CDFA <sup>1</sup>	Sm/Med avg	CA	2006-17	\$87	\$1,864	717	70.4	\$3,594	\$2,134	\$16.06	\$9.53	\$16.44	\$304
(12 yrs)	Large	CA	2006-17	\$252	\$2,175	2,586	75.3	\$3,634	\$2,180	\$15.13	\$9.07	\$16.16	\$336
	Difference			\$165	\$311	1,870	4.8	\$40	\$46	-\$0.92	-\$0.46	-\$0.28	\$32
KSU <sup>4</sup>	All herds	KS	2005-10	-\$351	n/a	114	55.7	\$3,964	\$1,688	\$19.50	\$9.29	\$16.29	26.0%
(6 yrs)	Top 33%	KS	2005-10	\$172	n/a	133	62.4	\$3,948	\$1,956	\$17.32	\$8.59	\$16.36	24.3%
	Difference			\$523	n/a	19	6.7	-\$16	\$48	-\$2.18	-\$0.70	\$0.07	-1.7%
G, M and Co <sup>5</sup>	All herds	CA	2001-20	\$236	\$1,905	1,927	70.8	\$3,386	\$1,894	\$15.29	\$8.52	\$15.68	38.5%
(20 yrs)	Top 25%	CA	2001-20	\$517	\$1,985	2,700	71.7	\$3,205	\$1,812	\$14.27	\$8.05	\$15.80	38.2%
	Difference			\$281	\$80	774	0.9	-\$181	-\$82	-\$1.02	-\$0.47	\$0.12	-0.3%
G, M and Co <sup>5</sup>	All herds	ID	2001-18	\$173	\$2,132	1,886	70.2	\$3,429	\$1,840	\$15.54	\$8.29	\$15.89	34.8%
(18 yrs)	Top 25%	ID	2001-18	\$391	\$2,197	2,111	70.8	\$3,351	\$1,782	\$14.98	\$7.94	\$16.04	33.4%
	Difference			\$218	\$65	226	0.6	-\$78	-\$59	-\$0.56	-\$0.36	\$0.15	-1.5%
G, M and Co <sup>5</sup>	All herds	TX	2001-20	\$220	\$2,121	2,061	67.A	\$3,417	\$1,729	\$16.51	\$8.30	\$16.95	35.9%
(20 yrs)	Top 25%	TX	2001-20	\$524	\$2,099	2,379	69.5	\$3,264	\$1,685	\$15.20	\$7.81	\$17.00	34.0%
	Difference			\$304	-\$22	319	2.1	-\$153	-\$44	-\$1.31	-\$0.49	\$0.05	-1.8%
	All herds	MN/WI	2001-20	\$154	\$1,174	144	55.1	\$3,218	\$1,608	\$16.82	\$8.06	\$17.44	26.9%
FINBIN <sup>4</sup>						142	59.0	\$3,089	\$1,548	\$14.33	57.26	518.49	27.3%
FINBIN <sup>4</sup> (20 yrs)	Top 20%	MN/WI	2001-20	\$869	\$1,296 \$122	-2	18	-5128	-\$60	-52.50	-50.80	\$1.05	0.3%

TABLE 1 Diff	erence from overall avera	age by profitabili	ity group		T
		High 40% profit minus overall avg <sup>a</sup>	Middle 20% profit minus overall avg <sup>a</sup>	Low 40% profit minus overall avg <sup>a</sup>	Two data sets (UW and UM), two time periods (2014-20)
Difference from ove	all average, AgFA Database	b			and 2018-2022), and two pro
Price	[+1.12]	0.64	-0.32	-0.48	metrics (ROA and net return)
Cost per cow per y	ear [-20]	31	-159	51 U\	N
Production, lbs/co	w/year [+3,863]	1,881	209	-1,982	<del>-</del>
Cost of production	per cwt [-3.29]	-1.35	-1.17	1.94	→ High profit farms:
Difference from ove	all average, FINBIN Databa	se'			2 mgm pront tarms.
Price	[+0.33]	0.16	-0.02	-0.17	1. receive higher price
Cost per cow per y		151	136	.259 UI	M 21 receive inginer price
Production, lbs/co		1,363	566	-1,832	<ol><li>have higher cost/cow/ve</li></ol>
Cost of production		-0.69	0.02	0.81	
	rences highlighted in red.				<ol><li>are more productive</li></ol>
	ers to the average of all farr				
	nsin's Center for Dairy Profi ased on Return on Assets.	tability's AgFA dat	abase of 178 farm	ns for years 2014-	<ol><li>have significantly lower</li></ol>
	sota's Center for Farm Final	cial Management	's FINBIN databas	se of 140 farms	cost per cwt of milk
		net return.			cost per CWL OF HIRK

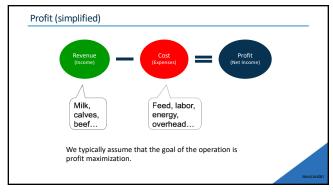
# Profitability drivers — Purchased vs home-raised feeds TABLE 1 A summary of 363 Pennsylvanis dairy farms from 2016-2021 The profitability drivers — Purchased vs home-raised feeds The profitability drivers — Purchased vs home-raised feeds The profitability drivers — In this sample of dairies, operations with a higher percent of the profitability from the dairy? Dec. 4, 2023 The profitability from the form the profitability from the dairy? Dec. 4, 2023 The profitability from the profitability from the profit for the dairy? Dec. 4, 2023 The profitability from the form the profitability from the dairy? Dec. 4, 2023 The profitability from the form the profitability from the pro

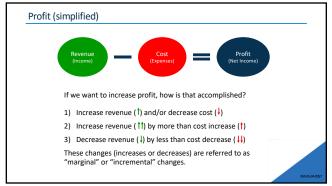
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## Where does the dairy make its money? General state Big differen and average Lower costs fixed resour (avg diff in \$/co Feed cost p indicator (av difference in fe Herd replacy very good in

General statements based on the data

- Big differences in profit between top group and average (similar variability across groups)
- Lower costs through more efficient use of fixed resources (i.e., both more cows and milk/cow) (avg diff in \$/cow = -3.5% and avg diff in \$/cwt = -8.4%)
- Feed cost *per cow* is not necessarily a good indicator (avg difference in feed/cow = -1.5%, but avg difference in feed/cwt = -5.8%)
- Herd replacement costs or cull rate is not a very good indicator of profitability

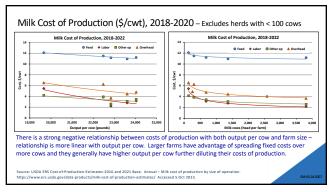




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### Incremental (more) milk

- 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)



### 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

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### Evaluating the profitability of incremental $\mbox{\sc milk}$



- 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

Partial b	oudget		
	Intervention Benefits	Intervention Costs	
	Increased revenue (1)	Decreased revenue (3)	
	+ Decreased costs (2)	+ Increased costs (4)	
	= Total benefit (B)	= Total costs (C)	
	Total benefit (B) – Total cost (C) =	•	
	Not all four factors will always b	e relevant.	
	Profitability can be expressed as:  1. Net return (\$) (farm, per head, p	er unit of production)	
	<ol><li>Breakeven level (production requirements)</li></ol>		
	Rate of return (ROI) (%)     Length of payback (years)		
			EM-US-24-0057

Parti	al budget v	with sen	sitivity	analys	is aroun	d key as	sumpti	on					
		Econo	mic (	Comp	arison	of Alt	ernat	ive Fe	ed Rat	ions			
	Feed cost, \$/lb Maintenance, I Productive fee Milk price Non-feed costs	lbs/day d, milk/lb o		Ration A \$0.140 20 2.5 \$18.50 \$8.00					Ration B \$0.145 20 2.5 \$18.50 \$8.00	result more cost/o	s in more econom lay and f se (and	e milk, it ical even eed cost,	n (Ration B) might be though /cwt of milk even total
	production	Feed		IOFC	Total cost	Profit	_	red cost	IOFC	Total cost	Profit	-	
	production lbs/day	(S/day)	(\$/cwt)	(S/day)	(S/cwt)	(\$/day)	(\$/da		(S/day)	(S/cwt)	(\$/day)		
	84.0	\$7.50	\$8.93	\$8.04	\$18.46	\$0.04	\$7.7		\$7.77	\$18.78	-S0.23	-	
	85.0	\$7.56	\$8.89	\$8.17	\$18.31	\$0.16	\$7.8		\$7.90	\$18.62	-50.11		
	86.0	\$7.62	\$8.86	\$8.29	\$18.16	\$0.29	\$7.8	9 \$9.17	\$8.02	\$18.47	\$0.02		
	87.0	\$7.67	58.82	\$8.42	\$18.01	\$0.42	\$7.9	5 \$9.13	\$8.15	\$18.33	\$0.15		
	88.0	\$7.73	\$8,78	\$8.55	\$17.87	\$0.55	58.6	0 59:10	58:28	\$18:19 -	50:28 -		
	89.0	\$7.78	\$8.75	\$8.68	\$17.73	\$0.68	\$8.0	6 \$9.06	\$8.40	\$18.05	\$0.40		
	90.0	\$7.84	\$8.71	\$8.81	\$17.60	\$0.81	\$8.1	2 \$9.02	\$8.53	\$17.91	\$0.53		
	91.0	\$7.90	\$8.68	\$8.94	\$17.47	\$0.94	\$8.1	8 \$8.99	\$8.66	\$17.78	\$0.66		
	92.0	\$7.95	\$8.64	\$9.07	\$17.34	\$1.07	\$8.2	4 \$8.95	\$8.78	\$17.65	\$0.78		
	93.0	\$8.01	\$8.61	\$9.20	\$17.21	\$1.20	\$8.2	9 \$8.92	\$8.91	\$17.52	\$0.91		
	94.0	\$8.06	\$8.58	\$9.33	\$17.09	\$1.33	\$8.3	5 \$8.89	\$9.04	\$17.40	\$1.04		
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Partial Budget Analy			ntrowding"				adding stalls to barn			
"blue" values are inpu	ts — all others are o	alculated values					duding stans to barri			
Item			Current	Alternative	Change					
Number of stalls for n	Bring cows		450	580	50		Increased income			
Stalls for fresh cows			65	65	0		Increased income			
Stalls available for n		ng fresh cous	585	433	50					
Total cous (milking as	d dry)		630	630	0		- Milk/day/cow			
Total milking cows			550	550	0		- Milk from more cows?			
Percent of cours mile Percent of cours fres			17.1%	17.5%	2006 2000		- IVIIIK from more cows?			
Percent of cours fres			50%	506	0.0%					
Non-fresh milking op			495	495			Decreased income			
Stacking casacity for I			84.6%	M 65	0.0%					
Stacking capacity for a		ws	125.6%	113,8%	14.0%		<ul> <li>None expected</li> </ul>			
Expected milk product			90.0	52.0	2.0		14011C EXPECTED			
							3. Increased costs			
Investment for new st							5. Increased costs			
Number of stalls to a	dd	\$2,500	n/a	50	50		- Investment			
Expected life, years			n/e	30.0	10.0		- IIIVESLITICITE			
Interest rate, %			n/a	7,0%	7.0%		- Feed			
Total investment, \$/	am		r/a	\$125,000	\$125,000		- reeu			
Feed remainments on	Louis						- Cow investment?			
Maintenance feed, I		50,1350	20	20						
Marginal feed, Ibs D			0.4	0.6	0.0		<ul> <li>Cow supplies, etc.?</li> </ul>			
Total feed requireme		s, toes DM/year	5,621	5,721	80		., .			
Dry cow feed, lbs 04	Ulley	50,3080	90	90			Decreased costs			
Dry period, days			55	55	0		4. Decreased costs			
Total feed requireme	nts for dry cours, to	ns DM/year	66.0	66.0	0.0		None expected			
Replacement cest, S/r	and man		n/a	9545	940					
"Other" variable costs t		m Sirmalinar	1/0	5000	5000			J		
Wiscellaneous costs, Si			90	- 20	50					415.24
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Notes Parkall	udget (i)									

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	c	0		- 1	6	н	1	1	Partial budget to look at	R S	T U	
NCOME				Current	Alternative	Change			adding stalls to barn			
Total milk pro	duction, (bs/yea			18,067,500	18,469,000	431,500			adding stalls to barri			
Milk proce, \$70	wt			\$18.00	\$18.00	\$18.00						
Milk Income.	Syear			\$2,890,800	\$2,555,040	584,340						
COSTS, S/year									<ul> <li>Expected increase in</li> </ul>			
Feed for lacta				\$1,517,630	\$1,539,351	\$21,681						
reed for dry o				\$34,296	514,256	50			profit of ~\$25K/year			
Replacement				n/e	50	50						
Othervariable				1/4	50	50			Less than 1.0 lb/day			
	and interest (P&	pyrel		ryla So	\$47,797	\$17,797 Sp			• Less triair 1.0 ib/day			
Miscellaneou Total cost				\$1.531.906	\$1,571,484	50 519.478			needed to breakeven			
STURN CAPE O				\$1,511,900	\$1,571,600	\$20,737			liceueu to breakeveri			
RETURN OWER	OSTS			31,900,004	\$1,083,656	156,162			(given 10-yr life, 7% interest)			
Net return (exc	luding dep & int			\$1,858,824	\$1,001,011	\$42,550						
Increased milk	production to be	okeven, lbs/da	Y			0.84			Payback length of less			
Payback for low	estment, years					3.40			- Fayback leligiti of less			
<b>BOI given bene</b>	fits, years and in	vestment, %				31.8%			than 4 years			
* Accounting for a	added strik, tevests	wet in barn, cast	of additional field	and costs associa	and with additional	cove.						
									(given 7% interest, 2 lb			
	yels of ROI for V	rying Milk Prod	luction increases						response)			
Mik	\$13.00	\$14.00	515.00	se, \$/cwt	517.00	510.00			response			
response	-100.0%	-100.0%	-100.0%	-100.0%	-100.0%	-100.05						
1.00	3.8%	6.3%	-100.0% 8.8%	11.1%	13.7%	-200.0% 15.4%			Return on investment of			
2.00	20.7%	24.5%	25.5%	31.5%	33-3%	29.6%			1 1 2 0001			
100	34.0%	40.0%	45.1%	50.2%	55.2N	50.2%			approximately 32%			
4.00	42.8%	34.5%	61.1%	67,7%	74.2%	50.7N			(given 10-yr life, 2 lb response)			
	41,000		11.17	41.5%	1423	00.74			(given 10-yr life, 2 to response)			
											EM-US-2	1005

Dally milk production, lbs/day  INCOME  Milk sales  Coff sales  Derivations of the control of th			These are the types of thing that need to be identified to properly evaluate the economics of a management intervention/change.
Milk asles  Colf sales  Cort S			that need to be identified t properly evaluate the economics of a management
Celf sales DEVENSS Feed (Bictating and dry cows) Labor Supplies, drugs, and veterinary Breeding, charge (seem, Al services, etc.) Testing and trimming Utilities and weter Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership'			properly evaluate the economics of a managemen
EXPENSES feed [datating and dry cows) Labor Supples, drugs, and veterinary Breeding charge (semen, A) services, etc) Testing and trimming Utilities and water fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership <sup>2</sup>			economics of a managemen
Feed (Inctating and dry cows) Labor  Supplies, drogs, and veterinary  Breeding, charge (tenne, Al services, etc.)  Testing and trimming Utilities and water  Fuel and oil  Repairs  Bedding, corral maintenance, etc.  Equipment ownership'			•
Labor Supplies, drugs, and veterinary Breeding charge (smens, Al services, etc) Testing and trimming Utilities and water Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership <sup>2</sup>			•
Supplies, drugs, and veterinary Breeding charge (semen, A) services, etc) Testing and trimming Utilities and water Feel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership <sup>2</sup>			intervention/change.
Breeding charge (semen, Al services, etc) Testing and trimming Utilities and water Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership		=	
Testing and trimming Utilities and water Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership		_	
Utilities and water Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership			
Fuel and oil Repairs Bedding, corral maintenance, etc. Equipment ownership <sup>2</sup>			
Repairs  Bedding, corral maintenance, etc.  Equipment ownership <sup>2</sup>			
Bedding, corral maintenance, etc. Equipment ownership <sup>2</sup>			
Equipment ownership <sup>2</sup>			
Building/facility ownership <sup>2</sup>			
Insurance and taxes			
Professional fees (legal, accounting, etc)			
Other			

	Incremental c	hange in	
	Cow number	Milk/cow	
Daily milk production, lbs/day	Depends	Varies	There is not a set of answers
INCOME			that is correct in all situation
Milk sales	Depends	Varies	
Calf sales	Varies	Fixed	as what is variable versus
EXPENSES			fixed will depend upon each
Feed (lactating and dry cows)	Varies	Both	
Labor	Depends	Varies	dairy's unique set of
Supplies, drugs, and veterinary	Varies	Fixed	constraints and situation.
Breeding charge (semen, Al services, etc)	Varies	Fixed	
Testing and trimming	Varies	Fixed	
Utilities and water	Varies	Fixed	In other words, partial
Fuel and oil	Fixed	Fixed	budgets can be quite simple
Repairs	Fixed	Fixed	
Bedding, corral maintenance, etc.	Fixed	Depends	to extremely complex
Equipment ownership <sup>2</sup>	Fixed	Fixed	
Building/facility ownership <sup>2</sup>	Fixed	Fixed	
Insurance and taxes	Fixed	Fixed	
Professional fees (legal, accounting, etc)	Fixed	Fixed	
Other	Depends	Depends	
Replacement cost	Varies	Fixed	

Streets in		Ente		% Exed	% cha	Married	na militatro	_	Ow	nge from Bo		% fixed	% char	No.	wase cows		Own	ee from ita	
Months for budget to 12	Per Dairy	Per Cow*	Per Cwt	for dairy	ger cow	Per Dairy	Per Cow*	Per Cwt	Per Dairy	Per Cow*	Ser Cut	for dainy	ON COM	Per Dairy	Per Cow*	Per Cwt	Per Dairy	Per Cow*	Sec Cut
PRODUCTION					-								J						
Number of lactating cows	1,200	82%	87%			1,200	82%	87%						1,300	82%	87%	100	0	
Number of dry cows	190	126	12%			190	12%	13%		0				195	13%	12%	15	0	
baily milk production, lbs/day	102,000	85.00	100			104,400	87.00	100	2,400	2.0	0.0			109,850	84.50	100	7,850	-0.5	0.0
baily component production, lbs,/day	7,088	5.87	6.90			7,204	6.00	6.90	166	0.1	0.0			7,580	5.83	6.90	542	60	0.0
NCOWS							_								_				
Quata milk sales	\$8,190,600	\$5,695	\$22.00			\$8,383,320	\$6,005	\$22.00	\$192,720	\$140	\$0.00			\$8,820,955	\$5,900	\$22.00	\$630,355	-535	\$0.00
Above quota milk cales	50	50	\$0.00			50	50	\$0.00	50	50	\$0.00			50	50	\$0.00	50	50	\$0.00
Calfisales	\$414,000	\$300	\$1.11			\$414,000	\$300	\$1.09	50	50	-50.03			\$448,500	\$300	\$1.12	\$34,500	50	\$0.01
EXPENSES (for 12-month period)																			
Feed (factating and dry cows)	\$4,107,727	\$2,677	\$11.08	0%	0%	\$4,122,979	\$2,988	\$10.82	\$15,253	\$11	-90.31	0%	0%	\$4,434,136	\$2,966	\$11.06	\$326,410	-911	\$0.03
Labor	765,000	554	2.06	100%	OK.	765,000	554	2.01		0	-0.06	90%	0%	775,375	516	1.92	6,376	-22	-0.13
Supplies, drugs, and seterinary	350,000	254	0.94	0%	0%	350,000	254	0.92		0	-0.02	0%	016	379,167	254	0.95	29,167	0	0.01
Technology		0	0.00	OK	OK.			0.00		0	0.00	0%	0%	0	0	0.00	0	0	0.00
Breeding charge (semen, Al services, etc.)	50,000	36	0.13	0%	0%	50,000	36	0.13		0	0.00	0%	016	54,167	36	0.14	4,167	0	0.00
Testing and trimming	24,000	17	0.06	OK	OK.	24,000	17	0.06		0	0.00	0%	0%	26,000	17	0.06	2,000	0	0.00
Hauling and assessments \$1.00	372,300	270	1.00		rs.	381,060	226	1.00	8,760	- 6	0.00		*	400,953	268	1.00	28,653	-2	0.00
Utilities and water	125,000	91	0.34	50%	2%	127,500	92	0.33	2,500	2	0.00	50%	016	130,208	87	0.12	5,208	-3	-0.01
Cudam hire	125,000	91	0.34	100%	0%	125,000	91	0.33		. 0	-0.01	90%	016	127,083	25	0.12	2,082	- 4	-0.02
Fuel and oil	150,000	109	0.40	100%	0%	150,000	109	0.39		0	-0.01	79%	016	153,125	102	0.38	3,125	-4	-0.02
Regains	250,000	181	0.67	100%	OK.	250,000	181	0.66		0	-0.02	76%	CNL	255,208	171	0.64	5,208	-00	-0.03
Bedding, corrol maintenance, etc.	90,000	65	0.34	50%	2%	92,700	er er	0.24	2,700	2	0.00	0%	016	97,500	- 65	0.24	7,500	0	0.00
Equipment ownership*	220,000	159	0.59	100%	OK	220,000	159	0.58		0	-0.01	500%	CNL	220,000	147	0.55		-12	-0.04
Building/facility ownership*	290,000	276	1.02	100%	0%	390,000	275	1.00		0	-0.02	500%	CNL	380,000	254	0.95	0	-21	-0.07
Insurance and taxes	135,000	98	0.36	100%	OK	135,000						500%	CNL	135,000					-0.03
Professional fees (legal, accounting, etc)	60,000	43	0.16	100%	0%	60,000	48	0.16		0	0.00	500% 500%	016	60,000	40	0.15	0	- 4	-0.01
Marketing	80,000		0.31	100%	OK	80,000		0.31				500%	COL		54				
Micelanous	20,000	14	0.06	$\Diamond$		20,000	181	0.06		0	0.00	$\Leftrightarrow$	$\Rightarrow$	25,000	18	0.06		-4	0.00
Regiscement cost	5892,200	5629	52.37	-	- 0%	5892.200	5639	52.32	10	50	-90.05	-	0%	5955.716	5639	52.18	573.517	50	90.0s
Total cost	58 436 716	56,113	522.66	-		59.665.699	56.1M	\$22.22	579.713	691	-50.64	-	-	58 929 539	\$5,923	\$22.22	5893,817	-5183	-50.00
Net return	\$168.774	5122	50.45		_	5221 891	5340	50.97	\$163.500	5118	50.43		-	5229.917	5117	50.65	\$171.443	5105	50.40
Breakeven base milk grice, \$/cwt	\$21.55	(\$21.55 all	prod)			\$21.13	(921.114)	prod)	-50.42					\$21.15	(\$21.15 all	prod)	-50.60		
Breakeven milk production, (bs/day	92.5					82.1			-0.4					79.8			-2.7		
* Percow in herd (lactating + dry) * Depreciation and interest, principal and inte	rest, and rent/h	sace payment	×	•															

### Pen move and ration change analysis

(another way of looking at incremental milk)

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### Background (email received by Elanco sales rep)

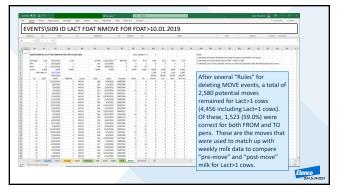
I would like to look at what, if any, milk loss is associated with cows that move from a high cow ration diet to a maintenance cow ration diet.

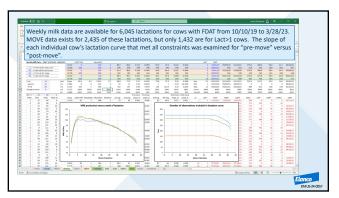
Here is some of the relevant information that you will need:

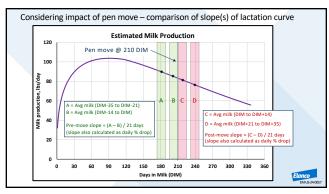
Mature cow peak pens: 3, 13, 14, 15 Pen 2 is 1/2 heifers and 1/2 cows Mature cow maintenance pens: 6, 12, Pen 5 is a DNB pen

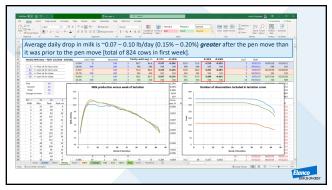
1st Lact peak pens: 4, 17, 18
1st Lact maintenance pen 8
(this is a fairly new change and we probably shouldn't do the analysis on 1st lact animals)

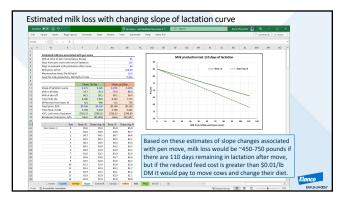
Pen move analyses can be "messy" because of changes routinely being made at the dairy and the fact that move events are not always recorded with the best level of accuracy...

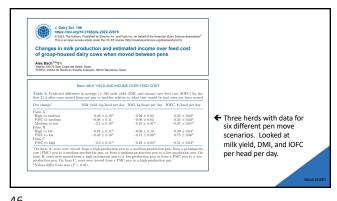


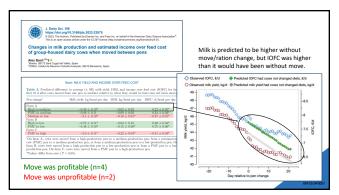












### Pen moves / ration changes summary

- Incremental milk is often profitable, but there will be times it is not economical (i.e., cost savings are greater than foregone income)
- Estimating the economics returns associated with pen moves and ration changes is challenging, but that is not a reason to ignore it
- Income over feed cost might be the primary metric examined, but there are other factors to consider that can be equally important
  - Body condition of cows and the impact this has for the next lactation or when cows are marketed
  - Ability to manage changes (people, equipment, facilities)

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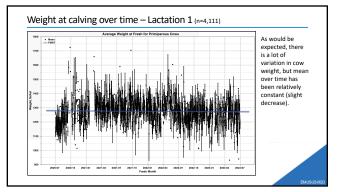
## 

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

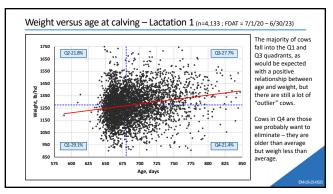
- How is milk production in first lactation impacted by weight at calving?
- Does cow weight at calving have an impact on removal rate and reproduction in first lactation?

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### 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)

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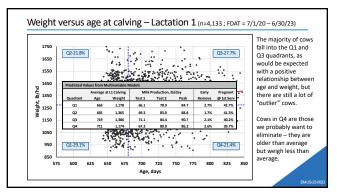
### Multivariate statistical models (Lactation 1)

- 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)

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- 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

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### 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

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### Summary

- Market variability (input and output prices) is high and likely will continue into the foreseeable future
- In commodity market, being low cost <u>per unit of production</u> 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, ???)

