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The cost of retailing milk in Knoxville, Tennessee

George K. Criner

To the Graduate Council:

I am submitting herewith a thesis written by George K. Criner entitled "The cost of retailing milk in Knoxville, Tennessee." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Agricultural Economics.

Charles Sappington, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:
Carolyn R. Hodges

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)

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We have read this thesis
and recommend its acceptance:

Thomas D. Klindt

Luther H. Keller

Accepted for the Council:

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Vice Chancellor
Graduate Studies and Research

THE COST OF RETAILING MILK IN KNOXVILLE, TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee, Knoxville

George K. Criner

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To Francie

ABSTRACT

The objective of this study was to estimate the costs of retailing milk in Knoxville, Tennessee, in a convenient store and in a supermarket during August 1978.

The procedure employed was the economic-engineering method of analysis. The costs of retailing milk in each store were broken into five cost elements: the land and building cost element; the refrigeration equipment cost element; the utility cost element; the direct milk labor cost element; and the store services cost element.

The total annual cost of retailing milk in the representative Knoxville supermarket equaled $22,127.83 and $9,063.11 in the representative convenient store. The per quart equivalent cost of retailing milk equaled 4.041 cents in the supermarket and 8.286 cents in the convenient store.

Per quart equivalent milk retailing costs were also determined for each of the cost elements in the two stores. The supermarket had lower per quart equivalent milk retailing costs for all cost elements except for the direct milk labor cost element. The store services cost element in both stores had higher per quart equivalent milk retailing cost than any of the other cost elements. The per quart equivalent milk retailing cost for the store services cost element in the supermarket equaled 2.417 cents while in the convenient store it equaled 5.501 cents.

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CHAPTER I

INTRODUCTION

The Congressional Acts of the United States which helped establish the United States public policy surrounding the dairy industry are over forty years old. These acts include the Capper-Volsted Act of 1922, the Agricultural Adjustment Act of 1933, the Agricultural Adjustment Act of 1935, and the Agricultural Marketing Agreement Act of 1937. These acts were not the federal government's first dealing in agriculture, but they marked the beginning of a long history of government intervention into the marketing of agricultural products. The primary goal of the above acts was to raise the farmer income which was, during the 1920's and early 1930's, unusually low.[1] For the dairy sector there were three national goals: (1) to assure the public an ample supply of high quality milk and dairy products; (2) to achieve an orderly milk market; and (3) to provide dairy farmers with a fair income.[2]

The Clayton Act of 1914 first exempted farmers from the Sherman Anti-Trust Act. The Clayton Act exempted labor and agricultural groups from the Sherman Anti-Trust Act, provided the groups did not possess

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[1] Harold G. Halcrow, Food Policy for America (New York: McGraw-Hill Book Company, 1977) p. 143-144; John D. Black, Parity, Parity, Parity (Cambridge, Massachusetts: The Harvard Committee on Research in the Social Sciences, 1942) p. 140.

[2] Anthony S. Rojko, The Demand and Price Structure for Dairy Products (Washington, D.C.: U.S.D.A., 1957) Technical Bulletin No. 1168, p. 138; Halcrow, p. 274.

capital stock.[3] The portion of the Clayton Act concerning capital stock disallowed the cooperatives from owning trucks, warehouses, processing plants, etc. Without owning equipment the cooperatives could not become very economically independent. It was the purpose of the Capper-Volstead Act to remove the no capital stock clause from the cooperative laws as the act states that "persons engaged in the production of agricultural products as farmers, planters, ranchmen, dairymen, nut or fruit growers may act together in associations, corporate or otherwise, with or without capital stock. . . ."[4] The Capper-Volstead Act reaffirmed the farmers' right to act collectively and enabled the farmers' groups to own capital stock.

The Capper-Volstead Act permits the existence of the many dairy cooperatives. Class I milk prices (fresh fluid milk for consumption) are set either by the Secretary of Agriculture or by the negotiations between the dairy cooperatives and the milk processors and distributors. Whichever price is higher, the price set by the Secretary of Agriculture or the negotiated price, is used.

The cost of retailing milk has traditionally been determined on a quart equivalent basis (one gallon of milk equals four quart equivalents). The determining of per quart equivalent milk retailing costs is achieved by dividing the total cost of retailing milk by the number of

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[3]Edwin G. Nourse, The Legal Status of Agricultural Co-operation (New York: The Macmillan Company, 1927), p. 247.

[4]O. B. Jenness, The Cooperative Marketing of Farm Products (Philadelphia: J. B. Lippincott Company, 1923), Lippincott's Farm Manuals, Kary C. Davis, Editor, p. 237.

milk quart equivalents sold during a certain time period. Increasingly the dairy cooperatives are obtaining prices over the Secretary of Agriculture's price for Class I milk.[5] By influencing milk prices, the dairy cooperatives affect the quantity of milk sold which in turn effects the quart equivalent cost in retailing milk.

The Agricultural Agreement Act of 1933 was the first federal government action involving "the pricing in farm products on a national level."[6] The Agricultural Agreement Act of 1933 contained, among other things, two short paragraphs authorizing the Secretary of Agriculture to enter marketing agreements with and to license processors, associations of producers, and others engaged in handling of certain agricultural commodities.[7] Fresh fruits and vegetables and milk were among the several agricultural products eligible for the marketing agreements and licenses.

Many years have passed since this early legislation concerning the dairy industry was enacted by Congress. The Capper-Volstead Act of 1922, the Agricultural Agreement Acts of 1933 and 1935, and the Agricultural Marketing Agreement Acts of 1937 seemed to achieve at least two of the three national goals for the dairy sector. Milk

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[5]Paul W. MacAvoy, Editor, Federal Milk Marketing Orders and Price Supports (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1977), p. 13.

[6]Irving Dubov and E. L. Rawls, American Farm Price and Income Policies: Main Lines of Development 1920-1973, (The University of Tennessee Agricultural Experiment Station, 1974), Bulletin 539, p. 8.

[7]Carl McFarland, Milk Marketing Under Federal Control (New York: Central Printing Company, 1946), p. 8.

strikes and violence involving the participants of the dairy industry have diminished and an orderly milk market has developed since the passing of the above legislation.[8] The goal of providing dairy farmers a fair income, which in this case meant a higher income, was also met.[9]

The third national goal concerning the dairy industry, that of having an ample supply of milk and dairy products available to the public, has not been as clearly met as the others. Harold G. Halcrow states that consumers have been assured "an abundant supply of high quality milk" but that "per capita consumption of all milk on a milk equivalent basis declined steadily from 653 pounds in 1960 to 557 pounds in 1973.[10] Roland W. Bartlett noticed this decline of per capita milk consumption and attributed it to the high price of milk under the Federal Milk Order system.[11] There has been a downward trend in per capita milk consumption for many years. Whether this trend is due to personal consumption preferences, the price of milk, or both, is not within the scope of this paper. However, the price of milk affects the quantity sold, and this is a factor in determining the cost of retailing milk.

It can be argued that the Federal Milk Orders and its pricing system are a form of monopoly control over milk and that this system is

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[8]Halcrow, p. 275.

[9]Black, p. 401; Frederick Lundy Thomsen and Richard Jay Foote, Agricultural Prices (New York: McGraw-Hill Book Company, Inc., 1952), p. 425.

[10]Halcrow, p. 275.

[11]R. W. Bartlett, The Price of Milk (Danville, Illinois: The Interstate Printers and Publishers, 1941), pp. 1-5.

unfair and unjust to the public.[12] Some who feel this way are Peter Barton Hutt, John E. Kwoka, Jr., and the United States Department of Justice.[13] The above parties, as well as other groups, feel that a change in the United States' public policy concerning the production and marketing of dairy products is necessary and overdue.

There have been several suggested possible alternatives to the current marketing structure of the dairy industry. Two alternatives examined by the Department of Justice were the reducing of Class I price differentials and the phased deregulation of milk marketing.[14] The first alternative would involve the reduction of the price of Class I milk set by the Secretary of Agriculture. This alternative suggests that the price of fluid milk is too high and that the supply of milk might not be adequate.

The Department of Justice's second possible alternative would be the phased deregulation of milk marketing. The Department of Justice points out that milk marketing under the absence of regulation would be

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[12]The Federal milk pricing system uses at least two milk classes, Class I and Class II. Class I milk is Grade A and is used as fluid milk for consumption. Class II milk is Grade A and Grade B and is used for manufactured dairy products. Class I prices are set by the Secretary of Agriculture at levels which the Secretary feels are "reasonable." Cooperatives recently (1975) were obtaining prices for Class I milk over these "reasonable" prices set by the Secretary of Agriculture "for over half the fluid milk marketed."* This payment for milk of prices over the Secretary of Agriculture's prices is an area where the pricing structure is receiving charges of being unjust. *(Source: a paper presented by Peter Barton Hutt, at the Conference on Milk Prices and the Market System held by the Community of Nutrition Institute on December 4, 1975 in Washington, D. C.)

[13]John E. Kwoka, Jr., Pricing Under Federal Milk Market Regulation: Theory, Objectives, and Impact, Unpublished Ph. D. dissertation, University of Pennsylvania, 1972; MacAvoy.

[14]MacAvoy, pp. 141-159.

extremely different from the current system and that predictions of the effects of deregulation would be difficult to make. Some instability might return to the dairy industry if it were deregulated and it is possible that some effects could reach the retail level and affect the cost of retailing milk.

I. PROBLEM

On July 1, 1975, a five-year Southern Regional Cooperative Project was begun to "estimate the impact of selected alternative milk pricing systems at the producer, processor, retailer, and consumer levels in terms of operational efficiency, equity, and security effects on each of the market participants." The study is entitled Market Performance of Selected Milk Pricing Systems for the Southern Region, and shall examine some possible alternatives to the current dairy marketing structure. Operational efficiency deals mainly with the per unit costs of milk marketing at each level of the marketing chain including the consumer level. Equity and security effects are concerned with the net revenue of the market participants and consider the variability of the market participants' net revenue over time. The regional project was divided into several parts and assigned to different universities in the southern region. The University of Tennessee was assigned the task of estimating the cost of retailing milk in representative small and large stores. The thought was that these two costs would represent boundaries of costs for all stores in Knoxville, Tennessee, and could be easily adjusted to reflect different costs for different locations and/or time periods.

II. OBJECTIVE

The objective of this study is to estimate the cost of retailing milk in a supermarket and convenient store in Knoxville, Tennessee in 1978.

III. JUSTIFICATION

This study is part of the Southern Regional Cooperative Project entitled Market Performance of Selected Milk Pricing Systems for the Southern Region which is examining the impact of selected alternative milk pricing systems at the various marketing levels.

There are twelve universities as well as the United States Department of Agriculture working on this Southern Regional project. The University of North Carolina and the United States Department of Agriculture have been developing a model to help examine the impact of selected alternative milk pricing systems at the various marketing levels. The University of Tennessee is estimating the cost of retailing milk while other universities are compiling information pertaining to other facets of the milk marketing chain.

The information gathered by the universities and the U.S.D.A. shall be examined with the help of a milk marketing model at the University of North Carolina. The results obtained from this model may have policy implications which may affect future policies concerning the dairy industry. Public policy changes to the dairy industry may endure for several decades making it desirable that any proposed changes be thoroughly examined.

Studies have shown an inverse relationship between grocery store size and the average quart equivalent cost of retailing milk (quart equivalents are the total gallons of milk sold divided by four).[15] An important factor contributing to this relationship is that larger stores have higher milk sales volumes than convenient stores, which tends to reduce the average quart equivalent cost of retailing milk. Through this size relationship, it is assumed that the analysis of the representative supermarket and convenient store will produce approximate boundaries of the cost of retailing milk in Knoxville, Tennessee. These costs have been estimated in such a manner that they can easily be adjusted to produce similar boundaries of the costs of retailing milk in areas other than Knoxville, Tennessee.

IV. REVIEW OF LITERATURE

Two studies were found which estimated the costs of retailing milk, and in both, the economic-engineering method of analysis was used.[16] In 1951, Korzan and Pfanner conducted a study to determine the costs of retailing milk in Portland, Oregon. All costs involved the retailing of milk in this study were divided into eight cost elements. The eight cost elements were: refrigeration expenses, direct labor to milk, license and fees, checking stand expenses, store services,

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[15]Gerald E. Korzan and John A. Pfanner, Jr., "Costs of Retailing Milk Among a Group of Grocery Stores in Portland, Oregon." Oregon State College Agricultural Experiment Station Bulletin 504, October, 1951; Joe T. Davis, "The Relative Costs of Returnable versus Disposable Milk Containers to the Retailer," (unpublished Master's thesis, The University of Tennessee, 1972).

[16]Korzan and Pfanner; Davis.

advertising, administrative overhead, and miscellaneous. Thirty-one stores were used in this study and it was found that the per unit costs of retailing milk ranged from 7.15 cents in the smallest store to .97 cents in the largest store.[17]

In 1972, Joe T. Davis conducted a study in Knoxville, Tennessee, and determined the cost of retailing milk in returnable plastic and disposable containers in three different grocery stores.[18] The milk retailing costs were separated into four cost elements which consisted of equipment costs, investment in land and building, labor costs, and utility costs. The per quart equivalent costs of retailing milk in disposable containers was 1.23 cents, 1.18 cents, and 1.15 cents for the small, medium and large Knoxville grocery stores, respectively.[19]

Although only two studies were found which estimated the costs of retailing milk, several studies were examined which used the economic-engineering method of analysis which was the method used in this study. The procedure involved with the economic-engineering method of analysis is virtually identical to the procedures of the building block method and the synthetic method of cost analysis. These names seem to be different titles for the same method of analysis.[20]

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[17] Korzan and Pfanner, p. 6.

[18] Davis.

[19] Ibid., p. iii.

[20] For verification of this, the reader may wish to read the following: Guy Black, "Synthetic Method of Cost Analysis in Agricultural Marketing Firms," Journal of Farm Economics, 37, No. 2 (1955), and L.L. Samment and B. C. French, "Economic-Engineering Methods in Marketing Research," Journal of Farm Economics, 35, No. 5 (1953), and B. C. French, L.L. Samment and R. G. Bressler, "Economic Efficiency in Plant Operations with Special Reference to the Marketing of California Pears," Hilgardia, 24 (19), July 1956.

L. L. Samment and B. C. French, in an article entitled "Economic-Engineering Methods in Marketing Research," state that "if marketing research is analytical, the methods of study . . . in one phase of marketing may be applicable in other phases. This interchange of methods . . . can apply also to different commodities."[21] Samment and French state that once "the stage organization of production processes" is recognized, "aggregate cost studies may reveal little with regard to the effect on costs and efficiency of variations in individual stage techniques. This puts a special burden on accounting cost studies because accounting records alone often are not detailed enough to permit cost allocations to particular plant stages."[22] Samment and French point out that some of the difficulties of using accounting cost data in marketing research can be overcome with the help of engineering data. They state that "engineering data may be used only to supplement and 'rationalize' accounting record data."[23]

Guy Black in an article points out that the synthetic method of cost analysis can come to bear more directly on questions of economics of scale than can cross-sectional studies.[24] The synthetic method of cost analysis is one form of the economic-engineering method.

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[21]Samment and French, p. 924.

[22]Ibid., pp. 925-926.

[23]Ibid., p. 926.

[24]Black, p. 273.

V. PROCEDURE

Economic-engineering models are sometimes entirely hypothetical; in other words, there are no existing situations which can be examined as guides to the models. In such cases, much work must be done in the synthesizing of the hypothetical models. For example, machine-man operation relationships, when using a hypothetical situation, must be placed together with machine specifications and not merely examined.

The objective of this study is to estimate the costs of retailing milk in Knoxville, Tennessee, in a convenient store and in a supermarket. This type of objective necessitated the examination of existing Knoxville stores. Two Knoxville stores were chosen, one to represent the supermarket and the other to represent the convenient store. The process of milk moving through the stores and the milk-related facilities of each store were examined and used as foundations for the economic-engineering models.

The costs involved in the selling of milk in each of the two stores were separated into five cost elements.[25] The five cost elements were land and building costs, refrigeration equipment costs, utility costs, direct milk labor costs, and store services costs. Many of the costs could be determined directly, such as some of the land and building costs and the refrigeration equipment costs. These costs were determined by calculating the costs of the items concerned with the retailing of milk and prorating costs to milk according to the percent of the items (which was sometimes space) that milk occupied. A few

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[25] Similar to the cost separations made by Korzan and Pfanner except that five cost elements are being used instead of eight.

costs, however, such as the portion of the cashiers' wages attributable to the retailing of milk and the cost of lighting the store which should be attributed to milk, had to be estimated indirectly.

Much of the indirect costs were contained in the store services cost element. The store services cost element consisted of most of the goods and services in the store which were not particular to any one product but were present for the facilitation of the store. Korzan and Pfanner, in their study concerning the costs of retailing milk, used milk's percent of total sales as the percent of indirect costs attributable to milk.[26] According to this method, if milk sales amounted to five percent of total store sales, then five percent of all indirect costs would be considered costs of retailing milk. The percent of total sales method of allocating indirect costs was used in this study because it appeared to be the best method available to allocate these costs.

An alternative to using the percent of total sales method would be to examine each cost's exact relationship with milk and scientifically determine the portion attributable to the retailing of milk. For example, a time and motion study on the cashiers to determine what percent of their time (cost) is attributable to milk might proceed as follows. First, a thousand or more observations of the cashiers would need to be made where the observer notes whether the cashiers are handling milk or not. Then the portion of the observances of the cashiers where they were handling milk would equal the portion of the cashiers' time which milk actually occupied. Similar examinations of

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[26]Korzan and Pfanner, p. 5.

other store services' items would need to take place and this would require more resources than this study could afford which was why the percent of total sales method was adopted.

The facilities of each store were examined. The original costs of items in the stores and the original costs of the land and buildings were not the costs used in this study. Since original costs may have been out-of-date, replacement costs for all the store facilities were used. All information concerning the costs of retailing milk was taken during August 1978. Many of the costs observed during that month may have risen, since the United States has continued to experience inflation. The cost elements have been broken down such that the updating of this study would require only the replacement of costs which have changed. This assumes that the store layouts and the movement of milk in each store has remained the same.

The costs in this study are expressed in annual terms as of August 1978. The detailed determination of costs is given under the different cost elements of Chapters II and III for the supermarket and convenient store, respectively. Milk in this study refers to all fresh fluid milk items which include the different butterfat percent milks (1, 2, 3.5, and other percent butterfat milks), the different fresh cream items, buttermilk, chocolate milk, and half and half.

CHAPTER II

THE COSTS OF RETAILING MILK IN THE REPRESENTATIVE SUPERMARKET

The supermarket retailed two brands of milk—its own brand and a brand of a local dairy. The method of handling the two brands differed. The supermarket's brand milk was delivered onto the store's receiving dock at which time the store began incurring marketing costs. From the receiving dock, the milk was taken to a storage cooler where it stayed until periodically moved to a display cooler. The milk remained in the display cooler until purchase and removed from the store by the customers. Once removed from the supermarket by the customers, the retailing costs ceased.

The local dairy's brand was delivered to the supermarket, placed in the storage cooler, and periodically stocked in the display cooler by the dairy's employees. The supermarket's employees, except for the cashiers, did not handle the dairy's brand of milk. Employees of the local dairy would travel to the supermarket two or three times each day to stock their milk. The local dairy used a portion of the supermarket's storage and display coolers. The supermarket's cost of retailing the dairy's brand of milk resembled that of the supermarket's brand except for the lack of direct milk labor costs.

The procedure of retailing the two milk brands were different and it was only the cost of retailing the supermarket's brand which was estimated. Throughout this chapter, references to milk refer only to the supermarket's brand of milk.

I. DESCRIPTION OF THE SUPERMARKET

The representative Knoxville supermarket had 35,280 square feet of floor space which made it one of Knoxville's larger supermarkets. The supermarket was one of two major tenants in an outdoor shopping plaza. The shopping plaza was located on one of Knoxville's busiest four-lane highways and was one block from access to Knoxville's interstate highway system.

The supermarket was typical of Knoxville's newer and larger supermarkets. Some of its components were a delicatessen, a meat-cutting room, a fresh produce packaging room, several storage freezers, eleven shopping aisles, and eleven checkout counters. The flow of packaged milk through the supermarket was basically the same as Knoxville's other supermarkets. Once received at the truck unloading dock, the milk was taken to a storage cooler and from there, placed in a display cooler as needed.

II. SUPERMARKET LAND AND BUILDING COST ELEMENT

Several Knoxville real estate agents and appraisers were contacted in order to gain information about supermarkets' property arrangements.[27] According to those consulted, operators of supermarkets prefer to lease the land and building space which their store is to occupy rather than to purchase it. It was the agents' and appraisers' general consensus that a replacement lease for the representative

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[27]The consulted Knoxville real estate agents and appraisers were Scott Collins, William M. Curtis, and Richard E. Wallace, Jr.

supermarket would be one of twenty years duration. The annual lease payment would be based on the square footage of the building, and the supermarket would be entitled to the free use of the parking lot. An annual lease payment of $2.92 per square foot of building space was used in this study which was an average of the three estimates given by the Knoxville real estate agents and appraisers. Under this type of lease arrangement, the supermarket would be responsible for only minor building repairs.[28]

Since the supermarket's land and building lease arrangement was based on building square footage, the prorating of the cost of this cost element was also done on a square foot basis. The determining of milk's portion of the annual land and building cost was achieved by calculating the square feet of the supermarket occupied by milk and by determining the portion of the annual store services land and building costs attributable to milk. Milk directly occupied building floor space in the storage cooler, the display cooler, and in the dairy crate storage area.

The storage cooler occupied 356.5 square feet of floor space.[29] The supermarket's dairy crates occupied 139.5 square feet of the storage cooler with the remainder of the storage cooler being occupied by eggs and other nondairy items. Milk occupied 75 percent of the dairy crates in the storage cooler and consequently was considered as occupying 75 percent, or 104.63 square feet, of the 139.5 square feet which the dairy

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[28]In this study, the lessor was responsible for building repairs of $500.00 or more.

[29]Storage cooler information received from Brink's, Inc., Knoxville, Tennessee.

crates occupied in the storage cooler. The remaining 25 percent of the dairy crates were occupied with yogurt, cottage cheese, and other dairy products.

The 12-foot section of display cooler which contained the milk occupied 62 square feet of floor space. This included the actual 41 square feet which the display cooler occupied and 21 square feet of aisle space directly in from of the display cooler. It was assumed that items were responsible for the floor area which their display set-up occupied, for the aisle space directly adjacent to each item's display set-up and for each item's storage and preparation areas.[30] On a normal aisle with display set-ups on each side, the items on the display set-ups were responsible for one-half of the aisle space. Milk occupied 74 percent of the display cooler and was responsible for that percent of the building square footage which the display cooler occupied. Seventy-four percent of the 62 square feet which the display cooler occupied equals 45.88 square feet which equals the building square footage at the display cooler attributable to the retailing of milk. The remaining 26 percent of the display cooler was occupied by yogurt, cottage cheese, and other non-milk dairy items.

The final area of directly occupied floor space by milk was the dairy crate storage area. Although the dairy crates were empty in the dairy crate storage area, the dairy products were considered as

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[30]Once this floor allocation is done, the only supermarket floor areas unaccounted for are the store services floor areas which are prorated to items according to the percent of total sales method and thus total store square footage has been accounted for.

occupying this area since the crates were present in the store due to the retailing of the dairy products. The dairy crate storage area occupied 46 square feet of floor space. Milk crates occupied 75 percent of all dairy crates and were therefore prorated with 75 percent of the dairy crate storage area which equaled 34.5 square feet.

The milk directly occupied supermarket floor space in three areas: in the storage cooler; in the display cooler; and in the dairy crate storage area. The total area which milk occupied in these areas equaled 185.01 square feet. The annual cost of this area equals the square footage (185.01) times the annual square foot cost ($2.92) which equals $540.23. Table 1 summarizes and lists these data.

The indirect land and building costs attributable to the retailing of milk stemmed from the existence of the store services area. Store services items are those items present for facilitation of the store. The truck unloading dock area, the aisle in the back of the store used for transferring goods to the front of the store, the employees' room, the two store offices, the rest rooms, and the checkout area made up the store services area. The supermarket store services building square footage totaled to 4,103 square feet (Table 1). The annual cost of the store services area equaled the annual building square foot cost ($2.92) times the store services square footage (4,103), which equaled $11,980.76. Milk's portion of this cost equaled .0251 since this portion was the portion of the total annual store sales which

TABLE 1. Floor Space and Costs Associated with the Knoxville Supermarket's Land and Building Cost Element, 1978

Item	Amount
Directly occupied areas by milk	---square feet---
Storage cooler	104.63
Display cooler	45.88
Dairy crate storage area	34.50
Total floor space directly occupied by milk	185.01
	---dollars---
Total cost of directly occupied areas	540.23
Store services area	---square feet---
Truck unloading dock area	243.00
Store unloading aisle	840.00
Employee room and rest rooms	240.00
Checkout area and front and rear offices	2780.00
Total store services area	4103.00
	---dollars---
Total cost of store services area	11980.76
Store services land and building cost attributable to milk[a]	300.72
Total land and building cost attributable to milk[b]	840.95

[a]Prorated by the percent of total sales method, milk's portion of the store services land and building cost equaled $300.72 ($11,980.76 x .0251).

[b]Total supermarket land and building cost attributable to the retailing of milk equaled the direct land and building cost ($540.23) and the indirect, or store services, land and building cost ($300.72) which total to $840.95.

consisted of total annual milk sales.[31] The annual store services land and building cost attributable to the retailing of milk, therefore equaled $300.72 ($11,980.76 x .0251).

The annual direct land and building cost attributable to the retailing of milk equaled $540.23 and the indirect annual land and building cost attributable to the retailing of milk equaled $300.72. These figures total $840.95 and equal the annual land and building cost attributable to the retailing of milk.

III. SUPERMARKET REFRIGERATION EQUIPMENT COST ELEMENT

The supermarket used a 12.5 year depreciation period for all depreciable equipment and this depreciation period was used in this study. Depreciable equipment is equipment which is not consumed in a year or less. The cost of equipment was to be charged to the supermarket annually with equal charges being made each year. Part of the cost of the equipment was the opportunity cost of the investment in the

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[31] Milk sales during the month of August 1978 equaled 2.51 percent of total store sales. Milk sales experience seasonality and it was thought that the 2.51 figure for milk's percent of total store sales would need to be adjusted to reflect an average 1978 month's milk sales since any one month's milk sales could be different from the average. An average month of milk sales in the east-south-central area of the United States during the year 1978 equaled 61.87 million pounds. Milk sales for the same region of the United States for the month of August 1978 equaled 62.30 million pounds. Source: United States Department of Agriculture, Agricultural Marketing Service Dairy Division, Federal Milk Order Market Statistics (Washington: Government Printing Office, 1978-1979), monthly summaries from February 1978 to January 1978, FMOS 218-229.

There did not seem enough differences in 1978 average monthly milk sales for this region and August's milk sales to warrant adjustment.

equipment.[32] The equal annual costs to be charged to the supermarket for the equipment must include, or recover, the cost of the equipment and the opportunity cost of the investment. Equal annual costs to recover the equipment cost and the opportunity cost are capital recovery amounts or costs.

Each annual capital recovery cost consisted of an equipment recovery cost and some opportunity cost. In the first year of owning the equipment, there was an opportunity cost on the entire cost of the equipment. During the second year, there was an opportunity cost on less than the entire cost of the equipment as some of the equipment was used in the first year (depreciated). In each successive year, there was less of an opportunity cost as each year there was less capital remaining in the equipment. The portion of the annual capital recovery cost which recovered the cost of the equipment increased each year as the portion consisting of opportunity cost decreased.

The following equation was used to determine the annual capital recovery costs for most of the depreciable equipment: $P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} + \ldots + A(1.08)^{-12.5}$. The "P" equals the total cost of the equipment and the "A"'s equal the annual capital recovery costs which recover "P" and the opportunity cost of the investment.

The above capital recovery equation can be changed to $P = A(1.08)^{-1} + (1.08)^{-2} + (1.08)^{-3} + \ldots + (1.08)^{-12.5}$, and changed further to

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[32]The prevailing interest rate during August 1978 for deposits over $1,000 which were agreed to be left in deposit for over six months equaled eight percent which is the interest rate and opportunity cost used throughout this study. (Source: City and County Bank of Knoxville, Tennessee.)

P = A(7.719927), without affecting its equality. The equation P = A(7.719927) includes the eight percent prevailing rate of interest, the 12.5 year depreciation period, and a zero salvage value for equipment.[33]

The representative supermarket used two refrigeration units in its retailing of milk. Upon delivery to the supermarket, the milk was taken to a storage cooler. These coolers were necessary for the retailing of milk, and therefore a portion of the coolers' costs were included in the costs of retailing milk. The original cooler costs were not examined as the cooler costs were to reflect August 1978 costs. Coolers were priced in August 1978 which had the same physical dimensions and cooling capacities as the existing coolers.

The cost of a replacement storage cooler equaled $9,872.00.[34] The cooler accessories cost $5,814.00 and the freight and installation on the cooler and its components equaled $3,600.00. The sales tax (six percent) on all the storage cooler components equaled $1,157.16 which brought the total storage cost to $20,443.16 (Table 2).

Display coolers are usually purchased in 24-foot sections.[35] The cost of a 24-foot replacement display cooler with its accessories cost $8,909.78. The freight and installation on the cooler components

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[33]A zero salvage value was assumed for all coolers. Some equipment in the store services cost element were assigned a low salvage value and a compensating change in the equation shall be made.

[34]The storage cooler information was received from Butcher's Supply Company, Knoxville, Tennessee.

[35]The display cooler information was received from Brink's, Inc., Knoxville, Tennessee.

TABLE 2. The Knoxville Supermarket's Storage Cooler Costs Associated with the Retailing of Milk, 1978

Item	Cost
Cooler	$ 9,872.00
Cooler Accessories	5,814.00
Freight and installation	3,600.00
Subtotal	19,286.00
Sales Tax	1,157.16
Total storage cooler cost	20,443.16
Storage cooler annual capital recovery cost	2,648.10
Storage cooler annual capital recovery cost attributable to the retailing of milk[a]	777.22

[a]Milk was prorated 29.35 percent of the annual storage cooler capital recovery cost as milk occupied that percent of the storage cooler.

equaled $1,400.00. The sales tax (6 percent) on all the cooler components equaled $618.59 which brought the total 24-foot display cooler's cost to $10,928.37 (Table 3).

The capital recovery equation (P = A(7.719927) used to determine the annual capital recovery cost of the display cooler equaled $10,928.37 = A(7.719927) with "A," the annual capital recovery cost equaling $1,415.61. The supermarket's dairy products were contained in 12 feet of display cooler and the annual capital recovery cost of the 12 feet of display cooler equaled $707.81 ($1,415.61 / 2). Milk occupied 74 percent of the 12 feet of display cooler and was prorated that percent of its cost which equaled $523.78 ($707.81 x .74, Table 3).

The supermarket refrigeration equipment cost element consisted of the annual costs of the storage cooler and display cooler which were attributable to the retailing of milk. The annual storage cooler cost attributable to the retailing of milk equaled $777.22 (Table 2). The annual display cooler cost attributable to the retailing of milk equaled $523.78 (Table 3). Summing the above refrigeration costs, the total annual refrigeration equipment cost attributable to the retailing of milk equaled $1,301.00.

IV. SUPERMARKET UTILITY COST ELEMENT

Both the direct and indirect methods of cost determination were used in determining the annual utility cost attributable to the retailing of milk. The direct utility cost attributable to the retailing of milk consisted of the electricity cost of cooling the milk in the two coolers. The indirect utility cost attributable to the

TABLE 3. The Knoxville Supermarket's Display Cooler Costs Associated with the Retailing of Milk, 1978

Item	Cost
24 foot display cooler and accessories	$ 8,909.78
Freight and installation	1,400.00
Subtotal	10,309.78
Sales tax	618.59
Total 24 foot display cooler cost	10,928.37
24 foot display cooler annual capital recovery cost	1,415.61
12 feet of display cooler annual capital recovery cost	707.81
12 feet of display cooler annual capital recovery cost attributable to the retailing of milk[a]	523.78

[a]Milk was prorated 74 percent of the annual capital recovery cost of 12 feet of display cooler as milk occupied that percent of the cooler.

retailing of milk consisted of a portion of store services utilities cost. Examples of store service utility usage are the electrical requirements of the cash registers, the store lights, the electric front doors, and the use of water in the rest rooms and on the floors.

The direct utility cost of retailing milk was determined from technical data concerning coolers and from knowing the rate which the supermarket paid for kilowatt-hour electrical usage.[36]

A replacement storage cooler for the supermarket used 5.071 kilowatt-hours of electricity for each hour that the compressor was running.[37] The refrigeration industry's standard running time for cooler compressors is 18 hours per day.[38] Using the standard daily running time for cooler compressors, the daily kilowatt-hour usage of the storage cooler equaled 91.278 kilowatt-hours. Assuming the storage cooler cools 365 days per year, the annual kilowatt-hour usage of the storage cooler equals 33,316.470. The annual cost of the electrical usage equals the annual kilowatt-hour usage (33,317.200) times the cost per kilowatt-hour ($.03) which equals $999.49 per year (Table 4).

A 24-foot replacement display cooler for the supermarket used 7.484 kilowatt-hours of electricity for each hour that the compressor

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[36]The per kilowatt-hour cost used in this study for the supermarket was $.03. Earl Graham, head of Knoxville Utilities Board's Commercial Accounts Department, gave that rate as an approximate to what the supermarket actually paid for electricity usage.

[37]Original cooler data were not used as prices were to be current (August 1978). The replacement coolers, however, had the same physical dimensions and cooling capacities as the original coolers. Technical data concerning the storage cooler received from Brink's, Inc., Knoxville, Tennessee.

[38]Brink's, Inc., Knoxville, Tennessee; Butcher's Supply Company, Knoxville, Tennessee.

TABLE 4. The Knoxville Supermarket's Storage Cooler Utility Costs Attributable to the Retailing of Milk, 1978

Item	Amount
	---kilowatt-hours---
Storage cooler electrical usage per hour of compressor running time	5.071
Daily storage cooler electricl usage	91.278
Annual storage cooler electrical usage	33,316.470
	---dollars---
Supermarket cost per kilowatt-hour used	0.03
Annual storage cooler electrical usage cost	999.49
Annual storage cooler electrical usage cost[a] attributable to the retailing of milk	293.35

[a]Milk occupied 29.35 percent of the storage cooler and was responsible for that percent of the annual electrical usage cost ($999.49 x .2935).

was running.[39] Using the refrigeration industry's standard 18 hours per day of running time for cooler compressors, the display cooler used 134.712 kilowatt-hours per day. Assuming the display cooler cools 365 days per year, the annual cost of this electrical usage equals the annual kilowatt-hour usage (49,169.880) times the cost per kilowatt hour ($.03) which equals $1,475.10 (Table 5). The supermarket's dairy products were contained in 12 feet, or one-half, of the 25-foot display cooler section so the annual utility cost attributed to the 12-foot is one-half of $1,475.10 or $737.55. Milk occupied 74 percent of 12 feet of display cooler and was responsible for that percent (74) of its annual electricity cost ($737.55) which equals $545.79. The annual display cooler electricity cost attributable to the retailing of milk equaled $545.79 (Table 5).

There were many sources of store service utility cost. The main source of store services utility cost was the lighting, cooling and heating of the supermarket. There was only one electricity meter for the entire supermarket so the electricity usage for the store services items had to be estimated. Earl Graham, head of the Knoxville Utilities Board's Commercial Accounts Department, was contacted to estimate the cost of the store service utility usage.

Mr. Graham stated that it costs approximately one dollar per year per square foot of building space to light, cool and heat grocery stores. He further stated that all other store services electrical usage for items such as the outside lighting, the cash registers, the electric doors, etc.

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[39]Original cooler data were not used as prices were to be current (August 1978). The replacement coolers, however, had the same physical dimensions and cooling capabilities as the original coolers. Technical data concerning the display cooler received from Butcher's Supply Co., Knoxville, Tennessee.

TABLE 5. The Knoxville Supermarket's Display Cooler Utility Costs Attributable to the Retailing of Milk, 1978

Item	Amount
	---kilowatt hours---
24 foot display cooler electrical usage per hour of compressor running time	7.484
Daily 24 foot display cooler electrical usage	134.712
Annual 24 foot display cooler electrical usage	49,169.880
	---dollars---
Supermarket cost per kilowatt-hour used	0.03
Annual 24 foot display cooler electrical usage cost	1,475.10
Annual electrical usage cost for 12 feet of display cooler	737.55
Annual display cooler electrical usage[a] cost attributable to the retailing of milk	545.79

[a]Milk occupied 74 percent of the 12 feet of display cooler and was responsible for that percent of the annual electrical usage cost ($737.55 x .74).

would amount to about 5 percent of the annual lighting, cooling and heating cost. The entire water usage of the store was considered as a store services item since there did not appear to be any particular products which used a noticeably large amount of water. The annual cost of the supermarket's water usage was estimated by Mr. Graham to equal $500.00 per year.

The alternative to using Mr. Graham's estimation would be to estimate the electrical usage of each store services item and then add them to equal the total store services electrical usage cost. Mr. Graham stated that his estimate of store services items' electricity usage cost one dollar per square foot of building space annually to light, cool and heat the building with 5 percent of that cost for all other store services electricity usage costs would probably be as accurate an estimate as the alternative method.

Since Mr. Graham's estimates of the store services utility costs appeared to be the best method available, it was used to estimate the annual store services utility costs. The annual lighting, cooling and heating electricity cost for the supermarket equaled $35,280.00 per year (35,280 square feet times $1.00). The other store services items' electricity costs equaled $1,764.00 ($35,280 times .05 = $1,764). The final store services cost component, the store's annual water usage cost, equaled $500.00 annually.

The total annual store services utility cost for the supermarket equaled the sum of the lighting, cooling and heating cost ($35,280.00), the remainder of the store services cost ($1,764.00), and the water usage cost ($500.00) which equaled $37,544.00 per year. The supermarket's

total annual utility bill equaled $68,250.00 which meant that total store services utility costs equaled 55 percent of supermarket's annual utility costs. This store services cost estimate seemed reasonable and appear to leave enough utility costs ($30,696.00) to be accounted for by items such as the deli department, the many refrigeration and freezer units, the meat-cutting equipment, etc.

Store services costs are allocated according to the percent of total sales method. Milk was prorated 2.51 percent of the total store services utilities costs which equals $942.35 ($37,544.00 times .0251). The total annual utilities cost attributable to the retailing of milk equaled the store services utility costs attributable to the retailing of milk ($942.35) plus the direct utility cost of cooling the milk ($839.14, Tables 4 and 5), which equals $1,781.49 per year.

V. SUPERMARKET DIRECT MILK LABOR COST ELEMENT

Labor was involved in four milk related operations. The first operation was the transferring of milk from the truck unloading dock to the storage cooler. This operation occurred three times per week on Monday, Wednesday and Friday mornings. It was the responsibility of the truck driver to unload the dairy crates being delivered onto the supermarket's dock. Since the driver was not an employee of the supermarket, no cost to the store was involved. Next, it was a supermarket employee's duty to transfer the dairy crates to the storage cooler from the dock and the labor involved in this movement was the first operation. For each of the milk delivery days average times for the first operation was determined. The transferring of milk from

the truck unloading dock to the storage cooler averaged 30 minutes on Mondays, 30 minutes on Wednesdays, and 38 minutes on Fridays (Table 6).[40]

The second direct milk labor operation, the stocking of the dairy display cooler, consisted of the following timed components: the moving of milk from the storage cooler to the display cooler area, the stocking of milk into the display cooler, and the moving of the empty milk crates to the empty dairy crate storage area. This second direct milk labor operation occurred three times daily at approximately 6:00 a.m., 1:00 p.m., and 6:00 p.m. Daily times for the second operation ranged from 95 minutes during weekdays to 110 minutes on Saturdays (Table 6).

The third direct milk labor operation was the cleaning of the dairy display cooler. This operation occurred on Sundays at 10:00 p.m. and averaged 15 minutes.

The final direct milk labor operation was the ordering of milk from the milk supplier. This operation occurred on Tuesdays, Thursdays, and Saturdays at approximately 9:00 a.m. The employee who ordered milk stated that it took him approximately 20 minutes to order milk on each of the three ordering days which totals 60 minutes per week (Table 6).

The minutes involved in the four direct milk labor operations are shown in Table 6. Weekly direct milk labor amounted to 871 minutes or 14.52 hours which adjusted to a yearly figure (multiplied by 52) equals 755.04 hours. The wage rate for the employees who stocked items in the

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[40]Originally, the first operation's time was measured for all of the supermarket's dairy products. Milk occupied 75 percent of the delivered dairy crates and was consequently responsible for 75 percent of the original time. Milk's share of the original time is given above.

TABLE 6. The Knoxville Supermarket's Weekly Direct Milk Labor Associated with the Four Direct Milk Labor Operations, in Minutes, 1978

Day	Operations	Minutes
Sunday	stocking	108
	cleaning	15
Monday	unloading	30
	stocking	95
Tuesday	stocking	95
	ordering	20
Wednesday	unloading	30
	stocking	95
Thursday	stocking	95
	ordering	20
Friday	unloading	38
	stocking	100
Saturday	stocking	110
	ordering	20
Total direct milk labor for all operations		871

supermarket equaled $6.58 per hour according to the management. This hourly wage rate of $6.58 times the yearly direct milk labor hours (775.04) equaled the annual direct milk labor cost of $4,968.16 attributable to the retailing of milk.

VI. SUPERMARKET STORE SERVICES COST ELEMENT

The store services cost element consisted of items present for the faciliation of the store which were not included in the other cost elements. Examples of store services items are the cash registers, the store radio, the telephone bill, etc. A zero salvage value was assumed for all store services equipment except the two safes and the cash registers which were assigned a 10 percent salvage value. The safes were given a salvage value because safes usually have a very long life as they are built for durability.[41] The representatives of the company who make the cash registers felt that although the cash registers might be obsolete to the supermarket at the end of the depreciation period, the cash registers would have some value to other firms and should not be assigned a zero salvage value.[42]

The previously given equation of P = A(7.719927), with "P" equaling the present value of an equipment investment and "A" equaling the annual capital recovery cost of the equipment, was used in calculating most of the annual store services equipment capital recovery costs. This equation is the general capital recovery equation using the

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[41] F. M. George Safe and Lock Company, Knoxville, Tennessee.

[42] Preston Business Machines Company, Inc., Knoxville, Tennessee.

eight percent interest rate, the 12.5 year depreciation period, and a zero salvage value. A different equation, $P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} + \ldots + A(1.08)^{-12.5} -$ Salvage value $(1.08)^{-12.5}$, was used to determine the annual capital recovery cost of the two safes and the cash registers as these items had salvage values.

Table 7 lists the store services items with their annual costs. Some store services items were depreciable equipment while other store services items were not. The costs given in Table 7 include tax, freight, and installation where applicable. Costs in Table 7 which do not cite a source were obtained from the management of the representative supermarket.

The supermarket's total annual store services cost element equaled $527,339.95. Being a store services item, this annual cost is allocated to store items according to the percent of total sales method. In the supermarket, milk sales equaled 2.51 percent of total store sales and milk was prorated with that percent of the total annual store services cost element. The annual store services costs attributable to the retailing of milk equaled $13,236.23 ($527,339.95 times .0251).

VII. SUMMATION OF SUPERMARKET MILK RETAILING COSTS

The annual land and building costs attributable to the retailing of milk equaled $840.95 (Table 1, page 19). Annual refrigeration equipment costs attributable to the retailing of milk equaled $1,301.00 (Tables 2 and 3, pages 23 and 25). The annual utilities costs attributable to the retailing of milk equaled $1,781.49. Annual direct milk labor costs attributable to the retailing of milk equaled

TABLE 7. The Knoxville Supermarket's Store Services Cost Element, 1978[a]

Item	Cost Per Year
Adding machines[b]	$ 40.92
Advertising	51,000.00
Calculators[c]	82.32
Cashiers' wages	214,593.60
Cash registers[d]	3,826.14
Cash register supplies	1,929.20
Chairs[c]	4.94
Desks[c]	140.05
File cabinets[c]	45.31
Floor cleaning equipment and materials[e]	4,877.92
Insurance[f]	14,524.00
Large safe[g]	379.34
Local taxes	65.00
Managers' salaries[h]	75,000.00
Office supplies	1,351.50
Office worker's wages	55,774.00
Payroll taxes[i]	76.093.35
Push carts[j]	1,853.64
Radio[k]	64.12
Small safe[l]	14.11
Store cleaners' wages[m]	9,870.00
Store maintenance	8,221.00
Tables[c]	49.43
Telephone bill	2,520.00
Uncollected checks	4,500.00
Window cleaning	520.00
Total	$ 527,339.95

[a]All costs include tax, freight, and installation costs, where applicable. The costs which do not have a stated source were obtained from the management of the representative supermarket. The equation $P = A(7.719927)$ was used to determine a capital recovery cost on all equipment except where noted.

[b]Remington Rand Office Systems, Knoxville, Tennessee.

[c]Creswell Office Supply Co. Inc., Knoxville, Tennessee.

[d]Preston Business Machines Co. Inc., Knoxville, Tennessee; The equation $P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} + \ldots + A(108)^{-12.5}$ - (Salvage value, 10 percent of the original cost) $(1.08)^{-12.5}$ was used.

TABLE 7. (continued)

to determine "A", the annual capital recovery cost of the cash registers. The equation equals $28,450.40 = A(7.719927) - 1087.15 and when solved for "A" equals $3,826.14, the annual capital recovery cost of the cash registers.

[e]Equipment and materials included wax, wax remover, etc., and a floor cleaner with batteries and a battery charger. (Source: Kel San Products Co., Knoxville, Tennessee).

[f]This consists of fire insurance and liability insurance. (Source: Jim Clark of KMC Insurance Agency, Knoxville, Tennessee).

[g]F.M. George Safe and Lock Co., Knoxville, Tennessee; The equation $P = A(7.719927) - (\text{Salvage value, 10 percent of original cost})(1.08)^{-12.5}$ was used to determine the annual capital recovery cost for this safe. The equation equals $2,820.66 = A(7.719927) - $107.79 and when solved for "A" equals $379.34, the annual capital cost cost of this safe.

[h]Managers' salaries include head manager, two assistant managers, and one night manager.

[i]This consists of social security payments, federal and state unemployment taxes, and workmen's compensation payments for the entire store.

[j]Butcher's Supply Co., Knoxville, Tennessee.

[k]Roden Electronics, Knoxville, Tennessee.

[l]F.M. George Safe and Lock Co., Knoxville, Tennessee; The equation $P = A(7.719927) - (\text{Salvage value, 10 percent of original cost})(1.08)^{-12.5}$ was used to determine the annual capital recovery cost of the safe. The equation equals $104.94 = A(7.719927)-$4.01 and when solved for "A" equals $14.11, the annual capital recovery cost for this safe.

[m]Approximately 1500 man hours per year were used specifically to clean and wax the floors.

$4,968.16. The portion of the annual store services costs attributable to the retailing of milk equaled $13,236.23. The total annual cost of retailing milk in the supermarket equaled $22,127.83 (Table 8).

The supermarket sold 11,409 gallons of milk during August 1978.[43] The computed annual milk sales for the supermarket equaled 136,908 gallons or 547,632 quart equivalents (136,908 times 4).[44] The cost of retailing milk in the supermarket equaled $22,129.15 or $0,04041 per quart equivalent of milk sold ($22,127.83 / 547,632).

For the purpose of making comparisons with the convenient store later in this study, per quart equivalent retailing costs were determined for all cost elements. Per quart equivalent retailing costs were determined for each cost element by dividing each cost by its respective store's milk quart equivalents sold. For example, the per quart equivalent milk retailing cost for the supermarket's direct milk labor cost element equaled $0.00907 ($4,968.16 / 547,632). The store services cost element had the highest quart equivalent milk retailing cost of all the supermarket's cost elements with its annual cost of

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[43] Information received from August milk delivery invoices. Total gallons sold were determined by adding the amount of milk in every milk container sold.

[44] An average month of milk sales in the east-south-central area of the United States during the year 1978 equaled 61.87 million pounds. Milk sales during August 1978 for the same region equaled 62.30 million pounds. (Source: United States Department of Agriculture, Agricultural Marketing Service Dairy Division, Federal Milk Order Market Statistics, (Washington: Government Printing Office, 1978-1979), monthly summaries from February 1978 to February 1979, FMOS 219-229).

Since the August 1978 milk sales were approximately equal to the average 1978 monthly milk sales, yearly milk sales for 1978 were determined by multiplying August's milk sales (11,409 gallons) by 12 to equal the annual supermarket milk sales.

TABLE 8. Summation of the Knoxville Supermarket's Milk Retailing Costs, 1978

Cost Element	Total Annual Cost	Per Quart Equivalent Cost[a]
Land and Building Cost	$ 840.95	$ 0.00154
Refrigeration Equipment Cost	1,301.00	0.00238
Utility Cost	1,781.49	0.00325
Direct Milk Labor Cost	4,968.16	0.00907
Store Services Cost	$ 13,236.23	0.02417
Total	$ 22,127.83	$ 0.04041

[a]The supermarket sold 547,632 quart equivalents of milk.

$0.024.17. The supermarket cost element with lowest per quart equivalent milk retailing cost was the land and building cost element with its annual cost of $0.00154. Table 8 lists the per quart equivalent milk retailing cost for each of the five supermarket cost elements.

CHAPTER III

THE COSTS OF RETAILING MILK IN THE REPRESENTATIVE CONVENIENT STORE

The only brand of milk sold in the convenient store was the store's own brand. The convenient store carried food and nonfood items as did the supermarket although the convenient store seemed to have a higher percentage of nonfood items than did the supermarket. Unlike the supermarket, the convenient store carried no fresh produce nor did it have a meat-cutting room or a deli department.

I. DESCRIPTION OF THE CONVENIENT STORE

The representative Knoxville convenient store was located approximately 1.5 miles from the representative supermarket. The convenient store consisted of 2,240 square feet of building space and the store's land site consisted of 11,400 square feet. The convenient store was typical of Knoxville's other convenient stores in relation to building size, general store layout, and milk flow. The milk once delivered to the truck unloading area was then taken to the cooler where it was placed on display shelves as needed. The convenient store's components consisted of two checkout counters, six shopping aisles, a display cooler, a display freezer, and others.

II. CONVENIENT STORE LAND AND BUILDING COST ELEMENT

Three Knoxville real estate agents and appraisers were contacted to gain information about convenient stores' land and building

arrangements.[45] It was the real estate agents' and appraisers' general consensus that convenient store operators usually purchase their convenient store land sites and build their own stores. The average cost of the land as estimated by the Knoxville real estate agents and appraisers in August 1978 for the area of town in which the representative convenient store was located equaled $4.50 per square foot.

To obtain a construction cost estimate for a Knoxville convenient store, a Knoxville architectural firm was contacted. Leonard A. Robertson, Corporate Administrator for Community Tectonics, Inc., stated that the construction cost of a convenient store in Knoxville, Tennessee in August 1978 equaled approximately $50.00 per square foot. Mr. Robertson made his estimate from a blueprint of a convenient store which was similar to the representative convenient store in size and layout. Table 9 lists the itemized construction costs of the convenient store. Mr. Robertson and the Knoxville real estate agents and appraisers felt that a 33.3 year depreciable life was appropriate for the convenient store and the 33.3 year depreciable period was used in this study.

The construction cost of the convenient store equaled $112,000.00 (Table 9). The cost to the convenient store of buying their building included the opportunity cost of the investment. The capital recovery equation recaptures the total cost of the building and the opportunity cost of the investment. The annual capital recovery cost of the convenient store was determined by using the following equation:

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[45] The consulted Knoxville real estate agents and appraisers were Scott Collins, William M. Curtis, and Richard E. Wallace, Jr.

TABLE 9. The Estimated Construction Costs for a Convenient Store in Knoxville, Tennessee, 1978[a]

Item	Cost
Concrete slab on grade	$ 3,402.00
Perimeter grade beam	3,264.00
Exterior masonry walls	17,553.36
Roof--Concrete planks	9,573.75
--Roofing	1,470.75
Windows	481.80
Interior partitions	893.00
Exterior doors	775.00
Interior doors	1,060.00
Finishes--Paint	8,580.00
--Floor	1,276.80
--Ceiling	1,680.00
Plumbing fixtures	2,345.00
Air conditioning	7,350.00
Electrical equipment	11,110.40
Parking lot	5,200.00
Subtotal	76,015.86
Contractor's fee (19.6%)	14,899.11
Subtotal	90,914.97
Parking lot sign	5,000.00
Miscellaneous[b]	16,085.03
Total Convenient Store Construction Cost	$ 112,000.00
Annual Capital Recovery Cost of Store[c]	$ 9,708.90
Annual Capital Recovery Cost of the Store[d] per Square Foot of Building Space	$ 4.33

[a] Information computed by Leonard A. Robertson, Corporate Administrator for Community Tectonics, Inc.; Knoxville, Tennessee.

[b] Miscellaneous includes exterior site lighting, sewer hook-ups, any unusual site conditions, any beautification of site or building, etc.

[c] The annuity equation solved for "A", the annual store capital recovery cost, equals $9,708.90 ($112,000.00 = A(11.535802)).

[d] The annual capital recovery cost of the store divided by the store's building square footage equals $4.33 ($9,708.90/2240 square feet) the annual square feet capital recovery cost.

$P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} + \ldots + A(1.08)^{-33.3}$, where "P" equals the cost of the building and "A" equals the annual capital recovery cost of the building. A zero value of the building was assumed at the end of its economic life. The above equation reduced and solved for "A" equals $9,708.90 ($112,000 = A(11,535802)). The annual capital recovery cost of the store divided by the store's square footage equals $4.33, the annual square foot building cost (Table 9).

The prorating of the annual cost of the building to store items was done according to the building square footage which the items occupied and by determining each item's portion of the store services annual land and building cost. An item was considered as directly occupying an area if that area was present because of the item. For instance, dairy products were considered as occupying the dairy crate storage area even though the crates were empty. Items were also considered as occupying their display area (with milk, this equaled the shelf space in the cooler occupied with milk), and the aisle space directly adjacent to each item's display area. Once the allocating of the above directly determined floor space was done, the remaining unaccounted for areas are the store services areas whose costs were allocated to items according to the percent of total sales method.

The cooler which contained the milk occupied 416 square feet of floor space. This consisted of the actual 320 square feet which the cooler occupied and 96 square feet of aisle space directly adjacent to the cooler. Milk occupied 16.8 percent of the cooler and was responsible for that percent of the floor square footage which the cooler occupied. Milk, therefore, occupied 69.89 square feet of floor

space in connection with the cooler (416 square feet times .168, Table 10). The remaining 83.20 percent of the cooler was occupied with soft drinks, juices, beer, etc.

The only other area where milk directly occupied building floor area was in the dairy crate storage area. The dairy crate storage area consisted of 18.1 square feet of floor space. Milk was delivered to the convenient store in dairy crates along with other dairy items. Milk occupied approximately 88.07 percent of delivered milk crates. The remaining 11.93 percent of the dairy crates were delivered containing yogurt, cottage cheese, lemonade, and other nonmilk items. Milk was responsible for 88.07 percent of the 18.1 square feet of floor space which dairy crates occupied. Consequently, milk was responsible for 15.94 square feet of floor space in connection with the dairy crate storage area (Table 10).

Milk directly occupied floor space in the cooler and in the dairy crate storage area. The total directly occupied floor space in the convenient store equaled 85.83 square feet. The annual cost of this floor space equaled the annual square foot building cost times the building square footage directly occupied by milk which equals $371.64 (85.83 times $4.33, Table 10).

In the convenient store, there were three store services building areas. The store services building areas consisted of the truck unloading area and the back aisle, a room in back of the main part of the store, and the checkout area. The room in back of the main part of the store contained a desk, a restroom, a mop sink with mopping equipment, and some storage space for checkout equipment. All of the items

TABLE 10. Floor Space and Costs Associated with the Knoxville Convenient Store's Building Cost, 1978

Item	Amount
	- - - square feet - - -
Directly occupied areas by milk	
Cooler	69.89
Dairy crate storage area	15.94
Total floor space directly occupied by milk	85.83
	- - - dollars - - -
Total cost of directly occupied areas	371.64
	- - - square feet - - -
Store services areas	
Truck unloading area and back aisles	150
Back room	162
Checkout area	225
Total store services area	537
	- - - dollars - - -
Total cost of store services area	2,325.21
Store services building cost attributable to milk[a]	425.51
Total building cost attributable to milk[b]	797.15

[a]Prorated by the percent of total sales method, milk's portion of the store services building cost equaled $425.51 ($2,325.21 times .183). According to the management of convenient store, milk sales equaled 18.3 percent of total store sales.

[b]Total 1978 convenient store building cost attributable to the retailing of milk equaled the direct building cost ($371.64) and the indirect, or store services, building cost ($425.51) which totaled $797.15.

in the back room were for the facilitation of the store so the area was classified as a store service area.

Total store services building area consisted of 537 square feet (Table 10). The truck unloading area and back aisle consisted of 150 square feet, the back room consisted of 162 square feet, and the checkout area consisted of 225 square feet. The annual cost of this area equaled the total square footage (537 square feet) times the annual square foot cost of the building ($4.33) which equals $2,325.21 (Table 10).

According to the percent of total sales method, each product is allocated a portion of store services costs equal to the portion of total store sales which that item's sales consisted.[46] Milk's percent (18.3) of the annual store services building cost equaled $425.51, which is the annual indirect, or store services, building cost attributable to the retailing of milk (Table 10).

The total annual building cost of the convenient store equaled the annual capital recovery cost of the building. The annual cost of the building was allocated to items according to the direct square footage which the items occupied and according to the portion of the annual store services building cost attributable to each product. The annual cost of the building space which was directly occupied by milk ($371.64) and milk's portion of the annual store services building cost ($425.51) equaled $797.15, which is the annual building cost attributable to the retailing of milk.

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[46]According to the management of the convenient store, annual milk sales equaled 18.3 percent of the convenient store's total annual sales.

The land and building arrangements for the convenient store differed from the land and building arrangements of the supermarket. Supermarkets usually lease their land area as opposed to buying it. With the supermarket, the land use costs were incorporated into the lease of the building which was based on the store's square footage. There was no such incorporation of costs with the convenient store as the purchasing of the land and building was done separately.

The land area at the convenient store was considered as a store facilitating item as the land served all products equally. By the definition of store services items—those items not particular to any one product but rather for the facilitation of the store—the land at the convenient store was classified as a store services item. As a store services item, the portion of the land's annual cost attributable to the retailing of milk was equal to the portion of total store sales which were milk.

The total land cost for the convenient store equaled the land cost per square foot ($4.50) times the number of square feet purchased (11,400), which equals $51,300. The annual cost of this land could not be determined by depreciating the cost of the land as land, in general, does not depreciate and often appreciates. It is assumed that the convenient store's land site shall neither increase nor decrease in value relative to the general economy during the life of the building (33.3 years). Since it is assumed that the relative economic value of the land shall neither increase nor decrease, the cost of owning the land is equal to the opportunity cost of the money used to purchase the land. The purchase price of the land equaled $51,300 and the opportunity

cost equaled $4,104 annually ($51,300 times .08), which is the annual cost of owning the land. Milk's portion of this annual cost equaled $751.03 ($4,104.00 times .183).

The total annual land and building cost element for the convenient store consisted of the building costs attributable to the retailing of milk and the portion of the annual land cost attributable to the retailing of milk. The total annual building cost attributable to the retailing of milk equaled $797.15 (Table 10). The total annual land and building cost attributable to the retailing of milk equaled $1,548.18 ($797.15 + $751.03).

III. CONVENIENT STORE REFRIGERATION EQUIPMENT COSTS

The convenient store used one cooler in its retailing of milk. The cooler measured 32 feet by 10 feet and 8.6 feet high. The cooler was situated such that one of the long sides was built into the interior wall of the store. The cooler side built into the interior store wall had 13 merchandising glass doors 30-1/4 inches wide and 67 inches high. The cost of a replacement cooler equaled $8,547.00, the 13 doors cost $6,319.00, the door accessories cost $1,729.00, and the cooler accessories cost $5,814.00.[47] Freight and installation of the cooler equaled $3,600.00. The sales tax (6 percent) on these items came to $1,560.54 bringing the cost of the cooler and its accessories to $27,569.54 (Table 11).

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[47]The cooler information was received from Brink's, Inc., Knoxville, Tennessee.

TABLE 11. The Knoxville Convenient Store's Cooler Costs Associated with the Retailing of Milk, 1978

Item	Cost
Cooler	$ 8,547.00
Cooler accessories	5,814.00
13 Merchandising doors	6,319.00
Door accessories	1,729.00
Freight and installation	3,600.00
Subtotal	$ 26,009.00
Sales tax	1,560.54
Total cooler cost	$ 27,569.54
Cooler annual capital recovery cost	3,571.22
Cooler annual capital recovery cost[a] attributable to the retailing of milk	$ 599.96

[a]Milk was prorated 16.8 percent of the annual cooler capital recovery cost as milk occupied that percent of the cooler.

IV. CONVENIENT STORE UTILITY COST ELEMENT

There were direct and indirect utilities costs attributable to the retailing of milk in the convenient store. The direct utility cost attributable to the retailing of milk equaled the cost of the electricity used to cool the milk. The indirect utility cost attributable to the retailing of milk equaled a portion of the annual store services utilities cost.

The direct cost of cooling the milk was determined from technical data concerning coolers and from knowing approximately what rate the convenient store paid for kilowatt-hour usage.[48] The cooler used 4.37 kilowatt-hours of electricity for every hour which the cooler's compressor ran (Table 12). Assuming that the cooler compressor ran 18 hours each day, the daily kilowatt-hour usage of the convenient store's cooler equals 78.66.[49] The annual electricity usage of the cooler equals the daily kilowatt-hour usage (78.66) times 365 days (as the cooler is on the entire year) which equals 28,710.80 kilowatt-hours. The annual cost of the electrical usage of the cooler equals the annual electrical usage (28,710.90 kilowatt-hours) times the cost per

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[48]The technical data concerning a replacement cooler for the convenient store was received from Brink's, Inc., Knoxville, Tennessee. Earl Graham, head of Knoxville Utilities Board's Commercial Accounts Department, stated that the convenient store paid approximately $.035 for each kilowatt-hour of electricity used.

[49]The refrigeration industry has determined that cooler compressors run approximately 18 hours per day. This standard daily compressor running time has been used in this study. (Source: Brink's, Inc., Knoxville, Tennessee; Butcher Supply Company, Knoxville, Tennessee.)

TABLE 12. The Knoxville Convenient Store's Cooler Utility Costs Attributable to the Retailing of Milk, 1978

Item	Amount
	- - - kilowatt-hours - - -
Cooler electrical usage per hour of compressor running time	4.37
Daily cooler electrical usage	78.66
Annual cooler electrical usage	28,710.90
	- - - dollars - - -
Convenient store cost per kilowatt-hour used	0.035
Annual cooler electrical usage cost	1,004.88
Annual cooler electrical usage cost attributable to the retailing of milk[a]	168.82

[a]Milk occupied 16.8 percent of the cooler and was responsible for that percent of the annual electrical usage cost ($11,004.88 times .168).

kilowatt-hour used ($0.035) which equals $1,004.88. The annual cost of cooling the convenient store's cooler ($1,004.88) was prorated to the items in the cooler according to the percent of the cooler which each item occupied. The direct utility cost of retailing milk in the convenient store equaled 16.8 percent of $1,004.88, the cooler's annual electricity usage cost, which equals $168.82 (Table 12).

The indirect utilities cost attributable to the retailing of milk consisted of a portion of the annual store services utility costs. Examples of store services utility usage are the electricity required to light, cool and heat the building, and the water usage in the restroom and in cleaning the floors. As with the supermarket, Mr. Graham's method of estimating store services utilities costs was employed. Mr. Graham's estimate of the convenient store's store services utility usage equaled one dollar per year per square foot of building space to light, cool, and heat the building with five percent of that cost for all other store services electricity usage cost. The annual water usage cost for the convenient store was estimated to equal $120.00 by Mr. Graham. The entire convenient store water usage cost was considered as a store services cost because there were no particular products which used a noticeably above average amount of water.

Using Mr. Graham's estimates, the annual cost to light, cool, and heat the convenient store equaled $2,240 (2,240 square feet times $1.00). The remaining store services electricity usage costs equaled $112.00 (2,240.00 times .05). The final store services cost component, the store's annual water usage cost, equaled $120.00 annually. The total annual store services utility cost for the convenient store

equaled the sum of the lighting, cooling, and heating cost ($2,240.00), the remainder of the store services electricity cost ($112.00), and the water usage cost ($120.00) which equals $2,472.00.

As a store services item, the annual cost of this item was prorated to items according to the percent of total sales method. Milk sales amounted to 18.3 percent of total convenient store sales and consequently 18.3 percent of the store services utility costs were attributable to milk as a cost of retailing. The annual indirect, or store services, utility costs attributable to the retailing of milk equaled $452.38 ($2,472 times .183).

Total annual convenient store utilities costs attributable to the retailing of milk equaled the direct utility cost and the indirect utilities costs attributable to the retailing of milk. The direct annual utility cost of retailing milk equaled $168.82 (Table 12). The indirect utilities costs attributable to the retailing of milk equaled $452.38. The total annual utilities costs of retailing milk in the convenient store equaled $621.20 ($168.82 + $452.38).

V. CONVENIENT STORE DIRECT MILK LABOR COST ELEMENT

Direct milk labor was involved in two operations at the convenient store. Direct milk labor was involved in the transferring of milk from the truck unloading area to the cooler and in the stocking of the cooler shelves with milk.

The first direct milk labor operation was the transferring of milk from the truck unloading area to the cooler. The average transferring time per dairy crate equaled .44 minutes. This figure was

an average determined from repeated timing of milk transferring. The convenient store received and transferred approximately 6,065 dairy crates full of milk per year.[50] The annual labor time for transferring these crates equaled 2,668.60 minutes or 44.48 hours. The labor cost per hour equaled $2.75 which made the annual labor cost of transferring the milk equal to $122.32 (44.48 times $2.75).[51] To determine the annual milk stocking time, average stocking times were determined for dairy crates loaded with the different milk times. For example, it took 25 seconds to stock a dairy crate full of returnable gallon containers of milk. To get an annual labor time for the stocking of milk in gallon returnable containers, the number of dairy crates full of milk in gallon returnable containers that were received at the store in a year was multiplied by 25 seconds which is the stocking time for a dairy crate full of milk in gallon returnable containers. Table 13 lists milk items sold in the convenient store during an average year with the average stocking times for dairy crates full of each of the different milk items. The annual direct labor time involved in the stocking of milk items equaled 56.30 hours, and the annual cost of this labor equaled $154.83 (56.30 hours times $2.75).

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[50]The convenient store, unlike the supermarket, had detailed information concerning the annual flow of milk through the store. Another difference between the supermarket and the convenient store was the method of stocking milk which the stores used. With the supermarket, the stocking of milk occurred fairly regularly. The stocking of milk at the convenient store, however, occurred somewhat randomly whenever the shelves needed filling and whenever the stock boy deemed it time to stock the shelves.

[51]The stock boys who stock milk received an hourly wage of $2.75 according to the owner of the convenient store.

TABLE 13. Direct Milk Labor Involved in the Stocking of Milk at the Knoxville Convenient Store, 1978

Milk item	Number sold per year	Case equivalent	Stocking time per case in seconds	Total stocking time in hours
Returnable gallons	16,244	4,061	25	28.20
Returnable half gallons	3,848	428	52	6.18
Twin-pack paper gallons	4,680	780	37	8.02
Half gallon paper container	7,488	624	48	8.32
Quart paper container	2,340	117	50	1.63
Half pint whipping cream	1,560	32.5	257	2.32
Half pint of half and half	1,092	22.8	257	1.63
Total annual stocking hours				56.30

Total annual direct labor costs for milk at the convenient store consisted of the annual cost of transferring the milk ($122.32) and the annual cost of stocking the milk ($154.83), which equals $277.15 per year.

VI. CONVENIENT STORE'S STORE SERVICES COSTS ELEMENT

The store services cost element consisted of the store's facilitative items which were not included in the other cost elements. Examples of store services items not included in the other cost elements are the two cash registers, the telephone bill, the store radio, etc. Table 14 lists and summarizes the store services costs which were not covered under any other cost element. The costs present in Table 14 include tax, freight, and installation costs. A 12.5 year depreciable life was used for all equipment in the convenient store because the management stated that 12.5 years would be reasonable depreciation period for all equipment. All the costs listed which are not referenced were obtained from the management of the convenient store.

The equation $P = A(7.719927)$, where "P" equals the present value of an investment and "A" equals the annual capital recovery amounts which, when discounted, equal "P" was used to calculate the annual capital recovery cost ("A") of most of the store services equipment. For the items which were assigned a salvage value, the following equation was used to determine an annual capital recovery cost: $P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} \ldots A(1.08)^{-12.5} - \text{Salvage value } (1.08)^{-12.5}$.

TABLE 14. The Knoxville Convenient Store's Store Services Cost Element, 1978[a]

Item	Cost per Year
Adding machine[b]	$ 20.46
Advertising	1,910.00
Calculator[c]	27.46
Cash registers[d]	695.66
Cash register supplies	1,500.00
Chair[c]	1.65
Desk[c]	46.68
Insurance	3,260.00
Local taxes	1,242.10
Managers' salaries[e]	18,750.00
Payroll taxes[f]	2,899.76
Push carts[g]	41.19
Radio[h]	27.46
Small safe[i]	14.11
Store maintenance[j]	1,600.00
Telephone bill	191.16
Uncollected checks	650.00
Total	$ 32,877.69

[a]All costs include tax, freight, and installation charges where applicable. The costs which do not have a stated source were obtained from the representative convenient store. The equation $P = A(7.719927)$ was used to determine an annual capital recovery cost on all equipment except where noted.

[b]Remington Rand Office Systems, Knoxville, Tennessee.

[c]Creswell Office Supply Co. Inc., Knoxville, Tennessee.

[d]Preston Business Machine Co. Inc., Knoxville, Tennessee.; The formula $P = A(1.08)^{-1} + A(1.08)^{-2} + A(1.08)^{-3} + \ldots + A(1.08)^{-12.5}$ - (Salvage value, 10 percent of the original cost)$(1.08)^{-12.5}$was used to determine "A", the annual capital recovery cost of the cash registers. The equation equals $5,172.80 = A(7.719927) - $197.66 and when solved for "A" equals $695.66, the annual capital recovery cost of the cash registers.

[e]The convenient store employed two managers who made up 100 percent of the management and cashier labor. The costs of this personnel equaled the total hours they worked (2,500 hours each per year or 5,000 hours) times their hourly wage ($3.75) which equals $18,750.00.

TABLE 14. (continued)

[f]This consists of social security payments, unemployment taxes, and workmen's compensation payments for the entire store.

[g]Butcher's Supply Co., Knoxville, Tennessee.

[h]Roden Electronics, Knoxville, Tennessee.

[i]F.M. George Safe and Lock Co., Knoxville, Tennessee; The equation $P = A(7.719927) - (\text{Salvage value, 10 percent of original cost})(1.08)^{-12.5}$ was used to determine the annual capital recovery cost of the safe. The equation equals $\$104.94 = A(7.719927) - \$4.01$ and when solved for "A" equals $14.11, the annual capital recovery cost of the safe.

[j]This store maintenance includes store cleaning materials. The store cleaning labor costs are included in the labor costs.

The total annual store services costs for the convenient store equaled $32,877.69 (Table 14). The prorating of this cost to items was done according to the percent of total sales method. Milk's percent of total sales equaled 18.3 and that percent of the total annual store services cost equals $6,016.61 ($32,877.69 times .183) which is the annual store services costs attributable to the retailing of milk.

VII. SUMMATION OF CONVENIENT STORE MILK RETAILING COSTS

The annual land and building cost attributable to the retailing of milk equaled $1,548.18. Annual refrigeration equipment costs attributable to the retailing of milk equaled $599.96 (Table 11, page 50). The annual utilities cost attributable to the retailing of milk equaled $621.20. Annual direct milk labor costs attributable to the retailing of milk equaled $277.15. The portion of the annual store services costs attributable to the retailing of milk equaled $6,016.62. The total annual cost of retailing milk in the convenient store equaled $9,063.11 (Table 15).

The convenient store sold 27,343 total gallons of milk in 1978.[52] The total number of quart equivalents sold in the convenient store equaled 109,372 (27,343 times 4). The cost of retailing milk in the convenient store equaled $0.082.86 per quart equivalent of milk sold ($9,063.11 / 109,372).

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[52]The information concerning the annual quantity of milk sold by the convenient store was furnished by the management of the convenient store.

TABLE 15. Summation of Convenient Store Milk Retailing Costs, 1978

Cost Element	Total Annual Cost	Annual Per Quart Equivalent Cost[a]
Land and Building Cost	$ 1,548.18	$ 0.01416
Refrigeration Equipment Cost	599.96	0.00549
Utility Cost	621.20	0.00568
Direct Milk Labor Cost	277.15	0.00253
Store Services Cost	6,016.62	0.05501
Total	$ 9,063.11	$ 0.08286[b]

[a]The convenient store sold 109,372 quart equivalents for the year.

[b]The sum of this column does not equal $ 0.08286 due to rounding error.

For comparisons with the supermarket, the per quart equivalent of milk retailing costs for each of the five cost elements were determined. For example, the per quart equivalent milk retailing cost of the direct milk labor in the convenient store equaled $0.00253. This was determined by dividing the total annual direct milk labor cost ($277.15) by the total annual quart equivalent retailing costs of each of the cost elements. The store services per quart equivalent milk retailing cost for the convenient store equaled $0.05501, which was the highest per quart equivalent retailing cost for any of the convenient store's five cost elements. The direct milk labor cost element had the lowest per quart equivalent milk retailing cost ($0.00253) of any of the five convenient store cost elements. Table 15 lists the per quart equivalent milk retailing costs for all five of the convenient store cost elements.

CHAPTER IV

SUMMARY AND CONCLUSIONS

I. SUMMARY

The objective of this study was to estimate the cost of retailing milk in Knoxville, Tennessee in a supermarket and in a convenient store. The procedure used to achieve this objective was the economic-engineering method of analysis. Items contributing to the cost of retailing milk were separated into five cost elements: land and building costs; refrigeration equipment costs; direct milk labor costs; utility costs; and store services costs. The annual cost of these elements were determined either directly or indirectly. The directly determined costs were calculated by determining the cost of items involved with the retailing of milk and prorating a cost to milk according to the percent of the items which milk physically occupied. The indirect costs were determined by allocating a portion of the costs to milk equal to milk's percent of total sales.

The total of all the cost elements, equal to the total annual cost of retailing milk, equaled $22,127.83 for the supermarket and $9,063.11 for the convenient store. The supermarket sold 136,908 total gallons of milk for the year which equaled 547,632 quart equivalents. The convenient store sold 27,343 total gallons of milk for the year which equaled 109,372 quart equivalents. The determining of per quart equivalent costs of retailing milk in the two stores was calculated by dividing the total retailing costs by the quart equivalents sold. The

per quart equivalent cost of retailing milk equaled 4.041 cents for the supermarket and 8.286 cents for the convenient store. The per quart equivalent cost of retailing milk equaled .97 cents in the largest grocery store and 7.15 cents in the smallest grocery store in the study by Korzan and Pfanner.[53] Davis found the per quart equivalent cost of retailing milk to equal 1.23 cents for a small grocery store and 1.15 cents for a large grocery store.[54]

For the purpose of comparison, the per quart equivalent milk retailing costs for the different cost elements were determined by dividing each store's cost elements by the total quart equivalent sold in each store. The cost element which came closer to being equal in per quart equivalent costs than any other cost element in the two stores was the utility cost element. The supermarket's per quart equivalent utility cost equaled $0.00325 while the convenient store's equaled $0.00568. One reason for the convenient store's higher per quart equivalent utility cost was that the convenient store paid half a cent more for each kilowatt-hour of electricity it used than did the supermarket.

The direct milk labor cost element was the only element where the convenient store had a lower per quart equivalent cost than did the supermarket. An important factor here was that the convenient store paid its milk stockers $2.75 per hour while the supermarket paid its

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[53]Korzan and Pfanner, p. 7.

[54]Davis, p. iii.

milk stockers $6.58 per hour. Another reason why the convenient store had a lower per quart equivalent direct milk labor cost was because this cost element resembled a true variable cost. Direct milk labor time would logically tend to rise as the quantity of milk handled at the stores rose. The store services costs attributable to the retailing of milk would probably not rise as fast as the direct milk labor cost to an increase in the quantity of milk sold at the stores. The reason for this is that part of the store services cost element included fixed cost costs such as the cost of lighting the building. The cost of lighting the store per year was a fixed cost. With every quart equivalent of milk sold at the stores, the per quart equivalent cost of lighting the stores decreased. Direct milk labor appeared to resemble a variable cost more than any other cost element. The supermarket's high volume of milk did not reduce its per quart equivalent direct milk labor cost enough to compensate for the convenient store's lower wage for milk stockers.

II. CONCLUSIONS

The costs of retailing milk estimated in this study approximate boundaries of the costs of retailing milk for the vast majority of grocery stores in Knoxville, Tennessee. These costs will approximate boundaries of the costs of retailing milk in other locations once adjusted for each local area. It is unclear whether or not the estimated costs of retailing milk in the representative stores were minimum average quart equivalent retailing costs.

III. LIMITATIONS

The most apparent limitation of this study is also the most apparent limitation of the method of analysis used in this study. The major drawback of the economic-engineering method is the use of arbitrary allocations. In a study such as this, there was considerable identifying, grouping, and calculating of costs which could not have been accomplished without the use of arbitrary decisions and allocations. Sometimes the arbitrarily allocated costs may not have been 100 percent accurate, but were nevertheless since they were deemed the most accurate figures available.

Another limitation of the study was the omittance of administrative overhead from the costs of retailing milk. All the costs of retailing milk were estimated except the portion of administrative overhead attributable to the retailing of milk. The determining of these administrative overhead costs was deemed beyond the scope of this paper. It was felt that once the total administrative overhead costs were allocated to all the stores supporting the overhead administration and allocated again to each item in the store, that the additional per quart equivalent cost of retailing milk would be minor.

The cost of handling perishable merchandise usually includes any spoilage of the products. Milk spoilage equaled less than half of a percent of total milk sales in both the stores. The cost of milk spoilage has not been included in these costs of retailing milk.

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VITA

George K. Criner was born in Brunswick, Georgia, on October 12, 1955. His father served forty years in the United States Armed Forces and George consequently traveled throughout his youth. He graduated from Oxon Hill Senior High School in Oxon Hill, Maryland in 1973. In the fall of 1973, he entered The University of Tennessee, and in December 1977, he received the Bachelor of Science degree in Economics. In January 1978, he entered The University of Tennessee to work toward a Master of Science degree and in December 1979, he received a Master of Science degree in Agricultural Economics.

He is married to Margaret Frances Lundy of Harrogate, Tennessee.