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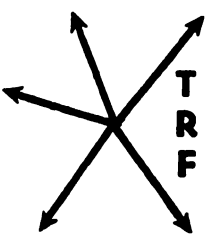

TRANSPORTATION RESEARCH FORUM

Economic Efficiency of Meat and Livestock Trucking Firms

by Dale G. Anderson and Wayne W. Budt**

TRANSPORTATION is a crucial link in the chain of activities that brings agricultural products to U.S. consumers. The development of specialized urban and rural areas reflects the important role that transportation has played in agricultural marketing and is suggestive of an important future role.

Transportation costs have accounted for approximately 7 to 10 percent of the cost of marketing the total output of farm food products during the last 15 years. It is important to shippers as well as to consumers that these transport activities be efficient in both an operational and a pricing sense.

Truck transportation plays a particularly important role in the shipment of meat and livestock. Nearly all livestock is moved by truck. Results of a recent survey of meat-packing firms indicate that more than three-fourths of the long-haul shipments of meat from Nebraska packers are moved by motor carrier.[1]

PURPOSE OF STUDY

This study was designed to measure costs of long-distance shipment of meat by motor carrier. These costs were then compared against published rates for meat shipments by truck, rail and trailer-on-flatcar (TOFC). Finally, meat trucking costs were compared with costs of shipping meat-equivalent amounts of livestock.

The results of this study provide a basis for evaluating the economic merits of expanded livestock production activities in grain-surplus Great Plains locations.[2] Such an expansion might aid in the economic development of the region and ease the chronic problem of rail freight-car supply.

This study sheds needed light on the merits of economic regulation of the trucking industry. Proposals ranging from extension of present regulation to cover livestock trucking to deregulation of all transportation activities are in need of economic scrutiny.

The study also analyzes the effects of the changing energy situation on delivered costs of meat. Such cost evidence has implications for national energy policy.

Finally, results provide commercial truckers with a standard against which they can measure efficiency of their own operations. Shippers or other prospective owners are afforded guidelines as to the feasibility of truck operation.

ANALYTICAL PROCEDURES

Economic-engineering cost-finding techniques were employed to synthesize costs for alternative trucking firm sizes and levels of resource employment.[3] Least-squares regression procedures were applied to published transportation rates to determine the average relationship between rates and distance. Livestock trucking costs were obtained from a secondary source.[4]

Model Meat Trucking Firms

Four sizes of meat trucking firms were structured:

Model I—10 semi-trailer/tractor units
Model II—100 semi-trailer/tractor units
Model III—200 semi-trailer/tractor units
Model IV—300 semi-trailer/tractor units

The trucks had 44-foot trailers with a net capacity of 40,000 pounds. Trucks traveled at an overall average speed of 55-60 miles per hour and had a fuel consumption rate of four miles per gallon. Each truck was driven a maximum of 150,00 miles per year.

An average round trip of 3,000 miles was assumed in computing average total costs. An additional 572 miles per trip were logged in collecting and delivering backhaul traffic. Only the long-run marginal costs attributable to the backhaul—the costs incurred in traveling the additional 572 miles—were charged to backhaul traffic (the additional variable costs plus 572/3572 of the total fixed costs).

Survey results indicated that approximately 28 percent of the meat trucked from Nebraska was moved 1,400 miles or more, while 42 percent traveled a distance of at least 1,000 miles. Since average variable costs per mile tend to be constant over a wide range of haul lengths, costs per mile would change (increase) only as annual mileage might be affected (reduced) by shortened hauls. Since more loads could be ca

**Associate Professor and former Research Assistant, respectively, Department of Agricultural Economics, University of Nebraska-Lincoln.*

ried per year, the average cost per ton would decline with shortened hauls.

Fixed Costs

Each firm's plant contained an office area and shop located in a steel and frame building; size of the facilities increased with the number of trucks. Fixed plant resources and their cost are itemized in Table 1, the annual fixed expenses in Table 2.

The investment costs for each of the four models were amortized over varying periods of time depending on expected life of each asset. An interest rate of 8 percent of the average undepreciated value of all capital assets was assessed as an annual opportunity cost of capital.

The straight-line method of calculation was employed for all depreciation. Trucks were traded every three years at which time units had an estimated salvage value of 58 percent. Buildings were depreciated over 20 years to a 20-percent salvage value. Shop equipment was assumed to last 10 years with a 20-percent salvage; office equipment was depreciated over 15 years to a 20-percent salvage value; and the company pickup trucks were depreciated over five years and had a 10-percent salvage value.

Office and shop salaries were treated as fixed costs. Since union and contract agreements limit management's ability to add or drop employees, the costs of these resources were quasi fixed. Thus, though not totally fixed their costs cannot be termed variable in the same sense as fuel expenditures. All wages and salaries, except those of the drivers, were viewed as fixed.

Annual managerial salaries varied by firm size: $15,000 for Model I, $19,000 for Model II, $21,000 for Model III and $23,000 for Model IV. Secretaries, dispatchers, and accountants were paid an hourly equivalent of $2.50, $5.00 and $5.60 per hour, respectively, for 40 hours of work per week. Mechanics earned $5.00 per hour. Servicemen, who earned $3.00 per hour, were responsible for minor maintenance such as oil changes and tire repair. Both mechanics and servicemen were employed on a 40-hour week. Personnel requirements for each firm are outlined in Table 3.

Variable Costs

Five categories of variable costs were identified:

Category	Cost/mile
Drivers' wages	12.4¢
Fuel	7.5¢
Tires	0.009¢
Maintenance	0.008¢
Miscellaneous	0.001¢

Annual total outlays for each category at capacity output are itemized in Table 2. Drivers were paid 12.0 cents per mile of travel. The addition of Social Security, unemployment insurance, and health and welfare payments resulted in total driving labor costs of 12.4 cents per mile.

Diesel fuel was assumed to cost 30 cents per gallon. Each diesel tractor travels approximately four miles per gallon of fuel consumed. Each one cent per gallon increase in fuel prices increases variable trucking costs by one-fourth cent per mile.

Tire costs were based on an assumed tire life of 150,000 miles plus two recappings. New tires cost $170 each, retreads $30. Maintenance costs were equal to 3 percent of the initial investment per year. Miscellaneous costs included fuel to power the refrigeration units, washing of trailers and spotting at packing plants.

Livestock Trucking Cost Analysis

Livestock transportation usually involves much shorter trips than those for meat because of the nature of the product hauled and the location of livestock production areas relative to slaughtering plants and to meat demand areas. The livestock trucking costs were converted to meat-equivalent costs on a ton-mile basis. Since trucks of comparable size are commonly used for shipment of both meat and livestock, costs for equal sizes were compared in

TOTAL INVESTMENT COSTS, MODEL MEAT TRUCKING FIRMS, 1973

Cost Component	Model I	Model II	Model III	Model IV
Equipment	10 units	100 units	200 units	300 units
Tractors	$250,000	$2,500,000	$5,000,000	$ 7,500 000
Trailers	150,000	1,500,000	3,000,000	4,500 000
Office equipment	3,924	19,712	30,356	45,136
Shop equipment	11,300	23,000	25,000	25,000
Buildings	26,800	160,800	201,000	225,000
Land	1,000	12,000	16,000	20,000
Pickup truck(s)	3,000	3,000	6,000	6,000
Total investment	$446,024	$5,218,512	$8,278,356	$12,321,136

TABLE 1

ANNUAL FIXED, VARIABLE AND TOTAL COSTS, MODEL MEAT TRUCKING FIRMS AT CAPACITY OUTPUT, 1973

Cost component	Model firms I 10 units	II 100 units	III 200 units	IV 300 units
Fixed costs ($)				
Telephone	6,000	60,000	120,000	180,000
Office & shop salaries	56,600	309,368	569,496	834,616
Depreciation & interest	86,233	833,487	1,652,188	2,400,577
Licenses	8,105	81,050	162,100	243,150
General office expense	2,400	24,000	48,000	72,000
Taxes	11,720	116,910	233,546	350,117
Insurance	35,798	306,690	586,863	841,875
Total fixed costs	206,856	1,731,505	3,372,193	4,922,335
Variable costs ($)				
Drivers' wages	186,000	1,860,000	3,720,000	5,580,000
Fuel	112,500	1,125,000	2,250,000	3,375,000
Tires	13,500	135,000	270,000	405,000
Maintenance	12,000	120,000	240,000	360,000
Miscellaneous	15,920	159,200	318,400	477,600
Total variable cost	339,920	3,399,200	6,798,400	10,197,600
Total cost ($)	546,776	5,130,705	10,170,593	15,119,935
Total cost per truck ($)	54,677	51,307	50,853	50,399
Total miles	1,500,000	15,000,000	30,000,000	45,000,000
Total cost per mile (¢)	36.4	34.2	33.9	33.6
Cost per ton ($)	65.09	61.08	60.54	60.00
Cost per ton-mile allocated to meat[a] (¢)	3.64	3.42	3.39	3.36

a All except long-run marginal costs of backhaul allocated to meat.

TABLE 2

the present study. Model meat trucks hauled 20 tons of beef per load. A livestock truck is assumed to be loaded to capacity with 12 tons of live animals. The slaughter yield of beef is approximately 60 percent, making the 12 tons of live animal weight equal to 7.2 tons of meat.

Rate Analysis

Published rates for contract carriage of meat were obtained from the Nebraska Public Service Commission and from shippers and carriers. Multiple linear regression analyses were applied separately to truck, rail and trailer-on-flatcar rates to measure the effect of load size and distance on rates per hundredweight. Estimated parameters and significance test results are found in Table 4.

FINDINGS

Average costs per mile of travel were

PERSONNEL REQUIREMENTS FOR MODEL MEAT TRUCKING FIRMS, 1973

Personnel	Model I 10 units (no.)	Model II 100 units (no.)	Model III 200 units (no.)	Model IV 300 units (no.)
Manager	1	1	1	1
Secretaries	2	16	25	38
Mechanics	2	12	25	37
Drivers	10	100	200	300
Dispatchers	1	5	10	15
Service men	0	3	5	8
Accountants	0	1	2	2

TABLE 3

MULTIPLE REGRESSION PARAMETERS FOR ESTIMATION OF RATES FOR INTERSTATE SHIPMENT OF MEAT, BY MODE, 1973

Mode	No. observations	Intercept	X_1 Distance (miles)[a]	X_2 Net Weight per load[a] (lbs.)	R^2	Standard error of estimate
Truck	43	1.594	.00214 (20.13)	—.00004 (—4.45)	92.14	.1742
Rail	54	2.567	.0014 (20.77)	—.00005 (—9.19)	90.17	.1414
TOFC	75	1.447	.00136 (12.86)	—.00002 (—5.26)	74.31	.3772

a All coefficients significant at .005 level; t values in parentheses.

TABLE 4

computed for alternative plant sizes and utilization levels. The results were converted to costs per ton-mile alternatively excluding and including the cost of leasing an ICC operating permit. These costs were then converted to costs per hundredweight of delivered meat for comparison with published rates.

Meat Trucking Costs

Firm Size. Meat trucking firm size has relatively little effect on per-unit costs. A firm with 10 trucks operating at full capacity had average costs of 4.72 cents per ton-mile, while a firm with 300 trucks had costs of 4.43 cents per ton-mile (Table 5). On a per-cwt. basis it cost $3.32 to ship meat using a fully-utilized 300-truck firm as compared to $3.54 using a 10-truck firm. Intermediate size firms experienced intermediate levels of costs.

Utilization. Meat trucking firms should be operated as near to effective capacity as possible. Average costs decline rapidly with increased volume due to improved utilization of fixed resource (Table 5). Average total costs for the 10-truck operation are reduced from 6.78 cents per ton-mile ($5.09/cwt.) at 40 percent utilization to 4.72 cents per ton-mile ($3.54/cwt.) at 100 percent utilization. For the 300-truck firm average total costs at 40 percent utilization were 6.07 cents per ton-mile or about $4.55/cwt., while costs at full utilization were 4.43 cents per ton-mile or $3.32/cwt. Corresponding savings are realized by other size firms. The resulting short-run average cost curves are illustrated in Figure 1.

AVERAGE TOTAL COST BY LEVEL OF PLANT UTILIZATION AND PLANT SIZE, MODEL MEAT TRUCKING FIRMS NEBRASKA, 1973

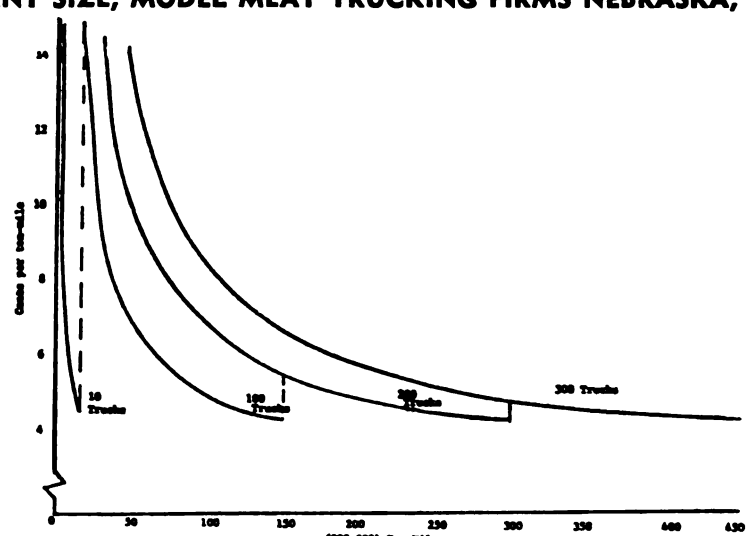

FIGURE 1

OPERATING COSTS AT VARYING LEVELS OF OUTPUT, MODEL MEAT TRUCKING FIRMS, 1973

Firm size and plant utilization	Annual miles	Excl. Permit Average fixed cost[a]	Excl. Permit Average variable cost[a]	Excl. Permit Average total cost[a]	Average total cost allocated to meat		Incl. Permit Average total cost	
	(million)	¢/mile	¢/mile	¢/mile	¢/mile[b]	¢/ton-mile[c]	¢/ton-mile[d]	$/cwt.[d]
10 trucks								
100%	1.5	13.790	22.661	36.451	72.902	3.645	4.715	3.54
80%	1.2	17.240	22.661	39.901	79.802	3.990	5.060	3.80
60%	0.9	22.980	22.661	45.641	91.282	4.564	5.634	4.23
40%	0.6	34.480	22.661	57.141	114.282	5.714	6.784	5.09
100 trucks								
100%	15	11.544	22.661	34.205	68.410	3.421	4.491	3.37
80%	12	14.430	22.661	37.091	74.182	3.709	4.779	3.58
60%	9	19.240	22.661	41.901	83.802	4.190	5.260	3.95
40%	6	28.860	22.661	51.521	103.042	5.152	6.222	4.67
200 trucks								
100%	30	11.241	22.661	33.902	67.804	3.390	4.460	3.35
80%	24	14.051	22.661	36.712	73.424	3.671	4.741	3.56
60%	18	18.734	22.661	41.395	82.790	4.140	5.210	3.91
40%	12	28.102	22.661	50.763	101.526	5.076	6.146	4.61
300 trucks								
100%	45	10.939	22.661	33.600	67.200	3.360	4.430	3.32
80%	36	13.673	22.661	36.334	72.668	3.633	4.703	3.53
60%	27	18.231	22.661	40.892	81.784	4.089	5.159	3.87
40%	18	27.346	22.661	50.007	100.014	5.001	6.071	4.55

a Cost per mile of travel.
b Cost of round-trip (3,000 miles) divided by one-way trip miles.
c Permit cost not included; round-trip (3,000 miles) costs allocated to meat.
d Includes permit cost of 1.07 cents per ton-mile; round-trip costs allocated to meat.

TABLE 5

Permit Costs. The utilization and size-cost relationships outlined above include the cost of leasing the permit needed for shipping meat by truck from Nebraska to the east or west coast.[5] The estimated rate for such shipments was $3.20 per cwt. while the cost of the permit was 25 percent of that rate or $0.80 per cwt. (1.07 cents per ton-mile). Total costs (including permit) and rates were nearly identical for the largest firm at full utilization ($3.32 vs. $3.20). The permit cost to such a firm accounts for 24 percent of the full cost of shipping meat. Rates for meat trucking firms appear to be set to allow the larger firms to cover all costs with minimum reliance on backhaul revenue. A backhaul is definitely needed, however, by smaller firms, particularly those operating below maximum annual output.

Livestock Trucking Costs

Costs per ton-mile of trucking meat were much lower than those for trucking livestock on a meat-equivalent basis. Livestock trucks must move far more tonnage, a large proportion of which is waste. Although the trucking costs per mile were not greatly different, the meat truck moves almost three times as much final product per trip as does the livestock truck—20 tons compared to 7.2 tons.

The cost per ton-mile of shipping meat ranged from 4.4 to 6.8 cents (Table 5) while the cost of moving meat-equivalent weights of livestock varied from 10.8 to 13 cents per ton-mile (Table 6). The costs were higher for transporting the meat-equivalent weight of livestock due to the additional weight that must be hauled. Shrinkage of the animals during transit, not accounted for in the analysis, would make live animal shipments still more costly. Additional costs might also be incurred owing to the decentralization of livestock pickup points but they were not measured in this study. Factors other than transportation are also important and would have to be accounted for in any over-all analysis of comparative advantage.

Rate-Cost Comparisons

Regression of published meat transportation rates against distance and minimum weight yielded general equations from which rates for a range of distances and weights could be derived. Linear regression equations were estimated for each of the three modes:

Truck rate = 1.594 + .00214 miles — .00004 pounds

Rail rate = 2.567 + .0014 miles — .00005 pounds

TOFC rate = 1.44 + .00136 miles — .00002 pounds

Since the present study was focused on one round-trip length (3,000 miles) and one truck size (40,000 pounds net), these weight and distance values were substituted into the regression equations to obtain rate estimates for comparison with synthesized cost. The relationships are presented graphically in Figure 2.

The truck rate per hundredweight for shipping meat 1,500 miles was $3.20/cwt. Costs for equivalent hauls ranged from a high of $5.09 per cwt. for the 10-truck firm at 40 percent utilization to a low of $3.32/cwt. for a 300-truck firm at 100 percent utilization. These costs included $0.80 per cwt. for the permit. No firm of any size or level of utilization was able to cover completely full costs including normal return to all resources when the price of the permit was included in the cost (Table 7). In the absence of the permit, costs would be far lower than rates at many levels of utilization. In addition, cost

COST OF OPERATING A LIVESTOCK TRUCK AT VARYING ANNUAL MILEAGES, 1973

Annual miles per truck	Fixed cost ¢/mile	Semi-fixed cost[a] Vehicle depr. ¢/mile	Semi-fixed cost[a] Driver wages ¢/mile	Direct variable cost ¢/mile	Total cost ¢/mile	Total cost allocated to livestock ¢/mile[b]	Total cost allocated to livestock ¢/ton-mile[c]
60,000	12.6	5.4	12.7	16.1	46.8	93.6	13.00
75,000	10.0	5.1	12.6	16.1	43.9	87.8	12.19
90,000	8.4	5.1	12.6	16.1	42.2	84.4	11.72
105,000	7.2	5.1	12.6	16.1	41.0	82.0	11.39
120,000	6.3	5.1	12.6	16.1	40.1	80.2	11.14
135,000	5.6	5.1	12.6	16.1	39.4	78.8	10.94
150,000	5.1	5.1	12.6	16.1	38.8	77.6	10.78

a Costs contain elements of both fixed and variable nature.
b Full round-trip costs divided by one-way trip miles (livestock bears all costs).
c Round-trip costs allocated to livestock in meat equivalents.

Source: Patrick P. Boles, *Cost of Operating Truck for Livestock Transportation*, ERS, USDA, Washington, D.C., Marketing Research Report No. 982, 1973.

TABLE 6

ESTIMATED RATE-DISTANCE RELATIONSHIPS FOR MEAT SHIPMENTS, IN 20-TON LOTS, BY ALTERNATIVE MODES FROM NEBRASKA ORIGINS, 1973

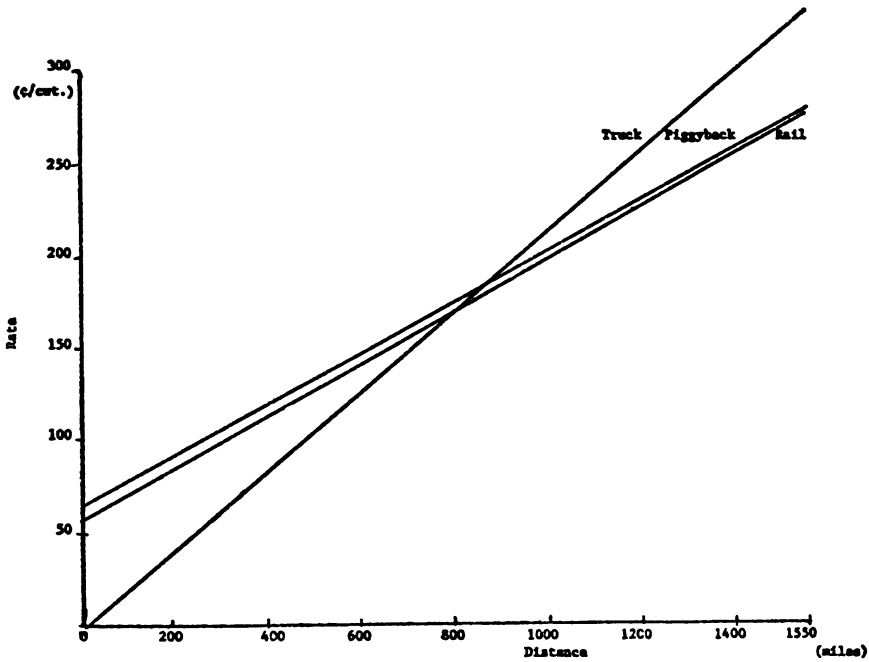

FIGURE 2

estimates were based on the assumption that all costs except the marginal cost of backhaul traffic were borne by meat. To the extent that backhauls are available, and trucking firms surveyed indicated that they frequently are available, income for the most efficient firms might be well above costs.

Rates for long-distance meat shipment by truck were higher than for comparable hauls by rail or TOFC. Costs of truck service were higher, even for the lowest-cost firm, than for rail or TOFC service. The least-cost trucking firm at full utilization experienced average costs of $3.32 per cwt. for a haul of 1,500 miles. The estimated truck rate for the same haul was $3.20, while rail service cost $2.67 and piggyback shipment $2.69 per cwt. Meat packing firms surveyed indicated a preference for truck service, however, owing to two factors:

1) Faster service by truck.
2) Reduction in risk of loss when shipping high-value, perishable products by truck. The trucker in effect becomes a full-time custodian of his cargo, a service not provided by alternative modes.

Effect of the Energy Crisis

Two recent energy-related adjustments of critical importance to the trucking industry have occurred. Fuel prices have risen dramatically and a national speed limit of 55 miles per hour has been imposed.

Each one-cent per gallon increase in the price of fuel adds one-fourth cent/mile to trucking costs. Diesel fuel prices have increased about 20 cents per gallon since the data for this study were analyzed, an amount sufficient to raise the cost of trucking meat to the coast by 38 cents per cwt. Each additional 5 cents per gallon increase in fuel prices adds an additional 9.5 cents per cwt. to delivered meat costs.

The reduced speed limit has the immediate effect of reducing the effective capacity of meat trucking firms. The result is a reduction in annual miles per truck and in number of loads of meat that can be delivered. Based on the assumption that trucks limited to 55 miles per hour on the open road average a speed of 35 to 38 miles per hour,[6] costs per mile will increase due to higher average fixed costs by [illegible] cents for the 300-truck firm an[illegible]

ROUND-TRIP INCOME AND EXPENSES FOR VARYING LEVELS OF OUTPUT, MODEL MEAT TRUCKING FIRMS, 1973[a]

Firm size and percent utilization	Estimated rate $/cwt	Income per trip $	Excludes permit cost: Average cost $/cwt	Excludes permit cost: Expense per trip $	Excludes permit cost: Profit or loss $	Includes permit cost: Average cost $/cwt	Includes permit cost: Expense per trip $	Includes permit cost: Profit or loss $
10 trucks								
100%	3.20	1,280	2.734	1,093.60	186.40	3.536	1,414.40	—134.40
80%	3.20	1,280	2.993	1,197.20	82.80	3.795	1,518.00	—238.00
60%	3.20	1,280	3.423	1,369.20	— 89.20	4.226	1,690.40	—410.40
40%	3.20	1,280	4.286	1,714.40	—434.40	5.088	2,035.20	—755.20
100 trucks								
100%	3.20	1,280	2.566	1,026.40	253.60	3.368	1,347.20	— 67.20
80%	3.20	1,280	2.782	1,112.80	167.20	3.584	1,433.60	—153.60
60%	3.20	1,280	3.143	1,257.20	22.80	3.945	1,578.00	—298.00
40%	3.20	1,280	3.864	1,545.60	—265.60	4.667	1,866.80	—586.80
200 trucks								
100%	3.20	1,280	2.543	1,017.20	262.80	3.345	1,338.00	— 58.00
80%	3.20	1,280	2.753	1,101.20	178.80	3.556	1,422.40	—142.40
60%	3.20	1,280	3.105	1,242.00	38.00	3.908	1,563.20	—283.20
40%	3.20	1,280	3.807	1,522.80	—242.80	4.610	1,844.00	—564.00
300 trucks								
100%	3.20	1,280	2.520	1,008.00	272.00	3.323	1,329.20	— 49.20
80%	3.20	1,280	2.725	1,090.00	190.00	3.527	1,410.80	—130.50
60%	3.20	1,280	3.067	1,226.80	53.20	3.869	1,547.60	—267.60
40%	3.20	1,280	3.751	1,500.40	—220.40	4.553	1,821.20	—541.20

a Excludes marginal costs as well as potential revenue attributable to backhaul traffic.

TABLE 7

for the 10-truck operation.[7] Costs of meat shipment will increase as a result of 27 cents per cwt. for the 300-truck firm, and 34 cents for the 10-truck firm.

If drivers' wages are increased sufficiently (4.1 cents per mile) to compensate them for their loss of driving time, mileage and annual wages, meat trucking costs must increase by another 31 cents per cwt. The total cost increase caused by higher fuel prices and lower speed limits is slightly less than one dollar per cwt. for the 300-truck firms, slightly more than one dollar for the 10-truck firms.

IMPLICATIONS

Managers of meat transportation firms can effect considerable cost savings by operating their firms at highest feasible levels of utilization. Development of backhaul traffic is an important aspect of efficiency in this business. The onset of the energy crisis makes improvements in efficiency particularly worthwhile. Shippers, livestock producers, and consumers of meat may also benefit if shipping rates reflect this increased efficiency. The distribution of benefits in this particular industry will depend in large part on actions of public regulatory authorities.

Meat shippers are largely dependent on truck transportation owing to the service advantages of this mode. There is potential competition, however, from rail and piggyback carriers. There would be additional competition and perhaps reduced costs as well if regulatory influence over the trucking industry were reduced. A large part of the current costs of permit leasing might be avoided in the absence of economic regulation. While the lease holder may provide some brokerage services to lessees, their value appears to be much less than their cost. The rather modest economies of size in meat trucking operations suggest the only meaningful entry barrier into the industry is that imposed by regulation. Limited size economies plus the inherent mobility of capital investment are indicative of easy exit conditions and suggest competition in the absence of regulation would not be disorderly.

FOOTNOTES

1 Wayne W. Budt, **Economic Efficiency of Nebraska Livestock and Meat Trucking Activities** (unpublished M.S. thesis, University of Nebraska, Lincoln, 1974), 58 pp.

2 A rigorous analysis of efficiency of meat transport vs. livestock transport would involve exploration of several issues in addition to transport costs. Any tradeoff between shipment of live animals and meat would involve alternative assumed locations of animal production, slaughtering, processing and storage activities, particularly with respect to proximity to feed sources and consumer centers. Comparative advantage or disadvantage of locational alternatives would have to be measured. In addition, the tradeoff between meat and livestock shipment is not an either-or matter. Both products must be moved some distance; the only question which can be resolved here is which can be moved at lowest cost per unit of distance in long-haul shipments.

3 For a procedural guide see B. C. French, L. L. Sammet and R. G. Bressler, "Economic Efficiency in Plant Operations With Special Reference to the Marketing of California Pears," **Hilgardia**, Vol. 24, No. 19, (July, 1956), pp. 543-721.

4 Patrick P. Boles, **Cost of Operating Trucks for Livestock Transportation**, Marketing Research Report 982 (Washington: USDA, 1973).

5 Interstate motor carrier shipments of meat are regulated by the Interstate Commerce Commission under the provisions of the Motor Carrier Act of 1935. Entrants into the contract trucking business must first secure a "permit" from the Commission. As a practical matter new entrants must either buy or lease their rights to service from an existing permit holder.

6 U.S. Senate, **The Immovable Feast: Transportation, the Energy Crisis, and Rising Food Prices for the Consumer**, Committee on Agriculture and Forestry, 93rd Congress, 2nd session (Washington: Government Printing Office, 1974), p. 13.

7 While experts disagree as to the effect of the speed reduction on fuel consumption rates, the consensus seems to be that the rate will be unaffected.