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Cost of collecting eggs from farms by firms located in West Virginia

Robert L. Jack

Ahmad Abdul Kadar

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AUTHORS

Authors of *Cost of Collecting Eggs from Farms By Firms Located in West Virginia* are Robert L. Jack, Assistant Agricultural Economist, and Ahmad Abdul Kader, Graduate Assistant in the Department of Agricultural Economics.

West Virginia University
Agricultural Experiment Station
College of Agriculture and Forestry
A. H. VanLandingham, Director
Morgantown

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Cost of Collecting Eggs From Farms By Firms Located in West Virginia

ROBERT L. JACK and AHMAD ABDUL KADAR

Introduction

PRODUCING MARKET EGGS is an important farm enterprise in West Virginia. Census data show that between 1959 and 1964 egg sales increased from 12.7 to 19.0 million dozens and the value of egg sales increased from 4.6 to 7.4 million dollars.[1] Egg sales accounted for 4.6 per cent of the value of all farm products sold in the State in 1959 and for 8.0 per cent in 1964.[2]

Changes which have occurred in the structure of egg-producing units have important implication for marketing personnel. In 1959, 1.7 of the 12.7 million dozens of eggs sold in the State were produced by farms selling 50,000 or more dozens per year. However, by 1964, 11.8 of the 19.0 million dozens sold were produced by farms selling 50,000 or more dozens per year.[3]

These figures indicate that the proportion of eggs produced by large egg-producing units is increasing rapidly in the State. Normally as production units become larger, managers tend to specialize or give more emphasis to one area and less emphasis to other areas, such as production, marketing, and distribution.

A recent study actually confirms the idea that egg producers do tend to emphasize or de-emphasize certain marketing functions as flock size increases.[4] Farmers responding to a questionnaire used in the above study indicated that none of the large flock owners (over 20,000 birds) delivered eggs door to door, while 49 per cent of all producers, regardless of size, delivered eggs door to door. Forty-three and one-half per cent of the eggs produced by flocks of over 10,000 birds were sold to packers and processors while none of the eggs from smaller flocks (200 to 2,500 birds) were marketed through this channel.

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[1] U.S. Bureau of the Census, Census of Agriculture, 1964 *Statistics by Subjects —Chapter 2 Livestock, Poultry, and Livestock and Poultry Products*, p. 190.

[2] Computed from U.S. Bureau of the Census, Census of Agriculture, 1964 *Statistics for the State and Counties, West Virginia*, pp. 13-14.

[3] U.S. Bureau of the Census, Census of Agriculture, 1964 *Statistics by Subjects —Chapter 2 Livestock, Poultry, and Livestock and Poultry Products*, p. 217.

[4] John C. Thorne and James L. Stallings, *Egg Production and Marketing in West Virginia*, W. Va. Univ. Agr. Exp. Sta. Bull. 566, June 1968.

It appears that as new technology is adopted and flock size continues to increase, we can expect egg producers to place more emphasis on production, and more of the marketing functions—grading, packaging, etc.—will shift to off-farm firms.

In order to develop an efficient marketing system to handle the volume of eggs that will be moving from farms to packer-processors and wholesalers in the future, the industry needs data on the cost of performing marketing functions that appear to be shifting to off-farm firms.

Purpose

This study was designed to answer the following basic question: **What is the present labor and truck cost associated with collecting a 30-dozen case of eggs from farms by packers and processors located in West Virginia?**

Procedure

During June, July, and August 1967, data were obtained from all known routes on which eggs were collected from farms by trucks and employees of processors and packers located in West Virginia. Data were collected from fifteen routes of which five were delivery-collection routes and ten were "true" collection routes. Only the ten "true" egg collection routes are analyzed in this report. That is, routes on which feed and other items were delivered or assembled along with egg collection were excluded from the analysis.

The ten collection routes were operated by four different firms located in different areas of the State. The number of routes per firm ranged from one to six. Eggs were usually collected from each route once a week.

A fieldman recorded the time utilized by employees performing various activities on the collection routes. Total miles traveled on the route and between each stop were also recorded. Hourly wage rates paid to route employees, annual volume of eggs handled by the firm, and annual mileage driven for the purpose of collecting eggs from farms were obtained from management personnel. Estimates were used in synthesizing the fixed and variable truck cost presented in the analysis.

Some routes were checked twice if the fieldman felt a second set of data was needed to reflect an accurate account of how time and travel were utilized. When the same route was checked twice, an average was computed and used in the analysis.

Discussion of Cost Concepts

Before discussing factors which affect cost of collecting eggs, it is desirable to introduce some cost concepts and relate them to the cost of collecting eggs from farms. Costs are generally classified as fixed or variable in the short run. This classification remains the same regardless of whether total cost or cost per unit of output is being studied.

This discussion of cost concepts assumes pure competition exists in the market. Most of the discussion will be directed to per unit cost figures since they are more useful than total cost figures in making management decisions.

AVERAGE FIXED COST (AFC)

Within a short time span the quantity of certain factors of production used in the production process cannot be changed by the operator of a firm. Since the operator does not have sufficient time to change the quantity of the factors employed in the production process, their total costs remain at a constant (fixed) level regardless of the output produced. With total fixed cost remaining constant for all levels of output, AFC (total fixed cost ÷ units of output) per unit will decrease with each additional unit of output. However, AFC will never reach zero.

To illustrate the AFC concept, suppose a firm purchases a $4,000 truck to be used in the business. Furthermore, suppose that after five years this truck will have zero trade-in value. Under these conditions annual depreciation cost (fixed cost) on this truck would be $800 ($4000 ÷ 5 years) per year regardless of whether the truck is used to collect 1,000 or 6,000 cases of eggs. However, AFC per case does not remain at a constant level but decreases as quantity of eggs collected increases. If this truck is used to collect 1,000 cases of eggs a year, the AFC per case would be 8 cents ($800 ÷ 1,000 cases) and would drop to 1.33 cents per case ($800 ÷ 6,000) if 6,000 cases are collected (compare costs at points A and B in Figure 1 to see this relationship). The AFC concept discussed above suggests that it would be wise to consider this concept when making a decision to purchase or to employ a factor of production which has a fixed cost.

In this study the concept of fixed cost is applied to depreciation, taxes, insurance, returns on investment, and license costs associated with owning a truck for the purpose of collecting eggs from farms. However, the concept can be applied to any item of cost that does not change with the level of output produced.

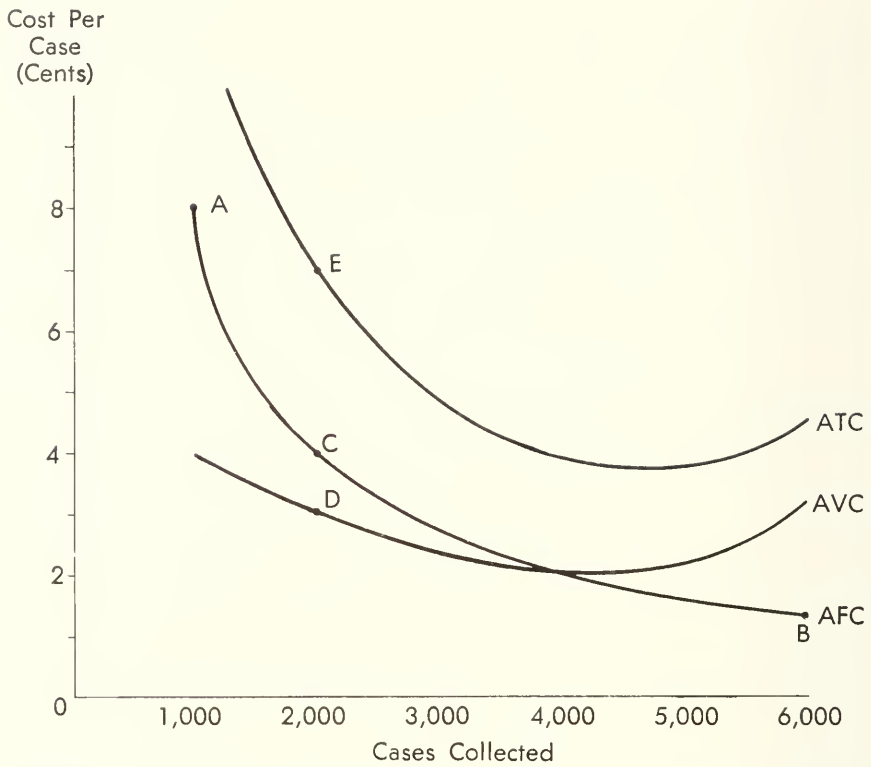

FIGURE 1. Theoretical Relationship of Per Unit Cost Curves for a Firm.

AVERAGE VARIABLE COST (AVC)

Average variable cost is directly related to the volume of output produced. Higher levels of output require larger quantities of variable factors, which result in greater cost obligations. For example, if the distance required to collect a 30-dozen case of eggs is increased from 1 to 5 miles, more gasoline is used, more hours of labor are required and greater tire wear occurs, which results in more units of variable cost being utilized per case of eggs collected. Average variable cost per unit (total variable cost ÷ units of output) is normally high at low levels of output, decreases to a minimum level as output increases, and then rises as variable factors of production become less efficient at higher levels of output. In other words, the AVC curve for a firm usually has an U-shaped appearance (Figure 1).

In this study the concept of variable cost is applied to hourly labor, gasoline, oil, tires, repair, and maintenance costs associated with

operating a truck to collect eggs from farms. However, the concept can be applied to any item of cost that changes with the level of output.

AVERAGE TOTAL COST (ATC)

Average total cost is the total cost of producing each unit of output at different levels of production. It is obtained by adding AFC and AVC at each level of output. Normally the ATC is high at low levels of output, decreases to a minimum level as output is increased, and then rises as output continues to increase. The ATC curve will normally have a U-shaped appearance similar to the AVC curve, however, its shape depends entirely on the behavior of AFC and AVC as the level of output changes.

To illustrate ATC suppose that at 2,000 units of output, the AFC is 4 cents and the AVC is 3 cents. In this situation ATC per unit of output would be 7 cents when 2,000 units are produced. The ATC may be larger or smaller as output is decreased to 1,000 units or increased to 3,000 units (cost at points C and D are added to obtain total per unit cost at point E in Figure 1).

In this study ATC includes depreciation, returns on investment, taxes, insurance, and license costs associated with truck ownership (fixed cost items) plus labor, gasoline, oil, tires, repair, and maintenance costs associated with operating the truck (variable cost items) for collecting eggs from farms.

USE OF COST DATA IN MAKING MANAGEMENT DECISIONS

Management has the responsibility of establishing policies and making decisions on how the business must operate in order to be competitive with other firms in the industry and profitable for the owner(s). Such management decisions as to employ more or less labor, to purchase or not purchase new items of capital equipment, to increase or decrease the present level of output, and to continue or discontinue business operations must be based on the best information available. Adequate cost data for a business firm can serve as a basis for making these decisions.

EXAMPLES OF MANAGEMENT DECISIONS BASED ON COST DATA

Adequate cost records enable management to determine if production cost per unit is more or less than price received, or to determine what proportion of production cost is associated with fixed and variable production factors. If product price is just high enough to cover

average variable cost, the business loss will be equal to average fixed cost whether the firm remains in operation or discontinues operation. Therefore, it really makes no difference in the amount of loss whether the firm operates or ceases to operate in this situation. If product price is not sufficient to cover average variable cost, then the firm's loss is equal to average fixed cost plus that portion of average variable cost not covered by product price. Under these conditions losses could be minimized by ceasing to operate the business. If the cost data show that the firm's output is within the range of the downward sloping portion of the ATC curve, the firm can increase profit or reduce loss by producing a level of output which is *not less* than the output existing at the minimum point of the average total cost curve, provided market price for the product is equal to or higher than ATC at this level of output. In cases where average fixed cost accounts for a large proportion of total cost, cost data would be useful in deciding if ATC per unit of product could be lowered by increasing the level of output to spread fixed costs over more units of products, or in this situation, management might also decide that production costs could be lowered by changing the proportion of fixed and variable resources being used in the production process.

The above discussion mentions only a few ways that adequate cost data can be used by management in making intelligent decisions concerning the operation of a business firm.

Utilization of Labor on Egg Collection Routes

Labor utilized on egg collection routes starts with preparing the vehicle for departure and ends when the eggs collected have been unloaded at the plant. The time period between departure from and return to the plant is spent traveling, before loading, and loading the truck.

Time used traveling between plant and first stop on route ranged from 9 to 221 minutes, with an average of 111 minutes for the routes studied. For all routes, travel time between each stop on the route was always less than the time spent traveling between the plant and the first stop. There was also a tendency for travel time between stops to decrease as the number of stops on the route increased. Evidently, the farms from which eggs are collected are not concentrated in an area close to the firm collecting the eggs. However, once the supply area is reached, the volume seems to be more concentrated (Table 1).

Upon arrival at the farm, route employees usually contacted the producer, located the eggs, and prepared the truck for loading. Average

before loading time per stop ranged from 6 minutes at the fourth stop to 14 minutes at the third stop.

Since route employees had to unload or rearrange cases in the truck before loading eggs at most of the stops, it was believed that the before loading time per stop would decrease as the number of stops on the route increased. However, the data in Table 1 do not support this belief.

After loading eggs the route employees spent time preparing receipts for eggs loaded. Average after loading time per stop ranged from 4 to 15 minutes for routes studied. After loading time was usually less than travel, before loading, and loading time for each stop.

After the last route stop had been completed, an average of 83 minutes of travel time was required to return to the plant, where 4 minutes elapsed prior to unloading the eggs and then 73 man-minutes were required to complete the unloading process for the average route.

There is not a great difference in the proportion of total time spent on each activity for small, medium, and large volume egg collection routes (Table 2). Averages for the three different size groups show that large volume routes use a smaller proportion of total time than small volume routes in preparing for departure, traveling, and before loading activities. On the other hand, the portion of total time spent loading, after loading, before unloading, and unloading was greater for large volume routes than for small volume routes. Furthermore, on all routes an average of 57.6 per cent of the total route time was used for an activity (travel) not directly related to the volume of eggs collected. Two other activities, loading and unloading, which would be expected to be closely related to volume collected, accounted for an average of 8.2 and 14.3 per cent respectively of the total time spent on all routes.

Although all simple correlation coefficients in Table 3 are significant at the 5 per cent or lower levels of probability, the degree of relationship between volume collected and loading time is greater than for the other relationships. The coefficient of determination (.404) for volume and time spent loading is relatively large and indicates that more than 40 per cent of the variability in loading time at each stop can be explained by the volume loaded. The fact that volume collected accounts for only 26.7 per cent of the variability in total time spent at each stop indicates that factors other than volume collected are important in determining the total time spent at each stop.[5]

[5] Linear estimating equations for the relationships between volume collected and various activities performed at each stop on the routes are presented in Appendix Figures 1-5.

TABLE 1. Total Employment Time on Egg Collection Routes Distributed by Stops on Route and Activity Performed at Each Stop, West Virginia, 1967

Route Stops	Activities Performed	Route Designation										
		I	J	D	B	H	F	G	E	A	C	Avg.
		(Minutes)										
Plant	Preparing for Departure	22	28	5	24	17	17	30	40	4	1	19
Plant	Travel	105	122	26	72	156	154	196	221	9	48	111
to	Before Loading	10	14	9	3	13	8	14	18	23	7	12
Stop 1	Loading	22	22	13	6	29	15	14	20	3	11	16
	After Loading	13	11	9	2	15	9	24	8	1	4	10
	Total Time	150	169	57	83	213	186	248	267	36	70	
Stop 1	Travel	21	25	7	30	40	76	44	175			52
to	Before Loading	4	9	4	5	7	6	18	7			8
Stop 2	Loading	5	9	4	3	8	11	75	8			15
	After Loading	5	6	3	2	10	14	5	3			6
	Total Time	35	49	18	40	65	107	142	193	0	0	
Stop 2	Travel	12	12	13	18	57	63	154				47
to	Before Loading	25	23	7	4	8	11	21				14
Stop 3	Loading	3	8	6	4	17	20	9				10
	After Loading	4	8	4	1	3	14	2				5
	Total Time	44	51	30	27	85	108	186	0	0	0	
Stop 3	Travel	37	38	12	10	78						35
to	Before Loading	9	10	2	2	8						6
Stop 4	Loading	6	7	1	1	12						5
	After Loading	5	8	2	1	7						5
	Total Time	57	63	17	14	105	0	0	0	0	0	
Stop 4	Travel	13	61									37
to	Before Loading	7	6									7
Stop 5	Loading	34	16									25
	After Loading	24	5									15
	Total Time	78	88	0	0	0	0	0	0	0	0	

TABLE 1—(Continued)

Route Stops	Activities Performed	Route Designation I	J	D	B	H	F	G	E	A	C	Avg.
		(Minutes)										
Stop 5	Travel	59										59
to	Before Loading	12										12
Stop 6	Loading	7										7
	After Loading	5										5
	Total Time	83	0	0	0	0	0	0	0	0	0	
Stop 6	Travel	23										23
to	Before Loading	10										10
Stop 7	Loading	13										13
	After Loading	4										4
	Total Time	50	0	0	0	0	0	0	0	0	0	
Last Stop	Travel	88	85	28	32	90	85	151	152	9	108	83
to	Before Loading											
Plant	Loading											
	After Loading											
	Total Time	88	85	28	32	90	85	151	152	9	108	
	Prior to Unloading	10	10	0	0	10	5	0	7	0	1	4
Plant	Unloading	115	151	45	20	110	100	105	59	8	18	73
Total Route Time		732	694	200	240	695	608	862	718	57	195	500
Dozens Collected		8,370	8,370	1,680	840	8,370	6,450	8,220	3,840	300	1,140	4,758
Labor per 30-dozen case collected (minutes)		2.62	2.49	3.57	8.57	2.49	2.83	3.68	5.61	5.70	5.13	4.27

TABLE 2. Proportion of Total Time Per Route Spent on Various Activities on Egg Collection Routes, West Virginia, 1967

Activities Performed	Small Volume Routes (300-1,700 Dozen)					Medium Volume Routes (3,000-6,500 Dozen)			Large Volume Routes (8,000-8,500 Dozen)					Average All Routes
	A	B	C	D	Avg.	E	F	Avg.	G	H	I	J	Avg.	
	(per cent)													
Preparing for Departure	7.0	10.0	.5	2.5	5.0	5.6	2.8	4.2	3.3	2.5	3.0	4.0	3.2	4.1
Travel	31.6	67.6	78.5	43.0	55.2	76.3	62.1	69.2	59.2	60.6	48.9	49.4	54.5	57.6
Before Loading	40.3	5.8	3.6	11.0	15.2	3.5	4.1	3.8	12.1	5.2	10.5	8.9	9.2	10.4
Loading	5.3	5.8	5.6	12.0	7.2	3.9	7.6	5.7	10.7	9.5	12.3	8.9	10.4	8.2
After Loading	1.8	2.5	2.1	9.0	3.9	1.5	6.1	3.8	3.4	5.0	8.2	5.5	5.5	4.5
Before Unloading	0	0	.5	0	.1	1.0	.8	.9	0	1.4	1.4	1.5	1.1	.9
Unloading	14.0	8.3	9.2	22.5	13.4	8.2	16.5	12.4	11.4	15.8	15.7	21.8	16.1	14.3

TABLE 3. Simple Correlation Coefficients (r) and Coefficients of Determination (r^2) for Relationship Existing Between Volume of Eggs Collected at Each Stop and Time Spent on Each Activity at Each Stop, West Virginia, 1967

	Time Spent Traveling Between Stops	Time Spent Before Loading	Time Spent Loading	Time Spent After Loading	Total Time Spent at Each Stop
Correlation Coefficients (r)	.362°	.391°	.636°°	.465°°	.517°°
Coefficients of Determination (r^2)	.131	.153	.404	.216	.267

°Significant at the 5 per cent level.
°°Significant at the 1 per cent level.

Cost of Collecting Eggs From Farms

LABOR

Total labor cost associated with collecting eggs from farms is a function of time and wages paid plus fringe benefits (hospitalization, retirement, social security, bonuses, etc.) paid by the employer. In this study only the costs associated with time and wage rate are considered in determining the cost per case for collecting eggs from farms. Although the cost of fringe benefits paid by the employer is not considered, it is doubtful that the inclusion of fringe benefits would produce a significant change in the per case cost of collecting eggs.

Labor cost can be classified as either fixed or variable cost, depending on whether labor is paid on a salary or hourly basis. Labor is considered as variable cost in this report since all firms in the survey paid egg route employees on an hourly basis.

The range of hourly wages paid to route employees was $1.00 to $2.00 with a simple average of $1.61 per hour. Labor cost per 30-dozen case ranged from 5.96 to 16.94 cents per case (Table 4). Difference in the per case cost for the high and low cost routes is a result of time spent per case, wage rate paid to route employee, and volume of eggs collected in a given time period. Route D, one of the four smallest volume routes, has the lowest labor cost per case collected.

Two items explain why this small volume route had the lowest per case cost of all routes in the survey. First, the time devoted to each case collected (3.57 minutes) was only slightly higher than that of the large volume routes. Secondly, the hourly wage rate ($1.00 per hour) for Route D was much lower than the wage rate paid to employees on large volume routes. In other words, the efficient use of the route

TABLE 4. Labor Cost and Time Spent on Egg Collection Routes, West Virginia, 1967

Labor and Time Data	Small Volume Routes (300-1,700 Dozen)			Medium Volume Routes (3,000-6,500 Dozen)			Large Volume Routes (8,000-8,500 Dozen)			
	A	B	C	D	E	F	G	H	I	J
Labor Costs Per Hour (Dollars)	1.25	1.00	2.00	1.00	1.80	1.80	1.80	1.80	1.80	1.80
Labor Cost Per Minute (Cents)	2.08	1.67	3.33	1.67	3.00	3.00	3.00	3.00	3.00	3.00
Total Time Per Route (Minutes)	57	240	195	200	718	608	1,070	695	732	694
Total Labor Cost Per Route (Dollars)	1.19	4.01	6.44	3.34	21.54	18.24	32.10	20.85	21.96	20.82
Total Volume Collected (30-Dozen Cases)	10	23	38	56	128	215	274	279	279	279
Time Per Case (Minutes)	5.70	8.57	5.13	3.57	5.61	2.83	3.91	2.49	2.62	2.49
Labor Cost Per 30-Dozen Case (Cents)	11.90	14.32	16.94	5.96	16.33	8.48	11.71	7.46	7.87	7.46
Average Labor Cost Per Case (Cents)		12.82			12.66			8.63		

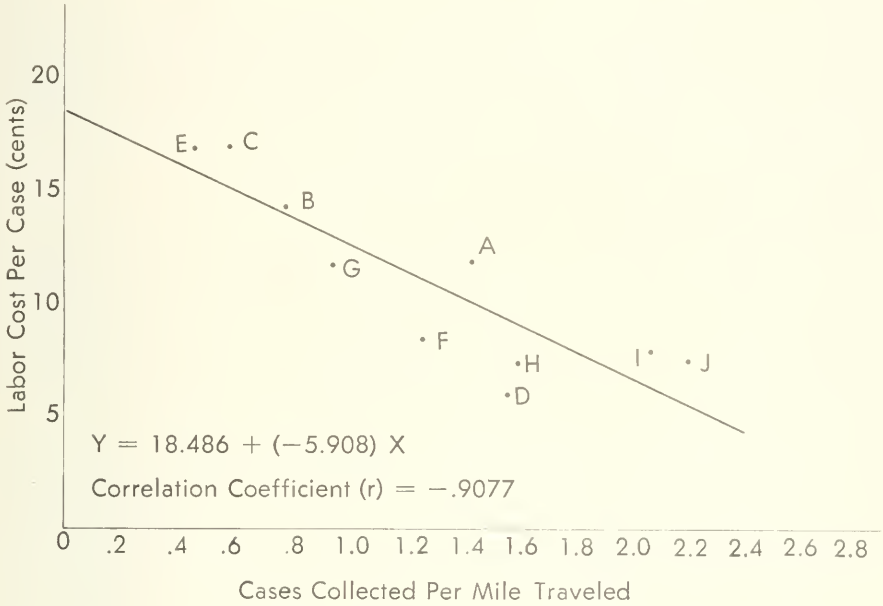

FIGURE 2. Linear Relationship Between Labor Cost Per Case and Cases Collected Per Mile Traveled, West Virginia, 1967.

employee's time plus a low wage rate resulted in the lowest labor cost per case collected. Route C had the highest labor cost (16.94 cents) per case collected. This high cost resulted from a large amount of labor (5.13 minutes) being used per case collected and a high wage rate of $2.00 per hour.

Although both the high cost and the low cost routes are small volume routes, a comparison of the per case labor cost figures in the bottom row and volume figures in row five of Table 4 suggests that in general labor cost per case decreases as volume per route increases. However, this inverse relationship was not significant when tested statistically.[6]

Earlier in this report (Table 2), it was shown that 57.6 per cent of the total route time was spent traveling. Travel on the route influences labor cost per case since the employee is being paid for riding or driving time which is not closely related to the volume of eggs collected. Therefore, one would expect labor cost per case to be lowest on routes where cases collected per mile driven is greatest. The linear regression line in Figure 2 estimates that labor cost per case decreases

[6] The regression coefficient (b) for this relationship was −.0178 and the correlation coefficient was −.55. The correlation coefficient was not significant at the 5 per cent or lower levels of probability.

5.908 cents as cases collected per mile driven increased from 1 to 2 cases. The correlation coefficient (r) of −.9077 is significant at the .01 level of probability. A correlation coefficient of this size indicates that over 82 per cent of the variability in labor cost per case is explained by the volume collected per mile driven.

TRUCK COST

Trucks ranging from ½ to 2 tons in size and from 1960 to 1965 in model were used in collecting eggs on the routes surveyed. Trucks used on six of the ten routes had refrigeration facilities. Seven trucks had a van type bed for hauling eggs. On the average route trucks traveled 135 miles at an average speed of 27 miles per hour and collected 4,758 dozens of eggs per route.

Data collected for this study did not include information on the cost associated with owning and operating trucks on egg collection routes. Furthermore, the authors were unable to locate any research which reported the current cost of owning and operating different size trucks. In the absence of adequate data, estimates were used in synthesizing the cost of owning and operating different size vehicles used on egg collection routes studied.

Truck cost associated with collecting eggs from farms was divided into fixed and variable cost. Fixed cost is associated with the ownership of a vehicle and includes such items of cost as depreciation, interest, taxes, license fee, and insurance. The annual cost of these five items does not change as the number of miles driven increases.[7] However, average fixed cost per mile will decline as annual fixed cost is spread over more miles of driving. Variable cost is associated with operation of the vehicle and includes such items as gasoline, oil, grease, tires, and repairs and maintenance. Total variable cost will increase as the number of miles driven increases.

Estimated total fixed cost per mile driven ranged from 1.499 cents for Route C to 8.098 cents for Route A with an average of 2.920 cents for all ten routes (Table 5). The wide range in fixed cost per mile for Routes C and A can be explained by annual fixed cost and the number of miles driven per year. The truck used on Route A was a 1963, ¾-ton vehicle driven 8,000 miles per year for an estimated total annual fixed cost of $647.44.[8] On Route C, a 1965, ½-ton vehicle was driven 50,000 miles per year for an estimated total annual fixed cost of $749.54. Although Route C shows a larger estimated annual fixed cost than Route

[7] This statement assumes that additional miles of driving does not change depreciation.

[8] Computation of annual fixed cost is presented in Appendix Tables 1-6.

TABLE 5. Estimated Fixed Cost Per Mile Driven for Trucks Used on Egg Collection Routes, West Virginia, 1967*

	Route	Depreciation		Interest		Taxes		License		Insurance		Total Fixed Cost Per Mile
		(cents)	(%)	(cents)	(%)	(cents)	(%)	(cents)	(%)	(cents)	(%)	(cents)
Small Volume Routes	A	4.988	61.6	.814	10.1	.427	5.3	.281	3.5	1.588	19.6	8.098
	B	1.113	43.9	.240	9.5	.126	5.0	.210	8.3	.847	33.4	2.536
	C	.918	61.2	.184	12.3	.096	6.4	.045	3.0	.256	17.1	1.499
	D	3.047	60.6	.607	12.1	.318	6.3	.210	4.2	.847	16.8	5.029
	Avg.	2.517	58.7	.461	10.7	.242	5.6	.187	4.4	.885	20.6	4.291
Medium Volume Routes	E	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	F	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	Avg.	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
Large Volume Routes	G	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	H	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	I	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	J	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	Avg.	1.167	58.1	.163	8.1	.085	4.2	.306	15.2	.286	14.2	2.007
	Average All Routes	1.707	58.5	.282	9.7	.148	5.1	.258	8.8	.525	18.0	2.920

*Appendix Tables 1-6 show assumptions and calculations used in deriving fixed cost estimates presented in this Table.

A, the fixed cost per mile for Route C was lower than for Route A because the total fixed cost was spread over more miles of driving.

An examination of the fixed cost per mile for the ten routes shows that depreciation accounts for more than 58 per cent of the total fixed cost for the average route (Table 5). Since depreciation cost per mile driven is related to value of vehicle and miles driven per year, management has several alternatives for reducing depreciation cost per mile. For example, used vehicles could be purchased for egg collections, or the high depreciation cost on newer vehicles could be lowered by making sure the vehicle is used more intensively and does not remain idle for long periods of time. Spreading high depreciation cost of a new vehicle over more miles might be a more desirable approach for lowering cost than using older vehicles which normally have low annual depreciation cost but high operating and maintenance cost. For example, although an older truck has a lower annual depreciation than a new truck, the increase in the cost of operating and maintaining the older vehicle may be more than enough to offset any reduction obtained by lower depreciation cost.

On the average route, insurance accounted for the second largest portion of fixed cost per mile, followed by interest on investment, license fee, and taxes, respectively.

The variable cost associated with operating trucks is to pay for such items as gasoline, oil, oil filters, grease, tires, and repairs and maintenance. Total cost for these items will increase with each additional mile driven.

Estimated variable cost per mile for operating different size trucks on the egg collection routes ranged from 4.946 cents per mile for ½- and ¾-ton trucks to 9.301 cents per mile for 2-ton trucks (Table 6).[9] Regardless of truck size, gasoline accounted for more than 50 per cent of the estimated per mile operating cost with tires and repairs and maintenance being the second and third most important items of cost.

Total truck cost per mile (fixed plus variable cost) for the collection routes ranged from 6.445 cents for a ½-ton truck on Route C to 13.044 cents for ¾-ton truck on Route A (Table 7). It is a common belief that the total per mile cost for larger trucks is higher than for small trucks. This is not necessarily true. The estimates in Table 7 show that total truck cost per mile for trucks in the survey is lower for the 2-ton trucks than for the ¾- and 1-ton trucks.

This relationship can be explained by observing the fixed cost and variable cost figures for different size trucks. Except for Route C, fixed

[9] Assumptions used in computing variable cost per mile for different size vehicles are shown in Appendix Table 7.

TABLE 6. Estimated Variable Cost Per Mile for Operating Different Size Trucks on Egg Collection Routes, West Virginia, 1967

Items of Variable Cost	Small Volume Routes (300-700 Dozen)			Medium Volume Routes (3,000-6,500 Dozen)			Large Volume Routes (8,000-8,500 Dozen)			
	A	B	C	D	E	F	G	H	I	J
Truck Size (tons)	¾	1	½	1	2	2	2	2	2	2
Gasoline Cost (cents per mile)	2.750	3.300	2.750	3.300	5.500	5.500	5.500	5.500	5.500	5.500
Oil Cost (cents per mile)	.090	.105	.090	.105	.120	.120	.120	1.20	1.20	.120
Oil Filter Cost (cents per mile)	.031	.031	.031	.031	.031	.031	.031	.031	.031	.031
Grease Cost (cents per mile)	.075	.150	.075	.150	.150	.150	.150	.150	.150	.150
Tire Cost (cents per mile)	1.000	1.500	1.000	1.500	2.000	2.000	2.000	2.000	2.000	2.000
Repairs and Maintenance Cost (cents per mile)	1.000	1.250	1.000	1.250	1.500	1.500	1.500	1.500	1.500	1.500
Total Variable Cost (cents per mile)	4.946	6.336	4.946	6.336	9.301	9.301	9.301	9.301	9.301	9.301

TABLE 7. Estimated Total Truck Cost Per Mile and Per Case for Egg Collection Routes, West Virginia, 1967

Truck, Cost, and Volume Information	Small Volume Routes (300-1,700 Dozen)			Medium Volume Routes (3,000-6,500 Dozen)			Large Volume Routes (8,000-8,500 Dozen)			
	A	B	C	D	E	F	G	H	I	J
Truck Size (tons)	¾	1	½	1	2	2	2	2	2	2
Fixed Cost per mile (cents)	8.098	2.536	1.499	5.029	2.007	2.007	2.007	2.007	2.007	2.007
Variable Cost per mile (cents)	4.946	6.336	4.946	6.336	9.301	9.301	9.301	9.301	9.301	9.301
Total Truck Cost per mile (cents)	13.044	8.872	6.445	11.365	11.308	11.308	11.308	11.308	11.308	11.308
Total Miles Driven on the Route	7	37	67	36	267	170	290	176	135	127
Total Truck Cost per Route (dollars)	.91	3.28	4.32	4.09	30.19	19.22	32.79	19.90	15.27	14.36
Total Volume (30-dozen cases)	10	28	38	56	128	215	274	279	279	279
Miles per case	.700	1.321	1.763	.643	2.086	.791	1.058	.631	.484	.455
Truck Cost per case Collected (cents)	9.10	11.72	11.36	7.31	23.59	8.94	11.96	7.14	5.47	5.15
Average Truck Cost per case (cents)		9.88			16.26			7.43		

cost is lower and variable cost higher per mile for 2-ton trucks than for ¾- and 1-ton trucks. The low fixed cost per mile for 2-ton trucks occurred because total annual fixed cost was spread over more miles of driving. In other words, the larger trucks were used more intensively than the ¾- and 1-ton trucks in the survey.

Total truck cost per case ranged from 5.15 cents for Route J to 23.59 cents for Route E. The high cost per case on Route E resulted from lack of concentrated volume. That is, more than two miles of driving was required to collect a case of eggs on Route E, while less than one-half mile was required on Route J. Difference in the concentration of volume on these two routes was responsible for an additional cost of 18.44 cents per case or .61 cents per dozen on Route E.

The linear relationship depicted in Figure 3 shows that truck cost per case decreases 7.28 cents as concentration on the route increases from 1 to 2 cases per mile driven. The correlation coefficient of −.8517 is significant at the 1 per cent level and indicates that more than 72 per cent of the variation in truck cost per case is explained by concentration of cases collected on the route.

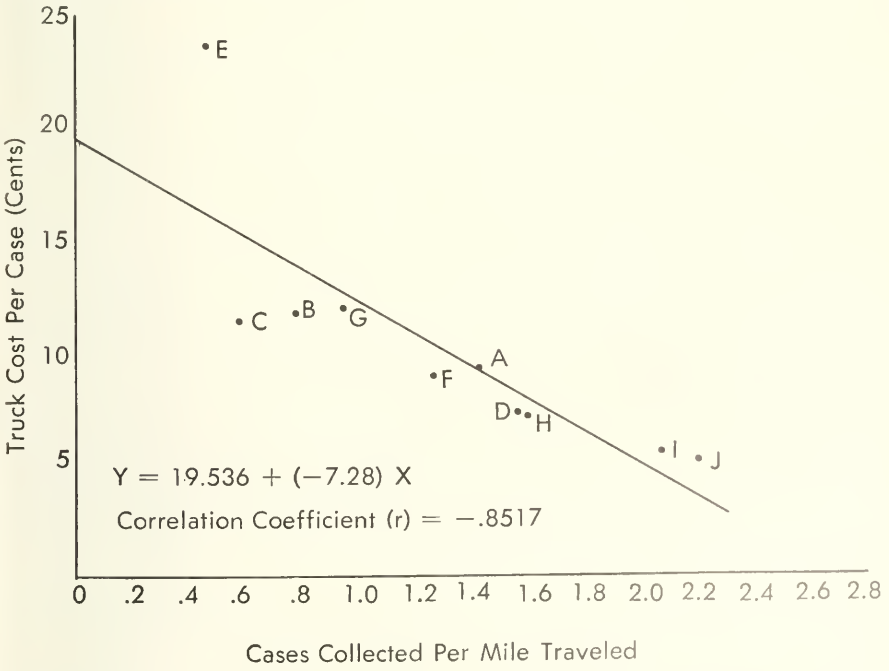

FIGURE 3. Linear Relationship Between Truck Cost Per Case and Cases Collected Per Mile Traveled, West Virginia, 1967.

TOTAL COST

The cost of labor per hour or the truck cost per mile are not as important to a firm as the total cost per unit of output. In this study, a 30-dozen case of eggs was considered as a unit of output.

Total cost (labor and truck) per case for collecting eggs from farms ranged from 12.61 cents for Route J to 40.42 cents for Route E (Table 8). A comparison of the low cost and high cost routes shows that although employees were paid $1.80 per hour on both routes, only 2.49 minutes of labor were required per case on Route J compared to 5.61 minutes for each case on Route E (Table 4). In other words, more efficient use of labor on Route J resulted in lower labor cost per case. Both the high cost and the low cost routes used two-ton trucks which had the same total cost per mile driven (Table 7). However, only .455 miles of driving was required per case on Route J, while 2.086 miles were required per case to Route E (Table 7).

The small volume routes had an average total cost per case which was about 38 per cent higher than the average for large volume routes. Average labor cost per case on small volume routes was slightly lower than medium volume and more than 42 per cent higher than large volume routes. Average truck cost per case on small volume routes was 6.4 cents lower than medium volume routes and 2.5 cents higher than large volume routes. The fact that medium volume routes have the highest average labor, average truck, and average total cost per case, indicates that labor and trucks are being used less efficiently on these routes compared to the small and large volume routes. The high average truck cost per case for the medium volume routes is a result of the lack of concentrated volume on the route. On medium volume routes, 1.4 miles of travel was needed to collect one case of eggs while an average of 1.1 and .7 miles were needed to collect a case of eggs on small and large volume routes respectively.

Average labor cost per case was about 4 cents lower for large volume than for small and medium volume routes. This lower cost resulted from more efficient use of labor. Table 4 shows that large volume routes paid $1.80 an hour for labor and used an average of 2.9 minutes of labor per case while the average for all routes was $1.61 per hour and 4.29 minutes per case.

The linear relationship depicted in Figure 4 estimates that the total cost (labor and truck) of collecting eggs decreases 13.18 cents per case as cases collected increase from 1 to 2 per mile of travel. The correlation coefficient is significant at the 1 per cent level and indicates that more than 86 per cent of the total cost of collecting a case of eggs is explained by the concentration of eggs on the route.

TABLE 8. Total Cost Per Case for Collecting Egg From Farms, West Virginia, 1967

Type of Cost	Small Volume Routes (300-1,700 Dozen)					Medium Volume Routes (3,000-6,500 Dozen)			Large Volume Routes (8,000-8,500 Dozen)					Average All Routes
	A	B	C	D	Avg.	E	F	Avg.	G	H	I	J	Avg.	
	(Cents per case)													
Labor	11.90	14.32	16.95	5.96	12.28	16.83	8.48	12.66	11.71	7.47	7.87	7.46	8.63	10.90
Truck	9.13	11.72	11.36	7.31	9.88	23.59	8.94	16.26	11.96	7.14	5.47	5.15	7.43	10.51
Total Cost	21.03	26.04	28.31	13.27	22.16	40.42	17.42	28.92	23.67	14.61	13.34	12.61	16.06	21.41

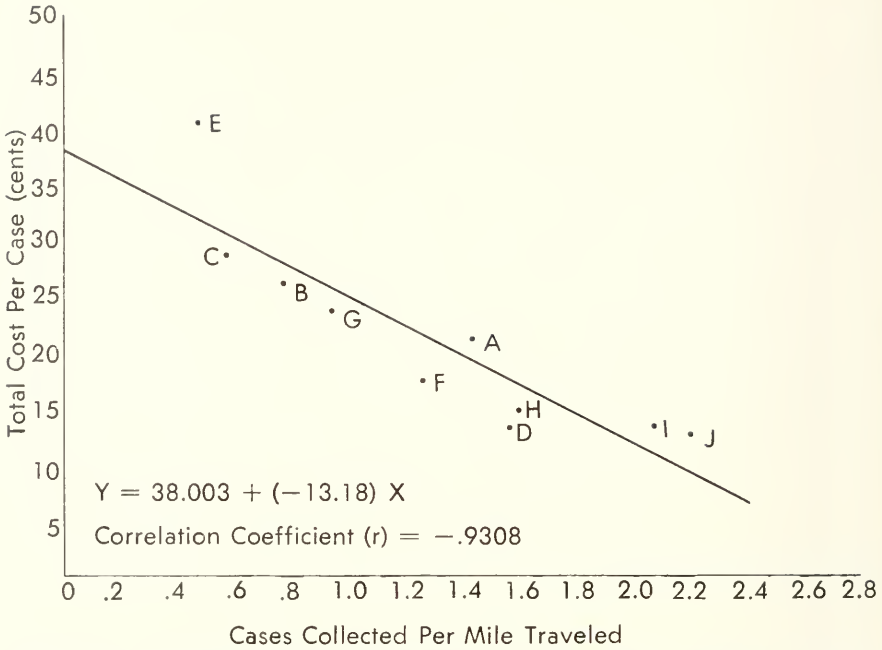

FIGURE 4. Linear Relationship Between Total Cost Per Case and Cases Collected Per Mile Traveled, West Virginia, 1967.

Cost in West Virginia Compared With Other Areas

Egg collection costs have been reported for farm cooperatives in the North Central and Western States. Cooperatives in these areas had an average annual volume of 101,659 and 181,348 cases respectively. Labor cost for collecting eggs included wages and salaries plus other costs associated with labor such as federal old age benefits, unemployment insurance, workmen's compensation, bonuses, pensions, and hospital insurance.

The firms interviewed in West Virginia averaged handling 49,000 cases of eggs per year. Labor costs reported for West Virginia included only the hourly wage rates paid to employees. Overtime and fringe benefits were not included in labor cost per case.

Although information presented above indicates that egg collection costs reported for cooperatives in the North Central and Western States are not comparable in all aspects with data obtained in West Virginia, a comparison of costs in the three areas still provides an insight to the relative position of each area.

Total cost per case for collecting eggs in the North Central States was 16.1 cents higher than in West Virginia and the cost in the Western States was 7.2 cents lower than in West Virginia (Table 9).

TABLE 9. A Comparison of Cost of Collecting a Case of Eggs from Farms in West Virginia, North Central States and Western States

Type of Cost	Area		
	West Virginia	North Central[a]	Western[b]
Labor (cents per case)	10.9[c]	22.9	8.7
Truck (cents per case)	10.5	14.6	5.5
Total Cost (cents per case)	21.4	37.5	14.2

[a] Harry E. Ratcliffe, *cost of marketing eggs and labor output of selected co-operatives* (part II—North Central States; general report 72, Farmer cooperative service, U.S. Department of Agriculture, May 1960), p. 17.

[b] Harry E. Ratcliffe, *cost of marketing eggs and labor output of selected co-operatives* (part III—Western States, general report 75, Farmer cooperative service, U.S. Department of Agriculture, July 1960), p. 17.

[c] West Virginia labor cost includes only wage paid to employees, while labor cost for North Central and Western areas include wages and salaries, plus other costs such as federal old age benefits, unemployment insurance, workmen's compensation, pensions, hospital insurance.

The difference in per-case cost in the three areas can be partially explained by the output per man hour. In West Virginia, the average output per man hour was 18.72 cases compared to 7 cases in North Central States and 38.8 cases in the Western States. Although no salary payments or wage rates were reported for the North Central and Western States, the data in Table 9 show labor cost per case varying inversely with output per man hour. Furthermore, average labor cost per case in West Virginia approaches the low cost in the Western States and is much lower than the North Central States. However, as pointed out above, fringe costs were not included in the West Virginia data.

Truck cost per case collected in West Virginia falls about midway between the cost in the other two areas. Although data are lacking for explaining why these differences exist between areas, Table 9 shows that West Virginia truck cost per case is not actually unfavorable relative to the other two areas.

In West Virginia, labor and truck cost each accounted for about 50 per cent of the total cost of collecting a case of eggs. In the other two areas, labor accounted for approximately 61 per cent and truck 39 per cent of total cost per case. These proportions indicate that in West Virginia labor is being used more efficiently than trucks when compared with the other two areas.

The inefficient use of trucks relative to labor in West Virginia could result from trucks not being used to full capacity so that fixed cost is spread over more units of output or the miles driven per case collected may be too high. Since miles driven per case collected requires service of driver and since use of labor appears to be fairly efficient, it leads one to believe the relative inefficient use of trucks results from not using them to full capacity.

Summary

As laying flocks continue to increase in size in West Virginia, producers are likely to place more emphasis on production and more of the marketing functions will shift to off-farm firms. As this shift occurs, an efficient marketing system must be organized for moving eggs from farms to packers and processors in order for egg production and marketing in the State to be competitive with other areas. With this in mind, this study was organized for the purpose of answering the following question:

What is the present labor and truck costs associated with collecting a 30-dozen case of eggs from farms by packers and processors located in West Virginia?

Basic data for labor utilization, volume collected, number of stops, and mileage traveled were obtained by a field recorder who traveled with the route employee on ten egg collection routes. Estimates were used in synthesizing per-mile cost of operating and owning different size vehicles used in collecting eggs. Data on wage rates, total volume per year, and total truck miles per year were obtained from managers of firms cooperating in the study.

Labor cost and truck cost averaged 10.9 and 10.5 cents per case respectively for the ten routes. Truck cost per case on small and large volume routes was lower than the all route average, while truck cost on medium volume routes was higher than the average. Large volume routes was the only group that had a per-case labor cost which was lower than the all route average (Figure 5).

More than 57 per cent of total route time was utilized traveling on the route. Only 22.5 per cent of the total route time was spent loading and unloading eggs. The first stop on the route required more time than other stops.

Although significant at the .01 level, the simple correlation coefficient showed that the degree of relationship between volume collected and total time spent at each stop was small ($r = .517$). The greatest degree of relationship existed between volume loaded and time spent loading ($r = .636$).

Labor cost decreased 5.908 cents per case as the cases collected per mile of travel increased from 1 to 2 ($b = 5.908$).

Truck cost per case ranged from 5.47 to 23.59 cents. Average truck cost per case was highest for medium volume routes and lowest for large volume routes. A simple regression coefficient (b) showed that truck cost per case decreased 7.280 cents as cases collected per mile increased from 1 to 2.

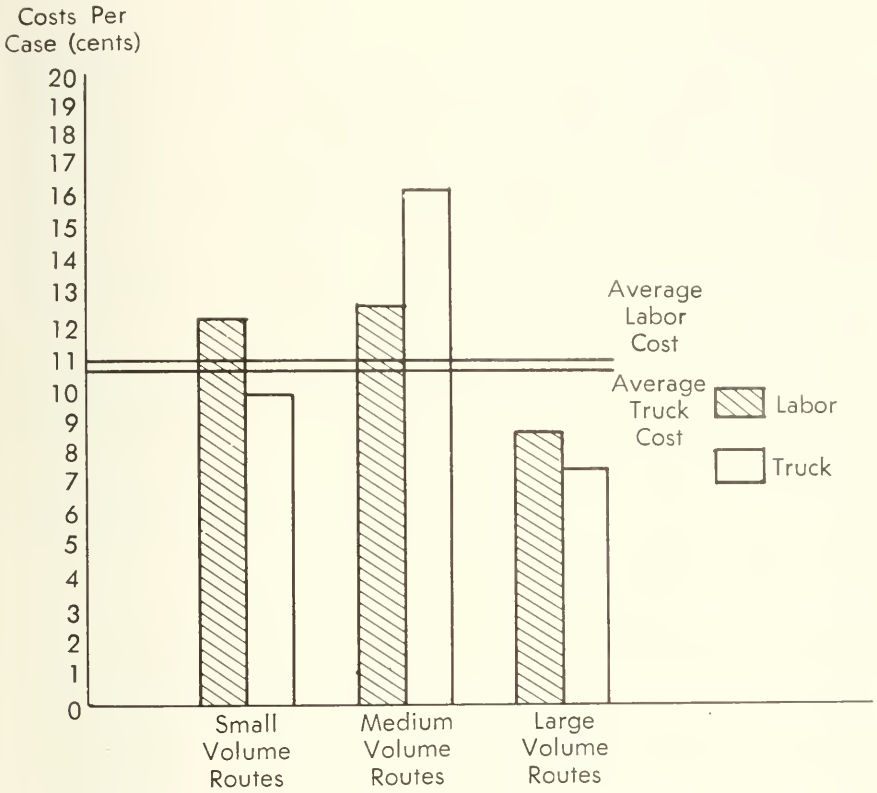

FIGURE 5. Average Labor and Truck Cost Per Case of Eggs Collected for Three Size Groups, West Virginia, 1967.

Total cost per case (labor plus truck) ranged from 12.61 to 40.12 cents. Medium volume routes had the highest average total cost per case, while large volume routes had the lowest average total cost per case. A simple regression coefficient (b) showed that total cost per case collected decreased 13.18 cents per case as cases collected per mile of driving increased from 1 to 2.

A comparison of egg collection costs in West Virginia with those for cooperatives in the North Central and Western States showed that total collection cost per case in West Virginia was more than 16 cents lower than in North Central and over 7 cents higher than in Western States. This comparison also showed that labor cost per case in West Virginia was more competitive than truck cost with the other two areas.

Inferences

Egg collection costs per case could be lowered considerably by increasing the concentration of eggs along the route. Firms collecting eggs on routes could attempt to bring about greater concentration by paying premiums to producers located near the processing plant or to those producers who have a large volume of eggs per stop. Cases of eggs collected per mile driven might by increased by better route planning. That is, routes of a single firm should not overlap and one route should supply enough eggs for a truck load so that the most efficient use can be made of trucks and labor.

In some instances the firms collecting eggs from farms may be able to reduce costs by paying producers a premium for delivering eggs to the plant instead of using their own employees and trucks for collecting eggs.

Collection cost per case could be reduced by using the trucks more intensively in order to spread total fixed cost over more units of output thus lowering the average fixed cost per case.

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APPENDIX

APPENDIX TABLE 1. Depreciation Cost for Trucks Used on Egg Collection Routes, West Virginia, 1967

Route Designation	Model	Size	Factory Price*	1967 Value**	Average Annual Depreciation***	Miles Driven Per Year	Depreciation Cost Per Mile Driven
		(ton)	(dollars)	(dollars)	(dollars)		(cents)
A	1963	¾	2,682	1,085	399	8,000	4.988
B	1960	1	2,470	600	267	15,000	1.113
C	1965	½	2,449	1,531	459	50,000	0.918
D	1965	1	2,432	1,518	457	15,000	3.047
E	1962	2	3,678	1,166	502	43,000	1.167
F	1962	2	3,678	1,166	502	43,000	1.167
G	1962	2	3,678	1,166	502	43,000	1.167
H	1962	2	3,678	1,166	502	43,000	1.167
I	1962	2	3,678	1,166	502	43,000	1.167
J	1962	2	3,678	1,166	502	43,000	1.167

*Average Factory Advertised Delivered Price, includes standard equipment federal excise tax, dealer handling and preparation charges. Transportation, state and local taxes, and refrigeration unit are not included. *Red Book*, Official Used Car Valuations, July 1 - August 14, 1967, Region-A.

**Taken from *Red Book*, Official Used Car Valuations, July 1 - August 14, 1967, Region-A.

***Average annual depreciation was computed by taking the difference between factory price and 1967 value and dividing age of truck in years Example —

1962 Chev Truck	
Factory Price	$3,678
1967 Value	1,166
Total depreciation	2,512

Age 1967-62 = 5 years
$2,512 ÷ 5 = $502

APPENDIX TABLE 2. Estimated Charge for Money Invested in Trucks on Egg Collection Routes, West Virginia, 1967

Route Designation	Model	Size	1967 Avg. Retail Value	6% Charge on 1967 Value	Miles Driven Per Year	Interest Cost Per Mile Driven
		(ton)	(dollars)	(dollars)		(cents)
A	1963	¾	1,085	65.10	8,000	.814
B	1960	1	600	36.00	15,000	.240
C	1965	½	1,531	91.86	50,000	.184
D	1965	1	1,518	91.08	15,000	.607
E	1962	2	1,166	69.96	43,000	.163
F	1962	2	1,166	69.96	43,000	.163
G	1962	2	1,166	69.96	43,000	.163
H	1962	2	1,166	69.96	43,000	.163
I	1962	2	1,166	69.96	43,000	.163
J	1962	2	1,166	69.96	43,000	.163

APPENDIX TABLE 3. Property Tax on Trucks Used on Egg Collection Routes, West Virginia, 1967

Route Designation	Model	Size	1967 Avg. Retail Value*	Avg. Tax Levy** Per $100 Value	Annual Tax Cost	Miles Driven Per Year	Tax Cost Per Miles Driven
		(tons)	(dollars)	(dollars)	(dollars)		(cents)
A	1963	¾	1,085	3.147	34.14	8,000	.427
B	1960	1	600	"	18.88	15,000	.126
C	1965	½	1,531	"	48.18	50,000	.096
D	1965	1	1,518	"	47.77	15,000	.318
E	1962	2	1,166	"	36.69	43,000	.085
F	1962	2	1,166	"	36.69	43,000	.085
G	1962	2	1,166	"	36.69	43,000	.085
H	1962	2	1,166	"	36.69	43,000	.085
I	1962	2	1,166	"	36.69	43,000	.085
J	1962	2	1,166	"	36.69	43,000	.085

*Average of retail values for various sized trucks reported in *Red Book* Official Used Car Valuations July 1 - August 14, 1967, Region—A.

**State of West Virginia, G. Thomas Battle, Tax Commissioner, Assessed Valuation and Taxes Levied 1956-1967—ALD-12-56.

APPENDIX TABLE 4. Fees for Motor Vehicle Licenses, West Virginia, 1967

Route Designation	Model	Size	Gross Vehicle Weight	Annual License Fee*	Miles Driven Per Year	License Cost Per Mile Driven
			(pounds)	(dollars)		(cents)
A	1963	¾	8,000	22.50	8,000	.281
B	1960	1	10,000	31.50	15,000	.210
C	1965	½	8,000	22.50	50,000	.045
D	1965	1	10,000	31.50	15,000	.210
E	1962	2	23,000	131.50	43,000	.306
F	1962	2	23,000	131.50	43,000	.306
G	1962	2	23,000	131.50	43,000	.306
H	1962	2	23,000	131.50	43,000	.306
I	1962	2	23,000	131.50	43,000	.306
J	1962	2	23,000	131.50	43,000	.306

* Schedule of Motor Vehicle Fees for All Classes, Effective July 1, 1960, Department of Motor Vehicles, State of West Virginia.

APPENDIX TABLE 5. Insurance Cost for Trucks Used on Egg Collection Routes, West Virginia, 1967

Route Designation	Model	Size	Annual Insurance Cost*	Miles Driven Per Year	Insurance Cost Per Mile Driven
		(tons)	(dollars)		(cents)
A	1963	¾	127.00	8,000	1.588
B	1960	1	127.00	15,000	.847
C	1965	½	128.00	50,000	.256
D	1965	1	127.00	15,000	.847
E	1962	2	123.00	43,000	.286
F	1962	2	123.00	43,000	.286
G	1962	2	123.00	43,000	.286
H	1962	2	123.00	43,000	.286
I	1962	2	123.00	43,000	.286
J	1962	2	123.00	43,000	.286

* Annual cost for following insurance coverage on each truck.
(a) Personal and property liability — 100/300/50
(b) Medical Payment — $2,000
(c) Uninsured motorist — $10,000 for one person
20,000 for two persons
(d) Collision — $100 Deductible
(e) Comprehensive — full coverage

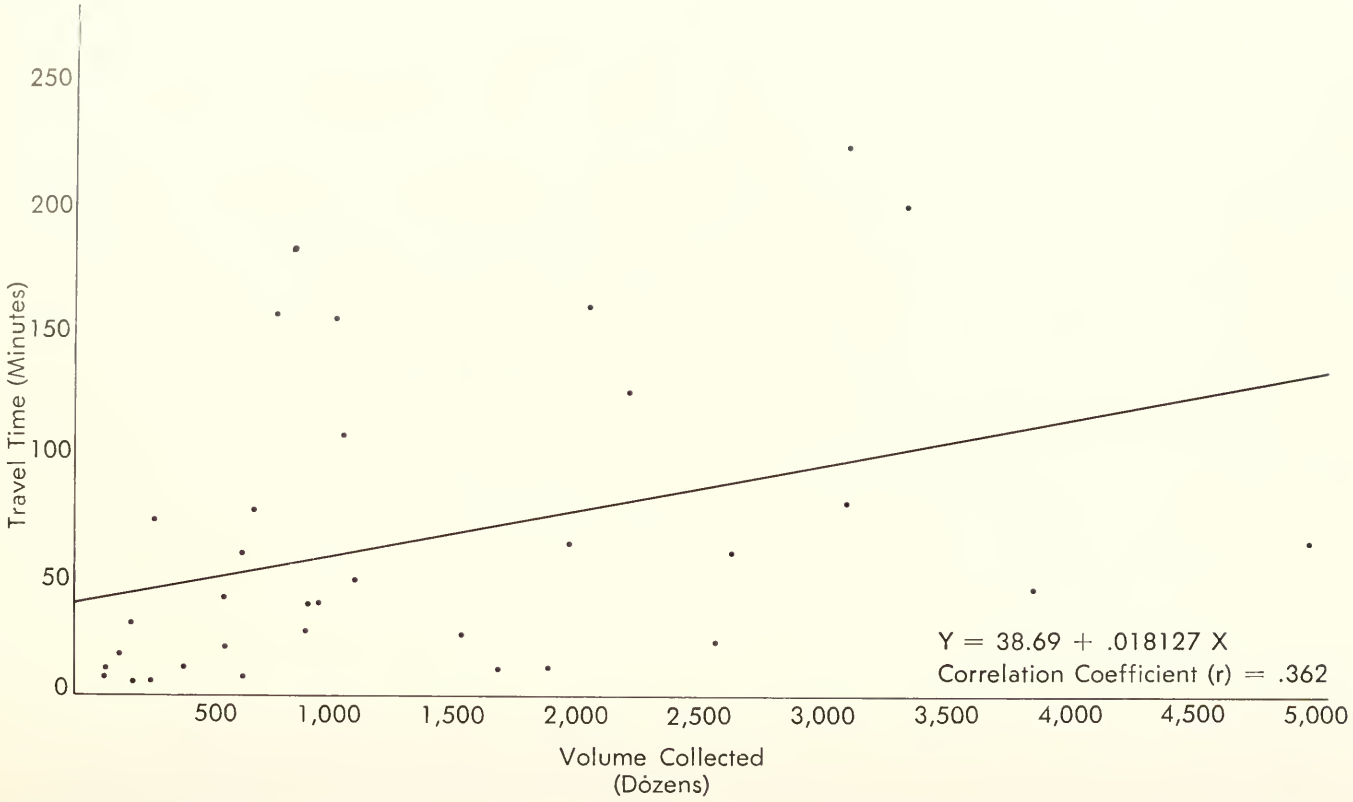
These cost figures were obtained from a local insurance agent in Morgantown.

APPENDIX TABLE 6. Annual Fixed Costs for Trucks Used on Egg Collection Routes, West Virginia, 1967

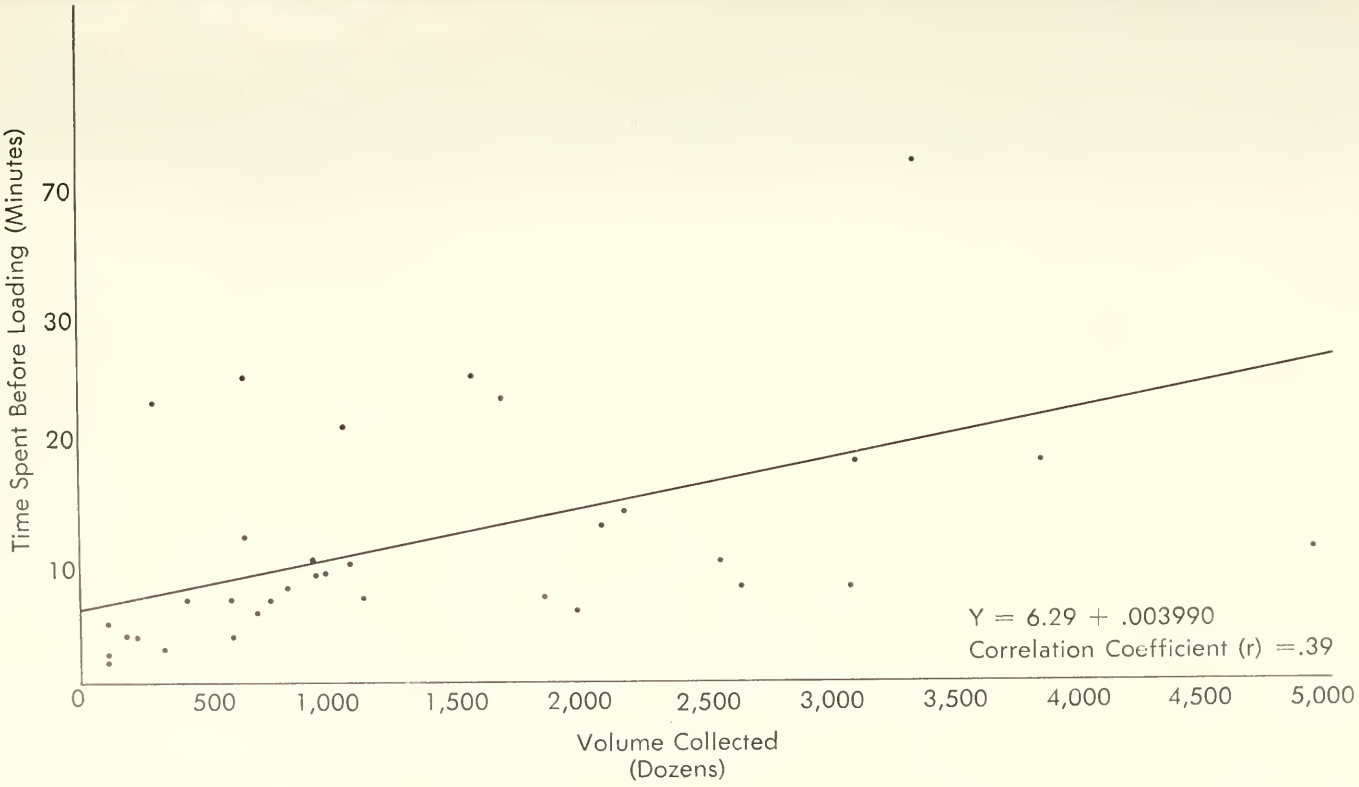
Route Designation	Items of Fixed Costs					Total Fixed Cost Per Year
	Depreciation	Interest	Taxes	License	Insurance	
A	$399.00	$65.10	$34.14	$ 22.50	$127.00	$647.74
B	267.00	36.00	18.88	31.50	127.00	480.38
C	459.00	91.86	48.18	22.50	128.00	749.54
D	457.00	91.08	47.77	31.50	127.00	754.35
E	502.00	69.96	36.69	131.50	123.00	863.15
F	502.00	69.96	36.69	131.50	123.00	863.15
G	502.00	69.96	36.69	131.50	123.00	863.15
H	502.00	69.96	36.69	131.50	123.00	863.15
I	502.00	69.96	36.69	131.50	123.00	863.15
J	502.00	69.96	36.69	131.50	123.00	863.15

APPENDIX TABLE 7. Estimates Used in Computing Variable Cost for Operating Different Size Trucks, West Virginia, 1967

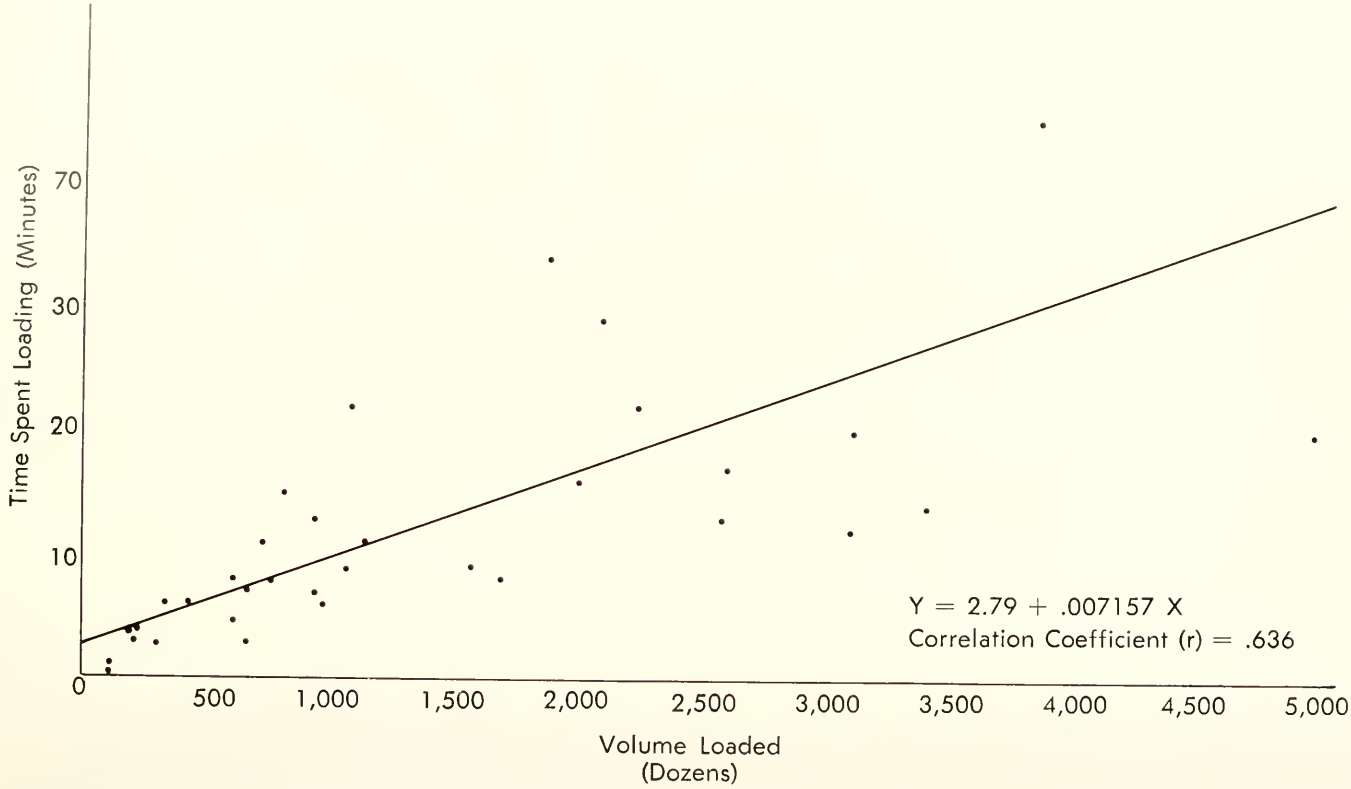
Items of Variable Cost	Truck Size (tons)			
	½	¾	1	2
Gasoline				
Price per gallon (cents)	33.00	33.00	33.00	33.00
Miles per gallon	12	12	10	6
Oil				
Quarts per 4,000 miles	6	6	7	8
Price per quart (cents)	60.00	60.00	60.00	60.00
Oil Filter				
Frequency of change (miles)	8,000	8,000	8,000	8,000
Cost per filter (dollars)	2.50	2.50	2.50	2.50
Grease				
Frequency of greasing (miles)	2,000	2,000	2,000	2,000
Cost of greasing (dollars)	1.50	1.50	3.00	3.00
Tires				
Cost per mile (cents)	1.00	1.00	1.50	2.00
Repairs and Maintenance Cost per mile (cents)	1.00	1.00	1.25	1.50



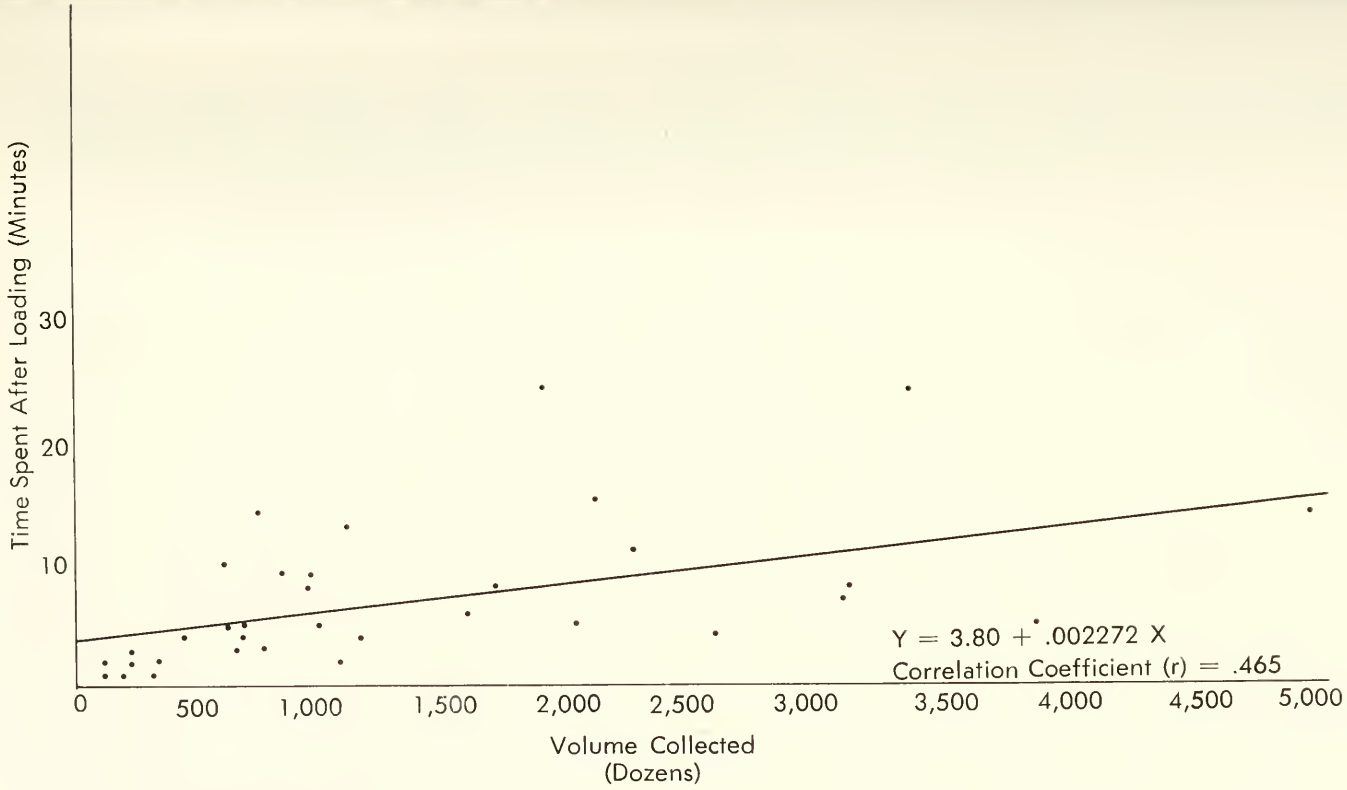
APPENDIX FIGURE 1. Linear Relationship Between Volume Collected at Each Stop and Time Used in Traveling to Pick-up Point.



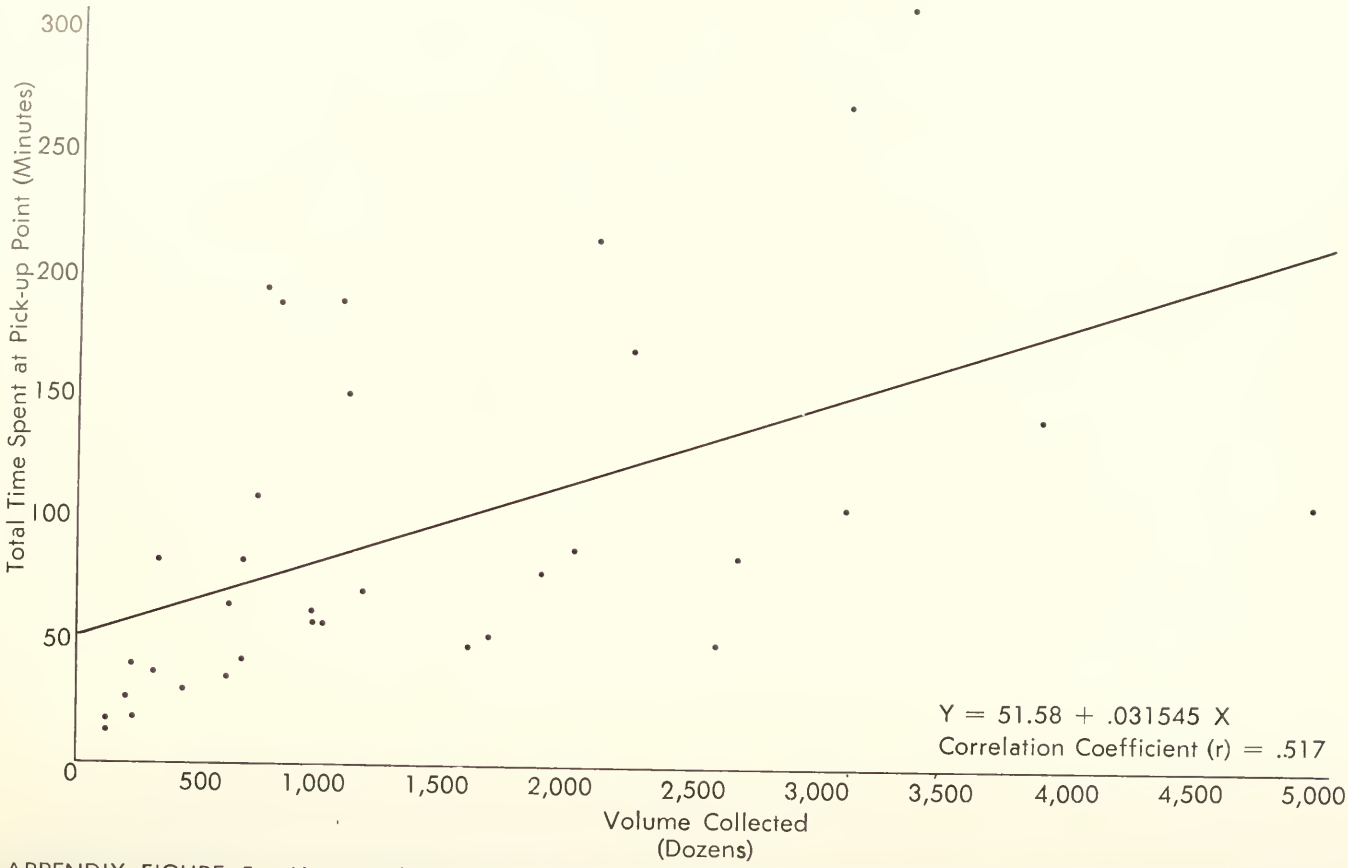
APPENDIX FIGURE 2. Linear Relationship Between Volume Collected and Time Spent Before Loading at Pick-up Point.



APPENDIX FIGURE 3. Linear Relationship Between Volume Collected and Loading Time at Each Pick-up Point.



APPENDIX FIGURE 4. Linear Relationship Between Volume Collected and Time Spent After Loading at Each Pick-up Point.



APPENDIX FIGURE 5. Linear Relationship Between Volume Collected and Total Time Spent at Each Pick-up Point.