The Economics of Dairy Facility Modernization

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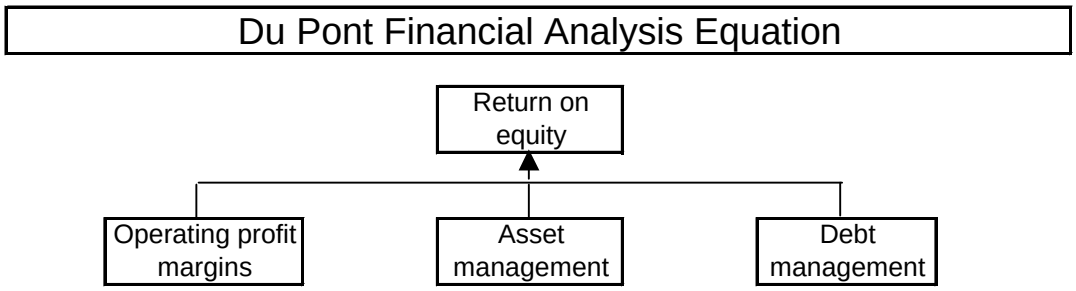
Dairy facility modernization is likely to involve major changes in all areas of the business. Like any major investment, it is best approached from a systems perspective. Economists have developed a number of tools over the years for comparing how a major change in the farm business might affect long-range profitability, liquidity, and solvency. FINPACK is perhaps the best known of these tools, and many of you are probably familiar with it or have used it over the years.

A discussion of the details of a FINPACK analysis would take more time than is available in this session. So, I'd like to just key in on a just few of the key financial analysis concepts included in a FINPACK analysis. I will use a framework based loosely on one that was developed a number of years ago by the chief financial officer of the Du Pont Corporation as a quick way to relate different financial ratios to the bottom line of the business[1].



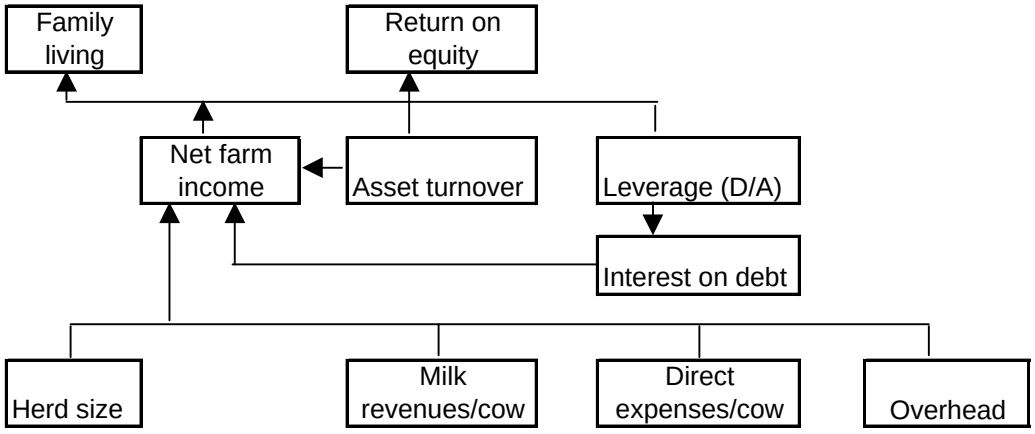
The Du Pont equation assumes that your objective is to increase the rate of return on the equity capital invested in your business. Any successful major change such as modernization of a dairy facility will likely affect return on equity in three main ways: first, it should increase operating margins; second, you are probably adding assets and changing the utilization of the assets you already have; and third, the investments probably require adding debt. If the assets are utilized well and the debt is kept within limits, the increase in operating margins should be sufficient to more than cover the additional debt servicing costs and depreciation.

Below is the same model with more detail. Operating margins can be measured in different ways. "Net farm income" is used here as the measure of operating profit margin, for simplicity. Net farm income is simply (cash farm income minus cash expenses, depreciation, and inventory adjustments). "Family living" is also added as another objective alongside "return on equity". It is perhaps just a matter of personal preference to some degree whether a manager focuses on net farm income, return on equity, or improving the cash available for family living as the main objective. Return on equity is calculated by subtracting an opportunity cost of labor and management from net farm income. Producers who see themselves as having reasonably attractive employment opportunities in cash cropping or working in town, may prefer to look at

[1] See Brigham and Gapenski, Financial Management Theory and Practice, 8th Ed., Dryden Press, 1997, or The Internet Business Center, http://www.ibizcenter.com/dupont_analysis.htm for a more in-depth discussion of the Du Pont equation.

return on equity because that is a number they can compare to what they can earn by just buying CDs at the bank or investing in the stock market. On the other hand, another perfectly appropriate way to view the objective of the business is in terms of increasing the amount you can take out of the business each year to live on without taking away from its earning potential or adding to debt.

Du Pont Financial Analysis of Dairy Parlor Investment Alternatives
(more detailed view)



The "asset turnover" ratio is used as a measure of how well the assets of the operation are being utilized. "Leverage" (debt:asset ratio) describes debt management. New borrowing to finance a new milking parlor will increase interest expenses, which will tend to offset the added returns from the added cows. Capital turnover feeds into net farm income through such expenses as depreciation, insurance, and property taxes. If production suffers during the transition to a new facility, the impact will be reflected in milk revenues per cow. Direct expenses per cow could also change, particularly if heifer raising or crop harvesting is contracted out. Additional production may also help cover existing overhead expenses.

Financial Performance Comparison Based on Selected Data from the Three Case Farms

The three farm situations described by Dr. Janni and Dr. Reneau show how different objectives can be met in a modernization project. A financial performance model was developed that draws on the experiences of these three farms in the areas of:

- Investment required to modernize
- Herd size
- Workforce (full-time-worker equivalents, or FTE)
- Milking time requirements
- Milk produced per cow per year

The model is fairly simplistic, but still requires certain other items of financial information. A comparison will be presented at the workshops that is based on numbers from farm record

summaries and other industry sources[2]. The farms were assumed to have low debt initially, with farm assets somewhat greater than average for Minnesota dairy farms so that they were in a position to borrow the funds needed for modernization and some degree of expansion.

The operation with the double-10 swing parlor is milking 110 cows with a production level of 23,500 lb per cow. They are able to milk in around 2 hours per milking, or 4 hours per day. A 2-hour milking time for 110 cows in a double-10 works out to around 2.3 turns per hour, assuming that 85% of the cows are in milk (defining a "turn" as the time from when the first cow of one group enters one side of the parlor until the first cow of the next group enters on the same side). Milking for only 2 hours per day gives them time in the day to deal with cow performance issues or simply "have a quality lifestyle" beyond milking cows. They operate the farm with the equivalent of 3 full-time workers, which works out to be 37 cows per FTE worker. Their debt position is better than for the other two farms, but the lower production level and smaller herd size result in a net farm income and return on equity capital (ROE) don't look as good (assuming that the assumptions that we are making in the model are accurate). The operators are to some extent still transitioning to the new system. They will probably increase the herd size further in the future, which might improve the economic numbers for this operation.

The operation with the double-6 flat step-up parlor has increased the herd size to 200 cows at 21,000 lb per cow. They made a significantly larger total investment, partly due to the need to purchase a larger milk tank. The workforce is 3.5 FTEs, or only one more half-time position than for the first situation. Milking runs to around 7 hours per day, so perhaps they have been able to move further in the direction of optimizing cow numbers than has farm one. A 7-hour milking time for 200 cows in a double-6 would imply a parlor throughput of around 4 turns per hour, compared to 2.3 turns for farm one. The performance measures of cows per worker and asset turnover appear as higher values. Production cost per cwt of milk is about the same as for the first operation, but the larger herd size results in a higher net farm income and a greater ROE. ROE is calculated after subtracting an opportunity cost on the operator's labor and management (or equivalently subtracting a family living draw).

The operation with the double-4 flat parlor made the smallest parlor investment, and is milking a herd of 143 cows at 27,000 lb per cow. With a workforce equivalent to 3.5 workers operating the milking parlor for 6 hours per day (5 turns per hour), labor efficiency is not quite as great in terms of cows per worker as for the second farm, and despite the lower facility investment, the asset turnover rate isn't quite as good.

Financial Performance Comparison When Daily Milking Time is Held Constant

The financial performance comparison was also repeated with several of the variables specific to the case farm, set at constant values so that the three systems (double-4 and double-6 flat step-up parlors and double-10 swing parlor) could be compared without confusing the comparison by factoring in the different objectives and limitations of these particular case farms. The daily milking time is held constant across the three low-cost systems at 6 hours per day,

[2] One source we drew on for the financial data was the FINBIN database of MnSCU Farm Management Program and Farm Business Management Association record summaries on the Center for Farm Financial Management's website http://www.agrisk.umn.edu/FinBin.asp. While the data is believed to be representative of typical dairy operations that might consider a modernization project, every farm situation is unique so some of the alternatives may work better than others in your situation. See us after the presentation if you would like to adjust the analysis to fit your situation.

and milk production is held constant at 22,000 lb per cow. The systems were also compared with a stanchion barn and with a completely new turnkey double-12 parlor and freestall system.

The stanchion barn system was set at 71 cows, which is the Minnesota state average herd size in 2001. At a milking time of 4 hours per day, the labor efficiency is 31 cows per worker while asset turnover is at 12%. The systems are compared with the goal of increasing net farm income and ROE. Some increase in these two financial measures is possible by expanding the stanchion barn by 50%, but if labor efficiency is not increased, milking time would also increase by a comparable amount. An increase in milking time under stanchion barn conditions of stooping under cows that are standing at the same level as the workers may not be an acceptable course of action for many operations.

The premise of this analysis is that an increase in milking time would be more acceptable with any of the parlor alternatives than with the stanchion barn, because the pit minimizes the amount of stooping required. The three low-cost modernization alternatives would appear to accommodate herd sizes of from 143 cows for the double-4 step-up to 214 cows for the swing parlor, if operated for 6 hours per day. Throughput for the step-up parlors is set at 4 turns per hour for the double-6 and 5 turns per hour for the double-4, as in the case farms. The swing parlor would have to operate at a somewhat faster rate than on the case farm, if it is to handle 214 cows in six hours. It would have to operate at 3 turns per hour rather than 2.3, but this is still a slower rate than for the other parlors to allow time for moving the larger numbers of cows in and out. It would appear that the parlors would as much as double labor efficiency (cows per worker) compared to the stanchion barn.

The asset turnover ratios indicate that capital is also being utilized more efficiently. The price for these efficiency gains is that debt increases, but the debt:asset ratio remains below 50%. Net farm income and the rate of return on equity capital both show that the parlors improve profitability significantly compared to the stanchion barn. The rate of return comparison is a little misleading in one way, however, because the farm's equity capital or net worth (on a market value balance sheet) declines somewhat when a major investment is made. This decline is due to the fact that the lender is not likely to credit the farm asset value with the entire construction cost, because it wouldn't bring that much on the market if sold.

A completely new turnkey double-12 parlor and freestall system was also included for comparison. It quickly becomes apparent that substantially more initial equity capital would be required to finance the completely new system than for the modernization projects that involved putting the parlor in a remodeled building. Facility investment per cow is substantially greater for the all-new facility compared to the other alternatives. The other main conclusion one can draw from the comparison is that if a new system is to be financially feasible, it is important to operate it as many hours per day as possible. The new double-12 parlor would handle a herd of 1,143 cows if operated for 16 hours per day, and provides very attractive rates of return. The herd size is only 571 cows if operated only 8 hours per day, and returns look much less attractive.

Summary

A few conclusions that will probably hold true for most situations are:

- A flat step-up parlor or swing parlor seems likely to increase throughput (cows milked per hour) compared to a stanchion barn. If herd size is kept to not much more than 100 cows, it

should be possible to milk in 3 to 4 hours per day in one of these parlor systems. The asset turnover rate and return on equity may not be a great deal better than for the stanchion barn, but the change may still be worthwhile in terms of milker health and quality of life.

- Increasing the herd size to around 200 cows or more may require extending the milking time to 6 to 8 hours per day. The increased throughput increased the asset turnover rate and net farm income quite a bit. The rate of return on equity might double compared to an equivalent system with 100+ cows.

- The increased borrowing required to finance the facility and cows increases the debt:asset ratio significantly, as well. How much it increases depends in part on how much of the construction cost translates into added asset values.

- Industry estimates seem to suggest that an entirely new facility with a state-of-the-art parlor and cows might cost two or three times as much per cow as a flat step-up parlor or swing parlor, perhaps in the range of $2,000 to $3,000 per cow or more plus the cost of the cows themselves, for a herd size of 600 to 1,200 cows. If true, then such an investment is likely beyond what many producers can finance. For someone with sufficient equity, the larger, high-technology facility could be quite profitable, however. Just how profitable depends on many factors such as how many hours per day the parlor is used, and what is really achievable in labor efficiency (cows per worker).

- Another popular cliché is that "leverage is a two-edged sword". Breakeven production costs are in the range of $12 to 13 per cwt for all of our scenarios, so they all tend to show negative net farm incomes and ROEs when prices fall below that level. A lower-investment modernization approach that minimizes investment and debt per cow may have greater flexibility to weather low prices than a totally new system requiring a greater debt commitment.

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