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Economic Analysis of Dairying in Gunnison Valley, Utah

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ECONOMIC ANALYSIS OF DAIRYING IN GUNNISON VALLEY, UTAH

by

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TABLE OF CONTENTS

ACKNOWLEDGMENTS ii

LIST OF TABLES iv

ABSTRACT v

INTRODUCTION 1
Brief description of Gunnison Valley 1
Purpose and scope of the study 2
The Gunnison Valley Dairy Association 4

OBJECTIVES 6

REVIEW OF LITERATURE 7

METHODOLOGY AND PROCEDURE 10

PRESENTATION AND ANALYSIS OF DATA 17
Feed price changes 17
Benefits accruing to partners 20
Economies of size 26
Capital utilization 35
Sources of capital 38
Developmental impacts 43

SUMMARY AND CONCLUSIONS 47

LITERATURE CITED 50

APPENDIXES 51
A. Questionnaires on
dairy operations 55
social rankings 58
employment 59
B. Regression analysis results 60
C. A weighted average of dairy capital, costs, and returns for dairies in Gunnison Valley, Utah 91

VITA 93

LIST OF TABLES

Table		Page
1.	Letter names of the dairies surveyed and their size in cow numbers and acres.	11
2.	Prices in different time periods associated with alfalfa hay and corn silage in the State of Utah as an average and in Gunnison Valley, Utah.	19
3.	Membership in the GVDA as related to community opinion of leadership in the following categories.	22
4.	Regression analysis result for the simple regression run on the dairies in Gunnison Valley, Utah.	28
5.	Regression analysis result for the multiple regressions run on the dairies in Gunnison Valley, Utah	29
6.	The dairies of Gunnison Valley, their return on dairy capital coefficient and their relative ranking of return on dairy capital.	33
7.	The dairies of Gunnison Valley with their accompanying size in cow numbers and return on dairy capital coefficient.	34
8.	Capital utilization ratios for the dairies in Gunnison Valley, Utah.	37
9.	Interest rates for various categories of loans, loan limits, maximum time limits for repayment, restrictions for loaning.	41
10.	GVDA employee response to the employment and migration questionnaire.	46

ABSTRACT

ECONOMIC ANALYSIS OF DAIRYING IN GUNNISON VALLEY, UTAH

BY

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Major Professor: Paul R. Grimshaw
Department: Economics

The purpose of this paper was to measure factors that affected the profitability of dairy operations in Gunnison Valley, Utah. Special attention was paid to economies of size, return on dairy capital and benefits accruing to the owners of dairies in the valley. Also, within the scope of this study was the subject of economic development and its accompanying impacts on an economy.

A census of the dairy operations in Gunnison Valley was conducted to acquire data on dairy capital owned, cow numbers and quantities of milk produced and returns to the owners of dairies of both a monetary and non-monetary nature. Comparisons were made of this data and overall profitability of dairy operations was measured in relation to various factors and the configuration of factor mixes. Developmental impacts were measured in an absolute and relative manner.

(93 pages)

INTRODUCTION

Brief description of Gunnison Valley

Gunnison Valley is located about 120 miles south of Salt Lake City in the southwest portion of Sanpete County. The City of Gunnison is the center of Gunnison Valley and is the oldest community in the area. Other towns in the Valley are: Centerfield, Axtell, Mayfield and Fayette.

The townsite was established in 1862 and was originally a home of refuge for isolated southern colonists attacked by hostile Indians. The town received its name in honor of Captain John W. Gunnison, a U.S. Army topographical engineer.

Gunnison is a trading center for the area and a highway junction.

Agriculture has played a dominant role in the economic life of Gunnison Valley. There are several hundred acres of dry land grain in the northern bench areas surrounding the Valley. The farms produce alfalfa, wheat, barley, oats, corn, some sugar beets, and a few row crops. The income of Sanpete County is substantially bolstered by the production of the Gunnison Valley farms.

Livestock production is a source of income to valley farmers. Livestock is grazed on both private and public range land. Summer ranges are available, with both sheep and cattle in these pastures. [8]

Purpose and scope of the study

In the late 1960's the federal government embarked on a study of the problems confronting rural Americans. One of the major problems brought to light within the scope of this federal study was rural poverty--to be exact, pockets of poverty. These pockets of poverty were rural areas that had an economic climate below the national average.

Among the areas designated as rural pockets of poverty was the four corners area of Arizona, Colorado, New Mexico, and Utah. Gunnison Valley, Utah, was within this particular pocket of poverty.

Since the early 1960's Gunnison Valley residents had seen their young people leave the valley for employment. The sugar beet industry that had been such a boon to the area economically was gone. The closing of the Gunnison Sugar Company resulted in increased labor and transportation costs which economically proved prohibitive to beet producers. This exit had left the valley's economy to stagnate.

In an effort to change their economic situation, the residents of Gunnison Valley organized the Gunnison Valley Economic Development Committee in 1966. Through the leadership of this committee, the valley started to formulate and implement plans to revitalize their local economy.

One of the major points of revitalization was to introduce new industry into the Gunnison Valley. Optimally, this new industry would not only use local labor but also materials for inputs. This would provide jobs in the new industry and secondary employment in providing the material inputs.

Development was desired that utilized the valley's innate agricultural potential of feed production. After two feasibility studies, it was decided by the leaders of the Gunnison Valley Economic Development Committee that a large size dairy operation would significantly help develop the area. The dairy development would follow the lines of comparative advantage and supplement the local economy with out-of-valley dollars. The Gunnison Valley Economic Development Committee fostered a continuing series of discussions which eventually led to 23 community members deciding to organize the Gunnison Valley Dairy Association in 1971.

The largest dairy organization in the Gunnison area, the Gunnison Valley Dairy Association, has proved to be an input to the development effort of the valley's residents.

There are several dairies in operation located within geographic boundaries of Gunnison Valley. The owners of the dairies, like most dairy owners, seek to maximize profit in their particular dairy operation.

It is the purpose of this study to analyze the factors that affect profitability of producing milk in Gunnison Valley. Analysis of return on dairy capital and economies of size for the different sizes and organizational types of dairies in the Gunnison Valley are of prime importance in this study.

Also within the scope of this study there exists a concept of resource development and its impacts both financially and demographically on the residents of the area involved.

Information available on dairy resource development and profitability in rural areas is limited. Rural development groups typically

have little choice of direction in implementing development strategies. This study is an attempt to, in part, fill the informational gap for these developmental groups.

The Gunnison Valley Dairy Association

The Gunnison Valley Dairy Association, GVDA, is a limited partnership in organization. There are 23 members in the partnership. There are 6 managing partners that act similar to a board of directors.

The GVDA was first planned to help effect the economic environment in the Gunnison Valley. The GVDA was financed in the following way: 10 percent of the total investment was raised from within the ranks of the 23 partners, 30 percent was borrowed from the Gunnison Valley Bank, and 60 percent was financed through the Small Business Administration. The GVDA was originally organized as a cooperative with bylaws to assure retention of control by local residents. Later due to adverse tax rulings by the Internal Revenue Service, the organization was changed to a limited partnership.

Under a unique arrangement, the GVDA leases the facilities from the Gunnison Valley Economic Development Company and operates the dairy. The partners originally bought unbred heifers to become members of the GVDA at a price, including feed for the first year, of $400 each. Originally there were 1,400 heifers purchased by the various partners.

The GVDA is located on the southeastern bench area of the Gunnison Valley. In 1975, there were approximately 1,200 milking cows, 1,200 heifers, 250 calves, and 15 bulls on the 260 acres of the dairy. The GVDA buys all the feed for its animals. Each year feed is purchased throughout the summer months as it is harvested. The feed is stored south of the dairy barn partially in a silage pit and partially in a dry feed storage area.

The cows are milked around the clock in a ten on a side double herringbone type milking parlor that is of the most modern design. Twenty-two people work at the dairy. They are paid an hourly wage plus a bonus for production above 36,000 pounds of milk per day.

The managing partners meet monthly or more often when needed to oversee the dairy operation. There is a hired manager that runs the dairy from day to day and works under the supervision of the managing partners.

Several of the partners in the GVDA have personal dairy operations of their own. The ownership of the GVDA is well endowed with expertise in the operation of dairies and the care and feeding of dairy animals.

OBJECTIVES

The objectives of this study were:

1. To determine the magnitude of increased returns to hay, silage, and grain producers.

2. To determine benefits to the partners of the Gunnison Valley Dairy Association, including dividends.

3. To determine economies of size in dairying. To analyze financial economies of size through comparing rates of return to dairy capital for the Gunnison Valley Dairy Association and the other smaller dairies in the area.

4. To determine the capital utilization ratios of the different sizes of dairies. Also, to determine the sources of capital for dairies.

5. To determine impacts of this development project on the Gunnison Valley area both economically and demographically.

REVIEW OF LITERATURE

How can a rural farming area recoup after it loses a portion of its major agricultural enterprise? The people of Gunnison Valley, Utah have found an answer. [5, p. 4]

The once thriving row crop industry largely composed of sugar beets faded due to increased labor and transportation costs. This loss was a terrible blow to the local economy. Fortunately, the loss of the row crop industry has been more than compensated by the introduction of the dairy industry in greater proportions than ever before in the valley.

After the loss of the beet industry, the economy of the Gunnison Valley started to decline. The Gunnison Valley Economic Development Committee was organized to study alternative methods of stimulating the local economy. The aid of Utah State University extension workers was enlisted and a feasibility study was initiated to explore the probability of expanding profitably the dairy industry within the valley. The result of this study was an affirmative answer to promote the dairy industry in the valley as a tool for economic development.

The Small Business Administration financed part of the new Gunnison Valley Dairy Association (GVDA) that was the end product of months of work of local leaders and extension workers.

In 1975, the new dairy brought over one and a quarter million dollars in gross receipts into the valley. Labor and dividend payments to many people in the area have improved their financial situation. The local tax base has been expanded by the new animals and facilities of the GVDA. The local banker reports that the Gunnison Valley area is

experiencing some of the best growth in the state. No longer do the local people lament the loss of the sugar beet industry. [5, p. 4]

A coefficient can be calculated to show the relative differences between returns on dairy capital for various dairies. The coefficient is calculated by dividing the net revenue of a dairy by its sum total valuation of equity capital. [1, p. 213]

Regression analysis can be used to figure physical economies of size. Utilizing the basic equation

$$Q = c + bN + e.$$

where

Q = the average quantity of milk per cow in pounds per unit of time

c = a constant term

b = the rate of change in Q per unit change in N

N = the number of cows in the herd on Dairy Herd Improvement test (DHIA)

e = an error term representing the difference between the actual regression line and the fitted one.

When the value for "b" is positive and statistically significant, physical economies of size are present in the system regressed. When the value for "b" is negative and statistically significant, there are physical diseconomies of size in the system regressed. [2, p. 201]

Physical economies of size is not the only factor affecting profitability in dairy operations. The capital use intensity is an important factor in maximizing the difference between the revenues and costs in a dairy operation.

A simple example of this is illustrated below and assumes that the equipment involved in either case becomes obsolete or depreciates at the same rate regardless of the use intensity.

Case 1: $40,000 worth of milking equipment is used to milk 40 cows per day. The resulting capital intensity is $1,000 per cow.

Case 2: $40,000 worth of milking equipment is used to milk 1,000 cows per day and the resulting capital intensity is $40 per cow.

In Case 2 the capital investment is much more efficiently utilized and the return per unit of time on capital is much higher. [3]

Finally, managerial skills are very important in maximizing the difference between revenues and costs. High capital investments are characteristic in modern dairy operations and are long term investments which must be managed carefully. Sufficient care in breeding intervals, sire stock selection, amount of feed and feed mix per cow and time spent milking are among the important aspects of dairying that need to be managed precisely for a maximum return in a dairy operation. [4]

METHODOLOGY AND PROCEDURE

In order to determine the change in magnitude of hay prices, corn silage and grain production, a survey was taken of the dairy farms in the Gunnison Valley. The survey questions were directed to the dairymen in such a way as to discover any increased acreage or change in the individual feed production factor mix. This survey also provided an opportunity to obtain data on the different amounts of dairy capital and the costs related to the production of milk for the various dairies in the area. The dairies surveyed were randomly assigned letter names to represent them in this study. Sufficient data for analysis was available for all but four dairies in Gunnison Valley. A copy of the survey questions is in Appendix A. Table 1 presents the assigned letter names of the dairies in Gunnison Valley and the respective size in milking cow numbers and acres. The Gunnison Valley Dairy Association will be represented by the letter name "G" throughout this study.

Table 1. Letter names of the dairies surveyed and their size in cow numbers and acres.

Name	number of cows	acres
A	50	175
B	300	490
C	120	260
D	180	350
E	50	100
F	80	10
G	1200	260
H	150	450

Partners of the Gunnison Valley Dairy Association, GVDA, were interviewed and benefits accruing to them were noted. An overall explanation of benefits to the partners was outlined by Mr. Roland Beck, accountant for the GVDA and member of the board of directors for the same. Both implicit and explicit benefits were covered within the context of the interviews and the outline by Mr. Beck. Social rankings of the members of the community were an implicit benefit dealt with in the interviews both with the dairy farmers and the board of directors of the GVDA. Special attention was paid to tax shelters, an implicit benefit, created by part ownership in the GVDA.

Explicit benefits to the GVDA members including dividends and wages were measured through interviews with the board of directors of the GVDA and information received from the GVDA secretary.

Regression analysis was used to estimate the physical economies or diseconomies of size in milk production as per the individual dairy operations. Initial regressions using the ordinary least squares technique and the basic equation

$$Q = c + bN + e$$

where

Q = the average quantity of milk per cow in pounds per unit of time

c = a constant term

b = the rate of change in Q per unit change in N

N = the number of cows on Dairy Herd Improvement Association, DHIA, test per unit of time

e = an error term representing the difference between the actual regression line and the fitted regression line

were computed using Dairy Herd Improvement Association, DHIA, reports for the individual dairies for the years 1972 through 1976.

The results of these initial regressions proved to have low coefficients of multidetermination, R^2, values that made the regression results unreliable. The Durbin-Watson statistics in these preliminary regressions showed that the data regressed was positively autoregressive. Autoregression is when the effect of the disturbance or error term in one period of time is carried over into following periods of time. [2, p. 269] In hopes of solving the autoregression problem and at the same time obtaining a higher R^2, the Corchrane-Orcutt Iterative technique of regression analysis was used. The autoregression problem was solved by this change and also the R^2 values increased to an acceptable level that showed a significant relationship between Q and N.

More variables were introduced into the basic equation for two reasons. One, to increase the knowledge available to the dairy farmers of the effects of various variables in the dairy industry, and two, to try to increase the R^2 statistics and predictive power of the equation. The basic equation was modified as follows:

$$Q = c + bN + e$$

was changed to

$$Q = c + b_1N + b_2V + b_3F + b_4CL + e$$

where Q, c, b_1, N, and e are defined as in the basic equation and

b_2 = the rate of change in Q per unit change in V

V = the number of calves from the herd per unit of time

b_3 = the rate of change in Q per unit change in F

F = the average pounds of butter fat per cow per unit of time

b_4 = the rate of change in Q per unit change in C

CL = a binary variable for culling.
0 = non-culling; 1 = culling

Neither the ordinary least squares nor the Corchrane-Orcutt Iterative techniques proved b_4 to be significantly different from zero, therefore, the term for culling, CL, was dropped from the equation. The final equation used was

$$Q = c + b_1N + b_2V + b_3F + e$$

Copies of the regression results for each dairy are in Appendix B.

A return on dairy capital coefficient was figured for each dairy by dividing the net revenue from each dairy operation by the dairy capital involved in the dairy operation for the year 1975. Both of these terms were listed in dollar amounts as a market value. As the value of this ratio increases, the return on dairy capital becomes greater. The total profitability of size or return on dairy capital for each dairy involved was measured by comparing the coefficients of return on dairy capital of the various dairies and their sizes in cow numbers.

This study was designed to analyze the differences in return on dairy capital for different sizes of dairy operations in Gunnison Valley, Utah. Special procedures were followed to maintain homogeneity among the dairy operations.

Net revenue for each dairy operation was computed so that only the dairy associated costs were subtracted from the dairy revenues. This was done to isolate the dairy operation costs and revenues as separate entities from their possible accompanying farm operation costs and revenues.

Revenues in all the dairy operations were computed through four elements. Total dairy operation revenue was computed by summing the amounts received from milk sales, butter fat differentials, bull calf sales, and an imputed amount of inventory value increase was added for

heifer calf births. Information on quantities of milk produced, butter fat, and calf births was gathered from DHIA herd summary records for the year 1975. It was assumed that 50 percent of all calves born were heifers and that their imputed average value to inventory increase was $300 per head. The remaining 50 percent of calves were assumed to be bulls with an average sale value of $35 per head. The quantities of milk and butter fat data obtained from DHIA records were converted into cash amounts by multiplying the various quantities by the appropriate blend price as per Western General dairies' published figures.

In an effort to preserve homogeneity of the entities analyzed, only costs related to the dairy operations were used to determine the gross revenue figures for each dairy. An imputed cost of feeding the dairy herd, using average market prices, was charged against the gross revenue of each dairy operation. This was done for all dairies in the study without consideration for feed produced in an accompanying farm operation. The overall effect of this was to preserve the comparability of the dairies in Gunnison Valley.

In conjunction with the above procedures, the value that was assigned to the capital of the various dairy operations was limited to only that capital which is directly associated with the dairy enterprise. Such capital items include the value of the cows in the milking herd, the value of the milking parlor and equipment, the value of the cow housing facilities, the value of feed storage and delivery facilities, and other items as they relate directly to the dairy operation.

Appendix C contains a list of the 1975 average capital per cow, costs per cow, and milk receipts per cow for the dairies in Gunnison Valley, Utah. These are weighted averages that exclude the GVDA. The

GVDA figures as per these categories is presented along side of the other dairies aggregate figures. The dairies in Gunnison Valley are presented in aggregate to preserve the anonymity of the owners.

A survey of various lending agencies, the Production Credit Association (PCA), Small Business Administration (SBA), Farmers Home Administration (FHA), and commercial banks was conducted to determine the ability of various sizes of dairy operation to acquire debt. Both the size of loans and the accompanying interest rate were of importance in this phase of the study.

Finally, impacts on Gunnison Valley were studied to find out changes in birth rate, employment patterns, retail sales and migration in the Gunnison area.

Hospital records were analyzed to determine any changes in the birth rate from before the organization of the GVDA to after its organization.

Employees of the GVDA were asked various questions to find out if they had migrated into the area for their job or had left another position in the area for their present one. A copy of these questions is in Appendix A.

Changes in retail sales and employment were not obtained for the Gunnison Valley. A comparison of business licenses granted before and after the organization of the GVDA was determined so that changes in absolute number of businesses was obtained. The relative change in gross receipts for the valley as a whole or for the individual businesses would have been useful for comparison sake but were not deemed absolutely essential as indicators for the study.

PRESENTATION AND ANALYSIS OF DATA

Feed price changes

Before the construction of the GVDA, feed producers in Gunnison Valley were receiving a return for their product that was less than the state average return for feed input production. After the GVDA was organized, the feed producers in Gunnison Valley received a return for their product that was higher than the state average return.

In November 1971, the announcement of the proposed 1,000 plus dairy unit construction in Gunnison Valley caused the price of alfalfa to increase rapidly from $30 per ton to $35 per ton. Prices of corn silage and feed grain, neither extensively produced in the Gunnison Valley for sale, experienced the same type of increase as alfalfa in as short a time period. After the announcement of the dairy construction, these two feed inputs were planted in increasing acreages for sale to the Gunnison Valley Dairy Association.

The introduction of corn silage into the rotation of the feed producers' farms helped to control the wild oats in the area and enhanced the productivity of the land for alfalfa yields.

The economic incentives on feed production were increased to a price equalling the cost of importing feed inputs from outside the valley. The local feed producers theoretically can charge a price for their feed equal to the price of non-valley feed plus transportation costs. The Gunnison Valley went from a surplus feed area in most years exporting feed to outside markets to a deficit feed producing area where feed (especially concentrate feed for dairy animals) is imported regularly.

Table 2 shows various prices in different time periods associated with alfalfa hay and corn silage as per the average price in the State of Utah and the Gunnison Valley price. The State of Utah prices are from the state statistical reporting service and the prices for the Gunnison Valley area are from feed sales receipts in the area. The majority of these receipts are held by the Gunnison Valley Dairy Association. Prices for corn silage in Gunnison Valley are not available for the years 1968-1970. These figures are not available because there was little or no sale of corn silage in the valley for this time period.

Table 2. Prices in different time periods associated with alfalfa hay, and corn silage in the State of Utah as an average and in Gunnison Valley, Utah.

date	state alfalfa	Gunnison Valley alfalfa	state corn silage	Gunnison corn silage*
6/'68	$22.00	$20.00	$ 8.10	n/a
12/'68	$22.50	$20.00	$ 8.10	n/a
6/'69	$23.50	$22.00	$ 8.30	n/a
12/'69	$25.00	$22.00	$ 8.30	n/a
6/'70	$25.50	$25.00	$ 9.80	n/a
12/'70	$25.50	$27.00	$ 9.80	n/a
6/'71	$28.50	$30.00	$10.00	$27.00
12/'71	$33.50	$35.00	$10.00	$27.00
6/'72	$33.00	$39.00	$11.50	$29.00
12/'72	$38.50	$39.00	$11.50	$29.00
6/'73	$36.50	$39.00	$14.50	$32.00
12/'73	$43.50	$45.00	$14.50	$32.00

*Gunnison corn silage prices are paid on a dry matter basis. To change the Gunnison price of dry matter to wet price per ton, the Gunnison price must be discounted to 70 percent of the listed value. This allows for 30 percent moisture in wet silage.

The organization and operation of the Gunnison Valley Dairy Association creates stability of demand for feed inputs. This stability allows the farmers in the Gunnison Valley to contract their feed sales and production in advance. The advance arrangement allows the GVDA security of feed availability at a fair price and allows the farmers in the Gunnison Valley flexibility in crop alternatives.

In summary, the over $500,000 spent locally on feed inputs each year by the GVDA contributes substantially to the Gunnison Valley economy. There are definite price changes associated with the production of feed inputs within the Gunnison Valley that are theoretically equal to the transportation cost of shipping feed inputs to the GVDA from outside the Gunnison Valley area.

Benefits accruing to the partners of the Gunnison Valley Dairy Association

Benefits both explicit and implicit that accrue to the partners of the Gunnison Valley Dairy Association, GVDA, can be broken down into four categories. The first is the explicit receipt of money from the sale of milk. The second is income generated by sale of feed inputs to the GVDA. The third is the tax shelter afforded by the dairy. Finally, the fourth, is the contribution that membership in the dairy has had to the partners as an increase in their personal power in the community, prestige, satisfaction and public esteem that is generated partly because of ownership in the GVDA.

The social clout accruing to the GVDA partners, the fourth benefit, is difficult to measure. This is an implicit benefit that the partners enjoy. Being one of the partners in the largest dairy operation in the

state is a prestigious thing the partners can be proud of and others revere.

Many of the partners of the GVDA operate dairies of their own and having ownership and input into the largest dairy in the state, a dairy in some cases ten times larger than their personal dairy, becomes a dream come true as far as the magnitude of the operation is concerned.

A survey to discover the most prominent figure in the Gunnison Valley in five social categories showed that the partners in the GVDA were leaders in four of the categories and among the top two in the other category. The results of this survey are summarized in Table 3.

Table 3. Membership in the GVDA corresponding to community opinion of leadership in the following categories.

Category	First choice	Second choice
Business	GVDA member	GVDA member
Finance	GVDA member	GVDA member
Politics	Non member	GVDA member
Religion	GVDA member	GVDA member
Society	GVDA member	GVDA member

The explicit payment of dividends is more easily measured as a benefit accruing to the partners of the GVDA than are increases in prestige, esteem, and satisfaction of the partners.

The GVDA is on a growth course that will eventually increase its cow numbers to the 2,000 milking cow level. All heifers born on the premises are kept for cull replacement and/or to build up the herd numbers. Bull calves are sold for the market price after weaning.

Just as heifers are channeled back into the GVDA milking operation, the returns on milk, bull calf, and cull cow sales above costs have been channeled back into the GVDA milking operation to increase equity overall.

Only one dividend has been paid to the partners of the GVDA since its origin in 1971. It was paid on a per cow basis and was for the amount of $60 per cow owned.

The partners have seen fit to not divide any further profits into dividends but rather increase the equity value of the dairy. When the dairy was organized in 1971, a person had to pay $400 per cow to become a partner in the GVDA. In 1976 the net worth value of the total operation expressed in terms of original cow value had risen to $1,000 each. This represents a 250 percent increase in the original investment per cow in just five years. Allowing for inflation, the increased value per cow still represents more than a 200 percent increase in investment over the five year period.

As the milking herd continues to grow in numbers, the value per original cow will increase. This increased value will translate into a firm financial asset for the partners of the GVDA.

The GVDA milking herd consumed 25 dry weight tons of alfalfa, corn silage and feed grain per day at an average cost of $1,375 for the year 1975. This daily cost translated into a figure exceeding $500,000 spent for feed produced locally in 1975.

Some of the partners of the GVDA are dairy farmers that produce and use all their own feed production for their personal dairies. Others of the partners of the GVDA are feed producers that grow alfalfa, corn silage, and feed grain on their farms for the express purpose of selling it to the GVDA partnership.

The policy of the GVDA has been to buy feed at the market price first from the partners in the dairy that have feed for sale, second from others that produce feed in the Gunnison Valley, and third from outside the valley as the need arises. This is a way in which the feed producing partners of the GVDA have secured a market for their feed and captured all the increased price changes on feed production in Gunnison Valley possible due to the GVDA feed buying policy.

The last way the partners of the GVDA receive benefits from being partners in the dairy is a secondary effect that creates a tax shelter for them. The shelter on taxes is composed of three elements.

The first element is the fact that when dairy cattle are properly taken care of, they approximately double in number each year. In all probability, one-half of the increased numbers are bull calves and are sold for the market price. The other half of the increased numbers are heifers and are kept to replace cull cows and increase the number of milking cows in the herd. Labor and feed for raising heifers is a cost of production expense and is chargeable as a current operating expense each year. Heifers raised go into the breeding herd. When these

animals are sold as cull cows, they are taxed on a capital gains type basis and 50 percent of the net sale price is taxable income. [7, p. 111] The partner will only pay tax on this amount when earnings are distributed or when their equity in the dairy operation is sold.

The second element of the tax shelter in the GVDA is the sale of cull cows that were purchased. These cows are depreciable and eligible for investment credit. These two items are legitimate taxable income reducing benefits that can be passed on in the form of tax losses to the partners. Depreciation on cows, milking equipment and facilities amounts to a $100,000 depreciation credit to be shared among the partners of the GVDA each year. Associated with this is an investment credit for 1975 allowed to equal ten percent of the original investment that can be carried backward on personal taxes three years or forward five years. Investment credit is a deduction from the calculated dollars of tax to be paid on the individual return.

The final benefit is the interest paid on the loans by the GVDA which is a deductible expense and thus is a deduction before taxes are calculated. When the partners are not receiving dividends this interest can lower their individual taxable income.

The total paper loss for 1975 on the GVDA from a tax basis was $475,132 when actually the market value of the total operation calculated on a per cow basis had increased.

The benefits to the partners in the GVDA are both explicit and implicit in nature. The explicit benefits are not outstanding as far as actual return of dollars on investment is concerned. The implicit benefits, i.e. feed market price increases and stability, increased equity value without increasing taxable income, and tax shelters, are

more than compensatory for the initial investment into the GVDA when amortized on a yearly basis.

Economies of size

There are two interpretations of economies of size that are basic to this study. The first is a physical orientation and the second is a financial orientation.

Physically, economies of size can be defined as a change in inputs in a particular production function that results in a greater than proportional change in output either positively or negatively for that production function.

Financial economies of size are fixed costs that are reduced with increased production. An agricultural example of this could be illustrated in a dairy operation. The fixed costs per cow of milking one cow in a milking parlor are considerably higher than milking several cows in the same parlor.

Regression analysis was used to estimate the physical economies of size in dairy operations in Gunnison Valley. Appendix B contains copies of the regression results as per the particular dairies.

A return on dairy capital coefficient was computed for each of the dairy operations in the Gunnison Valley to measure the relative financial economies of size. The coefficient of the return on dairy capital was computed by dividing the net return per dairy by the capital value associated with that dairy. This coefficient is a relative concept that is used to compare dairies within the area.

The simplest form of a relationship between two variables Q and N is the simple linear regression model. This model is formally described as

$$Q = c + bN + e$$

Economies or diseconomies of size in physical milk production can be discovered through the coefficient sign of b.

Regression analyses were run for each of the dairies in Gunnison Valley. At first, a simple regression equation was used as is defined above. Later more variables were introduced into the equation making the later equation a multiple regression as is defined below:

$$Q = c + b_1N + b_2V + b_3F + e$$

where Q, c, b_1, N, and e are defined as in the simple regression. The simple regression analysis results are listed in Table 4. The multiple regression analysis results are listed in Table 5.

Table 4. Regression analysis results for the simple regressions run on the dairies in Gunnison Valley, Utah

dairy	c (t)	b (t)	R^2	F statistic
A	2415.12 (5.675)**	-19.966 (2.530)**	.3618	30.045
B	1304.23 (3.238)**	-.15856 (.1253)@	.6078	61.986
C	1155.47 (6.563)**	-1.0665 (1.024)@	.5105	42.764
D	7.0867 (54.91)**	-.00057 (.6190)@	.3910	25.686
E	1132.99 (4.533)**	7.095 (1.300)*	.2261	11.975
F	6.454 (22.66)**	.008223 (2.028)**	.3870	23.360
G	1475.70 (4.676)**	-.40848 (1.428)*	.7284	134.075
H	7.046 (21.612)**	.00020 (8.730)**	.2830	18.950

**Significance to the .05 level of alpha

*Significance to the .10 level of alpha

@Significance at less than .10 level of alpha

definition of terms

c = a constant term

b = the rate of change in Q per unit change in N.

Q = the average pounds of milk produced.

N = the number of cows per unit of time.

Table 5. Regression analysis results for the multiple regressions run on the dairies in Gunnison Valley, Utah

dairy	c (t)	b_1 (t)	b_2 (t)	b_3 (t)	R^2	F statistic
A	1249.26 (4.510)**	-15.680 (3.373)**	6.3549 (1.500)*	18.971 (9.716)**	.7773	59.352
B	336.583 (1.548)*	-1.201 (2.765)**	2.0871 (1.688)*	28.750 (8.281)**	.8326	62.998
C	315.94 (2.082)**	-1.140 (1.712)*	.6221 (.4160)@	23.998 (7.752)**	.8066	54.213
D	446.663 (3.457)**	-.85208 (1.424)*	3.565 (1.915)**	19.3611 (6.819)**	.7486	37.719
E	369.136 (2.127)**	2.364 (.7290)@	-4.255 (.8787)@	18.403 (8.563)**	.7662	42.603
F	6.13317 (34.26)**	.00049 (.2022)@	-.00393 (.9607)@	.02129 (7.046)**	.7436	33.834
G	277.076 (1.527)*	-.1040 (1.108)@	-.26258 (.8439)@	24.495 (8.376)**	.8779	115.030
H	6.462 (33.815)**	-.00119 (.9190)@	.00084 (.8270)@	.01810 (9.819)**	.7926	58.611

**Significance to the .05 level of alpha

*Significance to the .10 level of alpha

@ Significance at less than .10 level of alpha

definition of terms

c = a constant term

b_1 = the rate of change in Q per unit change in N, as defined Table 4

b_2 = the rate of change in Q per unit change in V, number of calves

b_3 = the rate of change in Q per unit change in F, pounds of fat

Some of the values of "c" seem relatively larger than others because in certain regressions the log of the "Q" value was used rather than the actual value. The log value of "Q" was used because the data regressed was not linear. The use of the log value improved the statistical fit of the regression line.

The simple regression results brought out the important fact that the coefficient, "b", representing the rate of change in the average quantity of milk per cow with increased cow numbers per unit of time was negative and significant in six out of eight cases.

The negative sign on "b" and "b_1" represents physical diseconomies of size. Intuitively approaching this outcome, it is apparent that the greater the number of cows a dairyman has the less time he can spend with each cow in feeding, milking, and veterinary care due to the limited time factor affecting the dairyman. When the dairyman is trying to maximize production with a limiting time factor, he cannot milk cows for the marginal last ounces of milk when there are other cows to be milked with the easily obtainable first ounces. The dairyman can feed an optimum roughage to grain ratio diet to a few cows and maximize production per cow. When using a feeding truck and feeding grain in mangers, it is extremely hard and time consuming to maximize production per cow through administering exact feeding rations per cow. The alternative is to try to get the feed ration at a level of optimum production per unit of time.

The results of the multiple regressions run on the dairies in Gunnison Valley showed "b_1" coefficients negative for all the dairies in Gunnison Valley. This means that in the larger equation model there are diseconomies of size as are presented in the simple regression equation.

As cow numbers increase in the herds, the average number of pounds of milk produced per cow decreases.

As revealed by the large model equation, one of the factors related to the average quantity of milk produced per unit of time is the average number of pounds of butter fat produced per unit of time. It might seem necessary that as the average number of pounds of milk increased, the average pounds of butter fat also increased. When examining the magnitude of the increase in butter fat and the increase in pounds of milk, it can be noted that there is a more than proportional increase in pounds of fat per increase in pounds of milk. This is a sign that the cows are fed a better ration which increases the average amount of fat proportionally more than the increase in milk production. The overall effect of this is an increase in the gross revenue of the dairy farmer from the extra 100 wts. of milk produced and the increased butter fat differentials paid to him.

The number of calves born to the dairy herd is a positive influence on the average pounds of milk produced per unit of time, This fact was brought out in the multiple regression equation model run on the dairies in Gunnison Valley. The calf number and its accompanying coefficient is a relative indicator of the length of lactation period of the milking herds in the area. Allowing for the physiological limits of the dairy cows, the greater the number of calves produced per unit of time, the greater the average pounds of milk produced per cow.

Relative financial economies of size for the dairies in Gunnison Valley were measured by computing return on dairy capital coefficients. These coefficients were figured for the dairies by subtracting the costs of producing milk from the gross revenue received from milk sales, butter

fat differential payments, bull calf sales, and an imputed amount of inventory increase from heifer calf births. This computation provided a net revenue figure for each dairy. The net revenue was divided by the dairy capital calculated for the individual dairy operation. Only capital associated with the dairy operation was used in this study to maintain the comparability of the entities analyzed. The resulting quotient was a relative coefficient that compared the return on dairy capital for the dairies in Gunnison Valley. One part of this analysis was to compare all the dairies in the valley against the Gunnison Valley Dairy Association, dairy G in the table. The letter names randomly given to the dairies in Gunnison Valley, their profitability coefficient, and their relative rank are shown in Table 6.

The dairies are also presented in Table 7 according to size in cow numbers and return on dairy capital coefficients.

Table 6. The dairies of Gunnison Valley, Utah, their return on dairy capital coefficient, and their relative ranking of return on dairy capital.

Dairy	return on dairy capital coefficient*	rank
A	.3141635813	4
B	.6622474089	1
C	.0925312656	8
D	.2238258922	5
E	.121836464	7
F	.429057039	3
G	.1820037329	6
H	.5551496338	2

*To express the coefficients as a percent, the decimal point must be moved two digits to the right.

Table 7. The dairies of Gunnison Valley with their accompanying size in cow numbers and return on dairy capital coefficient.

Dairy	size in cow numbers	return on dairy capital coefficient*
A	50	.3141635813
B	300	.6622474089
C	120	.0925312656
D	180	.2238258922
E	50	.121836464
F	80	.429057039
G	1200	.1820037329
H	150	.5551496338

*To express the coefficients as a percent, the decimal point must be moved two digits to the right.

The mean return on dairy capital coefficient for the eight dairies in Gunnison Valley is .3226018772 and the standard deviation is .2082598732.

There is considerable difference in the return on dairy capital coefficients between dairies in the study. Even the dairies with approximately equal herd sizes have considerable difference in their return on dairy capital coefficient.

Many factors can affect the profitability of dairy operations. In the Gunnison Valley there seem to be no economies of size in dairying per se. However, the benefits accruing to the partners of the GVDA sufficiently compensate them for their involvement in the Association.

The secondary economic development benefits that are enjoyed by all of the inhabitants of the valley are hard to quantify in dollar amounts. The GVDA, although not quantifiable in an exact dollar amount, has helped develop the once stagnated economy of Gunnison Valley. The residents of Gunnison Valley are enjoying a better life now partially because of the GVDA and the effect of its over one and a quarter million "new" dollars brought into the valley yearly.

Capital utilization

Capital utilization ratios were computed for all the dairies in Gunnison Valley. These ratios are a coefficient of relative utilization intensity per cow for the dairies involved.

The major reason behind computing these ratios is to show the unused capital capacity or over capitalization of the various sizes of dairy operations.

The capital in a dairy operation is a fixed cost that can be minimized per cow as more cows are milked. Capital in this study is

defined as the assets of the dairy operation that are necessary for milk production. Items that were used in measuring the amount of capital owned by the dairies include: cows, milking equipment, the milking parlor, feed storage and distribution items, cow housing facilities, and trucks and tractors used in the dairy operation. A complete list as per the dairy questionnaire is available in Appendix A. Typically, capital in a dairy operation represents an investment with obsolescence costs, interest costs and depreciation over time.

The formula used to compute the capital utilization ratios is:

$$\frac{\text{capital assets of the dairy}}{\text{number of cows in the dairy}} = \text{capital use per cow.}$$

The capital utilization ratios for the dairies in Gunnison Valley, Utah are listed in Table 8.

Table 8. Capital utilization ratios for the dairies in Gunnison Valley, Utah.

Dairy	capital utilization (capital/cow)
A	$1,485.50
B	$1,232.61
C	$1,900.00
D	$1,377.78
E	$1,860.00
F	$1,161.56
G	$ 727.08
H	$1,138.88

The mean capital utilization ratio for the dairies in Gunnison Valley is $1,360.43 with a standard deviation of $389.64. The lowest dairy in this category is G, the GVDA, which has a capital utilization ratio of $727.08 which is -1.63 standard deviations from the mean ratio. The highest dairy in this category, C, has a capital utilization ratio of $1,900.00 which is 1.38 standard deviations from the mean ratio.

Dairies that use less capital per cow in Gunnison Valley have a greater probability of increased relative return on dairy capital each year.

The dairies in Gunnison Valley can also be compared by computing their return per cow ratios. The return per cow ratio is computed by dividing the net revenue from the dairy operation by the number of milking cows in the particular dairy. The resulting quotient is the net return per milking cow for each dairy operation. The dairies in Gunnison Valley have a mean net return per cow of $422.30. The GVDA net return per cow is -1.19 standard deviations from the mean at $102.74 per cow.

In the aggregate, regression analysis shows that the net return per cow ratio in Gunnison Valley dairies is negatively sloped. Numerically, this slope is -.244927163. This represents financial diseconomies of size in dairying among Gunnison Valley dairies in the year 1975.

Sources of capital

The ability to acquire debt for various sizes of dairy operations is relatively equal. Four types of financial loaning institutions were surveyed. The Production Credit Association, PCA, the Small Business Administration, SBA, the Farmers Home Administration, FHA, and two

commercial banks were surveyed. The only significant differences between these institutions were the interest rate charge on the loans and the loan limit in dollars.

The PCA is a non-profit cooperative type organization and seeks to only cover costs with the interest rate charged on loans. The PCA loan interest rate varies with the federal reserve discount rate. The PCA prefers to lend money to individuals or partnerships rather than corporations. The PCA also prefers to loan money for one year periods of time or less, but will loan money for longer periods of time up to seven years. A first mortgage is desired to be held by the PCA on both animals and equipment when money is loaned for either or both of these things. The interest rate on PCA loans in June 1976 was 7.91 percent per year on the unpaid balance.

The SBA is an agency of the federal government that makes two types of loans to farmers, direct loans and guaranteed loans made to qualified organizations by commercial banks or other loaning organizations. The loan guarantee is for 90 percent of the loan value in dollars. This is done to promote loans to organizations that would normally have difficulty in obtaining loans due to a higher than bank preference risk factor. SBA loans have a limit of $500,000. The interest rate for SBA loans is variable according to the different interest rates on loans at different banks. The SBA has a maximum interest rate that is placed on the loans that are guaranteed by it. This rate is 10.5 percent on the unpaid balance per year.

The FHA is also a government agency that promotes agricultural production and investment. The FHA has a loan limit of $100,000 on

real estate loans and a $50,000 loan limit on cattle, equipment, and building loans. The FHA has a maximum time period for repayment for these two types of loans which is: 40 years for real estate and seven years for other loans. The interest rate on FHA loans fluctuates with the economy. Once a loan is written, a borrowing party can refinance for a lower interest rate. A borrowing party does not have to refinance at a higher interest rate because of an increase in the interest rates in the economy.

A rural commercial bank offers loans for dairy development to depositing customers only. The limit of these loans is governed mainly by the banking reserve requirements and the asset portfolio mix of the bank. This particular rural bank does not deal with SBA guaranteed loans in any way. The interest rate at the rural bank was 9.3 percent per year on the unpaid balance.

An urban commercial bank offers dairy loans of up to 70 percent of the value of the livestock involved at 9.75 percent interest per year on the unpaid balance. Equipment loans of 80 percent of the appraised or sale value, whichever is less, at 13 percent interest per year on the unpaid balance. This bank was anxious to work with any interested borrower and through the Small Business Administration.

The interest rates for various categories of loans, loan limits, maximum time limit for repayment, and restrictions for the loaning institution surveyed are listed in Table 9.

Table 9. Interest rates for various categories of loans, loan limits, maximum time limits for repayment, restrictions for loaning

Institution	category	interest rate	loan limit	maximum time for repayment	restrictions
PCA	all	7.91%	none	0-7 years	partnerships or individuals
SBA	all	negotiable	$500,000	flexible	maximum interest rate 10.5%
FHA	real estate	5%	$100,000	40 years	agricultural use
	chattel	8.5%	$ 50,000	7 years	
rural bank	all	9.5%	none	flexible	reserve requirements
urban bank	chattle	9.75%	70% value	flexible	none
	equipment	13%	80% value	flexible	none

One alternative to borrowing the funds to start a dairy operation is to finance through selling stocks in the corporate type of organization. The advantages to common stock financing of a dairy operation as appraised from the standpoint of the dairy are: First, common stock does not entail fixed charges. If the corporation generates earnings, it can pay common stock dividends. Second, common stock carries no fixed maturity date similar to loans. Third, since common stock provides a cushion against losses for creditors, the sale of common stock increases the credit-worthiness of the operation. Fourth common stock may at times be sold more easily than debt. [8, p. 331]

The basic formula for determining the number of shares of stock to be issued is:

$$\frac{\text{Funds to be raised}}{\text{Subscription Price}} = \text{Number of Shares}$$

It is also possible to determine the subscription price of a share of stock when the number of shares is equal to the number of cows in the dairy operation. By manipulating the equation above to the following form, the subscription price can be calculated.

$$\frac{\text{Funds to be generated}}{\text{Number of shares (cows)}} = \text{Subscription Price per share}$$

These two formulas are important and useful in developing a dairy organization's financial strategy.

A group desiring to finance a dairy through common stock sales could compute the number of shares and the price per share to be sold. Those forming the dairy operation could buy the voting common stock and sell the non-voting common stock to finance their operation. The owners of the voting common stock could control the dairy operation. When profits accrue to the operation, dividends could be paid to all stockholders.

The corporate form of dairying in reality is limited to larger dairy operations. The larger dairy operations have more viable means to sell their stock, more need of this type of financing due to the amount of money needed for initiating a large operation, and more ability to share profits without taking away someone's living as in a smaller dairy.

Developmental impacts

The impacts of the Gunnison Valley Dairy Association, GVDA, in the developmental efforts of the Gunnison Valley Economic Development Committee are significant and positive. The general level of the local economy has improved since GVDA began business. Out migration has stopped. New business has been attracted to the area. The birth rate has increased significantly and is increasing. In sum, the Gunnison Valley is growing again.

One of the reasons the economy in Gunnison Valley is growing is the over $1,250,000 in out-of-valley dollars brought in each year to pay for the milk produced by the GVDA. These "new" dollars are spent on taxes, feed, and labor in the local economy. In an impact study before the construction of the GVDA, a multiplier effect was predicted for any "new" dollars brought into the stagnated economic environment of Gunnison Valley. Today the level of the local economy reflects this multiplier effect.

From 1960 to 1971, housing in Gunnison Valley was relatively inexpensive and plentiful as described by Pres. Paul Dyreng, a local, religious leader. From 1971 to the present, housing in Gunnison Valley has become more expensive and scarce. The out migration of young adults from Gunnison Valley left many rental types of housing vacant before the

construction of the GVDA. Since the dairy started operation in 1971, more young family heads have been more able to get work in the Gunnison Valley. Employment has been made available both in the GVDA operation and in secondary operations relating to the supply of feed inputs for the GVDA. The development of the GVDA has decreased the need for migration from the valley to obtain employment.

The young families that are staying in Gunnison Valley are utilizing all of the rental housing in the area. After a housing search and conferences with the two realtors in Gunnison, it was found that at a fair market price there were not any housing units for rent in the area.

New business has been attracted to the Gunnison Valley as a result of the GVDA development. The "new" dollars brought into the valley with their accompanying multiplier effect have stimulated the stagnated economic environment of Gunnison Valley. In Gunnison alone, 13 new businesses have opened their doors since the initiation of the GVDA.

Among the new businesses established are several nonvital services that have been recently attracted to the valley's economy. These businesses serve the increased demand for nonvital services of the area that were only available outside of the valley previously. Examples of these are: a CB radio shop, an upholstery firm, a mod clothing boutique and two insurance companies.

The residents of Gunnison Valley are experiencing a relative increase in their incomes due to the "new" dollars brought into their valley from milk sales.

The birth rate in Gunnison Valley has increased since the construction of the GVDA. There are two alternative explanations for this: (a) There are more young families in the area that are having children;

or (b) the families that have been in the valley can afford to have more children.

Trend analysis was used to compute a slope coefficient for the birth rate in Gunnison Valley for two time periods, 1962-68 and 1969-75. These two periods were chosen because of the effect of the economic decline in Gunnison Valley in the earlier period and the impact of the Gunnison Valley Economic Development Committee and the GVDA in the later period.

The results of the trend analysis showed the earlier period to have a negative coefficient for the change in birth rate per year. The later period had a positive coefficient for the change in birth rate per year. The basic equation used in this analysis was:

$$Y = a + bX + e$$

Where

Y = the birth rate in each year

a = a constant term

b = the rate of change in Y per unit change in X

X = the year number

e = an error term representing the difference between the actual trend line and the fitted trend line.

The numerical value of these "b" coefficients is: for the earlier period, 1962-1968, b = -.6429; and for the later period, 1969-1975, b = 3.7857.

A census of the employees of the GVDA was taken to determine the native area of the employees, their mean age, their reasons for employment at the GVDA and their probable alternative for employment and its location. The results of this survey are listed in Table 10.

Table 10. GVDA employee response to the employment and migration questionnaire.

Mean age	32
Sex	male, 13; female, 5
Hometown	Gunnison
Hometowns within 20 miles of the GVDA	16
Current residence	Gunnison
Previous occupation	farm oriented
Reason for working at the GVDA	
a. location	14
b. wage level	8
c. type of work	15
d. availability of work	10
The majority of the GVDA employees would probably work ? the Gunnison Valley if they did not work at the GVDA.	outside
The model probable occupation alternative is ? .	construction

SUMMARY AND CONCLUSIONS

Rural development groups typically have little choice of direction in implementing development strategies. This study provides information on an alternative development strategy along the lines of comparative advantage. The Gunnison Valley economy has been stimulated partially through the promotion of the dairy industry, the Gunnison Valley Dairy Association, GVDA. This stimulation has come through both primary and secondary modes.

A census was taken of the dairy operations in Gunnison Valley for 1975. A census was also taken of the employees of the GVDA. Data collected from these surveys provided information on costs of production, dairy capital value, employment trends, and migration. Coefficients of return on dairy capital were computed for each of the dairies in Gunnison Valley that showed the relative return on dairy capital for each of the dairy operations.

Increased demand for dairy feed inputs within the Gunnison Valley in conjunction with the fixed supply characteristics of feed production in the short run caused the market price of dairy feed inputs to increase in the valley. The magnitude of this increase is theoretically equal to the transportation cost of shipping the feed into the Gunnison Valley. The increased return on feed production is allocated to the dairy feed producers in Gunnison Valley.

The partners of the GVDA receive benefits for being members of this partnership. Socially, the various partners are considered among the leadership in five basic community categories. Financially, the partners are sheltered from income tax and received dividends from the GVDA.

As a secondary benefit, the partners are enjoying the added prosperity, economic stimulation, and stable growth that the GVDA has helped bring into the Gunnison Valley.

Dairies with somewhat similar capital investments and dissimilar cow herd sizes have significantly different capital utilization ratios. The difference represents financial economies of scale or over capitalization. Regression analysis testing for physical economies of size in Gunnison for the year 1975 showed that as cow herd numbers increased the average pounds of milk produced per unit of time decreased. Secondary financial return per cow increased as cow numbers increased. This includes not only the absolute dollar amounts received for milk sales but also tax savings from participating in dairy operations.

Finally, the impact of the GVDA on the once stagnated economy of Gunnison Valley has been significant and positive. The general level of the local economy has increased, out migration has slowed, new businesses have been attracted to the area, and the birth rate trend is now positive instead of negative as before the creation of the GVDA. New dollars brought into the Gunnison Valley economy from milk sales have helped stimulate overall growth.

The information contained in this study provides an alternative to economic development committees for economic development. The impacts of development along the lines of comparative advantage, in this case dairy promotion, are economically viable.

At this time, financial economies of size are not present in Gunnison Valley. Physical economies of size are not present in the dairies in Gunnison Valley. Net dollar receipts per cow decreased as herd size increased in 1975. Secondary financial benefits such as tax

savings increased as herd size increased. Finally, management must be able to manage larger cow numbers within dairy herd to maximize the difference of revenues over costs.

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APPENDIXES

APPENDIX A

Questionnaire used to collect data on dairy farms' dairy capital and costs.

Questionnaire used to determine the opinions of Gunnison residents about the social rankings of leaders in various categories.

Questionnaire used to gather data on employees of the Gunnison Valley Dairy Association.

The following is a letter of introduction to the dairy farmers in the Gunnison Valley to the study questionnaire that was used to accumulate data on dairy costs and capital.

UTAH STATE UNIVERSITY · LOGAN, UTAH 84322

COLLEGE OF AGRICULTURE
COLLEGE OF BUSINESS

DEPARTMENT OF
ECONOMICS
UMC 35

The Department of Agricultural Economics of Utah State University is conducting a study of the dairy operations in Gunnison Valley, Utah. Dr. Paul R. Grimshaw, a former county agent of San Pete County, is directing this study and would greatly appreciate your help.

Mr. Craig L. Mangus, a research assistant, has been working since last August on researching the factors affecting profitability in dairy operations in Gunnison Valley, Utah. Enclosed is a questionnaire pertaining to dairy operations that will help in this research. We would appreciate your time in completing the questionnaire. Mr. Mangus will be in Gunnison on May 21 and 22 to collect these questionnaires and answer any questions that you may have pertaining to it.

Thanks so much for your help in our work to help the farmers of the state.

Sincerely yours,

Paul Grimshaw and
Craig Mangus

PGCM/kw

Enclosure

APPENDIX A

Questionnaire on Dairies in Gunnison Valley, Utah

Please answer the following questions with the appropriate answer as pertaining to your personal dairy operation.

Crop Production and Feeding

1. Do you produce your own feed inputs?_____
2. Do you sell feed?_____
3. How many acres do you plant of the following: hay_____, corn silage_____, and grain for feed_____?
4. What are your yields per acre on these acreages in the various crops? hay_____, corn silage_____, and grain for feed_____.
5. Have you significantly changed your production within the last five years?_____ If so, how?
   In which of the following categories? labor_____, capital_____, land_____, fertilizer_____, water_____.
6. Do you buy feed inputs?_____ If so, how much of each of the following? hay_____, corn silage_____, feed grain_____, other_____.
7. What are the daily rations of hay_____, corn silage_____, and feed grain_____ that your dairy cows receive.
8. Do you grain your heifers?_____ If so, how much?_____

Labor & Earnings

1. How many hours do you spend actually milking cows daily?_____
2. How many hours a week do you spend in cleaning up corrals?_____

3. Do you haul the manure from the corrals?_____

4. How do you dispose of this manure?_____

   How much time does this disposal take you each week?_____hours

5. Do you have hired help in your dairy operation?_____ If so, how many employees?_____ Are they full- or part-time?_____

6. Do family members help in the dairy operation?_____ If so, how many?_____ Are they full- or part-time helpers?_____

7. Are your dairy cows bred by bull or artificial insemination?_____ Who does this work?_____ How long does it take per week?

   _____

Dairy Capital

Please list the estimated value of the following items as they pertain to your dairy operation.

1. Total acres of land: $_____
2. Milking cows: $_____
3. Milking parlor: $_____
4. Milking machinery: $_____
5. Corrals, barns, and fences: $_____
6. Shop and machine sheds: $_____
7. Silage pit and graineries: $_____
8. Irrigation and drainage systems: $_____
9. Water development (springs, wells, and reservoirs): $_____
10. Horses used for dairying: $_____
11. Extras _____: $_____
12. Equipment (tractors, harrows, disks, bailers, etc.): $_____
13. Trucks: $_____

Costs

Please list the amount outlaid for each of the following per year.

1. Repairs (both machinery and buildings): $_____
2. Salt: $_____
3. Grinding: $_____
4. Publications: $_____
5. Veterinary costs: $_____
6. Gas and oil: $_____
7. Seeds: $_____
8. Fertilizer: $_____
9. Sprays: $_____
10. Marketing expense: $_____ (or price per 100 wt.)
11. Travel expense: $_____
12. Auction fees: $_____
13. Insurance (crops, buildings, stock, machinery): $_____
14. Telephone: $_____
15. Electricity: $_____
16. Taxes (property and water): $_____
17. Interest payments (chattle, personal, land): $_____
18. Breeding (services and semen): $_____
19. Feeds purchased: $_____
20. Concentrates and supplements: $_____
21. Labor hours per week times $3.00 per hour times 52 wks: $_____

Questionnaire on the Social Rankings of Gunnison Valley, Utah

Please list your first and second choices for the outstanding person in the Gunnison Valley in the following areas:

Category	First Choice	Second Choice
Business	_____	_____
Finance	_____	_____
Politics	_____	_____
Religion	_____	_____
Society	_____	_____

Questionnaire Concerning Employment in Gunnison Valley, Utah

1. Age_____
2. Sex: Male_____ Female_____
3. Home town_____
4. Current Residence_____
5. Previously Employed with_____
6. Where was your previous employment?_____
7. What was your previous occupation?_____
8. Do you work at the Gunnison Valley Dairy Association for any or all of the following reasons:
   a. location_____
   b. wage level_____
   c. type of work_____
   d. availability of work_____
9. Where would you work if you were not employed by the Gunnison Valley Dairy Association?
   a. inside the Gunnison Valley_____
   b. Outside the Gunnison Valley_____
10. What would be your probable occupation if you were not employed by the Gunnison Valley Dairy Association?_____

APPENDIX B

Regression results testing for physical economies of size for the dairies in Gunnison Valley, Utah.

EQUATION 2
****

SMPL VECTOR
1 56

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

AQ
C
AN

ITERATION	RHO
*********	***
1	0.49382

FINAL VALUE OF RHO = 0.49382
NO. OF ITERATIONS = 1

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.241512E+04	.425578E+03	.567490E+01
AN	-.199661E+02	.789220E+01	-.252986E+01

R-SQUARED = 0.3618

F-STATISTIC(1, 53) = .300445E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 2.1393

NUMBER OF OBSERVATIONS = 55

SUM OF SQUARED RESIDUALS = .126995E+07

STANDARD ERROR OF THE REGRESSION = .154794E+03

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.181E+06	-.334E+04
-.334E+04	.623E+02

EQUATION 4
****

SMPL VECTOR
1 56

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

AQ
C
AN
AV
AF

ITERATION	RHO
*********	***
1	0.40663
2	0.40803

FINAL VALUE OF RHO = 0.40803
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.124926E+04	.277028E+03	.450950E+01
AN	-.156801E+02	.464855E+01	-.337311E+01
AV	.635486E+01	.423621E+01	.150013E+01
AF	.189711E+02	.195265E+01	.971558E+01

R-SQUARED = 0.7773

F-STATISTIC(3, 51) = .593528E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.9137

NUMBER OF OBSERVATIONS = 55

THIS JOB WAS RUN AT 1703 HOURS ON 06/29/76

SUM OF SQUARED RESIDUALS = .443042E+06

STANDARD ERROR OF THE REGRESSION = .932046E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.767E+05	-.121E+04	-.186E+03	-.226E+03
-.121E+04	.216E+02	.210E+01	.798E+00
-.186E+03	.210E+01	.179E+02	.987E-02
-.226E+03	.798E+00	.987E-02	.381E+01

LINE 8
END

EQUATION 3
****4******

SMPL VECTOR
1 43

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

BQ
C
BN

ITERATION	RHO
1	0.73027
2	0.74892
3	0.75856
4	0.76395
5	0.76709

FINAL VALUE OF RHO = 0.76709
NO. OF ITERATIONS = 5

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.130423E+04	.402782E+03	.323806E+01
BN	-.158559E+00	.126498E+01	-.125346E+00

R-SQUARED = 0.6076

F-STATISTIC(1, 40) = .619866E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.5030

NUMBER OF OBSERVATIONS = 42

```
SUM OF SQUARED RESIDUALS =          .466892E+06

STANDARD ERROR OF THE REGRESSION =          .108038E+03

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

   .162E+06  -.502E+03
  -.502E+03   .160E+01

LINE    7
  CORC
```

THIS JOB WAS RUN AT 1656 HOURS ON 06/29/76

EQUATION 2
****

SMPL VECTOR
1 43

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

BQ
C
BN
BF
BV

ITERATION	RHO
*********	***
1	0.32659
2	0.35065
3	0.36005
4	0.36382

FINAL VALUE OF RHO = 0.36382
NO. OF ITERATIONS = 4

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.336583E+03	.217340E+03	.154865E+01
BN	-.120133E+01	.434375E+00	-.276565E+01
BF	.287504E+02	.347157E+01	.828167E+01
BV	.208713E+01	.123591E+01	.168874E+01

R-SQUARED = 0.8326

F-STATISTIC(3, 38) = .629981E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.7668

NUMBER OF OBSERVATIONS = 42

SUM OF SQUARED RESIDUALS = .199282E+06

STANDARD ERROR OF THE REGRESSION = .724173E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.472E+05	-.686E+02	-.609E+03	.151E+02
-.686E+02	.189E+00	.312E+00	-.125E+00
-.609E+03	.312E+00	.121E+02	-.213E+00
.151E+02	-.125E+00	-.213E+00	.153E+01

LINE 6
CORC

EQUATION 2
****

SMPL VECTOR
1 44

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

CQ
C
CN

ITERATION	RHO
*********	***
1	0.71546
2	0.71553

FINAL VALUE OF RHO = 0.71553
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.115547E+04	.176066E+03	.656272E+01
CN	-.106646E+01	.104164E+01	-.102383E+01

R-SQUARED = 0.5105

F-STATISTIC(1, 41) = .427641E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.5059

NUMBER OF OBSERVATIONS = 43

SUM OF SQUARED RESIDUALS = .391608E+06

STANDARD ERROR OF THE REGRESSION = .977313E+02

THIS JOB WAS RUN AT 1702 HOURS ON 06/29/76

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.310E+05	-.175E+03
-.175E+03	.109E+01

LINE 6
CORC

EQUATION 4
****

SMPL VECTOR
1 44

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

CQ
C
CN
CF
CV

ITERATION	RHO
*********	***
1	0.61172
2	0.61364

FINAL VALUE OF RHO = 0.61364
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.315937E+03	.151752E+03	.208194E+01
CN	-.113962E+01	.665283E+00	-.171299E+01
CF	.239982E+02	.309559E+01	.775239E+01
CV	.622100E+00	.149529E+01	.416038E+00

R-SQUARED = 0.8066

F-STATISTIC(3, 39) = .542134E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.5783

NUMBER OF OBSERVATIONS = 43

```
SUM OF SQUARED RESIDUALS =          .154744E+06

STANDARD ERROR OF THE REGRESSION =          .629904E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

   .230E+05  -.689E+02  -.319E+03  -.881E+01
  -.689E+02   .443E+00  -.802E-01   .328E-01
  -.319E+03  -.802E-01   .958E+01  -.543E+00
  -.881E+01   .328E-01  -.543E+00   .224E+01

LINE    8
  END
```

EQUATION 3
****

SMPL VECTOR
1 43

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

DQL
C
DN

ITERATION	RHO
*********	***
1	0.63211
2	0.63287

FINAL VALUE OF RHO = 0.63287
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.708665E+01	.129056E+00	.549116E+02
DN	-.570677E-03	.921931E-03	-.619003E+00

R-SQUARED = 0.3910

F-STATISTIC(1, 40) = .256855E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.6662

NUMBER OF OBSERVATIONS = 42

SUM OF SQUARED RESIDUALS = .275532E+00

STANDARD ERROR OF THE REGRESSION = .829958E-01

THIS JOB WAS RUN AT 1328 HOURS ON 07/09/76

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.662E+05	-.144E+04
-.144E+04	.316E+02

LINE 6
CORC

EQUATION 2
****

SMPL VECTOR
1 43

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

DQ
C
DN
DF
DV

ITERATION *********	RHO ***
1	0.50531
2	0.51373
3	0.51490

FINAL VALUE OF RHO = 0.51490
NO. OF ITERATIONS = 3

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.446663E+03	.129169E+03	.345797E+01
DN	-.852088E+00	.598044E+00	-.142479E+01
DF	.193611E+02	.283914E+01	.681934E+01
DV	.356503E+01	.186068E+01	.191598E+01

R-SQUARED = 0.7486

F-STATISTIC(3, 38) = .377185E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.7678

THIS JOB WAS RUN AT 1329 HOURS ON 07/09/76

NUMBER OF OBSERVATIONS = 42

SUM OF SQUARED RESIDUALS = .139962E+06

STANDARD ERROR OF THE REGRESSION = .606894E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.167E+05	-.415E+02	-.276E+03	-.342E+01
-.415E+02	.358E+00	-.185E+00	.375E-01
-.276E+03	-.185E+00	.806E+01	-.980E+00
-.342E+01	.375E-01	-.980E+00	.346E+01

LINE 6
CORC

EQUATION 2
****

SMPL VECTOR
1 44

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

EQ
C
EN

ITERATION	RHO
*********	***
1	0.44129
2	0.44188

FINAL VALUE OF RHO = 0.44188
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.123724E+04	.257379E+03	.480707E+01
EN	.481972E+01	.562237E+01	.857240E+00

R-SQUARED = 0.2110

F-STATISTIC(1, 41) = .109653E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.8941

NUMBER OF OBSERVATIONS = 43

SUM OF SQUARED RESIDUALS = .544718E+06

STANDARD ERROR OF THE REGRESSION = .115264E+03

THIS JOB WAS RUN AT 1328 HOURS ON 07/09/76

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.662E+05	-.144E+04
-.144E+04	.316E+02

LINE 6
CORC

EQUATION 3
****

SMPL VECTOR
1 44

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

EQ
C
EN
EF
EV

ITERATION	RHO
*********	***
1	0.52183
2	0.52360

FINAL VALUE OF RHO = 0.52360
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.546938E+03	.184137E+03	.297029E+01
EN	-.199404E+01	.348624E+01	-.571975E+00
EF	.187745E+02	.214585E+01	.874919E+01
EV	-.408292E+01	.472608E+01	-.863914E+00

R-SQUARED = 0.7663

F-STATISTIC(3, 39) = .426169E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.9687

NUMBER OF OBSERVATIONS = 43

THIS JOB WAS RUN AT 1328 HOURS ON 07/09/76

SUM OF SQUARED RESIDUALS = .161375E+06

STANDARD ERROR OF THE REGRESSION = .643260E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.339E+05	-.478E+03	-.201E+03	-.256E+03
-.478E+03	.122E+02	-.134E+01	-.261E+00
-.201E+03	-.134E+01	.460E+01	.347E+01
-.256E+03	-.261E+00	.347E+01	.223E+02

LINE 7
CORC

THIS JOB WAS RUN AT 1710 HOURS ON 06/29/76

EQUATION 1
****

SMPL VECTOR
1 40

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

FQL
C
FN

ITERATION	RHO
*********	***
1	0.61588
2	0.62140
3	0.62229

FINAL VALUE OF RHO = 0.62229
NO. OF ITERATIONS = 3

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.645421E+01	.284808E+00	.226616E+02
FN	.822364E-02	.405470E-02	.202817E+01

R-SQUARED = 0.3870

F-STATISTIC(1, 37) = .233600E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.6863

NUMBER OF OBSERVATIONS = 39

SUM OF SQUARED RESIDUALS = .381076E+00

STANDARD ERROR OF THE REGRESSION = .101486E+00

THIS JOB WAS RUN AT 1710 HOURS ON 06/29/76

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.611E-01	-.114E-02
-.114E-02	.164E-04

LINE 5
CORC

EQUATION 3
****

SMPL VECTOR
1 40

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

FQL
C
FN
FF
FV

ITERATION	RHO
1	0.41980
2	0.43779
3	0.44236

FINAL VALUE OF RHO = 0.44236
NO. OF ITERATIONS = 3

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.613317E+01	.179007E+00	.342621E+02
FN	.491515E-03	.243063E-02	.202217E+00
FF	.212971E-01	.302271E-02	.704568E+01
FV	-.392973E-02	.409041E-02	-.960719E+00

R-SQUARED = 0.7436

F-STATISTIC(3, 35) = .338344E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 2.1502

```
NUMBER OF OBSERVATIONS =    39

SUM OF SQUARED RESIDUALS =          .159399E+00

STANDARD ERROR OF THE REGRESSION =          .674852E-01

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

   .320E-01  -.315E-03  -.220E-03  -.161E-03
  -.315E-03   .591E-05  -.233E-05   .358E-06
  -.220E-03  -.233E-05   .914E-05   .130E-05
  -.161E-03   .358E-06   .130E-05   .167E-04

LINE    7
   CORC
```

THIS JOB WAS RUN AT 1716 HOURS ON 06/29/76

EQUATION 3
****

SMPL VECTOR
1 53

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

GQ
C
GN

ITERATION	RHO
*********	***
1	0.76020

FINAL VALUE OF RHO = 0.76020
NO. OF ITERATIONS = 1

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.147570E+04	.315561E+03	.467642E+01
GN	-.408480E+00	.286057E+00	-.142797E+01

R-SQUARED = 0.7284

F-STATISTIC(1, 50) = .134075E+03

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.1728

NUMBER OF OBSERVATIONS = 52

SUM OF SQUARED RESIDUALS = .439206E+06

STANDARD ERROR OF THE REGRESSION = .937236E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.996E+05 -.889E+02
-.889E+02 .818E-01

THIS JOB WAS RUN AT 1716 HOURS ON 06/29/76

EQUATION 2
****

SMPL VECTOR
1 53

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

GQ
C
GN
GF
GV

ITERATION	RHO
*********	***
1	0.36815
2	0.41340
3	0.44466
4	0.46624
5	0.48090
6	0.49071
7	0.49718
8	0.50140

FINAL VALUE OF RHO = 0.50140
NO. OF ITERATIONS = 8

THIS JOB WAS RUN AT 1716 HOURS ON 06/29/76

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.277076E+03	.181409E+03	.152736E+01
GN	-.104004E+00	.938850E-01	-.110778E+01
GF	.244945E+02	.292428E+01	.837624E+01
GV	-.262572E+00	.311125E+00	-.843944E+00

R-SQUARED = 0.8779

F-STATISTIC(3, 48) = .115030E+03

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.6013

NUMBER OF OBSERVATIONS = 52

SUM OF SQUARED RESIDUALS = .197443E+06

STANDARD ERROR OF THE REGRESSION = .641358E+02

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.329E+05	-.139E+02	-.457E+03	-.163E+02
-.139E+02	.881E-02	.124E+00	.219E-02
-.457E+03	.124E+00	.855E+01	.168E+00
-.163E+02	.219E-02	.168E+00	.968E-01

LINE 6
CORC

THIS JOB WAS RUN AT 1310 HOURS ON 06/30/76

EQUATION 1
****

SMPL VECTOR
1 51

COCHRANE-ORCUTT ITERATIVE TECHNIQUE

VARIABLES...

HQL
C
HN

ITERATION	RHO
*********	***
1	0.53240
2	0.53410

FINAL VALUE OF RHO = 0.53410
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.704602E+01	.326031E+00	.216115E+02
HN	.199813E-03	.228878E-02	.873010E-01

R-SQUARED = 0.2830

F-STATISTIC(1, 48) = .189500E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.9518

NUMBER OF OBSERVATIONS = 50

SUM OF SQUARED RESIDUALS = .419878E+00

STANDARD ERROR OF THE REGRESSION = .935278E-01

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.106E+00	-.743E-03
-.743E-03	.524E-05

LINE 5
CORC

THIS JOB WAS RUN AT 1310 HOURS ON 06/30/76

EQUATION 2
****

SMPL VECTOR
1 51

COCHRANE-CRCUTT ITERATIVE TECHNIQUE

VARIABLES...

HGL
C
HN
HV
HF

ITERATION	RHO
*********	***
1	0.66025
2	0.66078

FINAL VALUE OF RHO = 0.66078
NO. OF ITERATIONS = 2

INDEPENDENT VARIABLE	ESTIMATED COEFFICIENT	STANDARD ERROR	T-STATISTIC
C	.646215E+01	.191099E+00	.338158E+02
HN	-.119312E-02	.129829E-02	-.918991E+00
HV	.841722E-03	.101784E-02	.826971E+00
HF	.181027E-01	.184371E-02	.981866E+01

R-SQUARED = 0.7926

F-STATISTIC(3, 46) = .586105E+02

DURBIN-WATSON STATISTIC (ADJ. FOR 0 GAPS) = 1.6419

NUMBER OF OBSERVATIONS = 50

SUM OF SQUARED RESIDUALS = .121441E+00

STANDARD ERROR OF THE REGRESSION = .513812E-01

ESTIMATE OF VARIANCE-COVARIANCE MATRIX OF ESTIMATED COEFFICIENTS

.365E-01	-.226E-03	.248E-04	-.995E-04
-.226E-03	.169E-05	-.488E-07	-.281E-06
.248E-04	-.488E-07	.104E-05	-.644E-06
-.995E-04	-.281E-06	-.644E-06	.340E-05

LINE 6
CORC

APPENDIX C

A weighted average of dairy capital, costs, and returns for the dairies in Gunnison Valley, Utah.

Category	Weighted Average Per Milking Cow	GVDA Per Cow
Dairy Capital	$1.360.43	$ 727.08
Costs		
Repairs	$ 22.51	1.00
Feed	881.66	800.00
Publication(s)	.12	.08
Veterinary Service	19.10	5.83
Gas and oil	9.65	4.00
Sprays	.38	.17
Marketing Expense	31.94	24.79
Auction fees	1.55	1.60
Insurance	13.52	1.67
Telephone and electricity	20.77	8.23
Interest	53.66	34.00
Breeding	64.96	20.00
Taxes	8.00	11.17
TOTAL	$1,127.82	$ 912.54
Receipts		
Total milk receipts	$1,418.21	$1,050.70

VITA

Craig LeGrand Mangus

Thesis: Economic Analysis of Dairying in Gunnison Valley, Utah

Major Field: Economics

Biographical Information:

Personal Data: Born in Herlong, California February 13, 1953, son of Bennie M. and Nola S. Mangus; married Nadine McDermott November 7, 1975.

Education: Attended elementary school at D.R. Tolman Elementary in Bountiful, Utah; graduated from Viewmont High School in Bountiful, Utah in 1971; 1975, received a Bachelor of Arts degree from Utah State University in Economics with a minor in Spanish and a certificate of area study specialization in Latin America; completed the requirements for the Master of Arts degree at Utah State University in 1976.

Professional Experience: Undergraduate tutor and teachers aid in both Economics and Spanish. Graduate research assistant 1975 through 1976.

Professional Objective: Career in research and teaching with an orientation in marketing and development.