FACTORS INFLUENCING INCOME AND PRODUCTION EFFICIENCY
ON MISSOURI DAIRY FARMS, 1955 AND 1956

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Eugene A. Leonard, B.S.
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The undersigned, appointed by the Dean of the Graduate Faculty, have examined a thesis entitled FACTORS INFLUENCING INCOME AND PRODUCTION EFFICIENCY ON MISSOURI DAIRY FARMS, 1955 AND 1956.

presented by Eugene A. Leonard, B.S.

a candidate for the degree of Master of Science

and hereby certify that in their opinion it is worthy of acceptance.

Fred E. Justus Jr.
B. H. Frame
Dwight C. Walker

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CHAPTER I

INTRODUCTION

Dairy farming is a major segment of the agricultural economy of Missouri. On January 1, 1956 there were 849,000 milk cows on farms in Missouri, and the gross farm income derived from dairy products was \$147,540,000.¹ These figures are somewhat misleading however, as they include cows and gross income derived from dairy cows on farms having only one or two cows for family use. According to the U. S. Census of Agriculture, there were 27,506 dairy farms in Missouri in 1954.² This study deals with the relationships of various factors to net income and efficiency on bonafied dairy farms.

It was not an accident that dairy farming became important in Missouri. The state is blessed with some highly productive land of which there are many alternative uses;

¹ Agricultural Marketing Service, U.S. Department of Agriculture, Dairy Statistics, Statistical Bulletin No. 218, October 1957.

² U. S. Department of Commerce, Bureau of the Census, 1954 U.S. Census of Agriculture, Volume I, part 10, Washington, 1956.

The census defines a dairy farm as a farm on which 50% of the total value of products sold was derived from the sale of milk and dairy products, or if;

1. Milk and dairy products made up 30% of total products sold.
2. Dairy cows totaled 50% of all cows.
3. Sales of milk, dairy products and dairy cattle and calves equalled 50% of total sales.

but there are many farms with limited land resources, both in quantity and quality. The topography and other soil characteristics are such that the most profitable use of a considerable acreage of land is the production of roughages. As the most profitable and often the only way to utilize roughage is through livestock, a livestock orientated agriculture has developed in Missouri. The proximity to the large population concentrations in St. Louis and Kansas City, and to lesser concentrations in St. Joseph and Springfield meant a great demand for milk and other dairy products. The perishable nature of dairy products, the proximity of good markets, and the available natural resources thus were principle contributors to the development of the dairy industry in Missouri.

Dairy farming in Missouri developed in areas close to population centers mentioned above. This is illustrated clearly by Figure 1 which shows the number of cows on farms, by counties, on January 1, 1956. The importance of dairy farming in the Ozark Plateau region is evident from the data in this Figure.

Reasons for Undertaking the Study

Dairy farmers are faced with the necessity to make major organizational changes if Missouri is to remain an important dairy producing state in the future. The introduction of new technology in the production, transportation, marketing, and processing of dairy products has

*Source: Missouri Livestock By Counties, an annual mimeograph publication published jointly by the Missouri State Dept. of Agriculture and A.M.S., U.S. Dept. of Agriculture.

erased much of the locational advantage that Missouri farmers enjoyed in the past. The number of dairy cows on Missouri farms has declined from a high of 1,039,000 cows reported in 1944.³ Much of this decline has been on farms having 5 to 10 dairy cows and selling grade C milk. Sanitation requirements and low profits from herds of this size account for a large percentage of the decline in number of cows. Nevertheless, there are still many dairy farmers that are operating businesses that are entirely inadequate to take advantage of the economies of large scale production, and thus are inefficient producers with high per-unit costs of production. The data presented in Table I points out the need for increasing the size and efficiency of dairy herds on Missouri farms. The average production per cow in Missouri of 4910 pounds is only 57 per cent of the average production in California, and is considerably lower than in the other states. The consequence of this low production per cow is readily apparent in the gross income data. Although there are approximately the same number of cows in Missouri as in California, the gross farm income from dairy products in Missouri is only 43.8 per cent of that received in California. The data on the number of cows per farm in Missouri is distorted by

³ Missouri Livestock by Counties, annual mimeograph publication published jointly by the Missouri State Department of Agriculture and the Agricultural Marketing Service, USDA.

the large number of Missouri farms that have one or two milk cows for the family milk supply. It does indicate, however, that there are far too many producers having too few cows to economically justify the capital investment necessary on an efficient commercial dairy farm.

TABLE I

A COMPARISON OF THE NUMBER OF COWS, MILK PRODUCTION, AND GROSS INCOME DERIVED FROM DAIRY PRODUCTION IN MISSOURI, CALIFORNIA, WISCONSIN, AND MINNESOTA.

State	Number of Milk Cows on Farms in 1956*	Prod. per Cow in 1956*	Gross Farm Income From Dairy Prod. 1956*	Number of Milk Cows per Farm Reporting Milk Cows in 1954**
Missouri	849,000	4910	\$147,540,000	5.5
California	850,000	8600	336,439,000	23.2
Wisconsin	2,302,000	7360	549,214,000	17.3
Minnesota	1,387,000	6760	274,251,000	11.0

*Preliminary data published in Dairy Statistics, Statistical Bulletin No. 218, AMS, USDA.

**Data from 1954 U. S. Census of Agriculture, Volume I, part 10, Bureau of the Census, U. S. Department of Commerce.

The purpose of this project is to study the competitive position of Missouri dairy farms using business records of dairy farmers in order to determine the cost of producing milk on farms of different sizes (economics of scale), and the relationship of various factors to efficiency of resource use and net farm income.

Objectives of the Study

Specifically, the major objectives of the present study may be stated as follows:

1. To determine the relationship of various production, organization, and marketing factors to farm income and efficiency of resource use on Missouri dairy farms. The following are among those factors to be studied:
 - a. Size of business
 - b. Pounds of milk produced per cow.
 - c. Intensity of business.
 - d. Level of technology.
2. To determine the cost of producing milk on Missouri dairy farms, and to determine the relationship between size of business and cost of producing milk.

CHAPTER II

REVIEW OF LITERATURE

Several studies with objectives similar to those of the present study have been carried on during the past few years. One of them was made by Suter in 1952.¹ His analysis was based on records kept by 56 of the "better" dairy farmers in central Missouri in 1952, most of whom were located in Bates County. These cooperators kept complete records of all inventories, cash expenditures and cash receipts. As measures of income, Suter used cash balance, farm income, labor income, and per cent return to capital. The study showed that operator's labor income varied directly with volume of business; regardless of whether volume of business was increased by extensive expansion or by intensification, and regardless of the measure used to represent the size of business.

Direct relationships were also found between labor income and (1) crop yields, (2) rates of livestock production, and (3) labor efficiency, regardless of how labor efficiency was measured. It was Suter's opinion, however,

¹ Robert C. Suter, Compare Your Dairy Business With Analysis of 56 Central Missouri Farms, 1952, Missouri Agricultural Experiment Station Bulletin 614, January 1954.

that work units per man is probably the best overall measure of labor efficiency.

Robertson and associates of the Purdue Experiment Station collected detailed cost records in 1940 and 1941.² One feature of this Northwestern Indiana study was the attempt to determine the cost and returns per one hundred pounds of milk. Robertson concluded from the analysis that the factors determining profits in milk production were the amount of milk produced, gross costs, value of by-products, and price of milk. Milk production per cow was the factor most closely associated with profits.

Further evidence of the association between production per cow and profits was demonstrated by Underwood of the Oklahoma Experiment Station.³ Out of a random sample of 190 producers in the Oklahoma City market area in 1949, the highest-return group averaged 7717 lbs. of milk per cow, and the lowest-returns group averaged 4851 lbs. per cow. He also pointed out the relationship of labor efficiency and profits. In the high-return group, only 83 hours of labor were used per cow year, as compared to 177 hours for the low-return group.

² Lynn Robertson, Lloyd E. Slater, and V. C. Manhart, Dairy Cattle Costs and Returns in Northwestern Indiana, Purdue University Agricultural Experiment Station Bulletin 481, December 1942.

³ F. L. Underwood, Economic Survey of Resources Used by Dairy Farmers in Oklahoma, Oklahoma Agricultural Experiment Station Bulletin 482, December 1956.

The Department of Agricultural Economics at Illinois has been making detailed cost studies of different types of farming areas of the state since 1947. Their reports on the 1953 and 1954 project in Southern Illinois, and on the 1955 study in Northern Illinois contain significant information on commercial dairy farms.⁴

These studies were set up on an inputs and returns basis, with specified charges made for land, labor, and capital. In 1953, a specific charge was made for management as well as for other factors of production and the residual returns designated as returns to all factors of production. In 1954 and 1955 the returns above the cost of land, labor, and capital were attributed to management. The cost of producing a hundred pounds of milk was also determined in these studies. In 1955, (the most recent) the average net cost per 100 pounds of milk was \$3.66 and

⁴ R. H. Wilcox and J. T. Keeler, Detailed Cost Report For Southern Illinois, 1953, Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois College of Agriculture, Urbana Illinois, December 1954, AE3027.

R. H. Wilcox, A. G. Mueller and G. D. Von Landen, Detailed Cost Report For Southern Illinois, 1954, Department of Agricultural Economics, Agricultural Experiment Station, University of Illinois, College of Agriculture, Urbana Illinois, April 1956, AE3121.

A. G. Mueller and G. D. Von Landen, Detailed Cost Report For Northern Illinois, 1955, Department of Agricultural Economics, College of Agriculture, University of Illinois, Urbana Illinois, Research Report AERR-15, February 1957.

used to produce it.

Another study of the cost of milk production was carried out by Bolton and Wiegmann of Louisiana State University.⁶ They used a net-cost accounting method for arriving at the cost of milk production on dairy farms in the New Orleans area. In the net-cost accounting method, all farm costs were charged to the dairy enterprise. This method would have serious limitations in studying farms on which dairy products were not the only major source of gross cash income. However, sales of other enterprises on the farms in the Louisiana study averaged only \$300.

The mean cost of producing 100 pounds of milk for all farms studied in the New Orleans area, including charges for all factors of production was \$6.75. The average Class I (Grade A for fluid consumption) price for the same period, July 1953 - June 1954, was \$6.50. The production cost per hundred pounds of milk was tabulated by size of producing unit, and the cost varied from \$10.65 on farms producing 90 pounds of milk per day to \$5.30 on farms producing 1620 pounds of milk a day. The researchers found a negative relationship between milk production per cow and cost per hundredweight, and a positive relation between feed costs per cow and production per cow.

⁶ Bill Bolton and Fred H. Wiegmann, Milk Production Costs in the New Orleans Area, Louisiana Agricultural Experiment Station Bulletin 506, June 1956.

L. C. Cunningham of Cornell has over a period of years made several cost of milk production studies.⁷ His latest study, published in May of 1957 was of dairy farms in the Central Plain region of New York in 1953-54. The average cost per 100 pounds of milk produced on the 113 farms in the sample was \$4.59. The cost of feed was \$2.45 per 100 pounds of milk or 51 per cent of the total cost. Labor made up 25 per cent (\$1.21) of the total cost of production. In addition to the milk returns, 26 cents per 100 pounds of milk produced was ascribed to calves raised and manure returned to the land. As was found in the study in the New Orleans area (discussed above), the average price received for milk by the farmers in the Central Plains area of New York in 1953-54 was less than the computed cost of production. The average loss per 100 pounds of milk produced was sixteen cents.

One of the standard works in the field of milk production analysis was published by the U. S. Department of Agriculture in May, 1942.⁸ This technical bulletin contains a detailed input-output analysis of 346 cows over a 3 year period, showing different hay-grain substitution

⁷ L. C. Cunningham, Costs and Returns in Producing Milk, Central Plain Region, New York, 1953, 54, Cornell Agricultural Experiment Station Bulletin 922, May 1957.

⁸ Einar Jensen and associates, Input-Output Relationships in Milk Production, USDA Technical Bulletin 815, May 1942.

rates and feeding levels in general. The dollar and cents figures are out of date now, but many of the relationships are still pertinent. Among the conclusions derived from the analysis, the following are of particular interest:

1. The law of diminishing returns applies to all milk production.
2. Increased feeding will not stimulate the milk production of inherently low producing cows as much as cows of high inherent productivity.
3. Feeding at different levels has no effect on the fat content of milk.
4. There is no fixed level of feeding which is most profitable. Recommended feeding standards may be profitably exceeded if the ratio of feed to milk prices is favorable.

CHAPTER III

SCOPE AND METHOD OF STUDY

Source of Data

In 1955 the Missouri Agricultural Extension Service and the Agricultural Experiment Station initiated a cooperative arrangement to procure and summarize farm business records. Extension Service personnel secure the cooperation of farmers, direct the record keeping, and collect the records at the end of each calendar year. The records are then summarized and analyzed in the Department of Agricultural Economics. In 1955, 245 cooperating farmers kept records of their farming operations; and in 1956, 225 cooperated. Of the 470 records summarized for the two years, 122 farms were classified as dairy farms.¹ The farms were so designated if less than one-third of the total farm productive man work units (PMWU) were in grain production and more than one-third of the total were in the dairy enterprise.

The records collected in connection with the cooperative record keeping venture provide most of the basic data

¹ Paul H. Bebermeyer, 1955 Missouri Farm Business Summary, Agricultural Extension Service, University of Missouri, Columbia Missouri, January 1957.

Paul H. Bebermeyer, 1956 Missouri Farm Business Summary, Agricultural Extension Service, University of Missouri, Columbia Missouri, January 1958.

used in this study. An examination of the records, however, revealed that it would be advisable to establish new criteria for delineating the farms to be studied. In addition to the data taken from the business records, some information was obtained through the use of supplemental questionnaires.

Basis for Delineation of Sample

Farms were selected for use in this study if they fulfilled the requirements of the following criteria:

1. Milking herd was comprised of 10 or more cows.
2. At least 70 per cent of the total livestock productive man work units (PMWU) were in the dairy cattle enterprise.
3. No other cattle enterprise on the farm.

Ten as a minimum number of milk cows is an arbitrary figure. Some limit is necessary, however, and for the purposes of this study a herd of less than ten milk cows could hardly be classified as a commercial dairy enterprise.

By definition, a detailed input-output analysis necessitates the allocation of all farm costs to the various enterprises in the farm business. The greater the percentage dairy PMWU are of total livestock PMWU, the more accurately these charges can be budgeted. It would be very convenient if the dairy farms had no other livestock enterprises, but this is a seldom occurring situation.

The establishment of 70 per cent dairy PMWU as the minimum limit is admittedly arbitrary, but was used because the resulting sample was relatively homogeneous. At this level very few farms with sizeable dairy herds were eliminated.

Farms having cattle other than dairy were not included in this analysis because in the records there was no differentiation in the inventories or in the livestock receipts between beef and dairy cattle. It was therefore impossible to allocate some of the costs accurately on farms having both beef and dairy cattle.

In addition to the forementioned limitations it was necessary to reject a few farm records because of inconsistencies in the records which made it impossible to budget charges with a reasonable degree of accuracy and/or completeness.

Number and Location of Farms in Study

The records were subjected to the criteria discussed above. Of the 1955 records 48 were accepted for the study, and 41 of the 1956 records fulfilled the qualifications. On 17 farms, records were available for both years. Thus a total of 89 records on 73 different dairy businesses in 28 different counties were used in the study. The location of the farms in this study is presented in Figure 2. The farms are scattered fairly well throughout the state with concentrations in Lafayette

FIGURE 2--LOCATIONS OF FARMS IN STUDY, BY COUNTIES.
NUMERALS INDICATE NUMBER OF FARMS
IN EACH COUNTY.

county and in Central Missouri.

Limitations of Data

It was quite evident in the planning phase of this study that there would be definite limitations in the results obtained. Nevertheless, if the limitations are recognized and proper allowances made the results should be of considerable value.

It must be recognized that the farms in this study are not necessarily representative of the dairy farms in Missouri. Because of the stated criteria for selection the dairy farms in the sample are fairly homogeneous in organization. An examination of the dairy statistics for the state clearly illustrates that there are many dairy farms in Missouri having well developed livestock enterprises other than dairy. These combination type of business organizations are not represented in the sample. It must be understood that the study is of farms on which dairy is the primary livestock enterprise.

As noted earlier, the farms in the sample are scattered geographically throughout the state, but the sample is not geographically representative in regards to the location of the major dairy producing areas of Missouri. Conspicuous by their absence are dairy farms in the Springfield and St. Louis milkshed areas. As no attempt is being made to achieve an area analysis this is not a serious limitation.

The source of data for this study may come under further criticism. Whenever records of farmers in cooperative record keeping programs are being analyzed, there is some question as to how typical these farms are in respect to managerial ability, farm resources, and type of farm organization. Allan G. Mueller, agricultural economist at the University of Illinois conducted a research project in Western Illinois to test the representativeness of farmers in the Farm Bureau Farm Management Service.² A scientifically selected representative area sample of 179 farmers were interviewed and a comparison made with the 210 cooperating farmers in the area. Mueller in his summary of the differences of survey and record keeping farms stated:³

"Record-keeping farms differed from the representative sample survey farms in four major respects: (1) size of farm as measured in acres; (2) quality of soil (soil productivity rating) on the farm; (3) intensity of operations (inputs per unit of land); and (4) level of managerial ability as measured by aggregate and ratio measures of farm earnings.... When farm records are used for farm management research, these differences must be recognized. The bias in farm records will eliminate their use for farm management research where description of an area or measuring the impact of policy on an area is included in the objective. However, once the differences between record-keeping farms and all farms in an area are known,

² Allen G. Mueller, "Comparison of Farm Management Service Farms and a Random Sample", Journal of Farm Economics, Volume XXXVI, Number 2, May, 1954.

³ Ibid, page 289.

farm records may be used for certain types of farm management research with much more confidence."

Mueller then compared the farms in the survey with record keeping farms stratified on the basis of size of farm and quality of soil. The results of this paired - sampling technique showed the following:⁴

"The results of the comparison of survey and record-keeping farms paired on land inputs suggested that, given a comparable land area, farm operators on record-keeping and survey farms did not differ greatly in their ability to organize and utilize resources other than land to obtain net farm earnings. These observations lead us to the conclusion that differences between record-keeping farms and a representative sample of all farms are essentially differences in the quality of basic resources, particularly land and capital, utilized by the farm operators."

The weather conditions during 1955 and 1956 also influenced the results of this study. The weather during both years was hot and dry. The precipitation for the two years from four weather reporting stations in the state is shown in Table II. It may be observed that all stations received less than normal rainfall for both 1955 and 1956. Southwest Missouri suffered heavily from drought in both years, while the central part of the state recovered to some extent in 1956. Northwest Missouri was stricken by severe drought in 1956. Rainfall in both years was less than normal in Southeast Missouri, but that

⁴ Ibid, page 292.

TABLE II

NORMAL AND OBSERVED ANNUAL PRECIPITATION FOR FOUR
WEATHER STATIONS IN MISSOURI, 1955 and 1956*

Station	Area	Normal (inches)	1955		1956	
			Amount (inches)	Deviation (inches)	Amount (inches)	Deviation (inches)
Maryville	N.W.	36.93	29.78	-7.15	23.22	-13.71
Jefferson City	Central	38.29	27.71	-10.58	33.52	-4.77
Springfield	S.W.	41.58	28.61	-12.97	28.72	-12.86
Cape Girardeau	S.E.	44.35	40.14	-4.21	37.44	-6.91

*Climatological Data, Missouri, Annual Summary 1956, Vol. LX No. 13, and Vol. LIX No. 13, U. S. Dept. of Commerce, Asheville, 1957.

area did not experience the extreme conditions that prevailed in other parts of the state.

As the dairy enterprise depends heavily upon pasture, production can be severely curtailed by unusually hot and dry weather. One Southwest Missouri dairyman, interviewed with regards to this study estimated that his milk production was cut by one third both years because of a lack of adequate pasture facilities. Many other dairymen reported similar handicaps.

Drought also influences the cost of production. If farmers are to maintain their herd size during drought years, they must buy more commercial feed and hay. Obviously this increases the cost of production. The other alternative is to reduce the number of cows in the herd. The effect is much the same as the fixed costs of production are then spread among fewer units of output, thus increasing the per unit costs. It was impossible to quantitatively measure the effects of drought on this particular sample of farms; undoubtedly, it did reduce the profit on some farms.

CHAPTER IV

ORGANIZATION AND INCOME OF DAIRY FARMS

Description of Farms

In the spring of 1958, supplementary questionnaires were sent to the farmers cooperating in the study. The farmers were contacted by their respective county extension personnel, or personally interviewed by the writer. The purpose of this questionnaire was to obtain information which would make it possible to get a clearer picture of the organization on the farms. A monthly breakdown of milk production was also sought.

Of the 89 farmers in the study, supplemental information was obtained on 83; 45 of the 48 farms in the 1955 sample, and 38 of 41 in 1956. In a few cases, some items were unanswered, so that the number reporting in the data presented in Table III will not always be the total number of questionnaires returned.

Each farmer was asked if he lived in an area where there was a well developed Grade A milk market. This was asked on the assumption that the ease with which Grade A milk may be marketed, in part determines the willingness to produce it. Only two farmers in each of the two years indicated that they did not live in a well developed milk marketing area, and the two that so indicated in 1955 did sell Grade A milk. In 1955, five of 45 farmers sold

Grade C milk; and in 1956, three of 38 sold Grade C milk and one sold butterfat.

TABLE III

SUMMARY OF INFORMATION OBTAINED BY QUESTIONNAIRE ON
83 OF THE 89 MISSOURI DAIRY FARMS
IN THE STUDY, 1955 AND 1956

	45 Farms 1955	38 Farms 1956
1. Live in a well developed Grade A market area.	43	36
2. Sold Grade A milk.	40	34
Sold Grade C milk.	5	3
Sold butterfat.	--	1
3. Sold milk on a local market.	10	5
Sold milk on a large city market.	34	33
Kansas City	10	16
St. Louis	17	12
Springfield	2	--
St. Joseph	4	2
4. Belonged to Balanced Farming.	41	33
5. Belonged to a D.H.I.A.	16	10
6. Average butterfat content of milk sold. 3.98%		3.96%
7. Loose type housing and milking parlor.	33	25
Stanchion barn.	10	11
Other	2	2
8. Farmers indicating that operations were appreciably affected by drought.	26	23

Only four farmers in 1955 and two in 1956 were not members of a Balanced Farming Association. This is to be expected as the Missouri Looseleaf Farm Record Book is characteristically kept by Balanced Farming members, and the county extension personnel are responsible for getting

the cooperation of farmers in the record keeping project. Sixteen of 44 farmers in the 1955 group and 10 of the 37 in 1956 were in D.H.I.A.

To acquire knowledge of the type of housing and dairy equipment on these farms, the cooperators were asked whether they had loose type housing and a milking parlor, or a stanchion barn. In 1955, 33 had loose housing and milking parlors, ten had stanchion barns, and two had something other than these. In 1956, the figures were twenty-five, eleven, and two respectively.

Each farmer was also asked about the effects of the prevailing weather conditions on his operation during the designated year. Of the farmers in the 1955 sample, 26 reported that drought conditions had "appreciably affected" their farming operations in 1955, whereas 23 farmers in the 1956 sample reported similar comments. The most common complaint was that feed had to be purchased in unusually large quantities because of lack of moisture on the farm.

Organizational and Financial Data on Farms

Although the farms in this study are fairly homogeneous in type of organization there was considerable variation in the size of business, production efficiency and net farm income. The following chapters will be devoted to the analysis of these variations and the relationships of various factors to net farm income and efficiency. In Table IV is presented mean averages of the size of farm

business; size and productivity of the dairy enterprise; and various measures of intensity, efficiency, and income on the dairy farms studied.

TABLE IV
AVERAGES OF SELECTED MEASURES ON 89 MISSOURI
DAIRY FARMS, 1955 AND 1956

	48 Farms 1955	41 Farms 1956
<u>Size of Farm Business</u>		
Acres of Crop and Pasture Land	163	183
Total Farm PMWU	492	504
Total Capital Managed	\$34,936	\$38,936
Value of Total Farm Production	\$ 9,551	\$10,498
Value of All Crop Production	\$ 5,643	\$ 7,057
Total Farm Receipts	\$10,773	\$11,824
<u>Dairy Enterprise on Farm</u>		
Number of Cows Per Herd	25	26
Dairy PMWU	331	345
Pounds of Milk Per Cow	7533	7678
Gross Income From Dairy Enterprise	\$ 8,069	\$ 8,456
Per Cent Dairy Receipts Were of Total Farm Receipts	75	71
<u>Intensity and Efficiency Measures</u>		
Value of Production Per Crop and Pasture Acre	\$ 34	\$ 37
Value of Production Per Man	\$ 5,965	\$ 6,814
Value of Production Per PMWU	\$ 19	\$ 21
Total PMWU Per Man	311	327
Labor and Machinery Charge Per \$100 Production	\$ 66	\$ 60
Labor and Machinery Charge Per Cow	\$ 246	\$ 240
<u>Farm Income and Efficiency</u>		
Labor Income	\$ 1,579	\$ 1,747
Return to Management	\$ -468	\$ -176
Return to Capital and Management	\$ 1,337	\$ 1,823
Rate Earned on Investment	2.5%	4.3%
Net Earnings Ratio	\$ 86	\$ 98

The farms in the 1956 sample were somewhat larger than those in the 1955. The farms in the 1956 sample had an average capital investment of \$38,936 as compared with \$34,946 on the 1955 farms, and had an average value of total production of \$10,498 compared with \$9551 in 1955. The dairy farms in 1956 also fared better financially as illustrated by an average return to operator's labor and management of \$1747, and rate earned on investment of 4.3 per cent. The 1955 average return to operator's labor and management were \$1579 and the rate earned on investment only 2.5 per cent.

Average data or other measures used in this analysis are presented also in Table IV, but a discussion of these will be deferred until later in the text.

Characteristics of Farm Analyzed for Both 1955 and 1956.

It was mentioned in Chapter III that the records from 17 of the dairy farms in the study were obtained for both 1955 and 1956. The sample is too small to make generalizations concerning the changing characteristics of dairy farms from one year to the next, and for this reason a detailed analysis was not made. The information presented in Tables V and VI gives some descriptive characteristics of these farms in 1955 and 1956.

Table V is devoted to a few of the major organizational factors of a farm business. The measures chosen for tabulation were: (1) acres of cropland and open

pasture, (2) total capital managed, (3) total PMWU, and (4) number of dairy cows per herd. Most of these farms increased in size from 1955 to 1956, but a few of them changed very little. Only one farm showed a decrease in size of all four factors in 1956. On the average, the 17 farms increased in size 10 acres, \$2640 capital investment, 5 PMWU, and 2 cows from 1955 to 1956.

Table VI contains information on a few selected production, income and efficiency factors for the same 17 farms. The average figure for the value of total farm production, and pounds of milk produced per cow showed an increase in 1956 similar to the increase in size factors presented in Table V. Overall efficiency as measured by the net earnings ratio also was higher in 1956, but labor income and returns per \$100 feed fed decreased in 1956 as compared with 1955.

TABLE V

ORGANIZATIONAL FACTORS ON THE 17 DAIRY FARMS ON WHICH
RECORDS WERE AVAILABLE FOR BOTH 1955 AND 1956

Farm No.	Acres cropland & open pasture		Total Capital		Total PMWU		No. of Cows	
	1955	1956	1955	1956	1955	1956	1955	1956
1.	301	290	\$41,052	\$45,748	632	712	28	36
2.	295	390	97,821	101,345	778	751	31	38
3.	274	250	57,144	60,080	668	683	27	31
4.	211	292	38,761	45,704	528	569	19	23
5.	190	204	53,852	56,527	605	674	32	40
6.	138	138	46,655	50,648	584	639	30	34
7.	200	230	80,775	85,559	632	655	30	36
8.	312	238	36,734	34,312	675	677	34	30
9.	115	169	28,874	28,989	390	466	24	26
10.	139	151	30,653	40,309	431	461	23	24
11.	150	164	42,478	41,729	547	523	28	32
12.	160	151	26,376	27,717	512	511	30	34
13.	101	101	18,183	18,083	353	351	22	21
14.	75	75	22,831	20,175	290	308	19	18
15.	154	140	30,105	30,536	389	376	14	21
16.	128	145	29,073	40,721	439	541	16	20
17.	228	218	35,866	34,046	717	358	30	16
Average:	187	197	\$42,190	\$44,831	539	544	26	28

TABLE VI
PRODUCTION, INCOME, AND EFFICIENCY FACTORS
ON THE 17 DAIRY FARMS ON
WHICH RECORDS WERE AVAILABLE FOR BOTH 1955 AND 1956

Farm No.	Value Total Farm Production		Pounds Milk Per Cow		Labor Income		Net Earnings Radio		Returns per \$100 Feed	
	1955	1956	1955	1956	1955	1956	1955	1956	1955	1956
1.	\$14,578	\$ 6,786	7982	7417	\$6445	\$-1936	\$174	\$ 27	\$183	\$ 78
2.	21,639	16,963	9477	8440	4400	291	114	74	148	97
3.	15,449	17,318	8828	10425	5312	3787	114	113	164	135
4.	13,461	15,096	8747	10022	4220	2193	150	105	156	155
5.	13,705	15,736	10189	9881	3488	5142	98	131	157	143
6.	17,880	14,965	7800	7906	6184	622	165	80	284	186
7.	14,006	19,026	10184	9835	-903	3156	59	112	124	189
8.	7,922	14,255	4718	6449	-2329	1984	25	103	112	155
9.	6,931	8,942	6356	8942	-793	1394	26	90	172	112
10.	10,439	11,622	9109	9484	2938	3671	101	143	120	239
11.	6,142	11,525	10445	10123	-19	-1490	55	34	116	146
12.	8,124	10,718	7558	7368	2635	5361	123	208	170	234
13.	5,858	6,212	6570	6829	1154	1527	62	75	186	145
14.	6,677	5,687	9172	9507	875	-2	73	52	184	146
15.	6,845	8,635	7648	7857	1452	2808	82	129	164	157
16.	10,426	10,339	10044	11555	1074	604	77	72	179	114
17.	11,603	10,882	5832	8951	2931	5249	141	188	95	156
Average:	\$11,276	\$12,026	8274	8886	\$2298	\$2024	\$ 96	\$102	\$160	\$152

CHAPTER V

THE INFLUENCE OF SIZE OF BUSINESS ON FARM EARNINGS AND AGGREGATE FARM EFFICIENCY

Measures of Earnings

Throughout this study, two measures of earnings are principally used as dependent variables with which to relate the various measures of size, efficiency, and intensity. The first of these is the net farm income for the operator's labor and management. Net farm income for operator's labor and management is a measure of aggregate income and as used in this study, was arrived at in the following manner: Cash balance (receipts minus expenditures), plus home used produce, plus or minus the net change in the value of the farm inventory, minus unpaid family labor, and minus an interest charge of five per cent on total capital. This measure is frequently referred to as labor income, and will be so designated in this text. The average labor income for the 48 farms in 1955 was \$1579, and for 41 farms in 1956, \$1747. It appears that Missouri farmers in general received higher net incomes in 1956 than in 1955 because of the more favorable weather conditions.¹

Net earnings per \$100 charged for land, labor, and capital is the other measure used in this study. This

¹ Bebermeyer, op. cit.

measure shows the aggregate efficiency of the farm business. If the net earnings figure is exactly \$100, for each \$100 charged for land, labor, and capital, all factors of production used in the business (with the exception of management) have received their due compensation. If the returns are less than \$100 all the factors have not been paid for. Any returns above \$100 may be designated as management earnings.

For the sake of brevity, this measure will be referred to as the net earnings ratio. It is computed by dividing net earnings for the use of land, labor, and capital by total charges for the use of land, labor, and capital, and this result multiplied by 100. Net earnings for the use of land, labor and capital is the cash balance, plus home used produce, plus the value of hired labor, plus or minus the net change in inventory. Total charges for land, labor, and capital is equal to the interest charge on total capital plus the value of all labor.

As there were only a small number of dairy farms in this study, few conclusions can be drawn from the data presented herein. In some cases, the tables indicate inconsistencies in the relationships between various factors. This may in part be due to the fact that too few farms reported in some classes to display a representative average.

Measures of Size of Business

In this study, the size of business has been measured

both from the standpoint of the entire farm business and the dairy enterprise.

Farm Acreage as a Measure of Size

Farm acreage is probably the most commonly referred to measure of the size of a farm. The number of acres in a farm denotes the spatial dimensions of the farm unit. Actually, farm acreage is a poor measure of size of business because of existing differences in land productivity, levels of technology, climate, and intensification. In a cash grain area, where the land is relatively homogeneous in topography and productivity there is a relatively close association between acreage and size of business, but in Missouri, acreages are not good indications of size of business.

In order to put all the farms on a more equal basis, acres of cropland and open pasture are used for analysis rather than total farm acres. This excludes from all farms those relatively unproductive areas such as farmsteads, roads, wasteland and timber. Since different farms possess these areas in widely varying amounts, the influence thereof was removed.

The relationship between acres of cropland and open pasture to labor income and the net earnings ratio on the dairy farms in this study is shown in Table VII. As one would expect, the relationship was a positive one. The larger farms in terms of acreage tended to have higher

TABLE VII

RELATIONSHIP OF CROP AND PASTURE ACRES TO LABOR INCOME
AND NET EARNINGS RATIO

Item	Year :	Acres of Cropland and Open Pasture				
		all : farms	less than 101	101- 150	151- 200	Over 200
No. Farms	1955	48	8	16	14	10
Reporting	1956	41	4	12	10	15
Labor	1955	\$1579	\$827	\$1136	\$1424	\$3106
Income	1956	1747	62	1682	1365	2504
Net Earnings	1955	86	73	74	89	114
Ratio	1956	98	68	99	94	108

incomes and a greater degree of overall efficiency in the use of land, labor, and capital than the smaller farms. Farms having over 200 acres of cropland and open pasture in 1955 had an average labor income of \$3106 and in 1956, a labor income of \$2504. On the other hand the farms with less than 100 acres had an average labor income of \$827 in 1955 and only \$62 in 1956. The net earnings ratio data show a similar relationship.

Total Capital Managed

As the capital requirements in commercial agriculture have increased tremendously in recent years, more emphasis is being placed on total capital managed as a measure of size of business. The relationship of capital managed on the dairy farms in this study to labor income and the net earnings ratio is shown in Table VIII. Results here were not consistent with the theory that the largest farm businesses make the most money. For these dairy farms during

the designated years the largest farms in terms of capital managed did not make the highest incomes, nor were they the most efficient.

TABLE VIII
RELATIONSHIP OF TOTAL CAPITAL MANAGED TO LABOR INCOME
AND THE NET EARNINGS RATIO

		Total Capital Managed (thousands of dollars)					
	Year:	all	below	20-	30-	40-	50&
	:	farms	20	29	39	49	over
No. Farms	1955	48	10	11	13	7	7
Reporting	1956	41	5	10	7	10	9
Labor Income	1955	\$1579	\$ 784	\$1064	\$1319	\$3411	\$2949
	1956	1747	1188	1299	2706	1371	2230
Net Earnings	1955	86	67	85	80	115	100
Ratio	1956	98	83	97	123	88	99

In 1955, the farms in the \$40,000 to \$50,000 class had the largest net income and greatest aggregate efficiency. In 1956, farms in the \$30,000 to \$40,000 group fared the best financially.

These data on capital managed seem to give support to the thesis that management is a more critical factor of production on larger farms than on smaller ones. With good management, the larger farm businesses have the opportunity to reap profits consistent with the potential higher efficiency advantages due to size. With poor management, however, those with larger farm businesses tend to lose more because they have more at stake. Total capital managed probably is a more accurate measure of potential size of business than of actual size, as it tells how much capital

is available, but not how much is used, or how efficiently it is used.

Total Productive Man Work Units

Total productive man work units (PMWU) measures size of business in terms of the total labor required or theoretically expended on a farm. A PMWU is defined as the average amount of productive farm work accomplished by an average man in a 10 hour day, working with average efficiency and average equipment. In Table IX are the results obtained when using total PMWU per farm as the independent variable. The results show that the dairy farms in this study with the largest farm businesses in terms of PMWU did not have the largest labor incomes.

TABLE IX

THE RELATIONSHIP OF TOTAL PMWU TO LABOR INCOME
AND NET EARNINGS RATIO

		Total PMWU					
Year:		all	below	300-	400-	500-	over
:		farms	300	400	500	600	600
No. Farms	1955	48	7	7	13	9	12
Reporting	1956	41	*	10	10	12	9
Labor Income	1955	\$1579	\$663	\$ 494	\$3569	\$2570	\$2493
	1956	1747	*	1846	1938	1670	1530
Net Earnings	1955	86	59	62	86	111	98
Ratio	1956	98	*	103	98	102	87

*Only one farm reported and was included in the next class.

Aside from sample limitations discussed earlier, there are other factors to be taken into consideration. PMWU measures size in terms of only one factor of

production. As there is considerable variation in the degree to which farmers have substituted capital, in the form of machinery and equipment, for labor, an analysis in terms of only one of these factors of production can be misleading. Hired labor might have been an important factor in these data. The farms having businesses of 400-500 total PMWU yielded the greatest labor income in both years. This could be in the range of an efficiency organized one man operation using some unpaid family labor at various times during the year. In many cases, considerable amounts of hired labor are required beyond the 500 PMWU range. Some of these larger farms may be in between a "one man" and "two man" dairy operation. The need for skilled labor in handling dairy cattle puts a premium on skilled labor.

The relationship of PMWU to the net earnings ratio was not exactly parallel to the relationship between PMWU and labor income. Farmers with businesses between 300 and 400 PMWU had the highest net earnings ratio in 1956, but taking both years into consideration, farms of 500-600 had the greatest aggregate efficiency.

Number of Cows Per Herd

The average number of cows per herd for all the farms in the study was 25 in 1955 and 26 in 1956. This is perhaps the most obvious measure of the size of the dairy enterprise, and Table X shows a comparison of herd size with farm earnings and aggregate efficiency.

TABLE X

THE RELATIONSHIP OF NUMBER OF COWS PER HERD TO
LABOR INCOME AND THE NET EARNINGS RATIO

	Year:	Number of Cows Per Herd				
		All Farms	Below 21	21-25	26-30	over 30
No. Farms	1955	48	15	13	10	10
Reporting	1956	41	13	9	5	14
Labor Income	1955	\$1579	\$1002	\$1091	\$2581	\$2076
	1956	1747	1861	1861	2007	1334
Net Earnings	1955	86	70	82	110	93
Ratio	1956	98	100	106	102	90

There is not a great deal of difference between the two middle classes in 1956, but the 26-30 cow class was clearly the most profitable in 1955. Consistent with comparisons of size of the farm business as a whole, the large farms in terms of cows per herd once again were not the most profitable. This points out once more the importance of management on large dairy farms and the need for careful organizational planning especially in obtaining and utilizing skilled hired labor when moving beyond the "one man" dairy farm. A herd of more than 30 cows appears to be more than one man can handle efficiently.

The Value of Total Farm Production

The value of total farm production is another measure of size, based on farm output. This value is the sum of (a) value of all crop production, (b) all livestock returns above value of feed, (c) incidental farm labor off the farm, (d) custom machine work off the farm, and (e)

miscellaneous receipts. The results of using value of total farm production as an independent factor are presented in Table XI. The figures in the table indicate that as value of product increases, higher net incomes and greater aggregate efficiency were attained. The need of farmers to have an adequate volume of business so as to spreadout the fixed costs of production is very evident in these data.

TABLE XI

THE RELATIONSHIP OF TOTAL FARM PRODUCTION TO
LABOR INCOME AND THE NET EARNINGS RATIO

	Year:	Value of Total Farm Production				
		all below	\$ 7,000-	\$10,000	over	
		farms \$7,000	10,000	13,000	\$13,000	
No. Farms	1955	48	15	11	12	10
Reporting	1956	41	8	12	11	10
Labor Income	1955	\$1579	\$ 5	\$ 1,084	\$ 2,109	\$ 3,749
	1956	1747	779	1,583	1,859	2,580
Net Earnings	1955	86	49	89	104	119
Ratio	1956	98	76	98	105	108

The Value of All Crop Production

The value of all crop production is an imperfect measure of size of business that is sometimes used. The value of crop production varies with the organization of the farm, and more significantly with weather and other natural phenomena. Weather conditions were at least partly responsible for the value of all crop production of the dairy farms in 1955 being \$5643 as compared to \$7057 in 1956. In Table XII, the association of value of all crop production with

labor income and aggregate efficiency on the dairy farms in this study is presented.

TABLE XII

THE RELATIONSHIP OF VALUE OF ALL CROP PRODUCTION
TO LABOR INCOME AND THE NET EARNINGS RATIO

		Value All Crop Production				
Year:		all	below	\$4,000-	7,000-	over
:		farms	\$4,000	7,000	\$10,000	\$10,000
No. Farms	1955	48	16	19	8	5
Reporting	1956	41	9	10	15	7
Labor Income	1955	\$1,579	\$ 931	\$1,017	\$ 3,710	\$ 2,376
	1956	1,747	1,073	1,976	1,773	2,232
Net Earnings	1955	86	72	79	123	100
Ratio	1956	98	83	113	96	100

Farmers with the larger value of crop production tended to receive higher labor incomes. There was considerable variation, however, among the farms. Differences in the cost of producing the crops, and particularly differences in the costs and returns from the livestock segment of the business account for this variation.

Gross Receipts From the Dairy Enterprise

Another measure of the size of the dairy business on a farm is the receipts from the dairy enterprise. It is well to note that the matter of efficiency also is present here to some extent. The relationship of dairy receipts to net earnings and overall efficiency is presented in Table XIII.

There was a tendency for the farms with the larger gross receipts from the dairy enterprise in 1955 to

TABLE XIII

THE RELATIONSHIP OF GROSS RECEIPTS FROM THE DAIRY
ENTERPRISE TO LABOR INCOME AND THE NET EARNINGS RATIO

	Year:	all :farms	below \$5000	Gross Receipts - Dairy			
				\$5000- 7000	\$7000- 9000	\$ 9,000- 11,000	over \$11,000
No. farms	1955	48	10	8	11	11	8
reporting	1956	41	7	5	13	7	9
Labor Income	1955	\$1579	\$-486	\$1796	\$1772	\$ 2,656	\$ 2,195
	1956	1747	1696	1143	1761	1,946	1,949
Net Earnings	1955	86	41	98	90	112	91
Ratio	1956	98	103	80	100	108	94

receive higher labor incomes although the farmers with over \$11,000 in dairy receipts did not obtain the largest labor incomes. There seemed to be little or no positive relationship in 1956. The smallest class was highly unprofitable in 1955 which was a bad year for nearly everyone, but surprisingly profitable for those in this class in 1956.

The charts in Figure 3 illustrate graphically the relationships between labor income and three measures of size discussed in this chapter: (1) Total capital managed, (2) Number of Cows Per Herd, and (3) Value of Total Farm Production.

FIGURE 3

CHAPTER VI

THE RELATIONSHIP OF INTENSITY TO NET FARM INCOME AND EFFICIENCY

Intensification implies adding increments of capital and labor to a given unit of land. This is the most common conception of agricultural intensification. In this framework, to intensify means lowering the fixed cost of land per unit of production. Intensification is thus a method of attaining a larger volume of business and achieving greater production efficiency, insofar as volume lends to greater efficiency. Some of the measures discussed in this chapter on intensification are sometimes used as efficiency measures.

Value of Production Per Acre

Just as farm acreage is a common measure of the size of a farm business, the value of total farm production per acre is a frequently used measure of intensity. In order to reduce all farms in the study to a more equal basis, acres of cropland and open pasture is again used in the analysis instead of total farm acreage. The value of production per acre of cropland and open pasture indicates degree of intensification by showing the value of total farm output per unit of productive land.

For the dairy farms in this study, the average value of total farm production per acre was \$60 in 1955 and \$62

in 1956. In Table XIV is presented a comparison between production per acre and farm income and efficiency. The figures for 1955 indicate a positive relationship of product value per acre to both labor income and the net earnings ratio. Labor income varied in a similar manner in 1956 with one outstanding exception in the group reporting a value of \$61-\$70 production per acre. As there were only 5 farms in this class, it seems reasonable to question the representativeness of the figures. For the farms in 1956, there was little consistency in the relationship between product value per acre and overall efficiency.

TABLE XIV

THE RELATIONSHIP OF VALUE OF PRODUCTION PER ACRE
TO LABOR INCOME AND NET EARNINGS RATIO

	Year:	all farms	Production Per Acre			
			\$50 and under	\$51-60	\$61-70	over \$70
No. Farms	1955	48	17	8	10	13
Reporting	1956	41	13	10	5	13
Labor Income	1955	\$1579	\$ 411	\$2014	\$2035	\$2487
	1956	1747	1788	1718	1302	1901
Net Earnings	1955	86	61	96	102	101
Ratio	1956	98	101	94	85	103

Value of Production Per Man and Per PMWU

Intensity can effectively be measured by the value of production per unit of a factor of production other than land. Comparisons of farm earnings with the value of production per man and per PMWU were made on the dairy farms in these samples (Tables XV and XVI).

TABLE XV

RELATIONSHIP OF TOTAL FARM PRODUCTION PER MAN TO
LABOR INCOME AND THE NET EARNINGS RATIO

	Year:	all : farms	Value of Production Per Man			
			below \$4000	\$4000- 6000	\$6000- 8000	over \$8000
No. Farms	1955	48	10	14	15	9
Reporting	1956	41	5	12	13	11
Labor Income	1955	\$1579	\$-554	\$ 986	\$1857	\$4406
	1956	1747	-532	1592	1446	3309
Net Earnings	1955	86	43	75	100	124
Ratio	1956	98	59	91	92	131

A very definite positive relationship existed in both years between value of total farm production and labor income. The effect on aggregate efficiency as expressed in the net earnings ratio is just as pronounced. Value of total farm production per man is in reality a measure of how intensely the available labor is used. A farmer with a production per man of less than \$4,000 seems almost certain to lose money, as his labor supply is not being fully utilized. There were fifteen farms in the sample with less than \$4,000 of total farm production per man. Six of the 1955 farms with less than \$4,000 value of production and 3 in 1956 had negative labor incomes.

Value of total production per PMWU is in reality a ratio of total production to the size of business in terms of the labor needed (with average efficiency and equipment). The results of this analysis are similar to those attained in the comparison above, the greater the value of

TABLE XVI

RELATIONSHIP OF VALUE OF TOTAL PRODUCTION PER PMWU
TO LABOR INCOME AND THE NET EARNINGS RATIO

		Value of Production Per PMWU					
Year: all		below					over
; farms		\$16	\$16-18	\$19-21	\$22-24		\$24
No. Farms	1955	48	9	16	7	9	7
Reporting	1956	41	6	9	7	8	11
Labor Income	1955	\$1579	\$-235	\$1119	\$1469	\$2885	\$3392
	1956	1747	72	1213	2309	1158	2879
Net Earnings	1955	86	55	81	79	103	128
Ratio	1956	98	67	87	119	88	118

production per PMWU, the higher the labor income and net earnings ratio, with one exception in 1956. This positive relationship is as one would expect and points out the importance of production efficiency in dairy farming. The high value of production per man or PMWU is not just the result of size or intensity, but represents managerial ability and a balanced combination of all factors of production.

Milk Production Per Cow

Perhaps the most commonly used measure on dairy farms is the amount of milk produced per cow. It is generally recommended that farmers should strive to attain high production per cow, but the data on the dairy farms in this study indicate that the herds with the highest average production are not always the most profitable (Table XVII).

The average labor income and net earnings ratio in both 1955 and 1956 increased with the pounds of milk

TABLE XVII

THE RELATIONSHIP OF MILK PRODUCED PER COW TO LABOR
INCOME AND NET EARNINGS RATIO

		Pounds of Milk Produced Per Cow				
Year:		all	below	6,000-	8,000-	over
		: farms	6,000	8,000	10,000-	10,000
No. Farms	1955	48	8	21	13	6
Reporting	1956	41	8	14	14	5
Labor Income	1955	\$1579	\$-342	\$1949	\$2270	\$ 270
	1956	1747	656	2001	2269	1322
Net Earnings	1955	86	47	97	105	61
Ratio	1956	98	82	104	107	82

per cow up to 10,000 pounds, then showed a marked decline in the herds above 10,000 pounds per cow. From these results one could conclude that the farmers in this study with cows producing an average of more than 10,000 pounds of milk annually were applying production inputs beyond the intensive margin. This might possibly involve feeding too much grain, or pushing the cows beyond their natural genetic capability to produce by using high cost rations. Another possible explanation for the decline in farm earnings in the 10,000 pound class might be an overemphasis on lush green pastures for the dairy cows at the expense of high profit crops such as corn and soybeans on highly productive land. In Figure 4 is illustrated the relationship between production per cow and labor income received on the individual farms in 1955 and 1956.

Table XVIII is designed to show that the farms with a value of production per man of over \$8,000 are not

FIGURE 4--RELATIONSHIP OF MILK PRODUCTION PER COW TO LABOR INCOME

TABLE XVIII

COMPARISON OF LABOR INCOMES ON FARMS ATTAINING \$8000 PRODUCTION PER MAN,
WITH LABOR INCOME ON THE FARMS HAVING THE LARGEST TOTAL CAPITAL MANAGED, PMWU,
NUMBER OF COWS AND PRODUCTION PER COW

Factor	1955		1956	
	ave. of item	ave. labor income	ave. of item	ave. labor income
Total Capital Managed				
Highest Group (\$50,000 & over)	\$69,582	\$2,949	\$63,399	\$2,230
\$8,000 Prod. Per Man Group	52,018	4,406	41,986	3,309
Total PMWU Per Farm				
Highest Group (600 & over)	663	2,493	686	1,530
\$8,000 Prod. Per Man Group	612	4,406	506	3,309
Number of Cows Per Farm				
Highest Group (30 & over)	36	2,076	35	1,334
\$8,000 Prod. Per Man Group	29	4,406	26	3,309
Pounds of Milk Produced Per Cow				
Highest Group (over 10,000 lbs.)	10,336	270	10,857	1,322
\$8,000 Prod. Per Man Group	8,712	4,406	8,936	3,309

necessarily the largest farms, nor the farms having the highest producing dairy herds. In this Table is presented a comparison of the labor income on farms with \$8,000 production per man or more and the farms in the highest groups in terms of total capital managed, total PMWU per farm, number of cows per farm, and pounds of milk produced per cow. In every case, the average labor income on the farms having over \$8,000 production per man was considerably higher than on farms in the highest size and production group. In only two measures, total capital and total PMWU in 1955, was the average size of the farms producing more than \$8,000 per man above the lower limits of the highest group. In these two cases the averages of the \$8,000 per man group were considerably less than the averages of the highest groups.

Productive Man Work Units Per Man

Productive man work units per man indicates the size of business (in terms of labor needed with given assumptions) in relation to the supply of labor on the farm. This measure gives some idea of the state of technology on the farms as it indicates the amount of work being accomplished per man. PMWU per man is actually a measure of efficiency although it does indicate intensity of resource use. The relationship of PMWU per man to labor income and aggregate efficiency is presented in Table XIX.

TABLE XIX

RELATIONSHIP OF PMWU PER MAN TO LABOR INCOME
AND THE NET EARNINGS RATIO

		<u>PMWU Per Man</u>						
Year: all		below	200-	250-	300-	350-	over	
:farms		200	250	300	350	400	400	
No. Farms	1955	48	5	8	11	9	7	8
Reporting	1956	41	*	5	10	14	6	6
Labor Income	1955	\$1579	\$ 537	\$ 663	\$ 472	\$2534	\$1784	\$3413
	1956	1747	* 1199	1107	1597	3123	2247	
Net Earnings	1955	86	72	74	64	106	87	117
Ratio	1956	98	* 80	86	95	123	116	

*Only one farm reported and was included in the next class.

The analysis of the 1955 data indicates a positive relationship of PMWU per man to net income and aggregate efficiency on the dairy farms in this study. In 1956 the labor income increased as the PMWU per man increased up to 400 PMWU, but the labor income of farmers above 400 PMWU per man was considerably below the labor income of farmers attaining 350-400 PMWU per man. This analysis seems to provide evidence supporting the belief that farmers must fully utilize the available labor, but should not make maximum labor efficiency the major organizational goal. These data indicate that some of the farms having over 400 PMWU per man did not have the most profitable balance between the factors of production or did not have a large enough size of business to justify the capital investment in the form of machinery and equipment necessary to attain the designed level of labor efficiency.

Labor and Machinery Charge Per \$100 Production

Dairy farmers need to analyze very carefully their labor and machinery charge per \$100 production. This measure is an important indicator of efficiency of production because it takes into account both labor and machinery costs. As they can be substituted for one another to varying degrees, a meaningful study must analyze both inputs. With the high cost of modern milking, housing, feeding, and milk handling equipment it is possible for dairy farmers to over invest; in other words to invest more in buildings and equipment than the size and composition of the herd will justify. It takes a large volume of business to meet the costs of modern dairy equipment, and such a sizeable operation must be well managed to be profitable. The comparison of the labor and machinery charge per \$100 production to farm earnings and aggregate efficiency on the 89 dairy farms in this study shows a very interesting relationship (Table XX).

A very definite negative relationship existed between labor and machinery charge per \$100 production and both labor income and the net earnings ratio. The higher the labor and machinery charge, the lower the net income. For the farms in this sample, a negative labor income appeared as the charge exceeded \$70. The break even point on these farms as far as providing any net earnings to management appears to be around \$50 labor and machinery charge per \$100 production. These data show that a low labor and

TABLE XX

THE RELATIONSHIP OF LABOR AND MACHINERY CHARGE PER \$100
TO LABOR INCOME AND NET EARNINGS RATIO

		Labor and Machinery Charge					
Year: all		below	\$40-	\$50-	\$60-	\$70&	
: farms		\$40	49	59	69	over	
No. Farms	1955	48	6	11	8	12	11
Reporting	1956	41	2	8	16	8	7
Labor Income	1955	\$1579	\$3843	\$3192	\$1986	\$ 745	\$-656
	1956	1747	5328	2778	2098	1314	-759
Net Earnings	1955	86	120	122	89	67	38
Ratio	1956	98	198	122	100	88	50

machinery charge per \$100 production is one of the very important determinants of a profitable dairy farm business.

In Figure 5 is illustrated graphically the relationships between labor income and three of the factors discussed in this chapter: (1) Value of production per man, (2) Value of production per acre, and (3) Labor and machinery charge per \$100 production.

CHAPTER VII

ANALYSIS OF MILK PRODUCTION COST AND SEASONALITY OF PRODUCTION

Cost of Milk Production

The purpose of the following analysis is to obtain an estimate of the cost of milk production on the farms in the study for 1955 and 1956, and to determine how this cost is affected by the size of the milking herd and the milk production per cow. The procedure used in arriving at a net cost of production on these farms has several limitations, but it is hoped that the results will serve the stated purpose.

Method of Analysis

An inspection of the 89 farm records used in the study revealed that not all of them could be used for a cost of milk production analysis for the following reasons: (1) On some farms on which dairying was not the only livestock enterprise, no separate feed record for dairy cattle was available, and (2) Some records which contained separate feed records for the dairy enterprise were rejected because of inconsistencies which made a reasonably accurate allocation of charges impossible. Specifically stated, records were chosen for the cost of milk production analysis if they qualified under any of the following criteria:

1. Dairy cattle was the only livestock enterprise on

the farm.

2. If there were livestock enterprises other than dairy cattle, but a separate dairy feed record was available.
3. If there were livestock enterprises other than dairy on the farm and no separate feed record for dairy cattle was available, the value of livestock and livestock products (other than dairy) did not exceed \$300.

Using this as a basis for selecting records for a cost of milk production study, 31 of the 48 records in the 1955 sample were chosen and 20 of the 41 records in the 1956 sample were used. Thus a total of 51 farm records were analyzed in determining the net cost of milk production.

Items Included in Determining Cost of Production

In this analysis, charges were made for the following costs of milk production: (1) feed, (2) labor, (3) interest, (4) utilities, (5) building use, (6) equipment use, and (7) miscellaneous. This list is not exhaustive and the limitations will be discussed later.

Feed

Feed is typically by far the largest single cost item, amounting to from 50 to 55 per cent of the total according to most cost of production studies.¹ In this

¹ Cunningham op. cit., p. 5.

analysis, the charge for feed was obtained in one of two ways. On the records containing a breakdown of feed costs by livestock enterprise, the value of all feed fed to dairy cattle was used per se. In records on which this figure was not available, the "net cost" accounting method was used to obtain the charge for feed. On such farms, if there were no livestock enterprises other than dairy, the entire value of feed fed to productive livestock was charged to the dairy enterprise. On farms having other livestock (in most cases, a few broilers or hens for family use), the value of sales and products used was subtracted from the total value of feed fed to productive livestock, and the remainder charged to the dairy enterprise feed cost.

Labor

The total value of labor for the farm is the sum of: (1) value of operators' labor, (2) value of unpaid family labor, (both are based on the going wage rate in the particular community), and (3) hired labor. This total labor charge divided by the total number of PMWU on the farm gives a labor charge per PMWU, which was then multiplied by the number of dairy PMWU to give the labor charge for the dairy enterprise.

Interest on Investment in Dairy Cattle

Interest was charged at five per cent of the beginning inventory of dairy cattle.

Miscellaneous

This category includes veterinary expenses, breeding fees, sanitation products, and other livestock expenses incurred by the dairy enterprise.

Utilities

In this analysis, the entire farm share of utilities was charged to the dairy business. In most cases, very little other livestock was on the farms, and the assumption was made that the dairy enterprise consumed all but a negligible amount of utilities.

Building and Equipment Use

The farm records used for this study did not contain a breakdown of building and equipment costs between crop and livestock enterprises. This made allocation of such a charge to the dairy enterprise impossible. In view of this, a charge for building use and one for equipment use was adapted from the Southern Illinois detailed cost project.² Climatic and economic conditions in Southern Illinois are similar to those encountered in Missouri. The charge made for building use was \$18 per cow and \$10 per cow for the use of equipment. The charges include depreciation and interest on capital investment.

The sum of the above cost items (converted to a 100 pounds of milk basis) gives the total gross cost of

² R. H. Wilcox and J. T. Keeler, op. cit.

R. H. Wilcox, A. G. Mueller, and G. D. VonLanden,
op. cit.

producing 100 pounds of milk. In the cost analysis no interest was charged for the investment in land, as it was assumed this would be included in the market price of feed used by the dairy enterprise. It should also be noted that the cost of production is being determined up to the time of milk pickup.

Credits

In figuring the net cost of producing 100 pounds of milk an allowance must be made for the value of dairy cattle sold (calves, culls, etc.) and increases in the size of the dairy herd. Credit was given for these items using the inventory of dairy cattle. The way the inventories were handled on these records it was appropriate to do so. In most cases, there was a net increase in the inventory. If the inventory showed a net decrease, the decrease was charged as a minus credit.

Some credit must also be given to the value of the manure returned to the land. Credit for manure, taking into consideration reasonable wastage, was calculated at \$10.65 per cow. The value of bedding as a facility for handling manure was assumed to cancel the cost of obtaining it from small grain fields.

Net Cost of Producing 100 Pounds of Milk

Using the forementioned method of computation, a net cost of production per 100 pounds of milk was arrived at for each of the records selected for the purpose and for

the composite of the groups of farms in 1955 and 1956. The average net cost of producing 100 pounds of milk on the 31 farms used in this analysis from the 1955 sample and the 20 farms selected from the 1956 sample is presented in Table XXI. The breakdown of the cost items and the average charge for each is also shown in the Table.

TABLE XXI

COSTS AND RETURNS PER 100 POUNDS OF MILK PRODUCED ON THE DAIRY FARMS IN THIS STUDY, 1955 AND 1956

	<u>For Each 100 Pounds of Milk Produced</u>	
	<u>31 Farms</u>	<u>20 Farms</u>
	<u>1955</u>	<u>1956</u>
<u>Charges:</u>		
Feed	\$2.65	\$2.63
Labor	1.39	.98
Interest	.15	.14
Miscellaneous	.19	.18
Utilities	.11	.14
Building Use	.25	.22
Equipment Use	.14	.12
Total Charges	\$4.88	\$4.41
<u>Credits:</u>		
Calves	\$.63	\$.45
Manure	.14	.13
Total Credits	\$.77	\$.58
<u>Net Cost</u>	\$4.11	\$3.83
<u>Returns</u>		
Net Price	\$3.86	\$3.94
Net Returns	\$-.25	\$.12

The total cost calculated for producing 100 pounds of milk was \$4.88 in 1955 and \$4.41 in 1956. A large part of the difference is due to the higher charge for labor in

1955.

Total credits (other than milk) amounted to \$.77 in 1955 and \$.58 in 1956, making the average net cost of producing 100 pounds of milk \$4.11 in 1955 and \$3.83 in 1956.

The average net price received by the farmers in this study (less hauling charges) was then calculated for the farms in the analysis. The calculated net price in 1955 was \$3.86 as compared to \$3.94 in 1956, for an average net profit of -\$.25 per 100 pounds of milk produced in 1955, and \$.12 per 100 pounds in 1956.

Feed cost was, as expected, the largest individual cost item, amounting to \$2.65 per 100 pounds of milk produced in 1955 and \$2.63 in 1956. The feed cost represented 54.3 per cent of the total cost in 1955 and 59.9 per cent of the total in 1956. Labor cost was the next largest item, amounting to \$1.39 per 100 pounds of milk in 1955 and \$.98 in 1956.

Of all the items listed, only the cost of utilities was greater in 1956 than in 1955, though there was little difference between years for most items.

Relationship Between Cows per Herd and Net Cost

A large part of the investment in a dairy business is in the form of buildings and equipment. When this cost and other fixed costs can be distributed among a larger number of cows, or larger volume of production it would be realistic to conclude that the cost of producing 100 pounds

This should not be interpreted to mean, however, that the farms with the largest herd received the highest net incomes.

Production per Cow and Net Cost

Much emphasis is being placed upon high milk production per cow as a means of reducing fixed costs and increasing net incomes. In Table XXIII, the relationship between pounds of milk produced per cow and the calculated net cost of milk production is shown for the farms in this study.

TABLE XXIII

THE RELATIONSHIP BETWEEN MILK PRODUCTION PER COW
AND NET COST OF MILK PRODUCTION

	Pounds of Milk Per Cow					
	1955			1956		
	Low Third	Middle Third	High Third	Low Third	Middle Third	High Third
Range	3874- 6750	6639- 9002	9,109- 10,583	4221- 7906	8085- 9484	9507- 12161
No. farms	10	11	10	7	6	7
Ave. lbs. per cow	5848	7836	9,932	6502	8914	10441
Net Cost per 100 lbs. milk	\$4.66	\$3.49	\$4.14	\$3.98	\$3.58	\$3.87

The farms in the middle third with an average production per cow of 7836 pounds in 1955 and 9484 pounds in 1956, had the lowest net cost per 100 pounds of milk.

The results of the cost analysis are consistent with the results obtained in Chapter VI when the comparison was

made between milk production per cow and labor income and net earnings ratio, indicating that farmers need to carefully study the costs involved in attaining high milk production per cow.

Limitations of the Cost Analysis

As was mentioned earlier, this analysis is subject to several limitations which must be recognized. It is important to note once again that this is not a random sample. The farms on which a cost of milk production was calculated were selected on the basis of their acceptability for analysis.

Another general limitation is that although some of the same farms were in both the 1955 and 1956 groups the samples were basically composed of different farms. Thus the costs determined can not be used as conclusive evidence to denote cost changes between 1955 and 1956.

In addition, the validity of the cost of production analysis rests on two assumptions, which may be stated as follows: (1) In the "Net Cost" accounting method, livestock enterprises other than dairy are assumed to break even from the standpoint of costs and returns; and (2) The application of the total farm labor charge per PMWU to the dairy enterprise assumes equal efficiency for all labor on the farm.

The Seasonality of Production and Its Effect on Price

Mention was made in Chapter IV that part of the

questionnaire sent to the cooperating farmers was devoted to a monthly breakdown of milk production. This information was sought in order that the seasonal pattern of milk production might be established and its relationship to price studied. The results of this inquiry are graphically illustrated in Figure 6. The milk production and milk price patterns found on the farms in this study are fairly typical, with the milk price received by farmers lowest in the spring while milk sales are at the yearly peak. The recorded milk prices refer to a net price with hauling charges already taken out, and not a gross market price. The relationship shown on the graph might indicate that while the individual dairymen have done a lot to even out the seasonality of milk sales, they could profit from further effort in that direction.

FIGURE 6--RELATION OF VOLUME OF MILK SOLD TO PRICE

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The dairy farmers of Missouri need to make major organizational changes in their businesses if they are to compete with producers in other leading dairy states. Modern technology has erased much of the locational advantage of Missouri dairy farmers and has lowered their competitive position.

Size of business is one of the most important factors influencing net income and aggregate efficiency. Greater size is essential to take advantage of economies of scale that accrue to larger firms. Size of business measured in terms of product value or output exhibited the most direct relationship to net income and overall efficiency on the farms in this study. The results of the analysis indicate that achieving a large size of business measured in terms of the factors of production (inputs) or number of milk cows does not necessarily insure maximum net income.

Another important factor which influences the efficiency and net income of a dairy farm is the degree of intensification employed. Intensification is a means of attaining a larger volume of output on a designated area of land and achieving a greater level of efficiency of resource use. Intensity measured by product value or output displayed the most direct positive relationship to net farm

income and aggregate efficiency on the 89 farms studied. Intensity as indicated by capital or labor inputs did not always show a direct relationship to net farm income. Likewise, a high degree of intensity did not necessarily mean maximum efficiency of resource use.

One of the most significant results disclosed by the analysis of these dairy farm businesses was the manifest inverse relationship of labor and machinery charge per \$100 production to net income and production efficiency.

In this study, the usually accepted positive relationship of milk production per cow to net farm earnings and aggregate efficiency was not evident. This suggests that production per man is more important than milk production per cow, and, that too much emphasis is sometimes placed on the latter.

Management appeared to be the most critical factor of production on the dairy farms in this study. The successful dairy operation must be favored with high quality management. Quality of management is more vital on large farms than on small farms, as greater skill is required in handling the larger amounts of land, labor, and capital. A lack of good management appears to have been the factor of production which kept the largest and most intensive farming operations from being the most profitable.

The net cost of producing 100 pounds of milk on the farms analyzed seemed to be a function of herd size and milk production efficiency, although maximum production

per cow was not always associated with least cost.

The net price received by farmers for milk sold tended to show an inverse relationship to the quantity marketed, indicating that the individual farmer could profit from further efforts to even out the seasonality of milk production.

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