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# ***Staff Paper***

**1993 MILK PRODUCTION COSTS ON MICHIGAN  
TELFARMS**

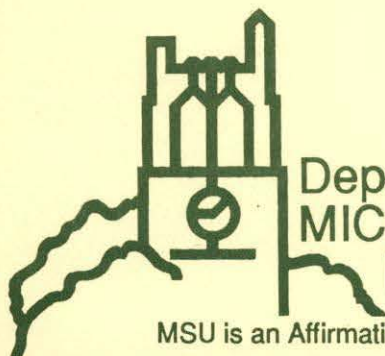
by

**Sherrill B. Nott**

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# 1993 MILK PRODUCTION COSTS ON MICHIGAN TELFARMS

by

Sherrill B. Nott, Ph.D.<sup>1</sup>

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## Introduction

The cost of producing a hundred weight (cwt) of milk is of interest to dairy farmers and policy makers considering dairy oriented legislation. The cost of production can also be called the break even price. The break even price is that price of milk which will make total farm income exactly equal to total farm expenses, assuming crop and livestock sales remain the same.

Costs of producing milk vary a lot from farm to farm. This paper attempts to show the amount of cost variation among a group of above average Michigan dairy farms in 1993. Five different cost definitions (profit measures) are discussed. The break even price for each farm is calculated. These prices are arrayed from high to low for the farms and are presented in graphs, one for each profit measure. Policy analysts should consider each definition in judging the impact of future legislation. It is left to you, the reader, to decide which profit measure best meets your needs.

## The Sample Farms and Profit Measure 6

The sample data set comes from 170 Michigan dairy farms who voluntarily kept records during 1993 with Michigan State University's Telfarm, a mail-in computerized accounting system. Farms were designated as dairy if 75 percent or more of their gross revenue came from the sale of milk. Dairy farmers using the Michigan Telfarm system are not necessarily representative of Michigan dairy farmers as a whole. Average herd size and per cow production are greater on Telfarms reflecting a higher level of management. However, general inferences should be relevant for USDA census Class I and II farms.

The 1993 sample of Telfarmers was noticeably different from the 1992 sample. It had 30 fewer farms. The farms averaged to have 125 cows, 12 more than in 1992. Milk sold per cow was 418 pounds higher in 1993, averaging 19,198 per cow. After being negative in 1991 and 1992, profitability turned positive in 1993. Inventories of corn and hay increased during 1993, but corn silage decreased. Yields per acre were slightly higher for most crops in 1993.

Profit Measure Six (PM6) was the management income calculation used by Telfarm. Details of how this was calculated plus the results by four farm sizes were reported elsewhere<sup>2</sup> for the 170 sample farms. Management income was defined as cash income minus cash expenses adjusted for inventory changes of feed, supplies, prepaid expenses, and livestock. Depreciation, calculated by income tax rules, was subtracted. In 1993, unpaid operator and family labor were charged at \$6.50 per hour. Interest on average capital (debt plus equity) during the year was charged at 6.0 percent.

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<sup>1</sup> Professor and farm management extension specialist, Department of Agricultural Economics.

<sup>2</sup> Business Analysis Summary for Specialized Michigan Dairy Farms, 1993 Telfarm Data, Ag. Econ Report No. 578, Agr. Econ. Dept, MSU East Lansing, 1994.



Telfarm also partitions farm returns between crops and livestock, one enterprise for each. The dairy farm livestock enterprise computes the cost of producing milk. All feed is treated as purchased by the cows. All livestock products sold (except milk) and all inventory changes are subtracted from total economic costs. The remaining costs are assumed to be attributable to milk. This PM6 associated cost of production in 1993 averaged \$12.08 per cwt. The range on the 170 farms was \$5.62 to \$27.74 per cwt. The average price received was \$12.98 which was \$0.90 per cwt. more than the cost. On average, the sample farms appeared to be more than covering their PM6 costs of production.

The sample farms in total sold 407,815,200 pounds of milk in 1993. When they were arrayed from high cost to low cost of milk production by the PM6 definition, the highest cost 10 percent (percentile) of 17 farms produced only 4.2 percent of the milk. Their average cost was \$19.01, ranging from \$16.72 to \$27.74 per cwt.

One might expect that economically rational farmers would not produce milk if the price received were less than the cost of production. Yet, 4.2 percent of the milk in the above sample was produced at costs of 46 percent or more above the average price. The individual managers may have received higher than normal prices. It is more likely they were willing to take less than 6.0 percent on their investment, less than \$6.50 per hour for their labor, or were not planning to replace machinery (thereby "living off their depreciation"). There may have been an expectation that prices would be even higher or costs lower, either in 1993 or in the near future. Several other factors in combination might have influenced their decisions.

Telfarm's management income formulas are theoretically correct by academic standards. However, few people understand the formulas. So, I assume no farmers will look at the PM6 average cost of \$12.08 per cwt. when deciding whether or not to continue milk production. Other profit measures that are closer to the pocketbook and easier to understand may give policy analysts a better indication of how farmers respond to major milk price drops. Five alternative profit measures are offered below; they may better indicate the staying power of Michigan dairy farmers. Table 4 at the end of the paper defines and summarizes the five measures.

### **Profit Measure 1: Cash Income minus Cash Expense**

No: Interest, Family Living, Capital Purchases

This measure, PM1, is the opposite end of the income measure spectrum from PM6. It assumes the farm will stay in business if cash income just barely covers cash expense. Inventory changes were ignored. Cash expenses included neither cash interest nor principal payments. No allowance was made for family living nor for depreciation. Nothing was spent on capital purchases such as machinery, building remodeling or animals.<sup>3</sup>

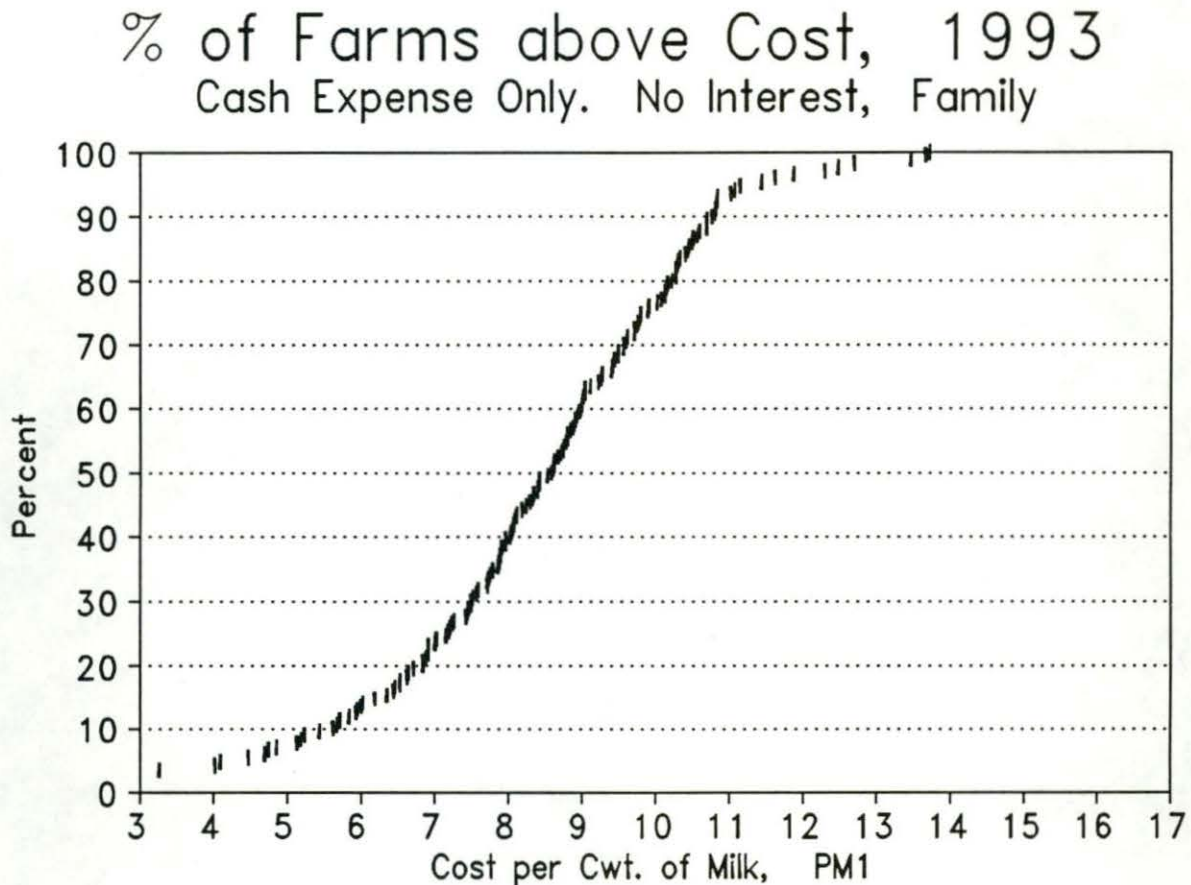
Using PM1 would be an extreme situation for a farm family to face. There could be no debt. Family living items would have to be covered from off-farm income, or by drawing down

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<sup>3</sup> All computations and graphic generation of the data set were done on QuattroPro, a brand name product of Borland International, Inc.

equity. If equity were close to zero, and all family members were fully employed on the farm, long term survival would be nearly impossible. On farms where one spouse earns the family living by off farm work, it would be possible to survive for a few months. There are dairy farms in this situation. They are the survivors whose breakeven milk prices would be the lowest.

Figure 1 is the cumulative breakeven chart for PM1 on the 170 farm sample for 1993. Each vertical tick mark on the plot is one farm. To review the computation steps, PM1 was computed for each farm. The average amount was \$95,901 with a range from -\$29,109 to \$459,097 per farm. The average farm milk price actually received was \$12.98 per cwt. The price needed to drive each farm's PM1 to zero was calculated next. This break even price averaged \$8.38 with a range of \$0.72 to \$13.72 per cwt. The farms were then ranked by this breakeven price from low to high.



**Figure 1.** Cumulative Distribution of 170 Michigan Farms, PM1

Read Figure 1 from left to right to best understand the implications. Along the bottom axis the break even cost ranges from \$3 to \$17 per cwt. of milk. Four of the 170 farms were not plotted on Figure 1; they had a breakeven cost below \$3.00 per cwt. The other axis ranges from 0 to 100 percent. Move up from the \$7 on the bottom until you reach the plotted line. Moving left from the line you intercept the other axis at about 23 percent. This means about 23 percent



of the farms would cover or exceed their cash expenses if milk were \$7 per cwt. At \$10 per cwt., about 76 percent of the farms would cover their costs or make a profit. At \$13 per cwt., nearly 99 percent of the 170 farms would cover their costs if PM1 were used.

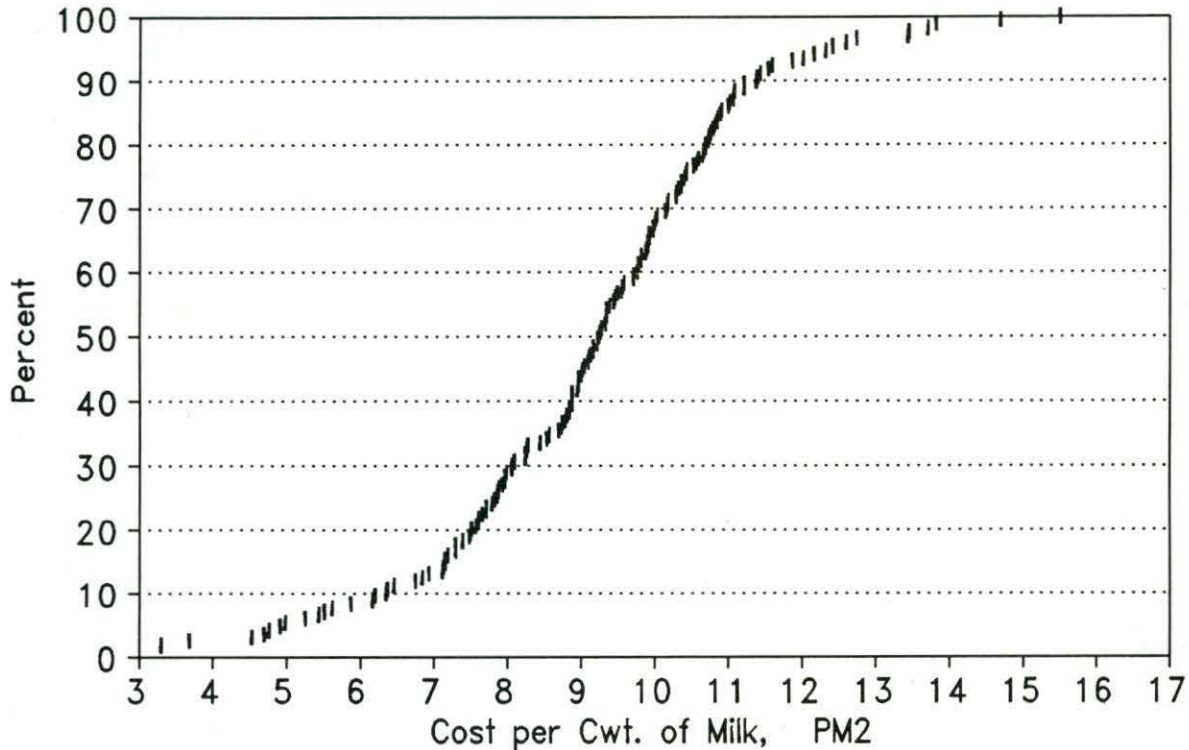
Using the extreme definition of PM1, Figure 1 indicates about 8 percent of the sample farms would not be able to break even if the farm milk price dropped to \$11.00 per cwt. for several months.

**Profit Measure 2: Cash Income minus Cash Expense & Interest**

No: Family Living, Capital Purchases, Principal Payments

Measure PM2 builds on PM1. Cash expenses now include cash interest, but not principal payments. It was assumed that if principal were paid, it was offset by further borrowing within the year. Nothing was spent on capital purchases unless they were 100 percent financed. For farmers heavily in debt and with no off farm income, it would be nearly impossible to survive if the milk price dropped to the breakeven price using PM2.

## % of Farms above Cost, 1993 Cover Cash Expense, Cash Interest



**Figure 2.** Cumulative Distribution of 170 Michigan Farms, PM2

Figure 2 is the cumulative breakeven chart for PM2 on the 170 farm sample for 1993. The average PM2 per farm (after paying interest) was \$80,457 with a range from -\$101,170 to \$358,956. The break even price averaged \$9.11 with a range of \$2.62 to \$15.53 per cwt.

Using the definition of PM2, Figure 2 indicates about 37 percent of the sample farms would not be able to breakeven if the farm milk price dropped to \$10.00 per cwt. for several months. Two farms had a breakeven price of less than \$3 and were not plotted on Figure 2.

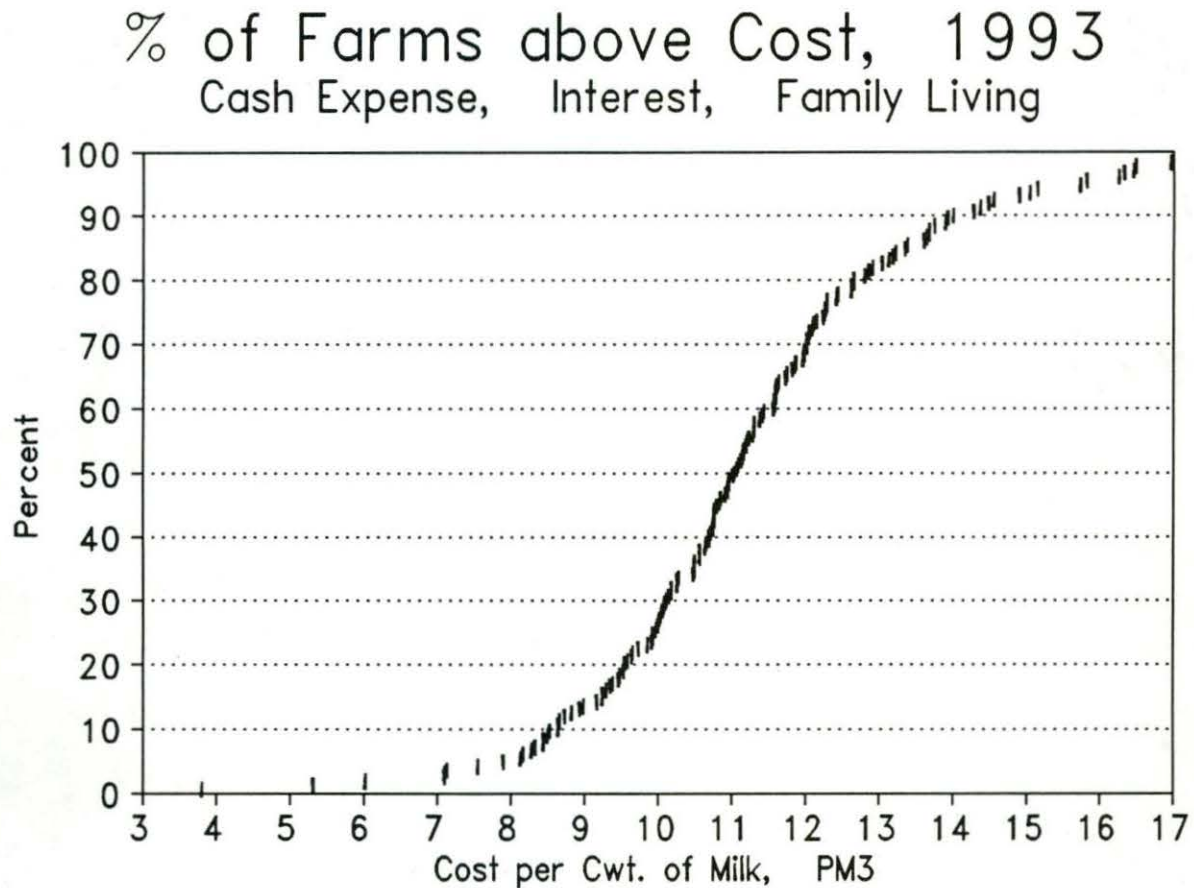
### Profit Measure 3: Cash Income minus Cash Expense, Family Living

No: Capital Purchases, Principal Payments

Measure PM3 builds on PM2. Cash requirements now include family living. It was assumed this amount would be the operator hours plus the unpaid family hours (which is reported to Telfarm by the farmers) times \$6.50 per hour. For many farms, this provides for 2 or more partners. There were 13 of the 170 sample farms that reported no hours in either the operator or the family categories. They were adjusted by assuming the farm had to provide

\$18,620 of family living for the operator. This is the average operator amount for the 170 farm sample resulting from hours reported times \$6.50 per hour<sup>4</sup>. After this adjustment, the cash for family living and personal taxes averaged \$33,662 per farm for the 170 farms.

The average PM3 was \$46,795 and ranged from -\$ 137,440 to \$336,206 per farm. The average break even milk price was \$11.30 per cwt. It ranged from \$3.82 to \$23.03 per cwt.



**Figure 3.** Cumulative Distribution of 170 Michigan Farms, PM3

It is expected that farmers able to pay at least their family living expenses plus cash interest could survive several months in the dairy business. Figure 3 shows that at \$12 milk, about 70 percent of the sample farms would break even or make a profit with PM3. However, 30 percent would not. Three farms were not plotted on Figure 3. They had costs of over \$17 per cwt.

<sup>4</sup> The Telfarm system allows users to input both unpaid hours and actual family living draws. Few farms report family living expenses. It was felt the hours times wage rate would be a better proxy for family living withdrawals than would the few actual reportings made.



### Profit Measure 4: Cash, Family Living and Inventory Changes

No: Capital Purchases, Principal Payments

Measure PM4 builds on PM3. Everything was the same except that inventory changes were added to cash income. They included crops, feeds, supplies and livestock values. This caused the average break even price to drop \$1.05 per cwt. for the 170 farm sample compared to PM3.

The average PM4 was \$72,794 and ranged from -\$85,240 to \$541,630 per farm. The average breakeven milk price was \$10.25 per cwt. It ranged from \$1.36 to \$27.62 per cwt.

### % of Farms above Cost, 1993 Cash Expense, Family Living, Inventory

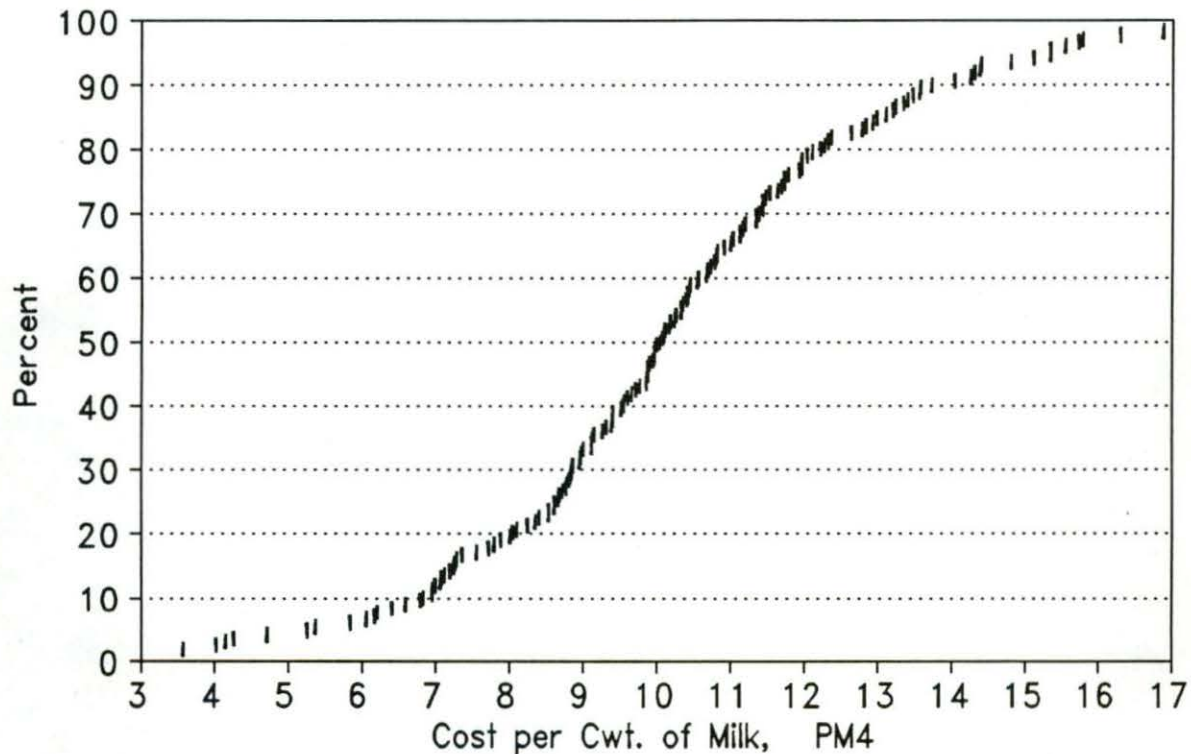


Figure 4. Cumulative Distribution of 170 Michigan Farms, PM4

Figure 4 shows that if inventories were available to support incomes in the short run, over 79 percent of the farms could break even or make a profit if milk price dropped to \$12.00 per cwt. Within 12 months or less, though, the consumption without replacement of inventories would start to have an impact. Five farms were not plotted on Figure 4; Two had breakeven prices below \$3.00, and three had break even prices above \$17 per cwt.

**Profit Measure 5: Inventory Changes, Family Living, Depreciation**

No: Capital Purchases, Principal Payments

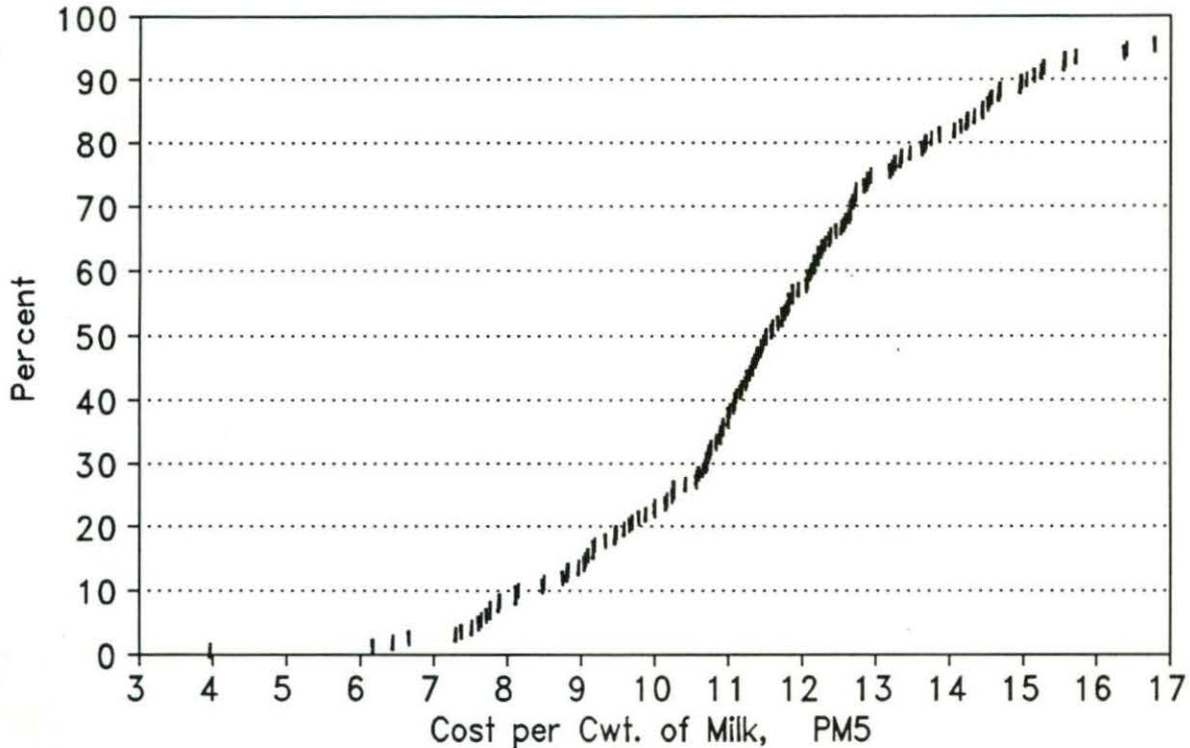
Measure PM5 builds on PM4. Everything was the same except depreciation on buildings and machinery had to be covered in order to break even. That amounted to an average of \$36,117 per farm. Allowing for depreciation assumed replacement capital would be available as assets wore out.

The average PM5 was \$36,677 and ranged from -\$149,695 to \$313,163 per farm. The average break even milk price was \$11.87 per cwt. It ranged from \$3.97 to \$28.87 per cwt.

A farm which could break even with this income measure could probably stay in business indefinitely. Although interest on equity is not provided for, the amount charged for depreciation would likely be enough to cover principal payments and provide for capital replacements if most of the latter were financed.



## % of Farms above Cost, 1993 Family Living, Inventory, Depreciation



**Figure 5.** Cumulative Distribution of 170 Michigan Farms, PM5

Figure 5 indicates 75 percent of the farms were breaking even or making a profit at the average milk price of \$12.98 received in 1993. Or, nearly 25 percent were at risk of not surviving over the longer term. If the long term milk price were to fall to \$11 per cwt., the PM5 break even calculation and Figure 5 indicate over 60 percent of the 170 sample farms would be at long term risk. Eight of the farms were not plotted on Figure 5; they had break even costs above \$17 per cwt.

### Interpretations

Table 1 indicates how sensitive the three highest cost percentiles might be to price drops given the 5 different profit measures. For PM1, where the break even milk price had to cover only cash expenses, and those did not include interest or family living withdrawals, the average break even price was \$8.38 per cwt. By the PM1 profit measure, half the farms would be covering costs, and half would not at \$8.38 per cwt. The ten percent of the farms with the highest costs, or 10th percentile, was made of up 17 farms. These 17 farms had an average break even price of \$18.81; the 17 farms in the 9th highest cost percentile using PM1 had an

average break even cost of \$10.48 per cwt. Using PM1, if the price of milk were between \$10.48 and \$9.92, then 20 percent of the farms would not be covering their costs.

Table 1. BREAK EVEN PRICES BY FIVE PROFIT MEASURES  
Michigan Dairy Telfarmers, 1993

Profit Measure	All Sample Farms	Average of ----- Percentile that Is:		
		10th Highest	9th Highest	8th Highest
----- Dollars per Cwt.				
PM1	8.38	11.81	10.48	9.92
PM2	9.11	12.76	10.97	10.46
PM3	11.30	16.29	13.42	12.32
PM4	10.25	16.26	13.05	11.78
PM5	11.87	17.93	14.44	13.13

The above material included a cumulative distribution for each of the 5 profit measures. One use of the graphs and the data set would be to ask how many farms will break even at a given milk price. Table 2 shows the calculated answers if the farmer pay price were to be the government support price of \$9.90 per cwt.<sup>5</sup> Using PM1, 75 percent of the farmers shipping 65 percent of the sample set milk would cover or exceed their costs.

Table 2. PERCENTAGE OF FARMS AND MILK COVERING EXPENSES  
Break-even Price = \$9.90; Telfarmers, 1993

Profit Measure	Percentage of Farms	Percentage of Milk
PM1	75	65
PM2	64	55
PM3	23	28
PM4	47	48
PM5	22	22

Table 3 shows the break even costs, the average herd size and the percentage of milk sold by percentile for PM3. It is an uneven distribution.

I believe PM3 is a key profit measure in judging the impact of falling milk prices on business survival. With PM3, cash income is covering cash expenses, including interest but not principal payments, and family living is being provided. For this sample of 170 Telfarmers, if the pay price were to move down to \$11.78, then 30 to 40 percent of the farmers will no longer be making enough to cover all their debt payments. Life style changes could become dramatic.

<sup>5</sup> There are many reasons why I'd never expect this to happen for more than a few days, if at all. They include classified pricing and market pooling, among others.



Table 3. PERCENTILE AVERAGES WITH PROFIT MEASURE 3  
170 Michigan Dairy Telfarmers, 1993

Cost Array Percentile	Average Break even Cost	Average Number of Cows	Percentage of Milk
10	\$16.29	90	5.9 %
9	13.42	115	7.8
8	13.32	162	13.6
7	11.78	105	8.4
6	11.27	174	13.8
5	10.86	109	9.0
4	10.45	100	8.6
3	9.93	100	8.3
2	9.18	186	16.1
1	7.50	106	8.4

Nearly 30 percent of the milk will be at risk. This assumes the other economic conditions of 1993 remain constant. Table 3 leads me to believe a farm pay price falling below \$12.00 per cwt. will hurt a lot of Michigan dairy farmers.

### Summary

The above paper examined what the break even cost of production was on a sample of Michigan dairy farmers during 1993 given 6 different ways to calculate profit. The ultimate profit measure was called PM6, Telfarm's formula for calculating management income.

Table 4 presents five alternative ways to look at profit calculations and break even costs. The average break even cost in Table 4 varies from \$8.38 to \$11.87 per cwt. The body of the paper has cumulative line charts for each of the 5 profit measures in Table 4.

As a reader, I invite you to choose the profit measure you think dairy farmers are most responsive to, then predict the milk price you think likely in the coming months, and use the above graphs to estimate the percentage of farms that will survive at the predicted price.

Table 4. AVERAGE BREAK EVEN PRICE BY PROFIT MEASURE  
Michigan Dairy Telfarmers, 1993

Description	Code	Average Break-even Cost per Cwt.
Cash income less expense But no cash interest or family living	PM1	8.38
Cash income less expense But no family living	PM2	9.11
Cash income less expense Family living covered	PM3	11.30
Inventory changes, cash income less expenses Family living covered	PM4	10.25
Inventory changes, cash income less expenses Depreciation and family living covered	PM5	11.87