

Monsanto Dairy Business Producer Council
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Dairy Economic Modeling



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Discussion Topics



- **Need for economic modeling**
- **Economic model (spreadsheet) example**
 - 2005 vs 2006 for various regions
- **Increased volatility (milk and corn prices)**
 - Low input vs high production
- **Management interventions**

Industry is changing...



... industry trends increase the need for dairy managers to better understand the *relative* strengths and weaknesses of their businesses if they are going to be economically competitive in the future.



Economies of size...

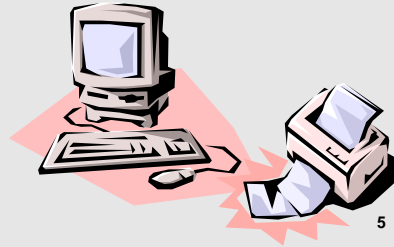


... as the proportion of “large” dairies increases, the economies of size benefits will diminish. In other words, the benefits to getting to a certain size (e.g., 3,000 cows) will likely be less in the future than they were in the past.

Decision-making...



... agricultural producers (including dairy) have made a lot of profitable decisions based on “gut-feel” in the past. While this will continue, the importance of more “numbers-based” decisions will likely increase as margins tighten and competition increases due to increased consolidation.



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Microsoft Excel - Dairy budgets analyzer (Regions x Year) - Dairy Producer Council Meeting.XLS

Dairy budgets analyzer (Regions x Year).xls
 A spreadsheet to develop projected budgets for a dairy that allows for side-by-side comparisons of alternative management strategies or styles.
 Version 6-09-06

INPUTS vs. CALCULATED VALUES:
 In the **Inputs**, **Budgets**, **SensitivityAnalysis**, **VariableFactors1**, and **VariableFactors2** tabs, all blue numbers are inputs and all black numbers are calculated from these inputs.

DESCRIPTION OF INPUTS:
 Many of the input cells (i.e., blue numbers) have a red diamond in the upper right hand corner of the cell. By moving your mouse cursor over this diamond, a brief description of the input will be displayed on the screen.

DESCRIPTION OF VARIOUS TABS:

Inputs – this tab is where basically all of the baseline input assumptions are entered for the various scenarios that might be compared in the spreadsheet. The spreadsheet is designed such that a total of up to six budgets can be examined at one time. These six budgets basically represent three different scenarios with two variants of each. Keep in mind that all blue numbers are inputs and thus any of them can be changed (including the description of the various scenarios).

Budgets – this tab is the “output” of the inputs that have been entered. Budgets are presented on the basis of *per cow at the dairy*, *per cwt of milk produced*, and *total for the dairy* for each of the scenarios and their variants. In Column Q (rows 17-44), users can enter the “**Percent of category to include in the analysis (0%-100%)**” which allows some or all of individual cost categories to be excluded from the budget (e.g., fixed costs associated with buildings or machinery can be “zeroed out”).

SensitivityAnalysis – this tab contains numerous sensitivity tables and figures around some of the key parameters from the budget (“picked” by the user (i.e., one of the six budgets)). The user also can set the range of values over which the various parameters are examined.

VariableFactors1 – this tab allows the user to “pick” one of the six budgets and then displays the information on the basis of *Total dairy*, *per cow*, *per cwt of milk produced*, and *per cow per day*. The user can enter a % change to see how this impacts all categories (the impacts are ranked according to magnitude). The user can also change any individual category, or multiple categories, to see what impact that has on profitability and breakeven price. Note: when production changes, feed and hauling costs automatically change. At the bottom of the budget, this tab also allows the user to enter in a Return over Total Costs (i.e., profit target for the dairy and then values for key parameters to approximately achieve that target are calculated).

DEVELOPED BY:

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Dairy Budgets Analyzer
 Excel spreadsheet being developed by K-State and Monsanto to help producers evaluate the profitability of alternative management strategies.

Features:

- \$/cow, \$/cwt, \$/dairy
- Side-by-side comparisons
- Breakeven prices, ROA & ROE
- Sensitivity tables & figures
- Ranking of factors importance
- “What-if” capabilities

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 DAI
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Introduction / Inputs / Budgets / SensitivityAnalysis / VariableFactors1 / VariableFactors2 / Figures /

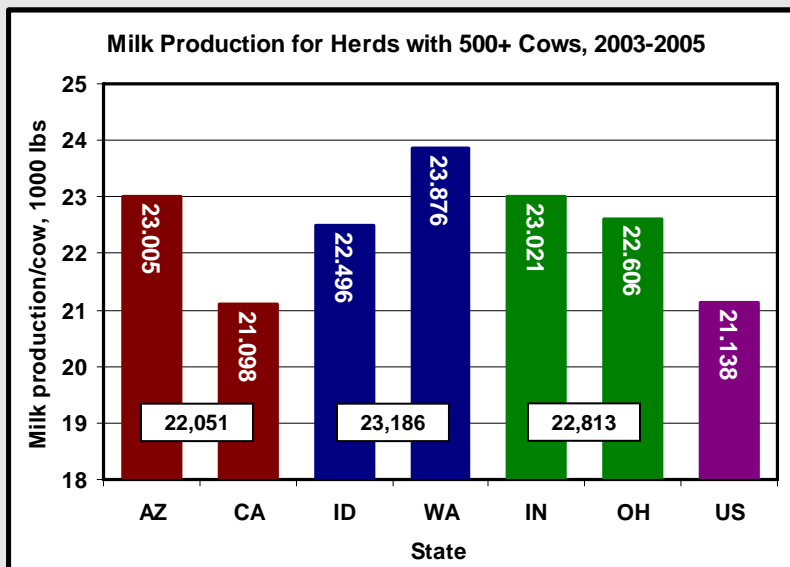
Dairy Budget Analyzer.xls – Example #1



- Comparison of 2005 vs. 2006
 - CA/AZ
 - ID/WA
 - IN/OH
- Differences (annual and/or regional)
 - Milk prices and production
 - Feed costs
 - Labor, utilities, fuel, hauling costs
 - Cow prices
 - Investment
 - Interest rates

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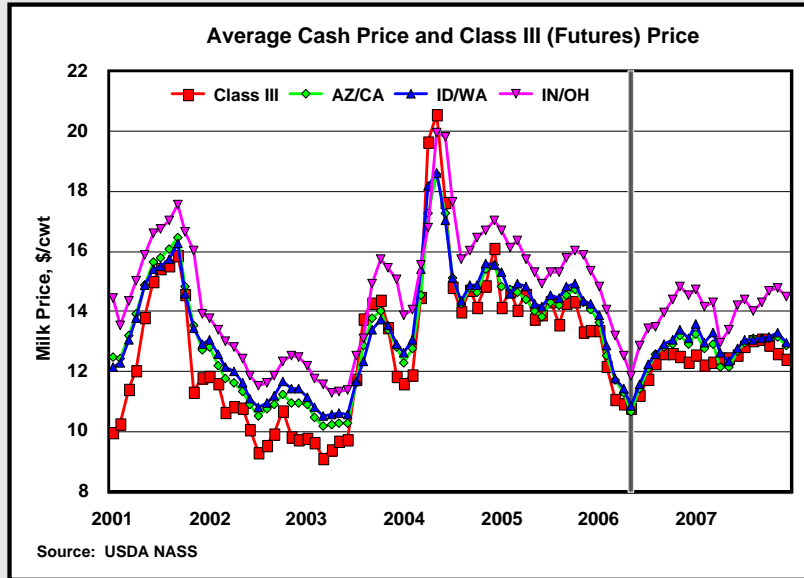
2003-05 Regional Milk Production/Cow



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2001-07 Class III and Regional Milk Prices

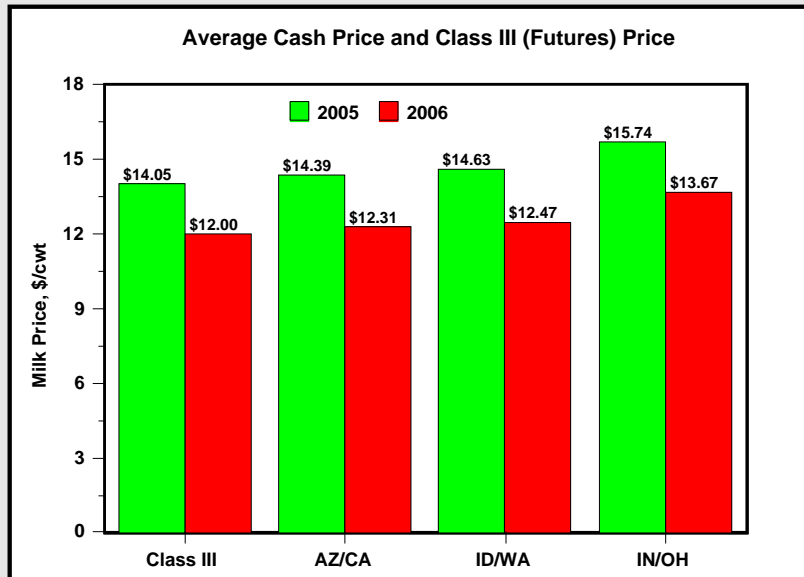
Source: USDA NASS & KSU



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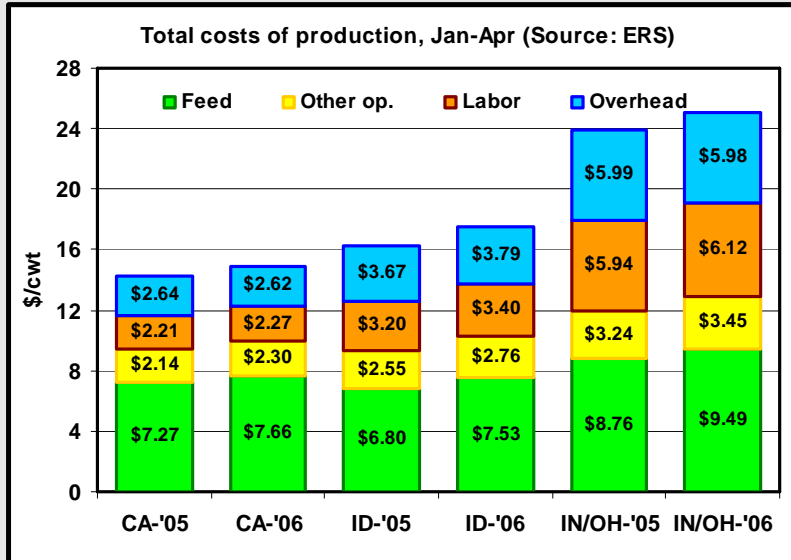
2005 vs 2006 All Milk Prices

Source: USDA NASS & KSU



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2005 vs 2006 Regional Costs of Production



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Percent change in costs (2006 vs 2005)

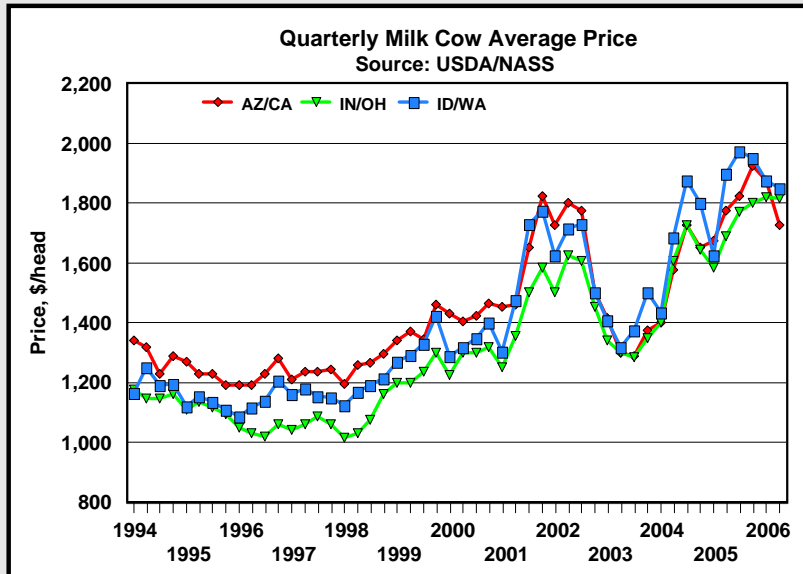


Cost category	CA	ID	IN/OH
Feed	5.4%	10.7%	8.3%
Other op.	7.1%	8.1%	6.5%
Labor	2.7%	6.2%	3.0%
Overhead	-0.7%	3.1%	-0.2%
Total	4.1%	7.7%	4.6%

Source: Economic Research Service (ERS)

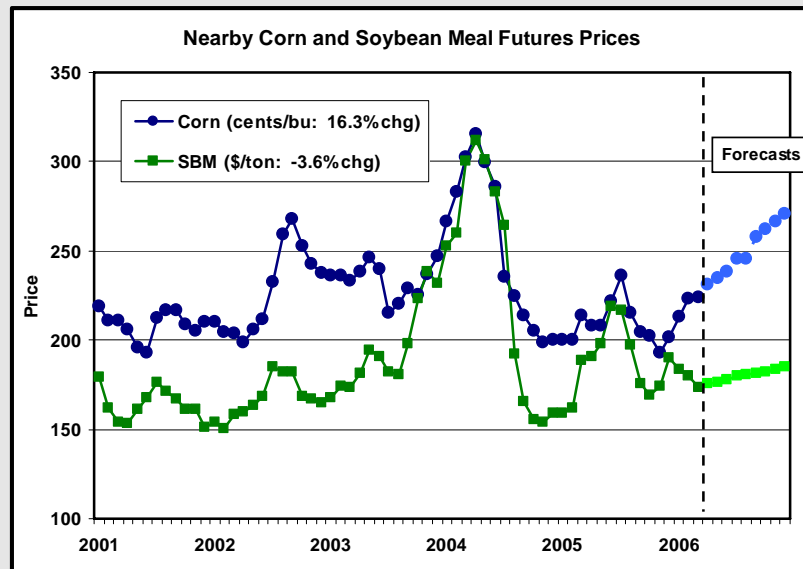
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1994-05 Regional Milk Cow Prices



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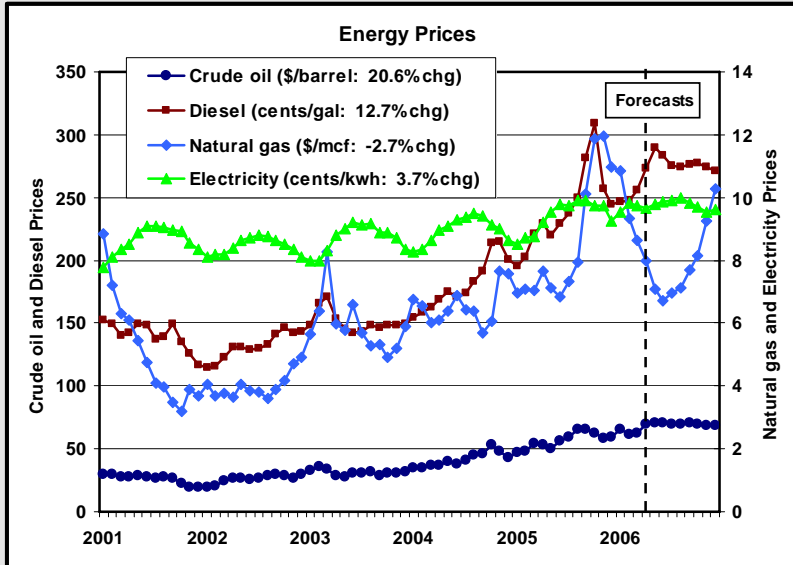
2001-06 CBT Corn and SBM Futures Prices



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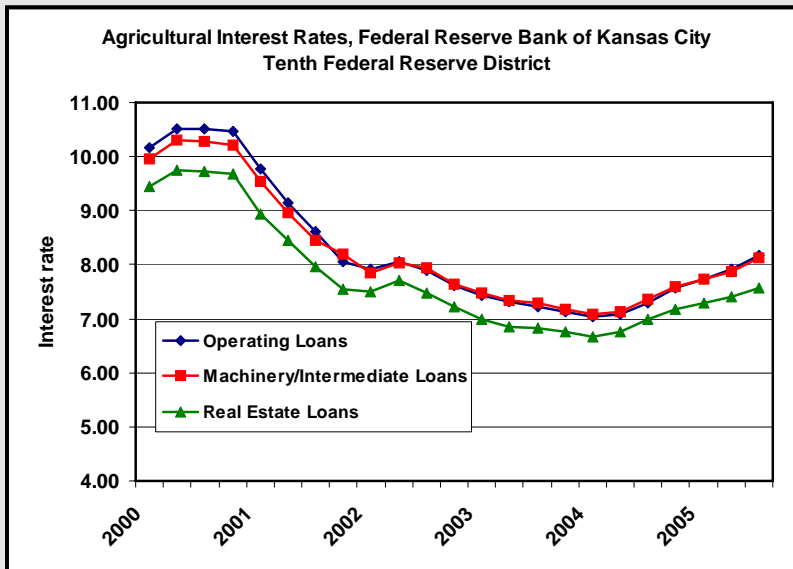
2001-06 Energy Prices

Source: EIA



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2000-05 Agricultural Interest Rates



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Microsoft Excel - Dairy budgets analyzer (Regions x Year) - Dairy Producer Council Meeting.XLS

INPUT Assumptions

State/region of analysis	CA/AZ		ID/WA		IN/OH		
Year of analysis	2005	2006	2005	2006	2005	2006	
FEED AND PRODUCTION:							
Lactating cow feed cost, \$/lb of DM	\$0.0815	\$0.0859	\$0.0760	\$0.0841	\$0.0736	\$0.0797	
Maintenance feed, DM lbs/day/cow	20	20	20	20	20	20	
Production feed, milk/feed (No DM)	3.25	3.25	3.25	3.25	3.25	3.25	
Lactating cow feed, DM lbs/day/cow	51.39	51.61	53.00	53.23	52.47	52.70	
Lactating cow feed efficiency	1.37	1.38	1.40	1.40	1.39	1.40	
Dry cow feed cost, \$/lb of DM	\$0.0530	\$0.0558	\$0.0494	\$0.0547	\$0.0478	\$0.0518	
Dry cow feed, DM lbs/day/cow	30	30	30	30	30	30	
Other feed (e.g., hay), \$/day/haifer	\$2.02	\$2.13	\$1.88	\$2.08	\$1.82	\$1.97	
Days of feed per purchased haifer	45	15.3	15.3	15.3	15.3	15.3	
Feed increase (decrease) -- ad hoc adjustment	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Daily milk production, lbs/cow	70.63	71.13	74.26	74.76	73.07	73.57	
Lactating days	355	355	355	355	355	355	
Dry days	60	60	60	60	60	60	
Calving interval, months	13.64	13.64	13.64	13.64	13.64	13.64	
Milking days/year	312	312	312	312	312	312	
Total production/cow/year (lbs produced)	22,051	22,207	23,186	23,342	22,813	22,969	
Production solid/yr (percent)	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Total production/cow/year (lbs sold)	22,051	22,207	23,186	23,342	22,813	22,969	
Total production/yr for dairy (lbs sold)	76,076,527	76,615,122	79,992,112	80,530,706	78,704,870	79,243,465	
Monthly production for dairy (lbs sold)	6,339,711	6,384,593	6,666,009	6,710,892	6,558,739	6,603,622	
Base price for milk, \$/cwt	\$14.39	\$12.31	\$14.63	\$12.47	\$15.74	\$13.67	
Volume/quality premium, \$/cwt	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Other income (total)/year	\$0	\$0	\$0	\$0	\$0	\$0	
OTHER VARIABLE COSTS:							
Labor (based on total cows/employees)	\$33,000	117.0	113.9	110.0	105.6	97.0	94.5
Full-time equivalents	29.5	30.3	31.4	32.7	35.6	36.5	
Supplies, drugs, and veterinary, \$/cow/year	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	\$100.00	
Supplemental (SMT), \$/cow/year	\$5.45	\$3.00	\$3.84	\$3.00	\$3.00	\$3.00	
Utilities, \$/cow/year	\$45.00	\$46.67	\$42.50	\$44.07	\$46.50	\$44.22	
Water, gallons/cow/year (\$1000 gal)	\$0.20	116	116	116	116	116	
Fuel, oil, and auto expense, \$/cow/year	\$45.00	\$50.72	\$42.50	\$47.90	\$46.50	\$52.41	
Milk hauling costs, \$/cwt	\$0.500	\$0.504	\$0.465	\$0.518	\$0.462	\$0.462	
Crop feed and production, \$/cwt	\$0.270	\$0.270	\$0.290	\$0.290	\$0.220	\$0.220	
Facility and equip lease or rent, \$/cow/year	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	
Buildings and equipment costs	\$1.124	\$1.124	\$1.002	\$1.002	\$1.041	\$1.041	

“Blue” values are inputs

Pasture Information “Calculator”
(calculated number of acres/cow/year)

10.0 Daily response, lbs
140 Response frequency, days
90% Compliance, %

Method 1 -- In herd use (HF)
62.3% Calculated IRU (lactating), %
53.3% Calculated IRU (total), %
53.3% Entered IRU (total), %
12.0% Pasture/cow

Basically six budgets set up as three side-by-side comparisons

Microsoft Excel - Dairy budgets analyzer (Regions x Year) - Dairy Producer Council Meeting.XLS

Dairy Enterprise Budget

Kevin C. Ditzgen, PhD Agricultural Economist
Kansas State University

Budgets for returns per cow and returns for entire dairy are shown below...

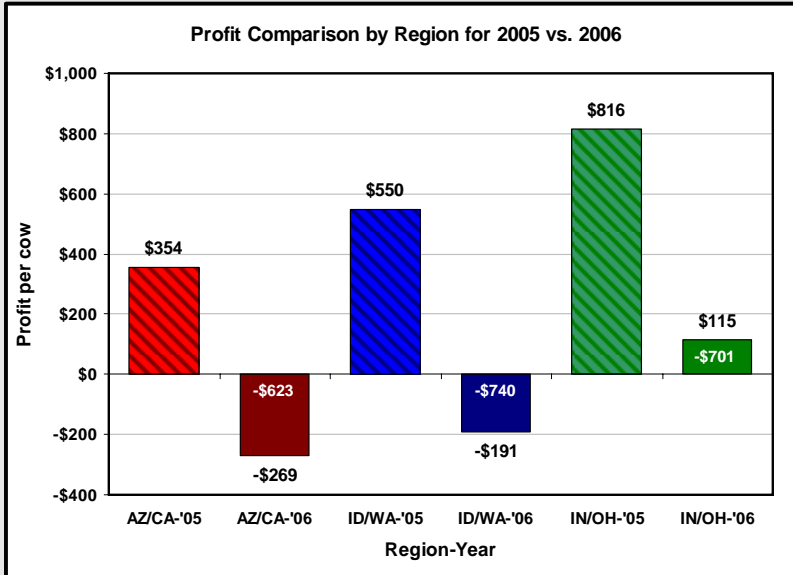
COST RETURN PROJECTION -- PER COW IN HERD BASIS
(REPLACEMENTS PURCHASED)

State/region of analysis	CA/AZ		ID/WA		IN/OH	
Year of analysis	2005	2006	2005	2006	2005	2006
Lactating cows (% milking)	3,000 (87%)	3,000 (87%)	3,000 (87%)	3,000 (87%)	3,000 (87%)	3,000 (87%)
PRODUCTION LEVEL						
Total pounds milk sold/cow/year	22,051	22,207	23,186	23,342	22,813	22,969
Daily milk production, lbs	70.6	71.1	74.3	74.8	73.1	73.6
RETURNS PER COW						
1 Milk sales	\$1,171.16	\$2,733.72	-\$430.45	\$3,992.13	\$2,910.76	-\$481.35
2 Other income	0.00	0.00	0.00	0.00	0.00	0.00
3 Cows sold	263.79	223.71	-40.08	263.79	223.71	-40.08
4 Cull cows sold	188.16	188.16	0.00	188.16	188.16	0.00
A. Gross Returns	\$3,623.11	\$3,145.59	-\$477.53	\$3,944.08	\$3,322.63	-\$621.45
VARIABLE COSTS PER COW						
5 Feed	\$1,422.40	\$1,505.17	\$82.77	\$1,364.75	\$1,516.62	\$151.87
6 Labor	282.05	289.73	7.68	300.00	312.59	12.59
7 Supplies, drugs, and veterinary	100.00	100.00	0.00	100.00	100.00	0.00
8 BST - Fostex	65.86	70.08	4.23	65.86	70.08	4.23
9 Utilities and water	23.92	24.99	1.07	23.92	24.99	1.07
10 Fuel, oil, and auto expense	45.00	50.72	5.72	42.50	47.90	5.40
11 Milk hauling, crop, and promotion costs	169.79	185.10	15.30	173.90	188.70	14.80
12 Building and equipment lease/rent and repair	32.61	32.61	0.00	39.13	39.13	0.00
13 Replacements and breeding charge:						
a. Capital replacement	703.80	703.80	0.00	711.00	731.00	0.00
b. Semen, A.I. service, and supplies	42.00	42.00	0.00	42.00	42.00	0.00
c. Interest	121.68	140.40	18.72	126.83	146.40	19.57
d. Insurance	9.36	9.36	0.00	9.76	9.76	0.00
14 Breeding and maintenance, etc.	14.00	14.00	0.00	14.00	14.00	0.00
15 Testing and trimming	15.00	15.00	0.00	15.00	15.00	0.00
16 Professional fees (legal, accounting, etc.)	6.96	6.96	0.00	6.96	6.96	0.00
17 Miscellaneous	3.22	3.22	0.00	3.22	3.22	0.00
18 Depreciation on buildings and equipment	28.95	28.95	0.00	28.95	28.95	0.00
19 Interest on land, buildings, and equipment	54.20	54.20	0.00	60.87	60.87	0.00
20 Ins. and taxes on land, buildings, & equip.	35.09	35.09	0.00	40.00	40.00	0.00
B. SUB-TOTAL	\$3,266.99	\$3,773.54	\$506.55	\$3,269.97	\$3,471.35	\$201.38
21 Interest on operating costs	34.02	41.17	7.15	33.44	41.88	8.44
C. TOTAL COSTS PER COW	\$3,270.90	\$3,414.54	\$143.63	\$3,304.40	\$3,513.23	\$208.82
D. RETURNS OVER TOTAL COSTS (A - C)	\$344.21	-\$268.95	-\$623.16	\$634.13	-\$150.58	-\$740.36
E. REPAIRS AND MAINT. PER COW	\$12.78	\$13.33	\$0.54	\$12.26	\$13.39	\$1.13
22 Lactating cow feed cost, \$/lb/day	\$4.19	\$4.21	\$0.02	\$4.32	\$4.34	\$0.02
23 Dry cow feed cost, \$/lb/day	\$1.39	\$1.39	\$0.00	\$1.39	\$1.39	\$0.00
F. ASSET TURNOVER (A/Average) / I	84.7%	73.5%	-11.2%	82.2%	71.0%	-11.1%
G. NET RETURN ON ASSETS (D + 13 + 19 + 20)/Average / I	13.19%	-0.73%	-13.90%	16.48%	1.23%	-15.22%

Portion of category to include in the analysis

Adjustment to mimic cash costs

Profit by region and year...



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Figure 3. Sensitivity of Return over Total Cost/Cow to Milk Production & Feed Price

Milk production	\$7.25	\$7.50	\$7.75	\$8.00	\$8.25	\$8.50	\$8.75
65.0	\$276.02	\$252.98	\$189.95	\$149.00	\$112.00	\$75.00	\$38.00
67.5	\$338.39	\$314.46	\$270.53	\$210.00	\$150.00	\$90.00	\$50.00
70.0	\$400.77	\$373.54	\$331.11	\$250.00	\$180.00	\$120.00	\$80.00
72.5	\$523.14	\$477.42	\$431.70	\$320.00	\$240.00	\$160.00	\$120.00
75.0	\$603.52	\$558.90	\$512.28	\$403.66	\$319.00	\$232.43	\$152.81
77.5	\$687.89	\$640.38	\$592.86	\$545.25	\$497.84	\$450.33	\$402.81
80.0	\$770.28	\$721.86	\$673.45	\$625.84	\$576.63	\$528.22	\$479.81

Figure 4. Sensitivity of Return on Assets to Investment & Milk Production

Investment per cow*	65.0	67.5	70.0	72.5	75.0	77.5	80.0
\$3,250	12.46%	14.50%	16.64%	18.73%	20.81%	22.90%	24.99%
\$2,500	11.19%	13.12%	15.11%	17.07%	19.04%	21.00%	22.96%
\$2,750	10.05%	11.91%	13.76%	15.61%	17.46%	19.31%	21.17%
\$3,000	9.04%	10.80%	12.55%	14.30%	16.06%	17.81%	19.56%
\$3,250	8.14%	9.80%	11.46%	13.13%	14.79%	16.46%	18.13%
\$3,500	7.32%	8.90%	10.48%	12.05%	13.62%	15.19%	16.76%
\$3,750	6.57%	8.06%	9.59%	11.10%	12.60%	14.10%	15.60%

Sensitivity analyses

Numerous sensitivity tables/figures pre-defined, but can also do "what if" types of analyses multiple ways as well.

Figure 5. Sensitivity of Return over Total Cost to Culling % & Milk Production

Profitability decreases as culling rate increases, but higher producing herds can "afford" higher cull rates.

Economic strategies given volatility

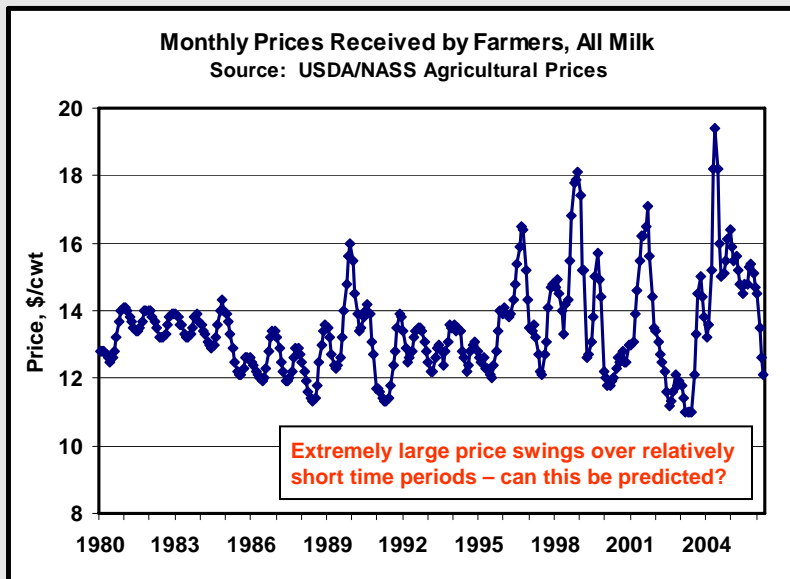


- Comparison of production alternatives for a 3,000 lactating cow dairy
 - Low input
 - High production
- Expected profit simulated for 2500 “months” given variability in milk prices, feed prices, and production (all costs constant except feed and hauling).

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Monthly milk prices...

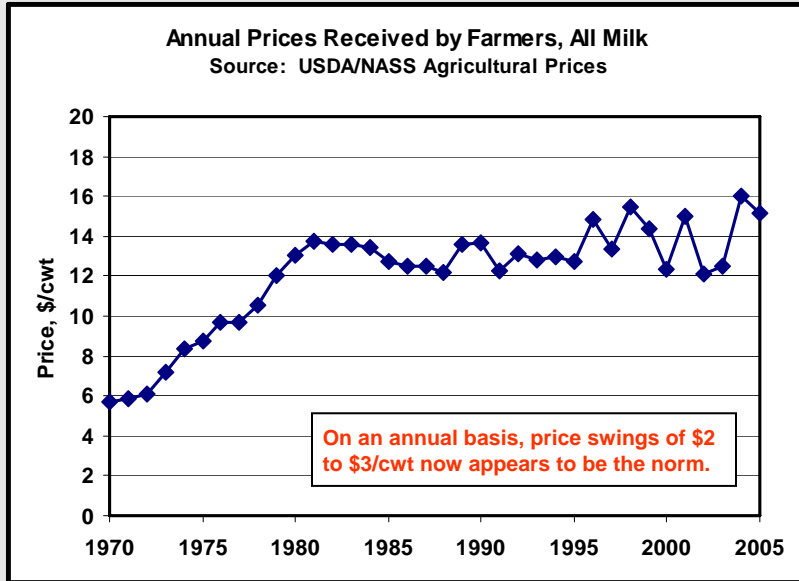
Levels constant for last 25 years, but increasing volatility.



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Annual milk prices...

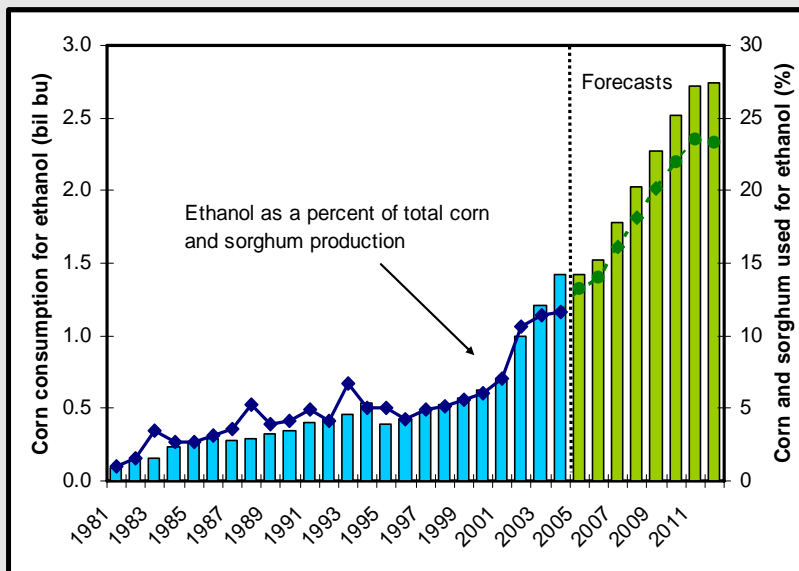
Levels constant for last 25 years, but increasing volatility.



23

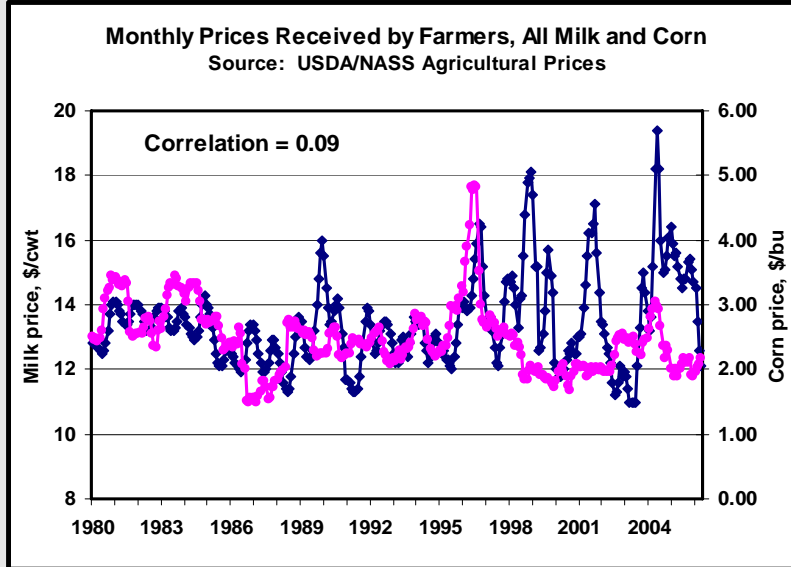
Corn prices...

Potential for significant increase in volatility in future???



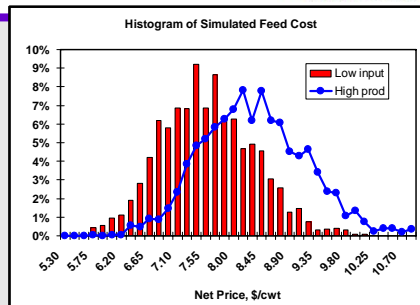
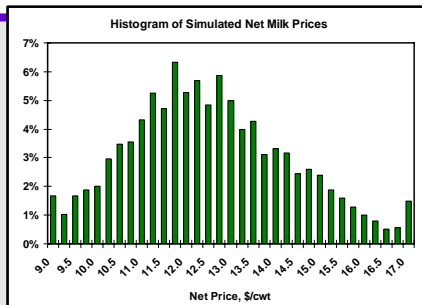
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Relationship between milk & corn prices...



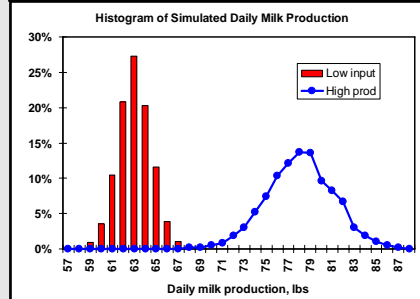
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Variability of inputs for analysis...



Variables are assumed to be independent in the simulation process.

Variable	Avg	Min	Max	Std
Milk price	\$12.41	\$9.00	\$17.00	\$1.79
Feed cost (LI)	\$7.50	\$5.20	\$10.00	\$0.75
Feed cost (HP)	\$8.25	\$5.75	\$10.75	\$0.82
Milk production (LI)	62.54	56.88	68.10	1.51
Milk production (HP)	77.58	67.50	88.70	3.02



Summary of annual returns...



COMPARISON OF ANNUAL COSTS AND PROFIT -- PER DAIRY						
Variable	Average		Minimum		Maximum	
	Low-Input	High-Prod	Low-Input	High-Prod	Low-Input	High-Prod
Feed cost	\$4,374,343	\$5,311,748	\$3,880,096	\$4,706,636	\$4,858,634	\$5,906,412
Difference	\$937,405		\$826,540		\$1,047,778	
Total cost	\$10,104,567	\$11,766,868	\$9,610,320	\$11,161,755	\$10,588,858	\$12,361,532
Difference	\$1,662,301		\$1,551,436		\$1,772,674	
Profit	-\$253,798	\$94,512	-\$1,384,706	-\$1,306,514	\$735,159	\$1,355,885
Difference	\$348,310		\$78,192		\$620,726	

Analysis based upon full economic costs.

5-year period: $\$348,310 \times 5 = \$1,741,550$

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Summary of annual returns...



COMPARISON OF ANNUAL COSTS AND PROFIT -- PER COW						
Variable	Average		Minimum		Maximum	
	Low-Input	High-Prod	Low-Input	High-Prod	Low-Input	High-Prod
Feed cost	\$1,268	\$1,540	\$1,125	\$1,364	\$1,408	\$1,712
Difference	\$272		\$240		\$304	
Total cost	\$2,929	\$3,411	\$2,786	\$3,235	\$3,069	\$3,583
Difference	\$482		\$450		\$514	
Profit	-\$74	\$27	-\$401	-\$379	\$213	\$393
Difference	\$101		\$23		\$180	

Analysis based upon full economic costs.

Costs per cow measures are NOT particularly useful benchmarks

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Summary of annual returns...



COMPARISON OF ANNUAL COSTS AND PROFIT -- PER CWT						
Variable	Average		Minimum		Maximum	
	Low-Input	High-Prod	Low-Input	High-Prod	Low-Input	High-Prod
Feed cost	\$6.39	\$6.25	\$5.68	\$5.56	\$7.08	\$6.92
Difference	-\$0.13		-\$0.12		-\$0.15	
Total cost	\$14.76	\$13.85	\$14.02	\$13.09	\$15.43	\$14.56
Difference	-\$0.90		-\$0.93		-\$0.86	
Profit	-\$0.37	\$0.11	-\$2.02	-\$1.54	\$1.07	\$1.58
Difference	\$0.48		\$0.48		\$0.51	

Analysis based upon full economic costs.

Per cwt measures are never worse for high production dairy due to the benefit of diluting fixed costs across higher levels of production

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Summary of annual returns...



COMPARISON OF ANNUAL RETURN ON ASSETS AND RETURN ON EQUITY						
Variable	Average		Minimum		Maximum	
	Low-Input	High-Prod	Low-Input	High-Prod	Low-Input	High-Prod
ROA	5.72%	8.01%	-2.35%	-0.60%	12.77%	15.76%
Difference	2.29%		1.75%		2.98%	
ROE	3.90%	8.59%	-12.28%	-8.67%	18.05%	24.13%
Difference	4.69%		3.61%		6.09%	

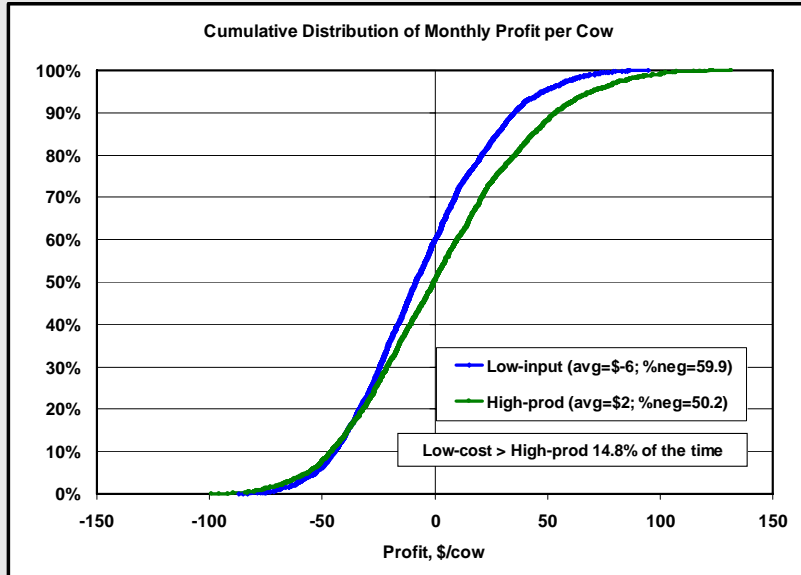
Analysis based upon full economic costs.

Note: analysis does not account for changing equity positions over time (i.e., values in table are all relative to initial starting point, 50% leverage)

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Distribution of *monthly* returns

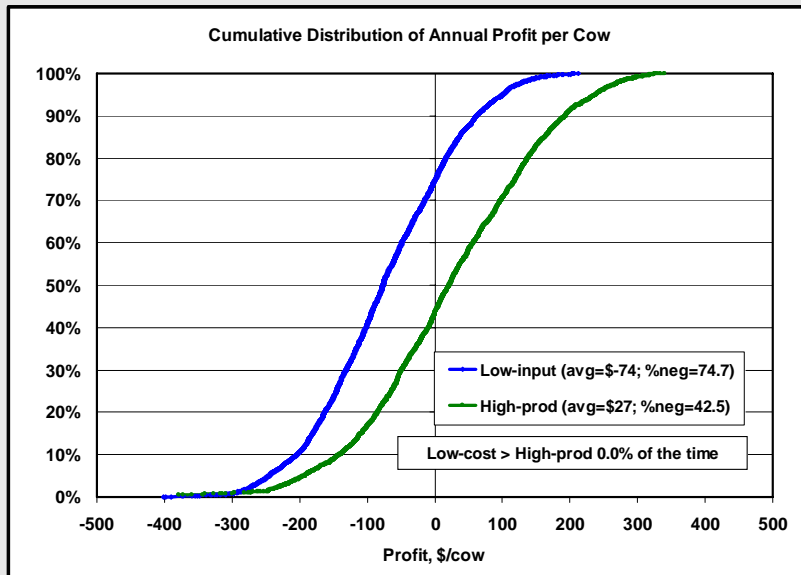
Analysis based upon full economic costs



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Distribution of *annual* returns

Analysis based upon full economic costs



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In a volatile market – who will thrive?



- In a commodity market, the most efficient producers will survive
- Efficiency is defined as producing the commodity at the lowest cost (relevant cost is cost per cwt)
- Cost/cwt is almost always lower with higher production due to dilution of huge fixed costs (parlor, barns/corrals, cow, labor, equipment,...)
- What are best financial measure of success?
 - \$/cwt
 - ROA and ROE

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Management...



What should a dairy manager focus on?

- Planning
 - UNDERSTAND THE SITUATION (what are your constraints)
- Optimize Efficiencies (production & costs interaction)
 - WHY?
 - HOW?
 - ALTERNATE MODELS AND THEIR IMPACT ON RETURNS
- Marketing
 - FOCUS EFFORTS ON THINGS YOU CAN CONTROL

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Management...



What should a dairy manager focus on?

- **Planning**
 - UNDERSTAND THE SITUATION (what are your constraints)
- **Optimize Efficiencies (production & costs interaction)**
 - WHY?
 - HOW?
 - ALTERNATE MODELS AND THEIR IMPACT ON RETURNS
- **Marketing**
 - FOCUS EFFORTS ON THINGS YOU CAN CONTROL

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Dairy Budgets Analyzer
Exact same spreadsheet as before, but rather than comparing regions by year it can be used to examine alternative management interventions.

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Management...



What should a dairy manager focus on?

- **Planning**
 - UNDERSTAND THE SITUATION (what are your constraints)
- **Optimize Efficiencies (production & costs interaction)**
 - WHY?
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- **Marketing**
 - FOCUS EFFORTS ON THINGS YOU CAN CONTROL

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Future...



- **Current trends will likely continue and may even accelerate**
 - Consolidation and structural change
 - Shifts in regional milk production
- **Change is always a challenge, especially when it occurs rapidly**
- **Industry survivors will capture EOS and will manage dairies such that they are low cost producers (typically means high production)**

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Questions ?

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