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TRANSPORTATION RESEARCH RECORD 851

Economic Development and Regulatory Reform Issues

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NATIONAL RESEARCH COUNCIL

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WASHINGTON, D.C. 1982

Transportation Research Record 851
Price $6.00
Edited for TRB by Scott C. Herman

modes
all

subject areas
11 administration
15 socioeconomics

Library of Congress Cataloging in Publication Data
Economic development and regulatory reform issues.

(Transportation research record; 851)
Reports presented at the 61st annual meeting of the Transportation Research Board.
Includes bibliographical references.
1. Transportation and state–Congresses. I. National Research Council (U.S.). Transportation Research Board. II. Series.
TE7.H5 no. 851 [HE193] 380.5s [380.5'068] 82-14365
ISBN 0-309-03354-3 ISSN 0361-1981

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Casavant, Kenneth, Department of Argicultural Economics, Washington State University, Pullman, WA 99164
Chan, Yupo, Department of Technology and Society, College of Engineering and Applied Sciences, State University of New York at Stony Brook, Stony Brook, NY 11794
Constantin, James A., University of Oklahoma, 520 Merrywood Lane, Norman, OK 73069
Everett, Michael D., Department of Marketing, East Tennessee State University, Johnson City, TN 37614
Fleming, M.S., Research Branch, Canadian Transport Commission, Ottawa, Ontario K1A ON9, Canada
Holyoke, Timothy R., Transportation Group, Department of Civil Engineering, University of New Brunswick, Fredericton, New Brunswick, E3B 5A3, Canada
Mittelhammer, Ron, Department of Agriculture Economics, Washington State University, Pullman, WA 99164
Pearman, A.D., School of Economic Studies, University of Leeds, Leeds, LS2 9JT, England
Pederson, Larry, Coast Trading Company, 1800 Southwest 1st Avenue, Portland, OR 97201
Stevens, Albert M., Transportation Group, Department of Civil Engineering, University of New Brunswick, Fredericton, New Brunswick, E3B 5A3, Canada
Wilson, Frank R., Transportation Group, Department of Civil Engineering, University of New Brunswick, Fredericton, New Brunswick, E3B 5A3, Canada
Yansouni, P.A., Research Branch, Canadian Transport Commission, Ottawa, Ontario K1A ON9, Canada

Economic Feasibility of Off-Track Elevators in Prairie Provinces of Canada

M.S. FLEMING AND P.A. YANSOUNI

Fifty percent of Canada's export grain originates on uneconomic branch lines. Peculiarities of the Canadian grain-handling and transportation system are such that virtually all the grain elevators that handle export grain are located on a rail line. Therefore, abandonment of a branch line results in the closure of on-line delivery points, and western grain producers are forced to deliver their grain an additional distance, thus resulting in higher delivery costs. The concept of an off-track elevator arose as a possible solution where all indications suggest that a branch line should be abandoned but, after this is done, relatively long grain-hauling distances would be incurred by the producer. The study focuses on one subdivision in the Saskatchewan Province in western Canada. It considers the comparative costs and savings of (a) leaving the branch line intact, (b) total abandonment of the branch line with the producer hauling to the closest alternative elevator, (c) an off-track elevator to continue operation at one or more designated delivery points after the line is abandoned, and (d) limited rail service to one or more designated delivery points on the uneconomic branch line to be abandoned. The study examines the distribution of savings and costs to government, railways, elevator companies, and producers for these options.

There has been considerable review of railway branch lines in western Canada, which started in 1977 with the Grain Handling and Transportation Commission (the Hall Commission) and was followed in 1978 by the Prairie Rail Action Committee (PRAC) and in 1980 by Doug Neil, a member of Parliament. In each instance, the review had the objective of recommending to the federal government whether or not branch lines should be retained or abandoned. There were a number of lines identified where all indications suggested that they be abandoned; however, in each case, relatively long hauling distances would be incurred by grain producers along those lines. The concept of off-track elevators arose as a possible solution to this particular situation. Within this context, therefore, the Research Branch of the Canadian Transport Commission (CTC) was requested by Neil to analyze 12 potential off-track sites in the Prairie Provinces.

In this analysis, an off-track elevator is defined as an elevator from which rail service had been withdrawn as a result of a recommendation from the Hall Commission, PRAC, or Neil. The continued operation of an off-track elevator requires that the grain be trucked from a point without rail service to a point with rail service (a transshipment point). It was further assumed that the federal government would be responsible for the cost of moving the grain (i.e., commercially trucking it from the off-track elevator to the transshipment point) as well as the cost of handling the grain a second time at the transshipment point.

This paper examines the economics of the off-track elevator concept as compared with the alternatives--first, the complete abandonment of the branch line and closure of all the associated delivery points and, second, the maintenance of rail services only to those points considered for potential off-track operation. The study compares the off-track operation with these alternatives from two different points of view. First, the study examines changes in the long-run costs of handling and transporting the grain. Second, it examines the changes in cash outlay of the federal government relative to changes in the trucking costs of the grain producers.

Changes in long-run costs consist of reductions in rail-line-related costs, branch-line rehabilitation costs, and capacity-related elevator costs as opposed to increases in farm-trucking costs. Government outlays consist of annual rail subsidy payments, payments for branch-line rehabilitation, payments for commercial trucking, and payments for secondary elevation of the grain. Producers' outlays consist of the increases in trucking costs.

The long-run cost analysis, to be complete, should include the added road cost associated with higher truck traffic. Unfortunately, the effects of incremental truck traffic on road cost are not understood and, at best, only a qualitative statement of the effect of increases in truck movements that result from branch-line abandonment can be made at this time.

Although the 12 potential off-track sites in Figure 1 were examined, only the site at Handel, Saskatchewan, will be discussed in this paper. A separate report (1) examines all 12 sites.

LONG-RUN COSTS AND CASH OUTLAYS: METHODOLOGY

Pattern of Producers' Grain Deliveries and Commercial Truck Movements

Determination of the new delivery pattern of grain following abandonment of a branch line is essential to the estimation of costs associated with farm trucking, commercial trucking, secondary elevation, and government subsidy payments. The closure of delivery points on an abandoned branch line forces the affected producers to choose alternative points on a neighboring line. The establishment of an off-track operation at a selected point will attract some, but not all, producers from the abandoned line, as others may find themselves closer to a delivery point on a neighboring line. Figure 2 locates the off-track elevator at Handel relative to the neighboring branch-line delivery points and road networks. The computer model PHAER (2), developed by the CTC Research Branch, was used to simulate the new delivery pattern by assigning the grain produced on each farm affected by closure to the closest alternative delivery point. It simultaneously estimates the new haul distance for each producer and the incremental bushel miles.

It was assumed that the grain from the off-track delivery point would be commercially hauled to a delivery point located on a line in the basic network. In selecting this point, consideration was given to the following constraints or trade-offs:

1. Road access: The road access to the transshipment point must be able to accommodate five-axle bulk-carrier trucks of approximately 80 000-lb gross weight. In all cases studied, adequate paved-road access existed. However, some segments were subject to administrative weight restrictions. These were disregarded under the assumption that special permits could be negotiated with the appropriate provincial authorities.

2. Elevator company: Companies that operate the elevators at the points of transshipment must be the same as those that operate the elevators at the off-track delivery points. Profitable operation of the off-track elevators would be questionable other-

Figure 1. Location of off-track elevator sites in Canadian Prairie Provinces.

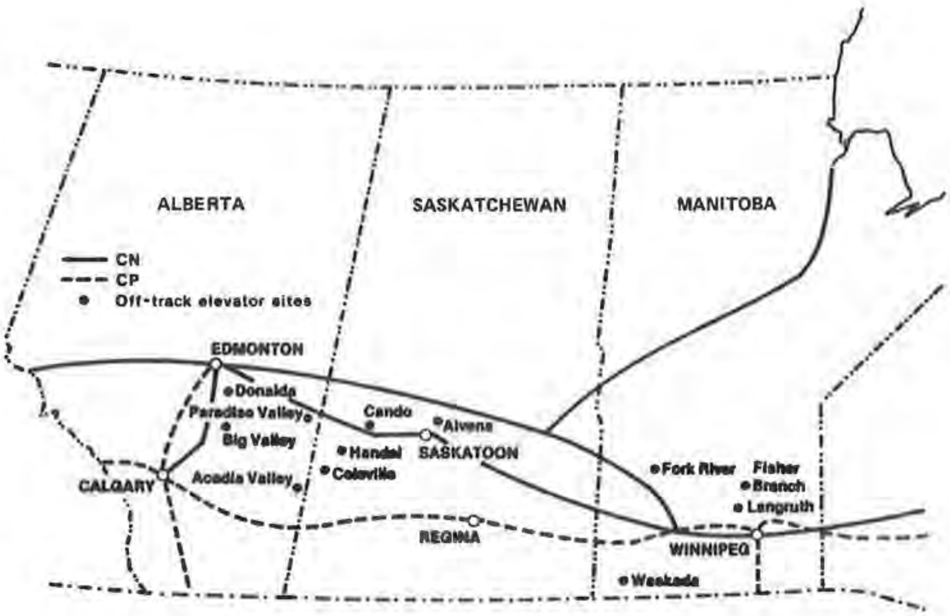
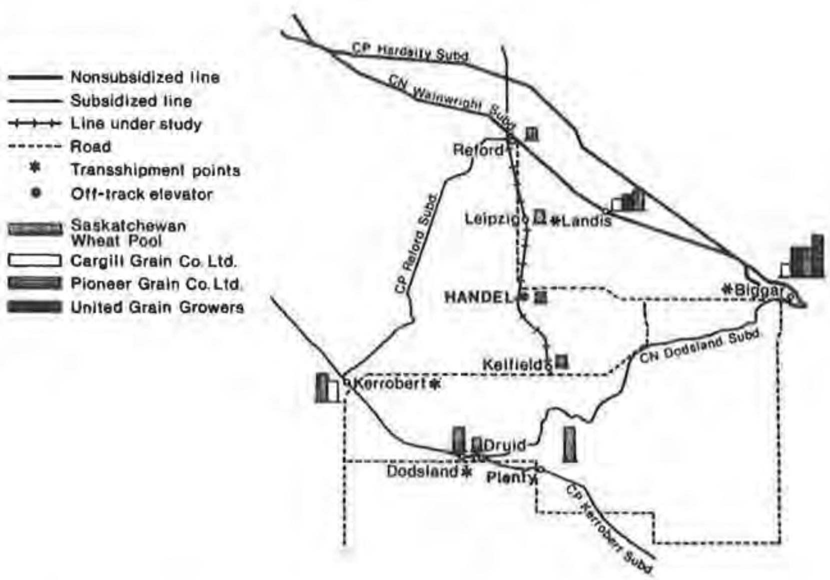


Figure 2. Off-track elevator at Handel, Saskatchewan.



wise. At the same time, it was assumed that the secondary elevation rate would approximate the marginal cost of elevation.

3. Elevator capacity at the point of transshipment: The elevator company at the point of transshipment should have a sufficiently large capacity to handle the additional grain without exceeding a ratio of receipt over physical capacity of 6:1. The system average was in the order of 3:1, and a ratio of 6:1 was considered by the trade to be operationally possible and desirable. In most of the cases examined, there was insufficient capacity at a single point to handle all of the grain from the off-track delivery point. Therefore, in most instances several points were selected for the transshipment of the grain. An alternative approach would have been to upgrade a single point to receive all of the grain. In the cases studied, however, upgrading costs would have exceeded the cost of trucking longer distances.

4. Category of neighboring line: Under the terms of the Canadian Railway Act, the federal government of Canada pays a subsidy to the railways for losses incurred in the operation of uneconomic branch lines that have been designated by the government as lines that cannot be abandoned. Grain represents the bulk of the traffic on these lines and the entire movement of this grain is subsidized, i.e., the movement on the branch line itself and the subsequent movement of the grain once it has left the branch line.

In 1977, the consulting firm of Snavely, King and Associates estimated that the average subsidy outlay per bushel on grain-dependent lines was approximately 16.5¢ (3). Of this, 4.2¢ was to cover costs related to the movement on the branch line while 12.3¢ was to cover the cost of moving the grain after it left the branch line. The subsidy payment after the grain leaves the branch line arises because the low freight rates (Crow's Nest Rates) set by Canadian statute do not cover the costs of movement. Approximately half the grain movement in

Canada originates on uneconomic branch lines and therefore government subsidies compensate the railways for the loss incurred on the entire movement of the grain to terminal points. However, on grain not originating on branch lines the railways received no subsidy to cover the gap between costs and revenues.

The closure of an uneconomic branch line would, on average, save government subsidy payments of 4.2¢/bushel for the branch-line movement, on the realistic assumption that the grain would move to another uneconomic line where the subsidy demand on the government would not be increased. If a branch-line closure were to cause the diversion of grain to elevators on lines not classified as uneconomic, the government would also apparently enjoy a further saving of 12.3¢/bushel, as the railway revenue shortfall occasioned by the Crow's Nest Rates is not subsidized on grain that does not originate on uneconomic lines. This provides the government with the option of commercially trucking a longer distance to a transshipment point on a line not classified as uneconomic to reduce its subsidy payments. Given a cost of commercial trucking of 0.35¢/bushel mile, the trade-off would be beneficial to the government if the increase in trucking distance was less than 34 miles. However, this saving in government cash outlay is not a genuine cost saving. The off-line cost of moving the grain has not been reduced and, corresponding to the reduction in the cash outlay by the federal government, there would be an equivalent increase in the burden carried by the railways from transporting grain at rates that do not cover costs.

Rail Costs

Abandonment of a grain-dependent branch line has two consequences: a reduction in the long-run cost of transporting the grain by rail (the line-related saving) and the avoidance of rehabilitation and upgrading expenditures (the rehabilitation saving).

Line-related savings are equated to the long-run line-related cost of the length of track considered for abandonment. Long-run line-related costs for grain-dependent lines have been developed for both Canadian National Railways (CN) and Canadian Pacific Limited (CP) by the Commission on the Costs of Transporting Grain by Rail (4) in 1974 and updated in 1977 (3). The average long-run line-related cost per mile of track in 1977 amounted to $11 598 for CN and $11 113 for CP. Note that line-related costs developed by Snavely (3) include normalized maintenance expenditures that are higher than the current deferred-maintenance expenditures of the railways.

Throughout this paper, the figures used to calculate upgrading and rehabilitation savings were the most recent figures submitted by the railways either to PRAC (5) or to Doug Neil, special advisor on prairie branch lines to the former Minister of Transport, Don Mazankowski. They reflect 1977 costs and were estimated by the railways on the basis of the actual costs incurred in their rehabilitation and upgrading work to that date.

Reductions in volume-related costs induced by branch-line abandonment have been assumed to be small and therefore were neglected in calculating the rail savings. According to Snavely (3), of the total branch-line costs, only 6 percent were volume related (on-line volume-related costs are slightly underestimated by Snavely because of the absence of crew wages) and 94 percent were line costs. Off-line costs were essentially volume related. However, they are unlikely to be affected by branch-line abandonment alone without major and concerted readjustment in the operating practices of the railways, elevator companies, and the Canadian Wheat Board (6). Evaluation of the effects of retention of rail services on these potential operating improvements was considered beyond the scope of this analysis.

Elevator Costs

The total cost of elevator operations has been broken down into three components: a fixed portion, a capacity-related portion, and a volume-related portion. It was assumed that the closure of an elevator would result in a saving equal to the sum of the fixed and capacity-related portions of the cost.

A total cost function, which reflects the above breakdown of components, has been estimated from data provided to the CTC Research Branch by the Canada Grains Council. These data result from a 1972-1973 survey of companies operating in Saskatchewan by the Area Eleven Subcommittee of the Canada Grains Council (7) and were updated to 1977 price levels by the use of appropriate Statistics Canada indexes.

The cost function is summarized as follows:

Total annual cost of elevation (in dollars) = 12 180
+ 0.151 88 x (physical capacity in bushels)
+ 0.075 33 x (total grain receipts in bushels).

All coefficients are significant at the 1 percent level with $R^2 = 0.84$.

The same cost function provides an estimate of the marginal cost of elevation that was used to calculate the secondary elevation cost at the transshipment points. Assuming that elevating additional grain does not require a change in the physical capacity, the marginal cost is the coefficient of the volume-related term in the preceding calculation and amounts of 7.5¢/bushel.

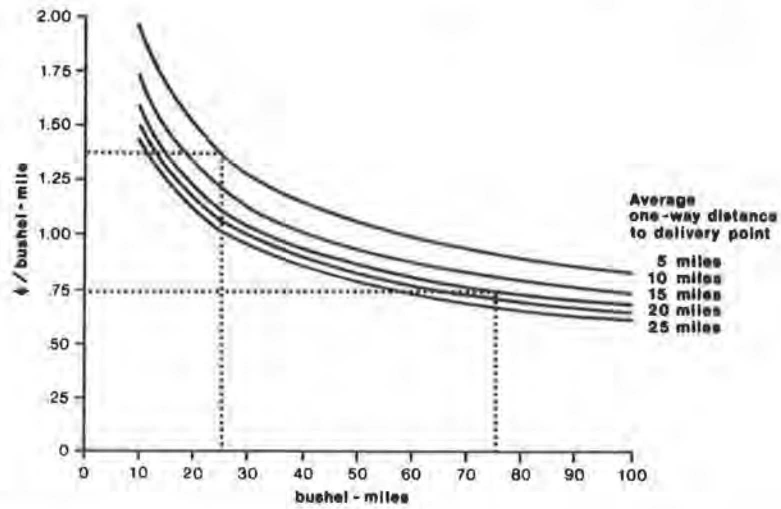
Farm-Trucking Cost

The long-run cost of farm trucking was based on an update by the CTC Research Branch of the previous work in the reports of the Area Eleven Subcommittee (7) and of the Hall Commission (8). A long-run cost function was reestimated by using the same 1972 survey of farm trucks conducted by Kulshreshtha in Saskatchewan and updated to 1977 price levels (9). The cost function and associated results are summarized in the calculation of the long-run farm-trucking cost function (1977 prices) given below:

Log (average cost in cents per bushel mile) = 2.9510
- 0.3803 log (total bushel miles) - 0.1876 log
(one-way distance to delivery) - 0.3012 log
(capacity of truck box in bushels) - 0.2566 log
(age of truck).

(Note that all coefficients are significant at the 1 percent level with $R^2 = 0.63$, average capacity of truck box is 216 bushels, and average age of truck is 15.3 years.) The cost function was applied for each affected producer by using, first, preclosure delivery distance and bushel miles and, second, the new delivery distance and bushel miles incurred by delivery to the closest alternative delivery point. The difference between the second and first cost estimate is, of course, the additional farm-trucking cost, as demonstrated in Figure 3. From this graph it is seen that for a producer who, prior to closure, was delivering 5000 bushels 5 miles (25 000 bushel miles), his or her cost per bushel mile would be 1.37¢ and the total cost $342.50. After closure, if the distance was increased by 10 miles to a total trucking distance of 15 miles, the total bushel

Figure 3. Average total cost per bushel mile for producers trucking in Prairie Provinces.



miles would be 75 000 at a cost of 0.75¢/bushel for a total cost of $562.50. The incremental trucking cost is therefore $220.00.

Commercial Trucking Costs

The long-run cost of commercial trucking was based on a study by Trimac Consulting Services of Calgary, Alberta (10), which is updated biennially for Transport Canada. Costs for 1977 were obtained by interpolation of the cost data published in 1976 and 1978. These costs were converted to a cost per bushel mile for each of the Prairie Provinces and are summarized below:

Province	Cost (¢)
Alberta	0.37
Saskatchewan	0.35
Manitoba	0.36

The derivation assumed the use of an 82 000-lb gross weight vehicle designed for bulk commodities, which had a net payload of approximately 50 000 lb, or some 800 bushels of wheat. Annual use of the truck was limited to 25 000 miles because of short hauls and loading-unloading times. The unit costs include a rate of return to represent profits and therefore should provide an estimate of the rates that may be negotiated with appropriate carriers. Applied to a 30-mile haul in Manitoba, the unit cost produced a trucking cost of 10.8¢/bushel, which was consistent with a rate of 9¢/bushel quoted by the Manitoba Pool for hauls between 0 and 30 miles.

Road Costs

The effect of branch-line abandonment on the road network has been the subject of submissions by provincial governments to the Hall Commission and to a number of CTC hearings on branch-line abandonment. Although there is consensus that there will be incremental road costs consequent on the abandonment of branch lines and on delivery-point closure, estimates vary widely because of a lack of data, which requires that a large number of assumptions be made. As an example, in CTC hearings on the abandonment of the Shamrock subdivision in Saskatchewan, the highest estimate of incremental road costs was five times higher than the lowest estimate. Experts at Transport Canada and Public Works Canada think the very high estimates cannot be substantiated. However, in the case of complete abandonment, the additional financial burden imposed on provincial governments and to a lesser extent on municipal governments would be at least as large as the burden imposed on the producers for added farm-trucking costs.

In the case of off-track operation, the impact may be slightly smaller in that commercial truck movements would replace a large percentage of the farm vehicle miles. The unit used to measure traffic from the standpoint of roadbed and road-surface deterioration is the equivalent standard axle load (ESAL). The ESAL is equivalent to an 18 000-lb axle load, and a cross-reference system has been set up that allows for the expression of any vehicle weight and axle combination in terms of ESALs. The number of ESALs associated with the commercial truck movement in all 12 branch-line cases was between 3 and 4. Based on the information given in the Hall Commission report (8), this number would have little impact on road costs.

ESTIMATE OF LONG-RUN COSTS AND CASH OUTLAY FOR THE OFF-TRACK ELEVATOR AT HANDEL

From Table 1 it will be seen that complete abandonment of 27.9 miles of the Kelfield subdivision (Brass to Kelfield) without an off-track elevator would effect a saving of $310 000/year in rail-line costs and avoid a government rehabilitation and upgrading cost of $439 000/year. Elevator closures would result in a reduction in fixed costs of $103 000/year. The increase in farm trucking costs for producers would be in the order of $50 000/year.

Similarly, abandonment with an off-track elevator established at Handel would save both rail-line costs and government rehabilitation and upgrading costs. However, government expenditures required to cover the cost of commercial trucking and secondary elevation would be about $152 000/year. Elevator savings on fixed costs would be reduced from $130 000 to $64 000/year. The increase in farm-trucking costs for producers would be about $21 000/year, compared with $50 000 in the case of complete abandonment.

If the rail line were maintained to Handel from Brass, the saving in rail-line-related costs would be only $103 000/year instead of $310 000, and government costs for rehabilitation would be only $147 000/year instead of $439 000. There would be no requirement for government expenditure to cover costs of commercial trucking or secondary elevation. Elevator savings and the increase in costs to producers would be the same as for the off-track elevator alternative.

Table 2 presents an examination of changes in government and producers' annual cash outlays that result from the implementation of the various options and shows that a new option has been added. This alternative trucking option was included to show the effect of commercially trucking a slightly longer distance to a transshipment point on a branch line not classified as uneconomic.

The complete abandonment of the Kelfield subdivision would result in annual savings to the government of $594 000, of which $155 000 is in subsidy payments to the railways and $439 000 in rehabilitation costs. The increase in farm-trucking costs for producers would be in the order of $50 000/year.

With complete line abandonment and the establishment of an off-track elevator at Handel, the added farm-trucking cost to producers would be reduced to $21 000/year. There would be no requirement from the government to cover line-rehabilitation costs and upgrading, but costs of $75 000 would be incurred for secondary elevation and $77 000-$84 000 for commercial trucking. Depending on whether or not the alternative elevator to which the grain was commercially trucked was located on a subsidized grain-dependent line, the net annual saving to the government would be between $428 000 and $485 000 instead of $594 000, and the increased cost to the producer would be $21 000 instead of $50 000.

With partial abandonment and the line maintained to serve Handel only, subsidy payments would be reduced by $51 000 to $230 000, and rehabilitation costs would be reduced by $147 000 to $292 000. There would be no expenditure for commercial trucking or secondary elevation. The net saving to the government would be $198 000. The increase in farm-trucking costs for producers would be $21 000/year, the same as that for the off-track alternative.

Table 1. Long-run cost analysis—CP Kelfield subdivision.

Item	1977 Cost ($000s/year) Abandonment of Kelfield[a]	Off-Track Operation at Handel	Rail Line Maintained to Handel
Saving			
Rail-line related	310	310	103
Rail rehabilitation	439	439	147
Elevator	103	64	64
Total	852	813	314
Cost			
Added farm trucking	50	21	21
Commercial trucking[b]	-	77	-
Secondary handling	-	75	-
Total	50	173	21
Net saving	802	640	293
Net cost of alternative to complete abandonment	0	162	509

[a]The Kelfield subdivision is close to the Dodsland subdivision recommended for abandonment by the Hall Commission. Because a substantial portion of Dodsland grain would go to Kelfield, the analysis is based on the assumption that Dodsland has already been abandoned.
[b]Transshipment is at Landis, Kerrobert, and Dodsland.

Table 2. Government and producers' cash outlays.

Item	1977 Cost ($000s/year) Current Configuration[a]	Abandonment of Kelfield	Handel Off-Track Trucking Option 1[b]	Handel Off-Track Trucking Option 2[c]	Rail Line Maintained to Handel
Subsidies on Kelfield grain	281	126	140	76	230
Subsidy reduction	-	155	141	205	51
Cost					
Commercial trucking	-	-	77	84	-
Secondary elevation	-	-	75	75	-
Net government outlay[d]	281	126	292	235	230
Rehabilitation outlay	439	-	-	-	292
Total government outlay	720	126	292	235	522
Reduction in government outlay	-	594	428	485	198
Producers' added farm-trucking costs	-	50	21	21	21

[a]This assumes the Dodsland subdivision has already been abandoned.
[b]Transshipment at Landis, Kerrobert, and Dodsland.
[c]Transshipment at Landis and Biggar.
[d]Excludes rehabilitation.

Table 3. Net savings and distribution of savings from alternative abandonment options.

Abandonment Options	1977 Cost ($000s/year) Net Saving	Distribution: Government	Rail Company	Elevator Company	Producers[a]
Without off-track elevator	802	594	155	103	-50
With off-track elevator and commercial trucking to					
Nearest on-line point with same elevator company	640	428	169	64	-21
Nearest on-line point on unsubsidized line with same elevator company	633	485	105	64	-21
Line retained to point considered for off-track elevator	293	198	52	64	-21

[a]Minus signs show losses.

SUMMARY AND CONCLUSIONS

Summarized in Table 3 (for the Kelfield subdivision) are the annual net savings; the distribution of savings between the government, railway, and elevator company; and the increased farm-trucking costs to the producer for each abandonment option. The largest savings are to be gained from complete abandonment without the off-track operation. However, savings from an off-track operation are almost as high in that the savings in branch-line rehabilitation and upgrading costs far exceed the cost of commercial trucking and secondary elevation. A relatively small saving is to be had from partial abandonment with rail service to points considered for an off-track operation.

Producers are likely to incur an increase in farm-trucking costs in all three options but it is, of course, smaller with the off-track operation or the rail line maintained to Handel. The increase in cost to the province or the municipality for road maintenance may also be as high as the producers' increase in farm-trucking cost for the first two options.

The government stands to gain approximately twice as much from any form of branch-line abandonment as the railways or elevator companies. For the most part, the savings are in the rehabilitation and upgrading costs that are avoided if the branch line is abandoned. The cost to the federal government for the establishment of an off-track elevator at Handel as opposed to complete abandonment of the Kelfield subdivision is more than $100 000/year. This would save producers about $29 000/year. This leaves open the alternative of a farm-trucking subsidy, but such a consideration is beyond the scope of this analysis.

REFERENCES

1. M.S. Fleming and P.A. Yansouni. Economic Feasibility of Off-Track Elevators. Canadian Transport Commission, Ottawa, Ontario, Canada, Rept. 80-01, 1980.
2. M.S. Fleming and W.E. Bell. PHAER Producer's Haul and Elevator Receipts. The Logistics and Transportation Review, Vol. 9, No. 2, 1973, pp. 119-130.
3. Snavely, King and Associates. 1977 Costs and Revenues Incurred by the Railways in the Transportation of Grain and Under the Statutory Rates. Grain Transportation Branch, Transport Canada, Ottawa, Ontario, Canada, Rept. TP 1758, 1978.
4. The Commission on the Costs of Transporting Grain by Rail Report, Volumes 1 and 2. Minister of Supply and Services, Ottawa, Ontario, Canada, 1977.
5. Prairie Rail Action Committee Report. Minister of Supply and Services, Ottawa, Ontario, Canada, Catalog No. 722-43/1979, 1979.
6. Booz, Allen and Hamilton, Inc., and the IBI Group. Grain Transportation and Handling in Western Canada, 1977. Grains Group, Department of Industry, Trade, and Commerce, Ottawa, Ontario, Canada, July 1979.
7. Area Eleven Subcommittee. Grain Handling and Transportation Area Eleven Study. Canada Grains Council, Winnipeg, Manitoba, Canada, 1975.
8. Grain Handling and Transportation Commission. Grain and Rail in Western Canada, Volumes 1 and 2. Minister of Supply and Services, Ottawa, Ontario, Canada, 1977.
9. S.N. Kulshreshtha. Cost of Grain Hauling by Farm Trucks in Saskatchewan. Saskatchewan Department of Agriculture, Saskatoon, Saskatchewan, Canada, Farm Management 810, Publ. 241, March 1974.
10. Trimac Consulting Services Ltd. Operating Costs of Trucks in Canada. Motor Carrier Branch, Surface Administration, Transport Canada, Ottawa, Ontario, Canada, Rept. TP 921, 1976 and 1978.

Publication of this paper sponsored by Committee on Transportation Programming, Planning, and Systems Evaluation.

Logistics Strategies for Regional Growth

JAMES A. CONSTANTIN

This paper analyzes the capability of the logistics system to (a) cope with regional growth and (b) be used as a tool to initiate desired growth. The focus is on small towns and rural areas (STRAs) of regions. Distinctions are made between operational and functional approaches to the analysis of logistics resources. An operational perspective of transportation resources results in the hind-part-before use of operational techniques as the basis for the design of strategies for resource use. This results in considering the transportation system and the transportation activities as ends to themselves. A functional perspective of logistics resources recognizes that transportation is only one subset of a group of related resources that collectively are means to an end. It recognizes that the function of the logistics system is to support the marketing effort of the users who collectively make up the economic infrastructure of regions. It also recognizes that strategies for the use of the system are designed in light of its market-support function and that operating techniques flow from strategies. Problems associated with the operational perspective are discussed as a backdrop for suggested strategies for the logistics system. The strategies suggested are designed to (a) improve the economic and temporal connections between STRAs and their markets and sources of supply and (b) relate the function of the system to certain environmental features.

Logistics resources are significant elements in the management of regional change. The purpose of this paper is to analyze the capability of the logistics system both to cope with change thrust on a region and to initiate desired regional change. The first objective is to relate the functional role of the logistics system to the relevant environmental features that may influence regional change. The second objective is to outline some strategies that will lead to more effective use of logistics resources and thus improve the prospects for strengthening the economic connections of small towns and rural areas (STRAs) with their nodal cities.

The functional approach, rather than an operational approach, is used to emphasize distinctions between the function and activities of the logistics system, to differentiate between economic ends to be attained and the physical means to those ends, and to separate strategic decisions from operational ones. The focus is on STRAs of regions because logistics problems seem to center on the economic links of STRAs and their nodal cities.

Unfortunately, a significant portion of this paper has to be devoted to correcting misleading and false notions about both logistics and STRAs. Specialists in fields other than logistics have been so misinformed that certain erroneous information about logistics has become a part of the conventional wisdom. Only some of those false notions can be corrected here. Also, for more than 30 years (until recently), some demographers and others have fed the world a steady diet of misinformation about the death of small towns and the emptying of the countryside. The myth has become such a part of the conventional wisdom that at least a token approach to rebutting it is necessary. Otherwise, some may wonder why bother trying to revive a dead horse.

FORCES THAT INFLUENCE REGIONAL CHANGE

The fragile economic connections between nodal cities and their hinterlands are influenced by many environmental pressure points, two of which are population and industrial growth. Logistics factors have a significant influence on the ability of a region to compete in national and world markets. For example, the design of rate structures, the setting of rate levels, and the characteristics of transportation service influence the attractiveness of STRAs as production sites.

The effect of energy and capital resources on the economic connections between nodal cities and STRAs is not an obvious logistics-related factor. However, their relation becomes obvious when it is recognized that transportation is one of the largest consumers of energy resources and a significant consumer of capital resources. Barring the development of major new energy sources or technologies, the energy shortage is permanent. At one time the cost of transportation capital was virtually ignored, but it is now likely to be a critical cost factor for years to come. Furthermore, there are resistances to the flow of capital to the transportation industry. Accordingly, improvements in the effectiveness and efficiency of the use of logistics resources will lessen both the demand for fuel and capital and the costs of operation.

Regional shifts and resource shortages are the environmental factors used as symbols to show the capability of the logistics system to respond to and influence regional change.

FUNCTIONAL NATURE OF LOGISTICS RESOURCES

Broadening Concepts

To provide a stronger foundation for later analyses and recommendations, it is important to differentiate between functional and operational considerations, logistics and transportation, and marketing and distribution channels.

Functional and Operational Considerations

Strategic planners usually begin their work by asking the question, What business are we in? If properly framed, the answer is in terms of the function of the business rather than in terms of the product produced or the activity engaged in. Transportation is not the function of carriers; it is an activity that involves several tasks that result in the movement of goods for users. Also, since movement is only one of several activities in the total marketing process, shippers and receivers want more than just transportation. They want support for their marketing effort. Thus, the function of transportation is to provide marketing support.

An operational perspective, so widely used in both regional and business analyses, has a tendency to encourage narrow thinking about both opportunities and threats. For example, it encourages a perspective of the entire logistics system as a group of discrete entities to be viewed in terms of tasks they perform, such as moving goods from here to over there and storing goods here or there. In turn, these perspectives cause the activities to be viewed as ends to themselves.

The functional approach reduces the potential for confusing functions with activities and tasks, ends with means, strategies with tactics, and concepts with techniques. Further, it broadens the horizons of the analyst and opens more options for using logistics resources as a system rather than using the several elements individually.

Logistics and Transportation

The words logistics and logistics resources are used not only because of their functional orientation but also because they are much more inclusive than transportation and distribution and other activity-descriptive terms. Transportation implies activities and facilities related to movement. Distribution implies activities and facilities related to holding or storage activities that involve an outbound dissemination of goods.

Logistics resources include all of these things and more. For example, included among the logistics resources are the facilities, activities, and concepts related to planning, implementing, and controlling the effective and efficient flow of materials, both inbound and outbound. Specifically implied as resources are the managerial and technical expertise of the people charged with the responsibility of bringing the concepts and facilities together as a system to implement the logistics function.

Marketing and Distribution Channels

The commonly used term channel of distribution suffers from the same disabilities as the term distribution, only on a larger scale. First, it implies a continually outward movement or distribution from the mine, forest, land, or sea to the manufacturer, wholesaler, retailer, or consumer and, finally, to the dump or recycling center. The implication is that only needs for distribution to some company or area are considered and that needs for acquisition from a company or area are the same as distribution to some company or area. Second, it implies tht the several intermediaries in the channel are discrete entities when they actually constitute a continuum in the flow of goods from mines to beyond the ultimate users. Third, the flow of communication about wants and needs of channel members is likely to be limited to immediate trading partners adjacent to one another in the channel. Those firms that have integrated some or all of these activities do not suffer from these disabilities.

The term marketing channel implies an integrated view of the function of the channel that is to support the marketing efforts of its members as goods and services flow through the system. Also, it implies that channel intermediaries do not confuse activities with functions or means with ends. The vitality of the production, marketing, and consumption institutions--the members of the marketing channel--determines the vitality of the region.

Strategic Nature of Logistics Resources

It can be inferred from some of the comments above that the strategic role of the logistics system in economic development has gone relatively unnoticed by regional analysts and economic developers. However, the strategic power of the system as used by carriers and businesses has a strong influence on geographic concentration of factories, on defining the economic hinterlands of nodal cities, on extending or delineating trade territories of businesses, on turning otherwise uneconomical location points into favorable locations, and on speeding up the settlement of the western half of our country for agricultural and extractive enterprises while discouraging industrial development.

Despite all of the evidence of the strategic importance of transportation rate systems and services to economic development, regional strategists have given it little attention. Most have viewed the physical aspects of transportation as necessary parts of the infrastructure and have assigned it the operational role of performing a task. Some did not understand the complexities of the rate structure; thus, their analyses were faulty. For example, some attributed an operational role to the transportation system by dwelling on the costs incurred by for-hire carriers rather than by dealing with rates charged or the cost of private transportation (1, pp. 84-86), the presence of facilities to provide access in the city or region (2, p. 513), and the speed and flexibility of motor transportation (3, p. 25). Also, some apparently did not understand the rate structure because they made it possible for the reader to infer that they were writing about railroad class rates (1, p. 103; 3, p. 4). A number of other regional scholars made the same kinds of errors.

On the other hand, there were those who showed both a good understanding of the strategic role of transportation in regional development and an understanding of the rate structures and service capabilities of the carriers (4, pp. 106-113; 5, p. 19; 6). To attribute and document possible reasons for the narrow view and to counter them is far beyond the scope of this paper. Instead, a positive approach will be taken that emphasizes how the system can be used as a strategic force to help accomplish certain objectives related to economic development and resource use.

An understanding of the conceptual base of the logistics system requires knowledge of the ways in which the structure of the system can be translated into regional development strategies as well as into ratemaking and operating practices of the industry to support those strategies. With this conceptual understanding and the perceptual view of the system as a means to an end, the true function of the system emerges as a support function for the production and consumption systems. In other words, its function is to support the marketing effort of those involved in the marketing channel; i.e., raw-material suppliers, manufacturing companies, wholesalers, retailers, and others.

LOGISTICS AND REGIONAL ECONOMIC ENVIRONMENT

Generalizations in this part of the paper are made in the context of those types of industries for which logistics considerations are important in location decisions.

Logistics in Location of Industry

The only problem with taking an operational view of logistics resources in regional development is that such a view is irrelevant. By and large it focuses on facilities, rail class rates, distance to markets, and sources of supply. This is a facilities view that is concerned with the physical connections between and among regions. The functional approach is concerned with the economic connections of regions and embraces an environmental view of logistics resources. Although the facilities view considers the transportation elements of the environment to be fixed, the environmental view recognizes the need for facilities but concentrates on their strategic use and assumes that all of their strategic elements are variable.

Facilities and Service

The factors that impinge on the location of industry are typically listed as nearness to market, raw materials, and fuel supply; availability of an adequate labor pool; and availability of transportation. These factors do not truly explain the location decision. They imply that the geographic or physical juxtaposition of market, raw materials, fuel, and distribution facilities determine the location of industry. In short, it is implied that distance and things are the location ingredients. This is a quantitatively based listing of the number of transportation companies, miles of track and highway, and distance to markets. Everyone acknowledges that facilities are necessary parts of the regional infrastructure, i.e., roads, rails, terminals, transportation companies, pricing systems, and the like. Because some location theorists do not understand the rail-rate system, they assume that there is a pattern of rates that makes distance and transportation rates proportional (1, p. 103) and/or that the structure of class rates is the structure of all rates (3, p. 4).

By and large, all regions have the necessary facilities; thus, decisionmakers who consider locations for their firms are concerned with the qualitative aspects of the logistics environment. They are concerned about such factors as (a) the quality of the service of the transportation companies, (b) the price of service from suppliers and to markets, (c) the time required to receive and deliver goods, (d) managerial flexibility of logistics-related companies in meeting wants and needs of the company, and (e) other qualitative factors that relate to the functioning of the logistics system as distinct from its operations or availability. The facilities view that centers on availability has little, if any, strategic importance. It is the planned use that is important. As Wilfred Owen said (6, p. 19), "Transport, then, is a necessary but not sufficient condition for economic development."

The abandonment of branch rail lines is increasing and will probably increase more under a law passed in 1976. These abandonments will affect the facilities and services of STRAs more than they will metropolitan areas. One study of 10 branch-line abandonments showed that only two communities felt any significant adverse effects (7). Even so, the long-run loss in opportunity is almost certain to be high because the mere presence of rail facilities is desirable for many firms. Later, suggested methods of lessening the bad effects of abandonment will be mentioned.

Proximity Considerations

Distance is the factor that many location theorists use to determine a region's proximity to raw materials, markets, and fuel. Certainly, physical proximity is one factor, but both economic proximity and temporal proximity are more important. Distance is primarily a factor in the carriers' cost structures and is only one factor in transportation rates. However, to the user it is mostly an irrelevant factor compared with the other two. If all rates were class rates and thus proportional to distance (as some location theorists assume them to be), physical proximity and economic proximity would be the same. However, class rates move only a small proportion of goods moved by rail.

Before the Interstate Commerce Commission stopped publishing the figures 20-25 years ago, only about 5 percent of the tonnage moved by rail moved on class rates, and that figure has probably fallen. Rates based on exceptions to the classification and commodity rates do not necessarily conform to any particular pattern. The rates on a given commodity among three pairs of points at different distances apart may actually vary inversely with distance, depending on the type of rate available, as shown in the example below:

1. A-B: 300 miles, rate of 100, only class rates available;
2. C-D: 400 miles, rate of 75, exception rates available; and
3. E-F: 500 miles, rate of 50, commodity rates available.

Physically, A and B are closer together than either of the other two pairs of points; economically E and F are closer. A third measure of proximity--temporal proximity--shows that all three pairs of points are, for all practical purposes, the same time-distance apart; i.e., overnight delivery between all three pairs of points is feasible. Certainly, the cost to the carriers is not even considered; only the cost to the company that pays for the transportation is considered. If that company sells at uniform delivered prices, then to the buyer of the goods neither the distance, type of rate, nor the rate charged is of any significance.

If the E-F distance is changed to 1500 miles, the points still may be overnight apart by air. If air shipments are not feasible, the use of strategically located warehouses can provide overnight service. It is also important from a strategic viewpoint to note that it is possible to negotiate with carriers to change the environmental quality of a given location. This can be done through the introduction of commodity or exception rates between A and B, commodity rates between C and D (or make additional exceptions), and to lower commodity rates between E and F--all of which would change the economic relations among the three pairs of points. Also, air freight or distribution centers can change temporal relations among the points. In other words, all of these constants are variable except distance, and distance is an irrelevant factor to all but the carrier.

Nearness to market, raw materials, and fuel take on new meaning when viewed in the strategic context of cost and time. Thus, it is not just the facilities that are important but the use of those facilities. Several of the types of strategic adjustments in facility use will be mentioned later.

Carrier Capacity and Environmental Considerations

The capacity of the transportation system has three basic facets: (a) right-of-way and terminal facilities, (b) power units and freight-carrying vehicles, and (c) extent to which the cube- and/or weight-carrying capacity of the vehicles are used.

The most difficult of these facets of the system to cope with is rail rights-of-way. To improve the deteriorated facilities will require huge amounts of capital that the railroads do not have and, for the most part, cannot obtain except from current earnings. Earnings for the industry and for most carriers are too low to provide the capital necessary for extensive refurbishing. Outside capital for these purposes is both scarce and expensive.

Terminal facilities for rail and motor carriers are a different matter. Outside capital can be obtained for both by arranging for private investors to build and lease to the carriers the needed piggyback and motor carrier terminals so long as current cash flow can cover payments. Of course, there is strong competition from other industries for the scarce and expensive investment capital, but that is a general economic problem not confined to the transportation industry.

Power units and freight-carrying vehicles do not pose the same long-term problems that rights-of-way and terminals pose. The numbers of these units can be expanded reasonably quickly to meet the demand for them. Again, the carriers can resort to leasing these units as they have been doing for several years. This method of acquisition does not require the carriers to raise large sums, but it does require them to have sufficient cash flow to support payments. Again, carriers have to compete with other industries for scarce capital.

The effective capacity of the rail-car fleet can be increased by the strategic use of the rate system. During World War II, the car fleet was effectively increased by increasing the minimum weight required for a shipment to qualify for carload rates. Although this would have obvious effects on shippers, it would encourage them to ship more at one time. A careful application of incentive rates for heavier loading could make this approach either more attractive or less unattractive for shippers. Many rail rates are structured this way now, but a greater use of incentive rates would reduce the need for some unknown number of new cars.

This approach has limited feasibility for motor carriers. One reason is that most of their shipments and tonnage shipped weigh substantially less than 10 000 lb. Another is that, in most truckload-type shipments, the trailer is loaded to either weight- or cube-carrying capacity.

The imbalance in directional flow of traffic--especially between STRAs and their major central cities--is another facet of the capacity problem. The carriers' problems with small towns center on excess capacity. Trucks often make daily trips or only a few trips per week to many towns of less than 50 000 in population. Typically, trucks that go to the smaller towns will be loaded to much less than full capacity. Of course, this does not hold in those instances where large inbound shipments are made to a local industry. The outbound vehicles often have hardly any loads at all. As for railroad capacity, since STRAs receive so few carload shipments, providing service is very costly to the railroads. As with the motor carriers, outbound capacity is hardly used at all.

The logistics environment of STRAs can be substantially improved by the strategic use of both incentive-type backhaul rates and satellite-distribution centers. These strategies will be mentioned later. There is plenty of unused transportation capacity in STRAs. Adjustments in ratemaking strategy and in carrier and distribution center managerial strategy can improve the logistics environment for both carriers and regions. Acquiring new capacity in the form of vehicles is complicated by current capital shortages and high costs. Otherwise, expanding and contracting this kind of capacity poses no problems because of the widespread and growing use of equipment leases. Improving rail right-of-way is the most vexing problem of all.

Implications of Capital and Energy Shortages

Shortages and high prices for both fuel and capital are likely to continue for at least several more years. The most obvious implication of these shortages is that carriers will use these scarce resources where returns to them are highest. This means, of course, where load concentrations are both the highest and the physical distance from their terminals is the shortest. Logically, outlying cities will be the first to have service reduced or eliminated, given present distribution patterns and other environmental circumstances and conditions. These are the cities that now have relatively poor service because of their location and relatively poor use of capacity by carriers in serving them.

The impact of this can be reduced in the long run by encouraging what appears to be a trend of industry to locate in STRAs. In the short run the impact can be reduced, as mentioned above, by modification of present logistics strategies related to rate structures and warehouse location, among other things. The logistics-related objective of encouraging the apparent trend to STRA locations and of redesigning logistics strategies would be to encourage the creation of small concentrations of economic activity in the STRAs.

The effect on logistics of attaining the objectives would have two facets. The first is the diffusion of what in many cases appears to be an overconcentration in metropolitan areas and the diseconomies of scale of operations that flow partly from congestion. The other facet is the opposite side of that coin. It would help STRAs reach the threshold of size where the economies of scale would become operative. At worst, it would diminish the diseconomies of scale that result from small size. Not only would capacity of the system be used more fully, which would result in the consequent better use of capital and fuel resources, but also other nontransportation objectives related to growth would be attained.

Writing in the context of underdeveloped countries, Owen made this same point when he said (6, p. 53), "Traffic projections are too often based on what may be expected to happen rather than on what can be made to happen. The first approach is guessing the future, while the second is planning it." By accepting the environment as it is and assuming all variables constant and unchangeable, the logistics system can do little to cope with and manage the impending changes that involve capital and fuel shortages and regional relocation and growth. It can only react to those changes as they act on the system. This reaction is almost certain to be the negative one of dropping areas of low concentration individually.

The system can be encouraged to take a positive posture by assuming the environmental constants as variables and by seeking to change them. By recognizing the functional aspects of the system and its strategic role, managers of the system can use it as an instrument to cope with and manage change. Some of these strategies for a capital- and fuel-shortage economy will be outlined in a later section.

REGIONAL CHANGE AND LOGISTICS STRATEGIES

Small Towns

One of the most significant characteristics of regional change is the vitality of STRAs. Population in towns of 50 000 or less has increased absolutely in every size group in every decade since 1910. The four size groups are 2500-5000, 5000-10 000, 10 000-25 000, and 25 000-50 000. Furthermore, the percentage of the U.S. population in all but the 2500-5000 group has also increased. That group showed small relative declines in 1930, 1960, and 1970 (1980 data are not yet readily available). In addition, the percentage of total U.S. population in these small towns has risen every decade until in 1970 they accounted for nearly 30 percent of the nation's people. Between 1960 and 1970, the U.S. population increased 13.3 percent while that of towns of 50 000 or less increased 20.7 percent (8,9).

Business Week (10) reports that, from 1970 to 1980, for the first time in history, more people moved to rural areas than away from them and that the bulk of Americans who are moving to new areas are headed for small towns. Newsweek (11) reports census findings that, for the first time since 1820, rural and small towns are growing faster than the cities and suburbs.

Small Towns as Markets for Industrial Goods

The movement of goods to small towns that are used in further production provide another clue to their vitality. The Census of Transportation divided the country into production areas (PAs). The top 25 PAs (1-25) contained the largest standard metropolitan statistical areas (SMSAs). PA 30 included all SMSAs not included in PAs 1-25. PA 50 included all non-SMSA places. An earlier study (12) tabulated the percentage of total tonnage of many industrial products used in further production that were shipped from PAs 1-25 and that were destined for PA 50 (non-SMSA towns). (Note that the time and cost to bring these 1968 figures up to date for this paper would far exceed the benefit.) The percentage of total shipments of selected industrial commodity groups that were destined for PA 50 is shown below:

Commodity Group	Percentage
Special industrial machinery	36.3
General industrial machinery	29.5
Industrial chemicals	27.8
Containers, boxes, etc.	26.0
Electronic components	24.6
Nonferrous basic shapes	24.1
Miscellaneous machinery and parts	17.7

Although these figures are not conclusive, they are indicative of the vitality that small towns have enjoyed at least since the early 1960s.

Industrial Expansion to Small Towns

A third clue that the economic base of small towns has been building for a long time is provided by a study nearly 20 years old (13). It showed that, of 1300 companies, 611 (47 percent) said they had moved or expanded between 1955 and 1959. Expansions were traced of firms that originally were located in the cities, suburbs, and STRAs and that expanded to each of the three types of locations. The percentage of firms moving to STRAs from each type of location is shown below:

Item	Percent
City to STRA	23
Suburb to STRA	6
STRA to STRA	12
Total	41

Although 41 percent of the expansions were to STRAs, 48 percent of the respondents reported their locations to be in STRAs while 25 percent were in cities and 27 percent in suburbs. Thus, STRAs seem to be exerting a pull for firms that seek expansion. The study indicated that the pull seemed to be the greatest for the standard industrial classification groups that employ large numbers of people. These were large firms that had an average of 349 employees. Seven different industries represented by 607 firms had an average of 482 employees. The range was an average of 167 employees of 119 firms in fabricated metal products to an average of 956 employees of 20 firms in miscellaneous business services. Again, while not conclusive, these figures are indicative of the vitality and attractiveness of STRAs in the late 1950s.

Small Towns and Logistics System

The older studies mentioned above that concern STRA population, STRAs as markets for industrial goods, and the industrial expansion to STRAs are indicative of the enduring vitality of STRAs. The 1981 Business Week and Newsweek reports on the 1980 census findings and other observations are other indicators. As mentioned earlier, Owen (6) commented that, while transportation is a necessary condition for economic development, in itself it is not a sufficient condition. For what follows, three points should be kept in mind. Voltaire: All generalizations, including this one, are false. Constantin: The only safe generalization that can be made about transportation rates is that no safe generalization can be made about transportation rates. Schiller: Against stupidity, the gods themselves struggle in vain.

STRAs have had the physical connections with their nodal cities, and through them with the rest of the country. Generally speaking, the physical connections have been third rate when compared with those of most SMSAs. The economic connections have been third rate at best and probably fourth rate. Many STRAs are located on branch lines of railroads. Most of those that are physically on main lines are effectively on branch lines because they are served indirectly from their nodal cities by local or switching trains just as if they were on branch lines. Conceptually, the same situation applies to motor truck service.

The economic connections are at least just as bad. These are high-cost areas for transportation companies to serve compared with nodal cities. A shipment that originates in the STRA and is destined to an STRA typically receives about twice the service of one that involves a movement only between SMSAs. For example, certain tasks at SMSA origin and destination terminals need to be performed for SMSA to SMSA terminals. Approximately those same tasks need to be performed at the origin STRA at both intermediate SMSAs and at the destination STRA. Also, cost of movement between SMSAs is spread over much more traffic than it is between SMSAs and STRAs.

Typically, the rail-rate structure, which was designed for operational reasons, does not reflect these additional costs. In fact, the rate on a movement STRA-SMSA-SMSA-STRA may be exactly the same as for the SMSA-SMSA movement. In these cases, rates for all points within a very large area--anywhere from several dozen miles to several score miles and, in some cases, several hundred miles--are grouped in such a way that the rates from some central city apply to all towns in that region. The same types of groupings may apply to destination points. Sometimes arbitraries are added to and from the rate from the basic city. But these are usually stated in terms of cents per hundred pounds as if weight were of some significance in the cost.

Motor carrier rates are similarly improperly made. Many of these rates, maybe even most, are made on the basis of distance. This is especially true for motor carrier class rates that move most of the less-than-volume shipments. Accordingly, a 400-mile shipment from SMSA to SMSA will pay the same rate as the same shipment from STRA-SMSA-SMSA-STRA. As if that was not bad enough, three (or more) carriers may be involved. Revenue is often (perhaps typically) divided among the three carriers according to the proportion of distance each moves the shipment.

The point is that costs of extra transportation tasks and the lighter-traffic density are not taken into account in either rate structures or rate levels. In one sense, STRAs are getting a free ride at the expense of the central cities and the carriers. This places a heavy financial burden on the carriers that serve STRAs, with the result often being a lower quality of service. The problem is compounded when the basically light traffic between STRAs and SMSAs is divided among two or more carriers. Despite all of these difficulties, the STRAs not only survive, they thrive and grow. The difficulties can be traced to managerial dedication to an operational view of the transportation system and the devising of strategies to make transportation operations more efficient. This is the reverse of the functional view of the logistics system. From the functional perspective, the facilities are viewed in light of their marketing-support function.

Logistics Strategies

Logistics strategies can be very influential in helping a region cope with growth and can be very valuable as tools in helping initiate desired growth. Growth has taken place in the STRA portions of regions despite certain resistances. The fact that they have had transportation services at least partly subsidized by carriers and central cities may have had some positive influence in their vitality. Other than rail rights-of-way and, in some cases, rail services, the transportation facilities are mostly in place and are relatively easy to expand; thus, most of the comments below relate to strategies for the intangible logistics resources. Warehousing facilities, on the other hand, are generally not available in STRAs; thus, some attention is given to them as strategic elements. Because background material has been provided for these strategies, in most cases a listing of the strategies will suffice.

1. Create small-town shippers associations--Associations are cooperatives historically set up in larger towns and with spotty records of success. The nature of several strategies suggests that some firm or other organization will have to set up operations to design and implement them. There is no reason that existing carriers or entrepreneurs in STRAs cannot create the company. Shippers associations are suggested as an expedient because the potential users would be the beneficiaries of the service.

2. Warehousing facilities--It is a fair generalization that public general-merchandise warehouses or distribution centers cannot be economically located in STRAs, other things remaining the same. However, those other things may be wired around or strategically adapted to enable a satellite facility to be established with several activities in mind. One activity could be as a partial substitute for abandoned rail service. To make the plan operable, receivers and shippers of freight would have to

arrange for goods to be shipped piggyback to and from the area through the shippers association. A second activity could be to serve as a consolidated terminal facility for carriers to drop off and pick up shipments and have local deliveries made by the terminal. A third activity would actually be a small public warehouse operated as something of a satellite of a central-city warehouse. A fourth activity, related to the others, would be to consolidate freight as backhaul for carriers to central cities.

3. Discriminatory rail rates--Adjustments should be sought for rail rates that discriminate against shippers or receivers of freight in a given area or that place them at a competitive disadvantage.

4. Special rates--Arrangements should be made for special rates that would encourage such companies as food wholesalers to use common carriers in STRAs instead of their own vehicles. This is actually a marketing situation that holds promise for carriers to help use their excess capacity. It also holds promise for wholesalers who may prefer to divert their fuel and capital resources used in STRA deliveries to other uses.

5. Backhaul rates--A carefully designed system of rates from STRAs to central cities should be designed. This system would encourage firms to locate in STRAs and provide additional use for the greatly underused capacity. These must be designed with care because they could backfire and in effect be so attractive that empty vehicles would have to be sent to STRAs to cover the shipments.

6. Incentive rates--Incentive rates are rates that provide incentives to shippers to make larger shipments. They lower the shippers' costs and increase carriers' profits if they are properly designed. Other types of incentive rates are multiple-car and trainload rates. These could, in the long run, help remove imbalances in the directional flow of traffic.

7. Restructure rates--Restructuring rates involves designing a rate structure that will both cover the special costs of serving STRAs and enable the carriers to make a profit. This may involve higher rates and thus may deter some firms from locating in the area.

8. Restructure carrier routes--Some STRAs are served by too many motor carriers, and none can profit. By some means or other, the number of these carriers should be reduced. Incentive and contract rates would accomplish part of this. Trading of routes with other carriers or pooling of freight by carriers would also accomplish this.

9. Encourage one-man-one-truck companies--One-man-one-truck companies could serve as assembly and distribution carriers only in the STRA.

There would be several effects of these approaches to managing change by adapting concepts and strategies related to the transportation system. Some of these effects would include the following:

1. Existing motor and rail capacity to and from small towns would be more fully used;
2. The burden on congested transportation facilities in metropolitan areas would be reduced;
3. To the extent that these two impacts are felt, the demand for capital for expansion would be reduced as would the demand for fuel for operation;
4. Because of better capacity use, small towns and cities are not as likely to suffer reduced service as capital and fuel become more scarce and expensive;
5. Small towns and cities would become more attractive to local entrepreneurs and expanding and migrating industries and thus help combat the unemployment problem in these areas; also, they would deter migration to the cities; and
6. To the extent that the transportation burden on the major cities is reduced, or its rate of growth as a burden decreased, congestion and air, thermal, and noise pollution would be diminished.

CONCLUSIONS

Several conclusions are drawn from the context of the purpose and objectives stated in the beginning of this paper. First, business institutions in the marketing channel are the bases for economic growth in regions. The function of logistics resources is to support the marketing effort of those institutions in order to strengthen their ties to each other. This strengthening process also facilitates the economic unification and integration of spatially separated places. Accordingly, the marketing-support function of logistics applies equally to businesses and regions. Second, while the presence of roads, airports, carriers, and other facilities and facilitating agencies provides physical access, it does not ensure economic integration of STRAs and the rest of the economic world.

Third, preoccupation with the operational role of logistics resources, rather than with their functional role, tends to cause confusion of means with ends and tactics with strategy in the use of the resources. Fourth, concern for physical proximity as a concept of spatial separation is largely a result of an operational view of logistics resources, and that concept is often irrelevant as a factor in evaluating regional connections. The appropriate factors are economic and temporal proximity with physical proximity as a subset.

Fifth, for more than 30 years STRAs have shown amazing economic vitality and growth despite resistances to that growth, including logistics-related resistances. Sixth, strategies can be designed for the effective and efficient use of logistics resources and thus improve economic and temporal connnections of STRAs. The strength and profitability of carriers and other facilitating agencies should figure importantly in the design of these strategies. Seventh, the creation of cooperative shippers associations in small towns would provide a corporate vehicle to design and implement the strategies. The encouragement of individual entrepreneurial efforts would accomplish the same thing. Eighth, the improved effectiveness and efficiency of the logistics resources would lead to conservation of scarce capital and fuel resources by improving the effectiveness and efficiency of their use.

Finally, in keeping with the purpose of this paper, it can be concluded that the logistics system has proved itself capable of coping with changes thrust on STRAs, despite the difficulties it has labored under as a result of managerial preoccupation with operations. A shift to a functional approach will improve its usefulness as a tool both in initiating desired change and coping with it.

ACKNOWLEDGMENT

I acknowledge with appreciation the indirect support for this paper that was provided by the Economic Development Administration, U.S. Department of Commerce. That support resulted in a monograph entitled Capability of Transportation and Distribution Systems to Respond to Regional Growth (14). This paper is based on the concepts presented in that monograph.

REFERENCES

1. W. Alonso. Location Theory. In Regional Development and Planning, A Reader (J. Friedmann and W. Alonso, eds.), MIT Press, Cambridge, MA, 1964.
2. J. Friedmann. The Concept of a Planning Region. In Regional Development and Planning, A Reader (J. Friedmann and W. Alonso, eds.), MIT Press, Cambridge, MA, 1964.
3. V.R. Fuchs. Changes in the Location of Manufacturing in the United States Since 1929. Yale Univ. Press, New Haven, CT, 1962.
4. H.L. Hunker. Industrial Development. Lexington Books, Lexington, MA, 1974.
5. H.S. Perloff and others. Regions, Resources, and Economic Growth. The Johns Hopkins Press, Baltimore, MD, 1960.
6. W. Owen. Strategy for Mobility. The Brookings Institution, Washington, DC, 1964.
7. B.J. Allen. The Economic Effects of Rail Abandonments on Communities: A Case Study. Transportation Journal, Fall, 1975, p. 57.
8. Statistical Abstract of the United States: 1972 (93rd ed.). U.S. Bureau of the Census, 1972, p. 17.
9. Statistical Abstract of the United States: 1967 (88th ed.). U.S. Bureau of the Census, 1967, p. 16.
10. America's New Immobile Society. Business Week, July 27, 1981, p. 61.
11. America's Small Town Boom. Newsweek, July 6, 1981, p. 26.
12. J.A. Constantin. Transportation and Distribution in the Arkansas River Basin of Oklahoma. Oklahoma Economic Development Foundation, Inc., Norman, 1968, pp. 41-49.
13. J.F. McCarthy. Highways, Trucks, and New Industry. American Trucking Associations, Washington, DC, 1963.
14. J.A. Constantin. Capability of Transportation and Distribution Systems to Respond to Regional Growth. Economic Development Administration, U.S. Department of Commerce, monograph, Oct. 25, 1976.

Publication of this paper sponsored by Committee on Transportation Programming, Planning, and Systems Evaluation.

Abridgment

Impact of Transportation on Regional Development

FRANK R. WILSON, ALBERT M. STEVENS, AND TIMOTHY R. HOLYOKE

The objective of this study was to examine the relation between transportation costs and level of service and regional economic development to determine whether public expenditures on transportation infrastructure and freight rate subsidies can be expected to stimulate industrial development in a region. To fulfill this objective, the importance of 13 factors, which enter the decision to locate in a particular region, was rated by a sample of industrial firms in the Atlantic region of Canada. Five transportation-related factors were assessed among other location factors to determine their relative importance in attracting industry to the region. Industrial location has been used as a proxy for regional economic development in this study, as has been done in previous studies elsewhere. A part of the study traced the developments in location theory and empirical studies that have been concerned with the relation between transportation and regional development. An empirical approach was developed by using the location factor preference indices model to assess the subjective ratings of the plant-location factors for the industries contained in the sample. This model provides a numerical analysis of the subjective survey data.

This study investigates the relation of transportation and regional economic development by using the case of the Atlantic region of Canada. This focus must not be confused with transportation as a component of a regional economy, which is indisputably of vital importance. Instead, this paper deals specifically with the role of public expenditures to improve transportation costs, service, and infrastructure as a policy instrument to enhance economic development.

The contribution of this paper is twofold. On one hand, a method of analysis of location factors is presented that is empirical, regionally case-specific, and easily undertaken. By including transportation factors among other location factors, the degree of importance of transportation in regional development can be determined. On the other hand, the location factor preference indices (FPI) model analysis, as developed, is applied to the Atlantic-region case; in this case, the contribution of the research is a clearer understanding of the relative importance of selected industrial location factors in the region for input to regional development and transportation policy. This research attempted to fulfill a need for an uncomplicated and inexpensive method of assessing transportation in the context of regional economic development.

LOCATION THEORY AND ANALYSIS: HISTORICAL DEVELOPMENTS

The premise that transportation costs are the major deterrent that affects industrial location in a particular area has persisted since the early theoretical works of Frederich and Weber (1). The formal location theory that emerged was a classical economic theory with typical classical assumptions. It assumed, either explicitly or implicitly, such things as economic rationality, complete information concerning source of materials, size of markets, production mix, transportation rates, and complete factor mobility. This static model was further simplified by assuming transportation costs proportional to distance and holding everything but transportation costs constant. The obvious solution determined by using this plant-location model is to choose a site that minimizes transportation costs.

Major works by such authors as Hoover, Losch, and Isard added some realism by relaxing some of the assumptions, such as product homogeneity, perfect competition, freight rate linearity, and the homogeneous distribution of economic factors. All of the works, however, maintained the unquestioned basic

Table 1. Location FPI of disaggregated sample subgroups.

Location Factor	Province				Industrial Sector				Time Period		
	NB	NS	NFLD	PEI	PULP	SAW	FOOD	MANU	PBW	PWD	PPD
MKT	1115	1127	524	1318	987	1105	1082	1153	1116	1138	965
RAW	1196	1378	1067	852	1544	1740	1489	515	1487	1410	545
LAB	893	973	553	933	398	827	748	1244	606	777	1513
GFA	561	489	2939	694	1356	309	457	1106	193	349	2205
ROAD	1041	1057	218	1426	716	976	1296	976	749	1192	1012
RAIL	841	1106	624	604	837	840	652	1065	1114	952	443
AIR	85	77	104	104	61	33	106	118	0	63	229
SHIP	707	625	1194	669	1324	601	493	699	1054	591	483
PROW	614	615	799	725	1122	451	860	392	749	682	364
PROE	622	452	824	725	772	252	699	660	674	521	586
PRI	526	368	592	556	237	619	396	515	456	528	396
OMR	1128	1463	305	1290	281	1709	1300	1101	1391	1305	782
RATE	673	270	257	104	366	537	423	458	412	492	476

premise of classical location theory that transportation cost, as a function of distance, was the key variable factor in choosing a plant site.

Although transportation cost studies have shown transportation costs to be considerably lower than normally presumed, they have not demonstrated whether regions that have relatively higher transportation costs than competing regions are viewed by industry as poor site locations. In other words, these studies do not provide a connection between transportation costs and regional development that is of great concern to regional policymakers. Furthermore, reliable transportation cost data are extremely difficult to obtain. Manufacturing firms are often uncertain of their transportation cost component, and published tariffs for products may not reflect the actual changes that are taking place. For these reasons, transportation cost studies are of limited value in determining transportation and regional development policy.

In conclusion, it has been argued that classical location theory is of no use as a policy tool due to the multitude of necessarily unrealistic assumptions and its failure to include all of the economic and noneconomic location factors that are known to enter, in varying degrees, the decision to locate a plant in a region. In addition, it is a microeconomic model and, at best, applies only to the choice of a plant site by an entrepreneur within a given region, not to a location choice among regions. In this case, classical location theory does not provide a good proxy for regional economic development (i.e., the attraction of new industry to stimulate the regional economy).

If industrial location is to serve as a proxy for regional economic development for policy analysis, the collective requirements of the individual firms within the region should be determined. Once the positive or attractive factors are known, in addition to those weaker or possibly detrimental factors, policies can be developed to promote and improve the region as a base for expanded industrialization. What is required is an approach that gives a quantitative ordering of the significance of all plant-location factors, both economic and noneconomic, that enter the decision to locate in a region.

LOCATION FPI MODEL

The location FPI model presented in this paper has been conceptually adapted from Burnett's (2) multidimensional scaling measurement technique for predicting travel behavior. Before demonstrating model development, it is necessary to outline the data-collection procedure and evaluation-assignment scheme used in this research project. First, a representative sample of firms from the study region was selected. Then each owner or manager was presented a questionnaire during a personal interview, which asked them to assess the list of plant-location factors and rate each according to its importance in the decision to locate in the region. Three levels of importance were distinguished. If the factor was very important, a value of 2 was assigned; if somewhat important, a value of 1 was assigned; and if unimportant or irrelevant, a value of 0 was assigned. This location-factor rating approach is very similar to Wheat's (3) scoring system that he developed to assess the Fantus study. However, the ambiguous distinction between "of critical importance = 3" and "of primary importance = 2" has been replaced by the single factor that rates very important = 2. Also, the grouping together of "minor or no importance" has been changed to irrelevant or unimportant = 0.

The location FPI model produces an index for each location factor in the following form:

$$FPI_{j,s} = \sum_{n=1}^{N_s} \left(FR_{j,n} \div \sum_{j=1}^{J} FR_{j,n}\right) \div N_s \quad (1)$$

where

- $FPI_{j,s}$ = location FPI for factor j in sector or disaggregate subgroup of firms s ($j = 1,2,3...,J$),
- J = total number of location factors,
- N_s = total number of firms in sector or disaggregate subgroup s,
- $FR_{j,n}$ = location factor rating of factor j by firm n ($n = 1,2,3...N_s$), and
- $FR_{j,n} \div \sum_{j=1}^{J} FR_{j,n}$ = location FPI of factor j for firm n.

Each firm needs only to rate each of the j number of location factors on the 0-1-2 level of importance rating scheme basis. At the microfirm level, the j factor preference indicates $FPI_{j,s}$, where $j = 1,2,...,J$ is produced and indicates the relative importance of each factor as assessed by the individual firm.

For the aggregate location FPIs ($FPI_{j,s}$), the indices from the N_s number of firms are summed for each factor j and averaged for the disaggregate subgroup s. The limiting range for the location FPI is from zero (the case where all firms of a subgroup rate a location factor as unimportant or irrelevant) to one (the case where all firms rate a location factor as either somewhat important or very important while rating all other location factors as unimportant or irrelevant). A scaling factor of

Product Market				Plant Size			All Firms
DEM	EEM	DRM	ERM	LT50	F50T150	GT150	
903	502	1322	1260	1232	1140	857	1090
1235	1229	1217	1149	1209	1035	1442	1227
843	854	974	958	988	966	725	901
1123	1754	275	89	368	1132	843	745
952	854	1092	1124	1168	986	844	1014
786	613	996	1084	745	989	943	880
115	61	45	61	51	160	49	84
946	1387	407	411	335	614	1274	706
755	918	467	527	551	366	984	626
627	679	530	531	531	506	728	583
486	281	461	555	564	487	348	475
793	281	1719	1802	1704	1275	497	1205
437	588	496	448	554	345	466	464

10^n may be used to yield positive integer indices ranging from 0 to 10 000.

The total sample was disaggregated to the following subgroups:

1. Subregions: provinces, states, or geographic and economic regions;
2. Industrial sectors: forest, agriculture, and primary and secondary manufacturing;
3. Time of plant location: time periods affected by historical, economic, or political changes;
4. Plant size: number of employees, asset value of plant, and gross annual revenues; and
5. Market orientation: whether products are marketed regionally, externally, or both.

LOCATION FPI MODEL ANALYSIS OF ATLANTIC REGION

To begin the regional case study, a sample of 95 Atlantic-region firms was selected that represent the forest product, food processing, and manufacturing sectors. A questionnaire was designed and presented to the owner or manager of each firm, who rated each of 13 location factors.

The respondents were asked to rate each of 13 plant site-location factors according to their importance in the decision to locate in the Atlantic region. Each factor was assessed independently and rated as to whether it was considered very important, somewhat or moderately important, or unimportant or irrelevant. The 13 plant site-location factors used in the Atlantic region study are as follows:

1. MKT--Proximity of plant site to prospective market,
2. RAW--proximity of raw materials used in production,
3. LAB--Availability of skilled and/or stable labor force,
4. GFA--Availability of government financial assistance and/or incentives,
5. ROAD--Accessibility of the plant site to highways,
6. RAIL--Accessibility of the plant site to railways,
7. AIR--Accessibility of the plant site to air services,
8. SHIP--Accessibility of the plant site to ports and waterways,
9. PROW--Availability of water for use in processing,
10. PROE--Availability of electricity for use in processing,
11. PRI--Proximity of related industry to the plant site,
12. OMR--Residence of the owner or manager located at or near the plant site, and
13. RATE--Existence of reasonable transportation rates for commodity movements to and from the plant site.

Of the five factors that relate to transportation, ROAD, RAIL, AIR, and SHIP refer specifically to the availability of modal service and infrastructure. RATE refers to the associated level of transportation costs, which include subsidies on designated freight rates and the service available to, and chosen by, the firm. By including the five transportation factors instead of a single general transportation cost and service factor, not only can transportation be assessed among the other location factors, but the cost and service aspects of transportation and the relative importance of each transportation mode can also be distinguished.

The table below illustrates the resultant indices, ranked by their relative importance, of the location factors by using the entire sample of firms:

Rank	Location Factor	FPI	Rank	Location Factor	FPI
1	RAW	1227	8	SHIP	706
2	OMR	1206	9	PROW	626
3	MKT	1090	10	PROE	583
4	ROAD	1014	11	PRI	475
5	LAB	901	12	RATE	464
6	RAIL	880	13	AIR	84
7	GFA	745			

(Note that the grand sample mean for the FPI is 769.) As previously stated, care should be taken when interpreting results from the entire sample. However, the inherent biases of the total sample can be used to advantage. By establishing bases for disaggregating the sample into subgroups (i.e., the firms that share common characteristics distinct from the other subgroups), each factor can be viewed in relation to its relative importance within its subgroup. This treatment not only reveals the biases of looking only at the entire sample but also indicates the particular concerns of the subgroups within the sample. Table 1 is a summary of the location factors for the various subgroupings of the sample. The subgroups used in Table 1 are as follows: NB, New Brunswick; NS, Nova Scotia; NFLD, Newfoundland; PEI, Prince Edward Island; PULP, pulp mills; SAW, saw mills; FOOD, food processing industry; MANU, secondary manufacturing; PBW, pre-World War II; PWD, post-World War II; PPD, post-regional development period (1969); DEM, dominantly external; EEM, entirely external; DRM, dominantly regional; ERM, entirely regional; LT50, less than 50 workers; F50T150, between 50 and 150 workers; and GT150, greater than 150 workers.

CONCLUSIONS

As previously mentioned, the lack of industrial development in the Atlantic region was claimed to be the consequence of the transportation barrier. Without a transportation system compatible to other parts of the country, the Atlantic region may not have accommodated its existing industries. There are also direct and indirect benefits from construction projects alone. But, although public expenditures on transportation infrastructure create economic activity from the capital inflow to the region, the effects are temporary and diminish after the project is completed. Despite these positive effects, the results of this study and the persistent regional disparities in the Atlantic region indicate that increased investment in infrastructure for construction and expanding system capacity is not likely to directly attract new industry to the region. It is apparent that there are other factors equally or more important in successfully attracting industry to the region.

In the total sample, the transportation-related location factors ranked fourth (ROAD at 1014), sixth (RAIL at 880), eighth (SHIP at 706), twelfth (RATE at 464), and thirteenth (AIR at 84). The average of all the transportation location factors is 630, which, if taken as a single location factor, ranks transportation sixth out of nine location factors and is well below the grand sample mean of 769. If only the three major freight-carrying modes [trucking, rail, and marine (ROAD, RAIL, and SHIP)] are combined for a transportation location factor, which leaves out the air freight mode (AIR) and the subsidized freight rates (RATE) factors that rated very low, transportation still only ranks fifth at 867, behind RAW, OMR, MKT, and LAB.

In the period following World War II to the end of 1960, huge public investments in transportation infrastructure were made, particularly in the highway system. The air system also developed to serve the larger urban centers during this period. Four transportation modes became available to industry (i.e., trucking, rail, marine, and air) for moving their input materials and output products. However, the importance of transportation as a location factor, as indicated by the averaged index of the four modes, dropped significantly during this period to 700. During the period 1945-1969, transportation ranked fifth of 10 factors, behind RAW, OMR, MKT, and LAB.

In the recent period (since 1969), transportation investment has continued, and particular emphasis has been on the air mode and marine port facilities. However, the combined average index for the four transportation modes dropped further in importance to 542.

However, ROAD by itself ranked third during the post-World War II period, following GFA and LAB. The growing importance of the highway trucking mode of transportation in recent decades to Atlantic-region industry indicates that public funds would be best spent on highways and secondary and service roads. In fact, the difference between the importance of ROAD versus the other transportation modes is substantial enough to suggest that public capital expenditures on airport facilities, for instance, may have negative effects from the opportunity cost of not spending the funds on highways. This still does not mean, however, that good highways necessarily draw new industry, but the ROAD factor is certainly an important consideration to industry.

REFERENCES

1. C.J. Frederich and A. Weber. Theory of Location of Industries. Univ. of Chicago Press, Chicago, 1929.
2. P. Burnett. Disaggregate Behavioral Models of Travel Decisions Other Than Mode Choice: A Review and Contribution to Spatial Choice Theory. In Behavioral Demand Modeling and Valuation of Travel Time, TRB, Special Rept. 149, 1974, pp. 207-222.
3. L.F. Wheat. Regional Growth and Industrial Location, An Imperical Viewpoint. Lexington Books, Heath and Co., Toronto, Ontario, Canada, 1973.

Publication of this paper sponsored by Committee on Transportation Programming, Planning, and Systems Evaluation.

Regulation of Road Haulage in United Kingdom: A Critical Review

K.J. BUTTON AND A.D. PEARMAN

Road haulage is the dominant form of freight transportation in the United Kingdom. For a variety of economic and political reasons, it has been the subject of government control and regulation. Recently, public policy with regard to road haulage has come under review and there are signs that official attitudes toward the sector are changing. This paper looks at the ways in which road haulage is regulated in the United Kingdom and considers the economic justifications advanced in support of current policies. The effects of regulation are considered in some detail, although the extent to which this can be done satisfactorily is severely constrained by the paucity and inappropriateness of available data. The paper specifically questions the ways in which policy is formulated in the United Kingdom and looks at the three recent official studies of road haulage that, in turn, have reviewed pricing, licensing, and environmental issues. The United Kingdom's membership in the European Economic Community has, in recent years, introduced a new dimension into road-haulage policy formulation. The evolution of a Common Transport Policy has posed its own problems, as described in the last section of the paper.

In aggregate terms, road haulage dominates inland freight transportation in the United Kingdom. Between 1953 and 1979, the ton kilometers moved by road haulage more than tripled while its share of the total freight market nearly doubled. The increase was particularly rapid during the late 1950s and throughout the 1960s, but the rate of increase, although still pronounced, slowed down somewhat in the 1970s (see Table 1). Further growth in road freight traffic to the end of the decade is forecast (see Figure 1). This performance contrasts markedly, for example, with that of British Rail, which suffered both a relative and an absolute decline in its freight business over this period.

The increase in road-haulage ton kilometers is attributable, to a large extent, to a substantial rise in the average length of haul--from 35 km in 1953 to 69 km in 1979. This trend represents something of an encroachment into the longer-distance freight market, traditionally the domain of rail transportation. Another factor worthy of note is the greater use made of larger lorries; nationally, recent years have witnessed a fall in the ton kilometers moved by lighter classes of lorry and a rise in that done by lorries of more than 8-t unladen weight (uw). For example, in 1967 vehicles more than 8-t uw accounted for only 24 percent of the ton kilometers done by lorries but by 1979 this had

Table 1. Freight transportation in United Kingdom by mode.

	Freight Ton Kilometers by Year (000 000 000s)					
Mode	1970	1975	1976	1977	1978	1979
Road[a]	85.0	95.3	95.6	98.0	99.1	104.6
Rail[a]	26.8	20.9	20.6	20.1	20.0	19.9
Coastal shipping	23.2	18.3	20.0	23.2	27.1	20.0
Inland waterways	0.1	0.1	0.1	0.1	0.1	0.1
Pipelines	3.0	5.9	5.7	8.8	9.8	10.3
Total	138.1	140.5	142.0	150.2	156.1	154.9

[a]Road as a percentage of rail is as follows: for 1970, 76.0 percent; 1975, 82.0 percent; 1976, 82.3 percent; 1977, 83.0 percent; 1978, 83.2 percent; and 1979, 84.0 percent.

Figure 1. Forecast growth of road freight traffic in Great Britain to 2005.

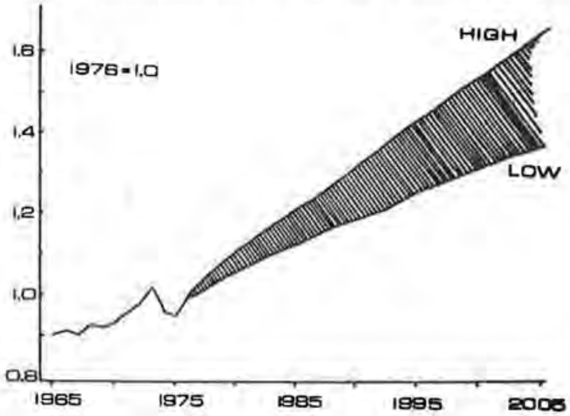


Table 2. Goods vehicles in United Kingdom by unladen weight.

	Goods Vehicles (000s)				
Unladen Weight	1970	1975	1976	1978[a]	1979[a]
Net ≤ 1.5 t					
< 16 cwt	391	434	438	405	411
> 16 cwt ≤ 1 t	174	191	182	195	216
> 1 t ≤ 1.5 t	410	531	544	553	583
Total	975	1156	1164	1153	1210
Net > 1.5 t					
> 1.5 t ≤ 2 t	71	78	68	63	69
> 2 t ≤ 3 t	136	137	135	116	111
> 3 t ≤ 5 t	244	169	156	142	148
> 5 t ≤ 8 t	135	138	132	118	119
> 8 t ≤ 10 t	40	57	59	55	56
> 10 t	15	39	44	56	65
Total	641	618	594	550	568
Total	1616	1774	1758	1703	1778

[a]Not strictly comparable with previous years.

risen by 76 percent. Put another way, more than two-thirds of all ton kilometers by road are now moved by lorries in excess of 24-t gross vehicle weight (gvw) and more than 90 percent by lorries of more than 16-t gvw. The increased importance of heavy lorries is reflected in the changed composition of the vehicle fleet (Table 2). Although there has been a marked rise in the number of small vans less than 1.5-t uw, the main trunk-haul fleet has been characterized by a steady fall in the number of lorries less than 5-t uw but a rise in those more than 8-t gvw; the latter now account for more than a fifth of the total road-haulage fleet. The result of this is that the total number of vehicles in the main fleet (i.e., more than 1.5-t uw) has actually declined by about 20 percent since 1967.

In addition to changes in the composition of the road-haulage fleet and the scale of its operations, there have been changes in the nature of the freight carried. We have already noted that the increased average length of haul contributed to the higher ton kilometers, but this must also be taken in the context of a fall in the actual total tonnage carried during recent years (from 1707 million t in 1968 to 1504 million t in 1979). There has been a marked shift away from bulk primary products (especially those associated with the mining, quarrying, and construction sectors of the economy) and a noticeable movement toward the carriage of final-product manufactures. The change reflects the evolving structure of the U.K. economy. Indeed, this changing structure has also contributed to the increased length of road haul, where economies of scale in manufacturing favor a greater geographical concentration of industry. (The average haul for crude minerals, ores, coal, coke, and building materials is much shorter than that associated with manufactures.)

Recent years have also seen changes in the type of haulage activities undertaken. Until the mid-1960s, the own-account (i.e., carriage of goods in connection with the business of the licensee) and hire-or-reward (i.e., exclusive carriage of another person's goods) sides of the road-haulage industry were more or less evenly balanced. Over the past 15 years or so, however, hire-or-reward operations have expanded more rapidly and now account for about 65 percent of the market, as shown in the table below [note that PH = public hauler (i.e., hire-or-reward) and OA = own account]:

	Haulage--Ton Kilometers by Year (000 000 000s)					
Item	1967	1969	1971	1973	1975	1977
Mainly PH	44.3	50	50.6	58.2	60.5	64.9
Mainly OA	30.2	33.4	35.3	32.2	34.8	33.1

(Note that PH as a percentage of the total is as follows: for 1967, 59.4 percent; 1969, 60.0 percent; 1971, 58.9 percent; 1973, 64.4 percent; 1975, 63.5 percent; and 1977, 62.2 percent.) Changes in licensing arrangements in the late 1960s seem likely to have exerted some influence, but the increasing costs of haulage operations are also likely to have acted as a constraint on the growth of own-account activities. International road haulage has also expanded considerably with a threefold increase in the number of lorries and trailers engaged in international journeys between 1971 and 1978.

It is against this general background that road freight transportation policy has been formulated in the United Kingdom. Of course, it must also be remembered that these policies have themselves played their part in shaping the trends. Investment in motorways (the system expanded from 153 km in 1960 to 2483 km in 1979) and improved trunk roads (there were 2768 km of dual carriageway in 1970, which rose to 4637 km in 1979) provided basic infrastructure for the sector and, insofar as faster but less-direct routes became available, contributed to the rise in the average length of haul. Increases in the permitted dimensions of vehicles in 1964 and 1968 (the current maximum width is 2.5 m and length is 15 m) and in maximum gross weight (which increased to 32.5 t for 4-axle articulated lorries in 1964 and 30 t for 4-axle rigid vehicles in 1972) have influenced the composition of the vehicle fleet. Similarly, changes in the licensing regulations in 1968 and, specifically, the termination of quantity controls in the hire-or-reward sector, seem likely to have accounted for some of the rapid growth in this type of operation. Membership of the

European Economic Community (EEC) from 1973, despite the apparent difficulties associated with formulating a Common Transport Policy (1), has stimulated the international dimension of road haulage.

EVOLUTION OF ROAD-HAULAGE POLICY

There is a long history of regulation associated with road haulage in the United Kingdom. Until comparatively recently, however, the dominant control was the system of licensing introduced as part of the Road and Rail Act of 1933, which limited entry to the industry. These quantity licensing arrangements were intended to provide a basis for fair competition between road and rail transportation. Legal restrictions since the 19th Century had limited the commercial freedom enjoyed by the railways and by the 1930s were preventing them from competing effectively against competition from road haulage. However, rather than permitting the railways greater freedom (and, incidentally, also as a means of protecting established road haulers), the policymakers of the 1930s attempted to create a balance by curtailing free entry into road haulage. The immediate effect of the Act was to reduce bankruptcies in road haulage and to increase the security enjoyed by existing operators. In the longer term, though, the underlying aim of protecting rail freight was not realized and the financial position of the privately owned railway companies continued to deteriorate. The road-haulage sector expanded, in part, because of the ease with which own-account (or C) licenses could be obtained and, in part, because of the changing structure and geographical distribution of U.K. industry.

Nationalization of long-distance road haulage in the post-World War II period was an attempt to improve the overall efficiency of freight transportation. Under the 1947 Transport Act, long-distance hire-or-reward haulage (i.e., more than 40 km) was placed under public ownership as British Road Services (BRS) and was combined with the newly nationalized railways, inland waterways, docks, and portions of the road passenger transportation sector under the umbrella of the British Transport Commission (BTC). Coordination of freight transportation, however, proved difficult and, in particular, the financial position of the railways continued to worsen. Three reasons for these problems can usefully be isolated.

1. Road haulage is essentially an atomistic industry that exhibits few managerial economies of scale. (In the relatively free-market situation of 1979, for instance, nearly 55 percent of operators had only one vehicle while 88 percent had five or less.) Many haulage activities rely on personal contacts and considerable dexterity and flexibility of management. A large nationalized undertaking, particularly if it is as highly centralized as BRS was in its early years, cannot offer the responsive and sensitive control that maximum efficiency demands.

2. The freedom left with own-account operators encouraged many potential customers to develop their own haulage activities rather than employ BRS or use the railways.

3. Within BTC there was a tendency for funds to be directed toward the road sector at the expense of the railways. BTC was given the remit to at least recover its costs and, despite its operational difficulties, BRS still offered a positive return, unlike the railways. The latter, after the massive disinvestment suffered during the war period--estimated at some £440 million in 1953 prices--was loss making.

BTC operated throughout with considerable financial difficulties and this resulted in a substantial denationalization of road haulage under the 1953 Transport Act. Part of road haulage, mainly that involving network services, remained in public hands, partly in response to the demands of those parts of the manufacturing industry that saw the need for a nationwide undertaking that could offer long-term, reliable contract services. The remainder of the industry was returned to the private sector and quantity licensing was retained to regulate entry. This situation remained, with some administrative amendments to the nationalized sector in 1962, until the 1968 Transport Act.

The 1968 Transport Act marked an important watershed in the regulation of road freight transportation. The Act rested on two important changes in emphasis. First, a political change was brought about by the return in 1964 of a Labor government committed to developing a comprehensive transportation policy that transcended individual modes (2). The keynote of the policy was controlled competition that, in the freight context, meant active and fair competition between alternative modes, limited only by the need to ensure adequate safety and environmental protection. Second, a committee looking specifically at road-haulage licensing reported in 1965 (3) and concluded that quantity restrictions did nothing to promote their stated objectives of ensuring public safety, reducing the harmful effects of road transportation on amenity, encouraging the greater use of rail facilities, or limiting traffic congestion. Further, it was argued that they reduced the internal efficiency of the industry by preventing more dynamic firms from entering and, also, by constraining the activities of haulers once licensed. In sum, the system was seen to be wasteful, ineffective, and unduly complicated and to be ill-designed to achieve its objectives. Competition and greater freedom of entry now became accepted aims of policy (4).

The 1968 Transport Act embodied these views and regulation of quantity gave way to the regulation of quality. (There were provisions to license heavy, long-distance public road haulage where competition exists with railways, on the grounds that consignors are often ignorant of relative overall costs or, at least, inert in the face of changing conditions, but this scheme was never actually impelemented.) Quality licensing was introduced to cover all forms of road haulage, irrespective of whether it was hire-or-reward or own account, which involved vehicles of more than 3.5-t plated weight or 30 hundredweight (cwt) net weight (smaller vehicles were completely freed from commercial licensing). The operator became required to satisfy the Licensing Authority that he or she has adequate facilities for maintenance, sufficient control over the loading of the vehicles, and adequate financial resources, and that he or she (or some senior employee) holds a manager's license. Safety standards had already been improved in the complementary 1967 Road Traffic Act, which laid down much more stringent standards for the testing of goods vehicles.

Existing regulations and controls are still based on the 1968 Transport Act, although there have been a number of technical changes as a result of membership in the EEC. For example, the EEC places its entire emphasis on the hire-or-reward sector and does not adopt the same comprehensive policy toward regulating road haulage as does the 1968 Act. Similarly, laws governing driving hours have been modified to correspond to EEC regulations, and mechanical monitoring of road-haulage operations by using tachographs has been accepted. These are, though, points of detail. The overall strategy of controlled competition has been broadly accepted by the EEC since 1973, and a philosophy based on minimal regulation of road-haulage operators has prevailed.

EFFECTS OF REGULATION

Our understanding of the effectiveness of the various controls and regulations imposed on road freight transportation in the United Kingdom is extremely limited mainly because of the inadequacies of statistical information. The dearth of comprehensive and reliable data on the road-haulage sector was highlighted more than 20 years ago by Munby (5), who pointed to the lack of the most elementary information on haulage operations. Subsequently, improvements have been made but the incompleteness of the data still poses serious problems, not least because most of the information is of a physical, aggregate nature (e.g., dealing with vehicle stocks, tons transported, etc.) with few details of costs, profit margins, investment levels, etc. Recently, however, a number of official studies have generated new sources of information that permit us to conduct a rather more satisfactory assessment of the existing regulatory system. These studies are themselves partly a response to a widening concern about road transportation in the United Kingdom in general and also represent something of a monitoring by government of its own regulatory policies. Specifically, three studies are of central interest, which have considered, in turn, pricing (6), licensing (7), and the wider environmental impact of road haulage on the community (8). In addition, recent interest in improving road investment resulted in the establishment of an Advisory Committee on Trunk Road Assessment (9), which produced some limited information about the interaction between infrastructure provision and road freight transportation activities.

The success or otherwise of freight transportation regulation can be judged in two ways. First, are the regulations that currently exist ensuring efficient (in the widest sense) freight service provision? This basically requires an assessment of performance in the sector since the introduction of the new, minimal regulation regime in 1968. Second, are the specific instruments of regulation fulfilling their particular objectives (e.g., are driving-hour restrictions improving safety standards)? This is a particularly difficult question, since the various regulatory instruments have diverse effects and, second, they tend to interact with one another by either complementing or diluting their effectiveness. We intend to look at the first question briefly before spending rather more time in the following section on the second.

In commercial terms, road haulage has suffered serious financial difficulties since 1968. The survey of hire-or-reward haulers conducted jointly by the Price Commission (6) and the Foster Committee (7) indicates that, despite a fluctuating ratio of profits (net of interest) to net capital employed that ranged between about 8 and 20 percent (partly influenced by fleet size) between 1975 and 1977, if account is taken of the cost of capital replacement, a much dimmer picture emerges. For example, the adjustments suggest that an average negative real rate of return of -1 percent was earned in 1977 with only about a quarter of operators earning a reasonable positive return. More recent trends suggest that despite some picking up of business in the late 1970s (by about 17 percent in 1979), demand dropped significantly (by about 25 percent according to the Road Haulage Association) in 1980, thereby putting even greater financial pressures on operators. Despite these difficulties, it is not clear that the existing methods of regulation are the cause of the potential instability in the industry. First, haulage services satisfy a derived demand and the extreme severity of the recent recession in the economy is likely to have placed considerable strains on the sector, irrespective of the package of regulations that control it. Second, there is evidence, mainly in the form of bankruptcy statistics (7), that liquidations in the 1970s followed similar patterns to those in the 1960s (3). Thus, although it is difficult to define the appropriate counterfactual, there is little evidence that the post-1968 regime has resulted in increased instability in the sector. Many of the financial difficulties seem to result from factors external to the sector and not directly from the operational regulations.

There is also little evidence that the competitive situation since 1968 has resulted in a deterioration of the capital stock in the sector. The Foster Committee (7) reported a decline in the average age of the haulage fleet in 1977 following a period of slight increase. There was also a considerable restocking in 1979 with sales of more than 305 000 vehicles. Although the rather uneven age profile of the fleet makes it difficult to draw firm conclusions from this, the growth in the average size of vehicles does suggest that the overall effect is an improvement in the quality of the capital stock. It is also clear from the extensive second-hand market that competitive conditions do prevent excessive and wasteful nonprice competition from developing.

Turning from the internal efficiency of the haulage sector to the broader social and environmental issues, controlled competition accepts that the market offers the most efficient method of providing haulage services, conditional on the external consequences of haulage activities being controlled. Clearly, potential conflicts arise between official policymakers who wish to regulate road haulage in order to maximize overall social welfare and the haulage associations that are more interested in profit margins and financial costs. Details of the actual economic performance of road-haulage firms are difficult enough to obtain, but the subjective nature of many external effects makes assessment even more problematic. There is certainly evidence that in recent years environmental problems attributable to lorries have increased in certain places and in specific circumstances where there have been marked increases in the incidence of the largest and heaviest lorries. The Armitage report (8) concludes, however, that although improvements via regulatory changes are still necessary, there have been major improvements in vehicle design that, combined with the numerically smaller vehicle fleet, have contained (if not improved) the general situation.

INSTRUMENTS OF REGULATION

Although the overall picture that emerges may suggest that the regulations under the regime of controlled competition have not seriously impeded the operations of the road-haulage sector, it is worth looking in more detail at the individual instruments of control themselves. These may be subdivided under five broad headings.

Entry Regulations

Entry regulations embrace both controls on the operators that enter the market and regulations on the types of vehicles allowed to enter the road network. The relative freedom of entry to the

Table 3. Heaviest lorries permitted in EEC countries.

Country	Weight (t) Single Axle	4 Axles	5 Axles	6 Axles
U.K. and Ireland	10.16	32.5	-	-
France	13	38	-	-
Belgium and Luxembourg	13	38/40[a]	-	-
Germany	10	36	38	-
Italy	12	40	44	-
Denmark	10	36	40/42[b]	44
Holland	10	36[c]	46[c]	50
EEC proposal	10/11[d]	35	40/42[b]	44

[a]Higher limit applies to road trains.
[b]Higher limit applies to 3-axle tractors pulling 2-axle trailers.
[c]The Dutch have no statutory limits apart from the 10-t axle and the 50-t total weight. Figures indicated for 4- and 5-axle vehicles are practical limits.
[d]Higher limit applies to driving axle. A 5 percent tolerance on individual axle weights is also proposed.

industry since 1968, subject only to the attainment of an operator's license (O license), seems to have resulted in some changes in the type of haulage that takes place. (In 1978, it should be pointed out, there were minor changes in the licensing system to conform to EEC regulations, but these do not substantially alter the argument.) The relative growth in hire-or-reward activities at the expense of the own-account operations highlighted above suggests that in freer market conditions more consignors' will opt for the public hauler rather than operate their own fleet. Public haulers can usually offer a wider range of services and are generally less expensive than own-account operators but do have the disadvantage of being outside the consignors' direct control. This would indicate an improvement in efficiency, especially since the range of options open to the consignor is wider.

Controls on the entry of different vehicle classes, however, seem to be much less efficient. To begin with, the existing regulations regarding loading and size seem to be both inappropriate and ineffectual, and they have serious repercussions for the environment, economic efficiency, and the public purse. Evidence of overloading, for instance, suggests a pronounced increase in the practice through the 1970s, where the percentage of axles more than 10 t has risen from 5.2 percent in 1973 to 11.8 percent in 1976 and the percentage more than 11 t has risen from 2.2 to 7.0 percent for the same period. More recent evidence from the M6 motorway near Birmingham collected by the Transport and Road Research Laboratory suggests that nearly half the drive axles of 32.5-t lorries were overweight. This situation has obvious implications for the degree of wear and tear inflicted on the road surface (10). It also implies that there is no genuine commitment to enforce the laws, although recently both the Foster (7) and Armitage (8) Committees have recommended much stronger enforcement. The former was particularly concerned about activities at off-peak periods (e.g., weekends).

The violation of the law raises a further question: Are the basic regulations appropriate? Certainly the weight regulations in the United Kingdom are, in most respects, rather more stringent than in other European countries (see Table 3). This, it is claimed, both pushes up the financial costs of operating a vehicle fleet and also imposes certain types of additional environmental costs on the community (mainly because a large fleet is required to carry any given volume of traffic). The Armitage Committee (8) took both of these arguments into account in recommending that the maximum permitted gross vehicle weight be increased to 44 t with supplementary rules governing axle loadings and vehicle dimensions. In particular, there seem to be substantial financial savings from such a change, as shown in the table below (note that for 38- and 40-t gvw, 4-axle vehicles--2 axles on tractor and 3 on semitrailer; for 42-t gvw, 5-axle vehicles--3 axles on tractor and 2 on semitrailer):

Vehicle	Savings (%)
35-t gvw, 4 axles	5-7
38-t gvw, 5 axles	5-9
40-t gvw, 5 axles	7-14
42-t gvw, 5 axles	9-13
44-t gvw, 6 axles	11-13

[There are more estimates for 40-t gvw, 5-axle vehicles than for others (i.e., 7-14 percent); most are in the range of 10-12 percent.] In the summer of 1981, however, the government rejected such a proposal mainly on the grounds of the potential infrastructure damage and also under pressure from environmentalist lobbies. It still seems likely, though, that some increase in maximum gross vehicle weight will take place, albeit at a lower level, and that enforcement of laws will be substantially tightened.

Operational Regulations

Once a hauler meets the entry requirements, his or her activities in the market are still restricted by operational rules (e.g., speed limits, route controls, etc.). These are essentially management regulations intended both to facilitate a smooth flow of traffic and to protect sensitive segments of the community. The geographical bluntness of the regulations, while not necessarily detracting from their overall function, often leaves specific problem areas. Attempts to specifically protect residential areas and concentrate traffic on lorry routes under the Dykes Act of 1973 (11), for example, combined with access controls and channeling of traffic within urban areas, have been attempted in the United Kingdom, but to date their success has been limited. One of the main difficulties is that there are few ideal routes on which to concentrate the goods traffic and, without very substantial investment, there is little hope that this situation will change (12). In many cases, channeling of traffic would only relieve some people from the nuisance of heavy lorries by inflicting a greater burden on others. A scheme proposed for Birmingham, for example, while benefiting 60 percent of houses in the affected area would be detrimental to the other 40 percent. This problem is recognized by official policymakers (13) and has been highlighted in the Armitage study (8). The latter report, indeed, seems to be indicating a policy of insulation and protection for those areas adversely affected by lorry movements in its lorry action area program rather than the adoption of more stringent regulations on vehicle use.

Financial Regulations

Vehicle and fuel taxation regulate both the overall composition of the haulage fleet and the kilometers run by individual vehicles. Although there is a substantial difference in the amounts of taxation paid by the various categories of vehicles, it is less certain that all pay a sufficient amount to cover their allocated road track costs (14) and their community cost. In addition, it is not clear that the method of financial regulation, which has a substantial fixed payment in the form of annual vehicle excise duty (the so-called road fund license), offers the appropriate inducement to make efficient use of road space. Once a license has been purchased, the relatively low fuel taxation is unlikely to encourage economy in the use made of that vehicle. In addition, since the fixed component of charges rises relatively slowly with vehicle size and the variable component (mainly fuel duty) in most circumstances increases less than in proportion to the ton kilometers of capacity obtained by operating the vehicle, there is also a bias that favors the adoption of larger vehicles. Consequently, the financial regulations, although in aggregate yielding revenue sufficient to recover the costs of road provision, may lead to some distortions by virtue of the ways in which charges are levied. Unfortunately, political and technical problems seem to make it difficult to transfer the main incidence of taxation from the fixed to the variable component.

Commercial Regulations

The main commercial regulations in road haulage relate to controlling rates charged to consignors, and at times since 1968 there have been attempts to regulate haulage charges as a tool in national macroeconomic (normally anti-inflation) policy. For example, the Price Commission (6) reported in 1978: "Apart from certain increases for individual firms which may be justified by higher provision for depreciation, in the economic circumstances now ruling, including recent stabilization of oil prices, we would expect to see only a very modest increase in charges over the next twelve months, certainly not above the rate of inflation currently prevailing in the economy generally." The difficulty in regulating road-haulage charges is that revenue in the sector is extremely sensitive to demand unless there is adequate flexibility in pricing. The pressure to regulate charges normally occurs at times of depression in the haulage sector, when capacity is abundant but consignments few. Hence, there is only limited scope for greater productivity and, indeed, the efforts to obtain more consignments may actually push up costs, putting additional strains on margins. Thus it seems strange that the Price Commission (6) recommended regulating charges in the late 1970s when much of their evidence pointed to depressed profits and a relatively efficient industry with minimal scope for price cutting.

To digress slightly, the suggestion of the Price Commission also serves a further purpose, namely, to illustrate one of the major shortcomings of the committee-of-inquiry system as operated in the United Kingdom. At the same time the Price Commission undertook its study into pricing, the Foster Committee (7) was concerning itself independently with entry regulations. Accepting the basic economic premise that price and quantity are codetermined, this must lead to serious doubts about the validity of the two exercises; it is impossible to devise policies on pricing without ipso facto determining the level of output in the sector.

Infrastructure Provision

In the broadest sense, the road-haulage sector is regulated by the infrastructure provided for its use. Over recent years, the U.K. government has placed high priority on directing road investment to places that facilitate easy movement of road haulage to the major ports and to schemes that take interurban freight traffic away from sensitive urban and rural areas. The aggregate provision of road investment also influences the ability of road haulage to compete with rail freight services. The difficulty with this long-term method of regulation is that it is extremely sensitive to economic conditions and policies not directly connected with road-haulage activities. The scale and nature of road investment programs are continually subjected to change to meet macroeconomic policy objectives (e.g., the reductions in the level of public sector spending since 1978 were designed mainly to keep government borrowing down). The link between policymaking and regulation at the microlevel (which is the main concern of road haulers) and the same factors at the macrolevel is often rather weak and ill-defined.

UNITED KINGDOM REGULATIONS AND THE EEC

Britain's membership in the EEC since 1973 has resulted in a number of major impacts on U.K. freight transportation (15-17). First, it means that U.K. operators are now subject to the same rules and restrictions as other operators within the EEC. This applies particularly to driving hours, licensing arrangements, and the use of tachographs but does not, as yet, apply to vehicle weights or taxation, although this seems likely to change in the near future. Second, it provides haulers with a larger potential market in which to offer their services, and there has been a gradual (albeit very slow) relaxation of the old established bilateral licensing system as an EEC quota of European licenses has become available. Of course, this also means increased competition from overseas haulers that operate into the United Kingdom, although cabotage is still not permitted. Third, limited finance is now available via agencies such as the Regional Development Fund to improve transportation infrastructure. Quite clearly, the ways in which such funds are used within the United Kingdom are likely to influence the relative competitiveness of road and rail freight transportation (18).

The formulation of EEC transportation policy and the associated regulation of the road-haulage sector in itself pose serious problems, not least because of the different philosophies favored by the various member states. Holland and the United Kingdom, for example, tend to pursue a broadly commercial approach to freight transportation and are liberal in their treatment of the road-haulage sector. In contrast, France and Germany, adopting a protective posture toward their railways, have traditionally favored entry controls into road haulage and have operated rigid quantity licensing regimes. The European Coal and Steel Community (ECSC) laid the foundation for a Common Transport Policy in the 1950s but was almost exclusively concerned with rail freight transportation and, in particular, the movement of bulk primary commodities (19). Nevertheless, the ECSC did establish the principle that a common policy with respect to transportation formed a necessary component of any free-trade area. The Treaty of Rome, which established the EEC, therefore contains a specific remit--one of only two such remits in the Treaty--on the formulation of a Common Transport Policy (i.e., "The activity of the Community [is to include]...the adoption of a common policy in the sphere of transport"). The guiding principle is the gradual introduction of consistent arrangements in line with social and economic requirements and promoting a sound development of the transportation industry itself. The transportation market must be organized in accordance with the generally recognized principles of the market economy, although public intervention is not precluded for reasons of overriding importance. Quite clearly, this general set of aims is not inconsistent with the types of road-haulage regulation policies pursued in the United Kingdom since 1968.

Although the general principles of regulation are consistent, the types of actual and proposed regulations (by the Commission of the EEC) for the EEC before 1973 conflicted seriously with those in force in the United Kingdom. By this one does not mean simply details of regulations (e.g., length of driving hours, maximum weight of vehicles, use of mechanical recording devices, etc.), which were almost inevitably different, but rather the approach to entry to the market, control of rates, and licensing regimes. Prior to 1973 the Commission of the EEC, in a series of reports, advocated and, to a much more limited extent, achieved a policy of operational regulation and control (20,21). Controls on prices, for instance, were proposed and introduced on an experimental basis; haulers were only permitted to charge within a predetermined fork or bracket of 23 percent. Licensing was restricted to hire-or-reward activities with proposals that operators over long distance be subjected to quantity controls on a zonal basis (22). For a variety of reasons, operational controls of this kind have proved unsuccessful. They are extremely difficult to set at an appropriate level and to enforce. Further, since they are bureaucratic in nature, they tend to be inflexible and insensitive to changing market conditions.

Since 1973 and the enlargement of the EEC following the membership of the United Kingdom, Denmark, and Eire, there has been a new impetus (23) to the Common Transport Policy. Attention has been directed and focused away from unimodal attempts at detailed regulation of individual modes of freight transportation and has instead turned to ideas of a more general supervision of capacity along with much greater emphasis on harmonizing infrastructure investment and pricing. However, policy has still been slow to evolve and, for example, ideas of expanding the quota of EEC licenses have been thwarted by disagreements between member states (some 95 percent of community trade is still carried under bilateral agreements). One of the main difficulties is that it is unclear from the Treaty of Rome where the boundaries of regulatory responsibility lie between the powers of national governments and the EEC Commission [see paper by Gwilliam (24) for a much more detailed discussion of this institutional problem]. Additional problems arise because transportation is but one concern of the EEC and frequently, for reasons of national political interest, policies in the transportation sphere are used in "horse trading" that involves other areas of EEC interest. Schemes put forward by the Commission are subjected to lengthy discussions by the Council of Ministers with the result that they are rejected or emerge in an entirely different, compromised form. It is also apparent that within the EEC the majority of members view transportation policy not as an end in itself but as an instrument for achieving the wider economic and political objectives of the EEC. This contrasts with the U.K. approach, which has traditionally centered on maximizing, in the widest sense, efficiency within the transportation sector, and, in consequence, areas of conflict in purpose have arisen.

CONCLUSIONS

The regulation of road haulage in the United Kingdom has broadly achieved its objectives but, within this overall picture, there are question marks hanging over the efficiency with which some of the tools of regulation have been applied. One of the major problems centers around the lack of regular and consistent monitoring of the economic performance of the sector and the inadequacy of research effort into the environmental and social impact of road haulage on the community. The system of periodic reviews by ad hoc committees is an extremely poor method of gathering information and formulating ideas regarding the effectiveness of regulatory policy. To date, the EEC Common Transport Policy has had only minimal effects on the internal control of the sector, and where regulations have been imposed they have generally involved points of detail rather than points of substance.

REFERENCES

1. The European Community's Transport Policy. EEC Periodical, Vol. 2, Luxembourg, 1981.
2. Transport Policy. Ministry of Transport, Her Majesty's Stationery Office, Cmnd. 3057, London, 1966.
3. Report of the Committee on Carriers' Licensing. Ministry of Transport, Her Majesty's Stationery Office, London, 1965.
4. K.J. Button. Transport Policy in the United Kingdom, 1968-1974. Three Banks Review, No. 103, 1974, pp. 26-48.
5. D.L. Munby. Road Transport--A Gap in the National Statistics. Bull., Oxford Univ. Institute of Economics and Statistics, Vol. 22, 1960, pp. 273-297.
6. The Road Haulage Industry. Price Commission, Her Majesty's Stationery Office, Rept. HC 698, London, 1978.
7. Road Haulage Operators' Licensing--Report of the Independent Committee of Inquiry. Department of Transport, Her Majesty's Stationery Office, London, 1979.
8. Report of the Inquiry into Lorries, People, and the Environment. Department of Transport, Her Majesty's Stationery Office, London, 1980.
9. Report of the Advisory Committee on Trunk Road Assessment. Department of Transport, Her Majesty's Stationery Office, London, 1978.
10. The Allocation of Road Track Costs, 1980/81: United Kingdom. Department of Transport, Her Majesty's Stationery Office, mimeo, London, 1980.
11. Routes for Heavy Lorries: A Consultation Document. Department of the Environment, Her Majesty's Stationery Office, London, 1974.
12. K.J. Button and A.D. Pearman. The Economics of Urban Freight Transport. Macmillan, London, 1981.
13. Transport Policy. Department of Transport, Her Majesty's Stationery Office, Cmnd. 6836, London, 1977.
14. K.J. Button. Heavy Goods Vehicle Taxation in the United Kingdom. Transportation, Vol. 8, 1979, pp. 389-408.
15. K.J. Button. Recent Developments in EEC Transport Policy. Three Banks Review, No. 123, 1979, pp. 52-73.
16. P.E. Lazarno. The Implications of EEC Transport Policy for the United Kingdom. The Highway Engineer, Vol. 25, 1978, pp. 2-7.
17. EEC Transport Policy. House of Lords Select Committee on the European Communities, Her Majesty's Stationery Office, Rept. HL 255, London, 1978.
18. The European Commission's Green Paper on Transport Infrastructure. House of Commons Transport Committee, Her Majesty's Stationery Office, Rept. HC 466v, London, 1980.
19. J.E. Meade, H.H. Leisner, and S.J. Wells. Case Studies in European Economic Union: The Mecha-

nism of Integration. Oxford Univ. Press, Oxford, England, 1962.
20. M. Allais, L. Duquesne de la Vinelle, C.J. Oort, H. St. Seidenass, and M. del Viscovo. Options de la Politique Tarifaire dans Les Transports. EEC Studies, Transport Series No. 1, Brussels, Belgium, 1965.
21. R. Malcor. Problèmes Posés par l'Application Practique d'une Tarification pour l'Usage des Infrastructures Routiéres. EEC Studies, Transport Series No. 2, Brussels, Belgium, 1970.
22. A.H. Reinarz. Problems of Construction and the Use of Regulations for Road Haulage in the European Economic Community. Transportation Planning and Technology, Vol. 2, 1973, pp. 81-84.
23. Commission of the European Communities. Communication of the Commission to the Council on the Development of the Common Transport Policy. Bulletin of the European Communities, Supplement 16/73, 1973.
24. K.M. Gwilliam. Realism and the Common Transport Policy of the EEC. In Changes in the Field of Transport Studies (J.B. Palack and J.B. Van der Kamp, eds.), Martinus Nijhoff, The Hague, Netherlands, 1980.

Publication of this paper sponsored by Committee on Application of Economic Analysis to Transportation Problems.

Reaction to Rail Transportation Deregulation by U.S. Dry Pea and Lentil Industry

KENNETH CASAVANT, RON MITTELHAMMER, AND LARRY PEDERSON

Significant deregulation of transportation modes has occurred in recent times. Most studies thus far have been only theoretical or conjectural in nature. The results of an empirical study of the impact on the dry pea and lentil industry from the deregulation of rail transportation that occurred over 18 months ago are reported. Methodologically, the marketing bill was decomposed into a market effect, rate effect, and joint effect. All of the processors of dry peas and lentils were surveyed. It was found that rail rates increased to all destinations after deregulation, but to a smaller degree than anticipated by shippers. This was due mainly to railroads changing rate quotas from a per hundredweight basis to a per car basis and shippers responding by loading cars heavier. This allowed railroads to move more tonnage with fewer cars, thus increasing efficiency. Railroads emphasized long-haul movement to the Gulf and East regions while motor and water carriers took over most of the short-haul movement. Cancellation of rail transit privileges directly impacted on those regions that had relied on this privilege for assemblying peas and lentils for processing. Finally, changes in marketing patterns had a far larger impact on the shipping bill than rate changes due to deregulation. Rates increased modestly, especially for long-distance movement.

Whether it be called deregulation or reregulation, it is obvious that significant changes in transportation regulation have occurred in recent years. Waterways, railroads, and motor carriers have all experienced modifications in the rules and regulations that affect their costs and operational alternatives.

The Motor Carrier Act of 1980 offered new exemptions in agricultural carriage, made entry into the industry significantly easier, and effectively eliminated the ratemaking of motor carriers by collective action. The Staggers Rail Act of 1980 increased carrier flexibility in rail rates and in contracting, increased Interstate Commerce Commission (ICC) exempt commodity groups, and also constrained collective railroad ratemaking. The water carriers had been previously affected by the user tax provisions of the Inland Waterways Revenue Act of 1978. Proposed legislation may increase the level and impact of this user fee on the waterways of the nation. The Airline Deregulation Act of 1978 will totally eliminate the control of the Civil Aeronautics Board (CAB) over what once was a highly regulated industry.

The evaluation of these regulatory reforms is currently under way but, with the exception of the airline deregulation experience, few studies have been completed at this time, due primarily to the lack of time since regulatory changes have occurred and the accompanying lack of data. Most studies have been national in scope and conjectural in analysis.

However, an opportunity to evaluate rail deregulation is available since dry peas and lentils were freed from ICC economic regulation in summer 1980. This deregulation, in Ex Parte 346, allowed railroads to offer any service at whatever rate they desired. In addition to the direct effect on the railroads, other modes of transportation were indirectly affected by the change because of an altered competitive environment (peas and lentils had been previously exempt when moved by motor carrier or barge) and also because railroad rates and services had been historically used as a standard for rate setting by alternative modes. The rail regulation made possible an in-depth analysis of an individual commodity so that specific empirical, rather than theoretical, interrelations and actual modal reactions could be identified.

BACKGROUND

Objectives

The overall purpose of this paper is to identify the impacts of rail regulatory reform on the dry pea and lentil industry in the United States. In order to achieve this purpose, the specific objectives are to (a) identify the transportation characteristics of dry peas and lentils, (b) identify modal reaction to deregulation, and (c) identify the responses of dry pea and lentil shippers to these transportation changes.

Study Area

Essentially 100 percent of the dry peas and lentils grown in the United States are grown in the study area of eastern Washington, northern Idaho, and northeastern Oregon. Growers use dry peas and lentils as alternative rotation crops to cereals.

Table 1. Dry pea and lentil export shipments.

	Peas				Lentils			
	1979[a]		1980[b]		1979[a]		1980[b]	
Destination	Volume (lb 000s)	Percent	Volume (lb 000s)	Percent	Volume (lb 000s)	Percent	Volume (lb 000s)	Percent
North America	169 470	8.8	71 960	4.8	51 730	5.0	33 920	5.2
South America	678 850	35.3	351 380	23.5	162 700	15.8	167 680	25.5
Europe	455 390	23.7	490 390	32.6	201 860	19.6	194 130	29.5
Asia-Oceania	595 540	31.0	557 790	37.1	25 370	2.5	21 510	3.3
Africa	22 240	1.2	30 000	2.0	586 180	57.1	240 190	36.5
Total	1 921 490		1 501 520		1 027 840		657 430	

[a]September 1979-August 1980. [b]September 1980-February 1981.

Table 2. Weighted average rates per hundredweight.

Mode-Destination	Spokane	North Palouse	South Palouse	River	Ore-Ida	Average
Rail-East						
1979 ($)	3.65	3.75	3.74	-[a]	-[a]	3.70
1980 ($)	4.17	4.03	4.20	-[a]	-[a]	4.109
Increase (%)	14.2	7.5	12.0	-[a]	-[a]	11.1
Rail-Gulf						
1979 ($)	3.00	3.00	3.00	3.00	-[a]	3.00
1980 ($)	3.256	3.16	3.116	3.015	3.17	3.14
Increase (%)	8.5	5.3	3.9	0.5	-[a]	4.7
Rail-West						
1979 ($)	1.01	-[a]	0.95	-[a]	0.65	0.987
1980 ($)	1.05	-[a]	1.61	-[a]	1.05	1.05
Increase (%)	4.0	-[a]	68.4	-[a]	61.5	6.4
Truck-East						
1979 ($)	4.25	-[a]	4.00	-[a]	-[a]	4.156
1980 ($)	4.60	-[a]	4.50	-[a]	-[a]	4.53
Increase (%)	8.2	-[a]	12.5	-[a]	-[a]	9.0
Truck-West						
1979 ($)	0.80	0.802 5	0.798	0.848	0.744	0.807
1980 ($)	0.865	0.875	0.932	0.919	0.931	0.894
Increase (%)	8.1	9.0	16.8	8.4	25.1	10.8
Barge-West						
1979 ($)	-[a]	-[a]	0.50	0.471	0.493	0.474
1980 ($)	-[a]	-[a]	0.60	0.524	0.617	0.549
Increase (%)	-[a]	-[a]	20.0	11.3	25.2	15.8

[a]No movement or incalculable.

Both dry peas and lentils are ultimately sold to processors who aggregate the relatively small volumes of uncleaned product, clean it, package it, and move it to domestic customers or export ports on order. Foreign sales account for 60-80 percent of the total volume marketed. Food processors or supermarket groups are the largest domestic customers.

The transportation options can be easily summarized. The general market destinations, summarized as West, Gulf, and East, reflect the typical shipping pattern of this export-oriented industry. Seattle-Tacoma and Portland are the major export ports in the West; these ports handle the majority of pea shipments to the Far East as well as pea and lentil shipments to Europe and South America. The Gulf ports of New Orleans and Mobile are the major ports for North African lentil shipments and also participate in South American pea and lentil shipments. New York and Baltimore are the major East Coast ports for pea and lentil shipments to Europe. In addition to the export movement, most major domestic customers are located in the eastern United States, close to the large population centers.

Procedure and Scope of Study

A telephone survey was used to solicit data to be used in evaluating general hypotheses about modal and shipper reaction to deregulation and the resulting impacts on costs to shippers and revenues to modes. Specifically, the data received in a telephone survey of all 22 processing firms in April 1981 allowed comparisons of the pea and lentil processing and transportation sectors structure and conduct before and after rail deregulation.

RESULTS

The impact of rail deregulation was found to vary significantly among modes and regions within the study area. In addition, since major changes in marketing occurred during the study period, it was necessary to decompose the shipping bill into regulatory effects versus marketing effects. Table 1 shows the export shipment of dry peas and lentils. The table below shows the domestic shipments for the same years (note that for 1979 the period covers July 1979-June 1980, and for 1980, July 1980-March 1981):

Item	Dry Peas (lb 000s) 1979	Dry Peas (lb 000s) 1980	Lentils (lb 000s) 1979	Lentils (lb 000s) 1980
Domestic shipment	698 350	578 660	207 860	194 240
Total production	2 504 300	3 022 800	1 567 700	2 104 500

The discussion of results includes the impact of deregulation on transportation modes and a review of changes in shipper costs due to marketing versus transportation changes during these two crop years.

Modal Effects

Railroad deregulation affected all three modes of transportation in two general areas: the volume of traffic and the rate charged for that movement. Because costs were changing during the period as well, it would be presumptuous to attribute all changes in rates to deregulation, and so deregulation should be considered as a contributing factor to, but not solely responsible for, rate charges.

Due to requests for confidentiality from survey respondents, processors were grouped into five regions, identified as Spokane, North Palouse, South Palouse, River, and Ore-Ida. This grouping, established on a geographical basis because the products handled and the transportation options available were similar for firms within regions but varied among regions, allowed the location of firms to be analyzed while honoring the request for confidentiality.

Rates

The rates paid by shippers in each region by mode and destination for shipments made in 1979 and 1980 are presented in Table 2. (The weighting was accomplished by aggregating the movements of individual shippers in a region at the rate each reported and dividing the total shipping cost by the volume moved.) The rates represent the average rate paid for a movement from a given region. Deregulation decreased the stability of rates since, after deregulation, rail rates were only valid when quoted by a railroad's rate clerk and usually valid for only 10 days. Also, rates were quoted on a per car basis after regulation compared with the earlier per hundredweight basis.

Rail rates increased 11.1, 4.7, and 6.4 percent to East, Gulf, and West destinations, respectively. This can be contrasted to truck increases of 9.0 and 10.8 percent, respectively, and a barge increase of 15.8 percent for shipments West.

Because of differences in car-loading practices, railroad rate increases varied among regions. The Spokane region, due primarily to the loss of the transit privilege, had the largest rate increases to the important East and Gulf markets.

Table 3. Volumes of dry pea and lentil shipments.

Mode	1979 Volume (lb 000s)	1979 Percentage of Total Shipment	1980 Volume (lb 000s)	1980 Percentage of Total Shipment	Change in Volume, 1979-1980 (%)
Rail	1 540 620	37.9	1 418 500	27.6	-7.9
Truck	2 074 380	50.9	3 044 000	59.4	+46.7
Barge	457 000	11.2	664 800	13.0	+45.5
Total	4 072 000		5 127 300		+25.7

Truck rates were fairly standardized for all regions in both years. Truck and barge rate levels varied among regions according to the truck-rate component necessary for the complete processor-to-port movement. Because of their proximity to the Columbia-Snake River system, firms in the River region were able to minimize the truck-cost component and enjoy the lowest combination of truck and barge rates.

From 1979 to 1980, rates increased modestly (compared with a 40-point increase in the wholesale price index) among the three modes. Of the six mode and destination options investigated, the two with the lowest percentage rate increases were rail to the Gulf and West, respectively. Barge rates exhibited the largest relative increase--15.8 percent. This occurred because regions more distant from the river, and thus with larger truck components in their truck and barge rates, shipped more products by this option. When individual costs were aggregated and averaged over the total barge volume, the average rates consequently reflected an increase. Rates for all transportation modes were flexible in 1980 compared with 1979 when the ICC regulated railroads.

Rail rates were quoted on a per car basis for 1980 rather than per hundredweight. Processors reported that before deregulation, 1100 hundredweight (cwt) was the average car loading for any destination. After deregulation and the institution of a per car rate, car-loading volumes varied from shipper to shipper, but increased to 1254 cwt on average, as shown in the table below (note that for 1979 the cars were all at 1100 cwt/car weighted average, and for 1980 the numbers in parentheses show the weighted average by hundredweight per car):

Destination	No. of Cars Moved 1979	1980	Change (%)
East	94.5	69.9 (1226)	-26.0
Gulf	848.9	973.4 (1261)	+14.7
West	457.1	87.8 (1200)	-80.0
Total	1400.5	1131.1 (1254)	-19.2

(The table was calculated from shipment volumes and weighted averages of hundredweight per car, loaded by destination, as reported in the survey.) Railcars that moved to the Gulf were most heavily loaded at 1261 cwt/car, followed by the East at 1226 cwt/car and the West at 1200 cwt/car. Quoting rates on a per car basis achieved the railroads' aim of larger volumes per car.

Volume and Market Share

It was found that modal volumes changed during the study period, both absolutely and relatively. The volumes of dry peas and lentils handled for 1979 and 1980 are reported by mode in Table 3. Total volumes moved were larger in 1980 than in 1979. Truck and barge carriers increased the total volumes they handled while rail carriage volume declined. Truck

Table 4. Dry pea and lentil shipment volumes.

Destination	1979 Volume (lb 000s)	1979 Mode (%) Rail	Truck	Barge	1980 Volume (lb 000s)	1980 Mode (%) Rail	Truck	Barge
East	120 000	86.7	13.3	0.0	110 250	77.8	22.2	0.0
Gulf	933 820	100.0	0.0	0.0	1 227 450	100.0	0.0	0.0
West	3 018 180	16.7	68.2	15.1	3 789 600	2.8	79.7	17.5
Total	4 072 000	37.9	50.9	11.2	5 127 300	27.6	59.4	13.0

Table 5. Total revenues and volumes for dry pea and lentil shipments.

Mode	1979 Revenue ($)	1979 Volume (lb 000s)	1980 Revenue ($)	1980 Volume (lb 000s)	Increase in Revenue (%)	Avg Revenue per Hundredweight ($) 1979	Avg Revenue per Hundredweight ($) 1980
Rail	3 682 280	1 540 620	4 317 631	1 418 500	17.3	2.39	3.04
Truck	1 728 002	2 074 380	2 809 527	3 044 000	62.6	0.83	0.92
Barge	216 385	457 000	364 970	664 800	68.6	0.47	0.55
Total	5 626 667	4 072 000	7 492 128	5 127 300	33.2	1.38	1.46

was the dominant mode in both 1979 and 1980; it increased its carriage from 50.9 percent of the total shipments in 1979 to 59.4 percent in 1980. Barge shipments also increased in relative importance, from 11.2 percent of total carriage in 1979 to 13.0 percent in 1980. Both of these modes expanded their carriage of peas and lentils at the expense of rail, since rail carriage decreased from 37.9 percent in 1979 to 27.6 percent in 1980.

Volumes by destination and the proportion of shipments arriving by each mode are presented in Table 4. The East and Gulf destinations were predominantly serviced by rail (100 percent in the case of the Gulf). The closer western destinations depended more heavily on truck. From 1979 to 1980, rail remained the only form of carriage that carried peas and lentils to the Gulf but lost market share in both East and West destination movements. Truck carriage gained the entire 8.9 percent market share rail lost in the East. The 13.9 percent loss by rail in the West was shared by the barge option (2.4 percent increase) and motor carriers (11.5 percent increase).

The volume of peas and lentils shipped by rail decreased 7.9 percent from 1979 to 1980 (Table 3). Over the same period, the number of rail cars shipped decreased by 19.2 percent, reflecting higher per car volumes. The greatest decrease in the number of carloads was experienced in the West (80.8 percent), where the short nature of the haul does not allow rail to compete effectively. The 26.0 percent decrease in the East could be largely due to the changed loading volumes. The number of carloads for Gulf destinations increased 14.7 percent due to increased volumes moving through Gulf ports and the ability of the railroads to operate competitively on this long-haul movement.

In summary, it appears that the rate and service structure of the transportation system was changed from 1979 to 1980. These alterations affected the allocation of pea and lentil shipments to the three competing modes. Railroads lost some of their total share of pea and lentil shipments from 1979 and 1980 while truck registered the largest gain. Railroads continued their complete dominance of shipments to the Gulf. Railroads, quoting rates on a per car basis in 1980, registered a decrease in the number of cars loaded but an increased average volume loaded per car. Rail movement in the West, which is not competitive because of the short distance, decreased the most while long-haul rail carriage to the Gulf increased. Shipments East decreased moderately.

Revenues

Total modal revenues are presented in Table 5. Barge and truck revenues show the largest increases--68.6 and 62.6 percent, respectively. Combined with a 17.3 percent increase in total rail revenues, revenues earned by all modes increased by 33.2 percent from 1979 to 1980. Railroads realized a smaller percentage gain in total revenue than the other two modes because rail volume decreased from 1979 to 1980 while truck and barge volumes increased. In particular, the railroads experienced a reduction in short-haul (average distance of 300 miles) carriage to the West from 1979 to 1980 due to rate and service changes. Volumes moved to Gulf destinations increased; this increase was indicative of greater demand from foreign markets serviced by Gulf ports. Movements by rail to the East were relatively stable.

Average revenues per hundredweight carried to all destinations increased for all modes from $1.38 in 1979 to $1.46 in 1980, a 5.8 percent increase. This can be compared with a 17.0 percent increase in the cost of private transportation for consumers in western states from 1979 to 1980, due in part to a 36.3 percent increase in the price of gasoline during that period.

Revenues per railcar by destination, for both 1979 and 1980, are presented in the table below (note that for 1979 the cars were all at 1100 cwt/car weighted average, and for 1980 the numbers in parentheses show the weighted average by hundredweight per car):

Destination	Revenue per Rail Car ($) 1979	Revenue per Rail Car ($) 1980	Change (%)
East	4070	5040 (1226)	+23.8
Gulf	3300	3960 (1261)	+20.0
West	987	1260 (1200)	+27.7
Weighted avg	2597	3817	+47.0

An average car loading of 1100 cwt/car and the quoted per hundredweight rate was used to calculate 1979 carload revenues. Comparison of 1979 and 1980 revenues per car reveals revenue increases to all destinations of at least 20 percent. The per hundredweight revenues, as shown in Table 2, increased more modestly because of greater volumes loaded per car. The increase in rail revenues was achieved concomitant with a relatively small increase in costs to shippers due to the greater efficiency of larger volumes of peas and lentils loaded per rail car.

Total truck and barge revenues increased from 1979 to 1980, as did the average revenue per hundredweight (Table 5). The increase in total revenue was partly due to increased barge rates (indicated to be about $0.05 per hundredweight by River region shippers) and by higher rates for the truck segment of shipments from regions more distant from the river system. These factors contributed to increases in average revenues, as did the greater volumes moved by regions more distant from river ports.

In summary, revenues for all three transportation modes increased from 1979 to 1980. Railroad revenues increased by more than 20 percent when calculated per car and by smaller percentages when calculated per hundredweight due to increased volumes loaded per car in 1980. Truck revenues were mainly generated from short-haul westbound movements for which the nature of their costs allowed them to be extremely competitive. Barge revenues were generated from shipments by those processors closest to river ports. Truck and barge rate increases contributed to revenue increases and were possibly in response to rail rate and service changes after deregulation.

TRANSPORTATION VERSUS MARKETING EFFECTS

Changes in transportation and marketing environments changed both rates charged for shipments and volumes moved. The combination of rate and volume changes resulted in a change in the total shipping bill. The change in the total shipping bill between 1979 and 1980 can be calculated as $P_2Q_2 - P_1Q_1$, where P_1 = 1979 rates, P_2 = 1980 rates, Q_1 = 1979 volumes, and Q_2 = 1980 volumes. The shipping-bill calculations are shown in Table 6.

The change in the shipping bill can be decomposed into three separate effects: rate, marketing, and their joint effect. The separate rate effect can be calculated as follows: $P_2Q_1 - P_1Q_1$. The rate-effect calculations are presented in Table 7.

The separate marketing effect can be calculated

Table 6. Dry pea and lentil shipping bill.

Region	Rail East	Rail Gulf	Rail West	Truck East	Truck West	Barge-West	Total
Spokane							
1979 ($)	189 800	496 500	496 020	42 500	642 000	0	1 866 820
1980 ($)	141 780	679 736	110 250	39 100	1 182 023	0	2 152 889
Increase (%)							15.3
North Palouse							
1979 ($)	131 250	1 527 750	0	0	205 258	0	1 864 258
1980 ($)	161 200	1 910 415	0	0	232 250	0	2 303 865
Increase (%)							23.6
South Palouse							
1979 ($)	63 750	393 210	57 000	24 000	283 903	0	821 863
1980 ($)	49 350	481 335	0	72 000	434 950	38 400	1 076 035
Increase (%)							30.9
River							
1979 ($)	0	384 000	0	0	408 325	189 025	981 350
1980 ($)	0	776 400	0	0	636 750	248 750	1 661 900
Increase (%)							69.3
Ore-Ida							
1979 ($)	0	0	14 820	0	122 016	27 360	164 196
1980 ($)	0	15 850	315	10	212 454	77 640	306 269
Increase (%)							86.5
Total							
1979 ($)	384 800	2 801 406	496 020	66 500	1 661 502	216 385	5 698 487
1980 ($)	352 330	3 854 736	110 565	111 100	2 698 427	364 790	7 500 958
Increase (%)							31.6
Change, 1979-1980							
Cost ($)	-32 470	+1 053 276	-385 455	+44 600	+1 036 925	+148 405	+1 802 471
Percentage	-8.4	+37.6	-77.7	+67.1	+62.4	+68.6	+31.6
Percentage of total shipping bill							
1979	6.8	49.8	8.9	1.2	29.5	3.9	100
1980	4.6	51.5	1.5	1.5	36.0	4.9	100

Table 7. Isolation of rate effect, comparing 1979 volumes and 1980 rates with actual 1979 volumes and rates.

Region	Rail East	Rail Gulf	Rail West	Truck East	Truck West	Barge-West	Total
Spokane							
Potential ($)	213 668	519 670	441 000	45 300	717 435	0	1 937 073
Actual ($)	189 800	496 500	424 200	42 500	642 000	0	1 795 000
Change (%)							+7.9
North Palouse							
Potential ($)	143 815	1 599 045	0	0	228 641	0	1 971 501
Actual ($)	131 250	1 527 750	0	0	205 258	0	1 864 258
Change (%)							+5.8
South Palouse							
Potential ($)	69 853	411 560	63 000	27 180	317 933	0	889 526
Actual ($)	63 750	393 210	57 000	24 000	283 903	0	821 863
Change (%)							+8.2
River							
Potential ($)	0	401 920	0	0	429 567	220 423	1 051 910
Actual ($)	0	384 000	0	0	408 325	189 025	981 350
Change (%)							+7.2
Ore-Ida							
Potential ($)	0	0	23 940	0	146 616	30 470	201 026
Actual ($)	0	0	14 820	0	122 016	27 360	164 196
Change (%)							+22.4
Total							
Potential ($)	427 336	2 932 195	527 940	72 480	1 840 192	250 893	6 051 036
Actual ($)	384 800	2 801 460	496 020	66 500	1 661 502	216 385	5 626 667
Change (%)							+7.5
Change in total bill[a] ($)	+42 536	+130 735	+31 920	+5980	+178 690	+34 508	+424 369
Increase in total bill[a] (%)	11.1	4.7	6.4	9.0	10.8	15.9	7.5

[a] Potential compared with actual.

Table 8. Isolation of the marketing effect, comparing 1980 volumes and 1979 rates with actual 1979 volumes and rates.

Region	Rail East	Rail Gulf	Rail West	Truck East	Truck West	Barge-West	Total
Spokane							
Potential ($)	124 100	618 000	106 050	36 125	1 093 200	0	1 977 475
Actual ($)	189 800	496 500	424 200	42 500	642 000	0	1 795 000
Change (%)							+9.2
North Palouse							
Potential ($)	150 000	1 813 500	0	0	213 065	0	2 176 565
Actual ($)	131 250	1 527 750	0	0	205 258	0	1 864 258
Change (%)							+16.8
South Palouse							
Potential ($)	44 063	463 350	0	64 000	372 506	32 000	975 919
Actual ($)	63 750	393 210	57 000	24 000	283 903	0	821 863
Change (%)							+18.7
River							
Potential ($)	0	722 500	0	0	589 240	223 725	1 583 465
Actual ($)	0	384 000	0	0	408 325	189 025	981 350
Change (%)							+61.4
Ore-Ida							
Potential ($)	0	15 000	195	0	169 781	62 019	246 995
Actual ($)	0	0	14 820	0	122 016	27 360	164 196
Change (%)							+50.4
Total							
Potential ($)	318 163	3 682 350	106 695	100 125	2 435 791	317 744	6 960 419
Actual ($)	384 800	2 801 460	496 020	66 500	1 661 502	216 385	5 626 667
Change (%)							+23.7
Change in total bill[a] ($)	-66 637	+880 890	-389 325	+33 625	+774 289	+101 359	+1 334 201
Increase in total bill[a] (%)	-17.3	+31.4	-78.5	+50.6	+46.6	+46.8	+23.7

[a]Potential compared with actual.

Table 9. Weighted average cost of dry pea and lentil shipments per hundredweight.

Region	East 1979	East 1980	Gulf 1979	Gulf 1980	West 1979	West 1980	Total 1979	Total 1980
Spokane	3.747	4.256	3.00	3.256	0.872	0.878	1.238	1.246
North Palouse	3.750	4.030	3.00	3.160	0.803	0.875	2.330	2.532
South Palouse	3.815	4.373	3.00	3.116	0.820	0.892	1.443	1.509
River	NA	NA	3.00	3.015	0.677	0.770	0.972	1.166
Ore-Ida	NA	NA	NA	3.170	0.678	0.819	0.678	0.852
Avg	3.761	4.203	3.00	3.140	0.787	0.837	1.382	1.461

as follows: $P_1Q_2 - P_1Q_1$. The calculations of the marketing effect are given in Table 8. The joint effect, caused by the combination of the rate and marketing effects, is the total shipping-bill change minus the rate and marketing effects. Arithmetically, calculation of the joint effect could be accomplished by subtracting the rate and marketing effects presented in Tables 7 and 8, respectively, from the total change found in Table 6.

Changes in the transportation and marketing environments caused changes in the transportation costs for shipments from each region from 1979 to 1980 (Table 6). The North Palouse shippers paid the largest shipping bill, followed by shippers in the Spokane, River, South Palouse, and Ore-Ida regions. Rail shipments to Gulf destinations and truck movement to the West were the largest contributors to the total shipping bill in both years, followed by rail-West, rail-East, barge, and truck-East, respectively. Total shipping costs rose in 1980 while the regions retained their rank in contributions to the overall shipping bill.

The two components that determined the total shipping bill--rates and volumes by destinations--both changed from 1979 to 1980. In order to isolate the effect of rate changes from the influence of larger pea and lentil volumes and different destinations in 1980, a potential shipping bill was calculated by using 1979 volumes and 1980 rates and then compared with the 1979 actual shipping bill (rate effect, Table 7). An examination of the calculations indicates an increase of $424 369 (7.5 percent) as a result of 1980 rate increases.

The influence of volume and destination changes was isolated from the rate effect by comparing the potential shipping bill if 1979 rates had been used on 1980 volumes and destinations with the actual 1979 shipping bill. The shipping bill increased $1 334 201 (23.7 percent) as a result of marketing changes. The joint effect of rate and marketing changes, calculated by subtracting the two separated effects from the total change in the shipping bill, was $106 711 (2.0 percent).

It does appear that the major causes of increases in the total shipping bill from 1979 to 1980 were changes in the marketing environment, particularly the volumes shipped. Some regions exhibited changes in destinations for their shipments, which also influenced their shipping bill. The weighted average cost per hundredweight by destination and region for both 1979 and 1980 are presented in Table 9.

Averaging costs provides a more representative basis for comparisons; volume changes are accounted for while changes in rates and shipment destinations are incorporated into the average total cost. Firms in the River, North Palouse, and Ore-Ida regions all exhibited increases in average costs per hundredweight, mainly as a result of changes in marketing environments and, to a lesser degree, because of rate increases. The average costs to Spokane and South Palouse processors were very consistent over the two years. The average per hundredweight shipping costs, aggregated over all regions, modes, and destinations, increased from $1.382/cwt in 1979 to $1.461/cwt in 1980, a 5.7 percent increase.

Rail shippers' costs per hundredweight are presented in the table below (note that for 1979 the weighted averages are from rates reported in the survey, for 1980 the numbers in parentheses show the weighted average by hundredweight per car, and the averages for 1979 and 1980 show the total rail shipping bill divided by total rail shipments):

Destination	Cost per Hundredweight ($) 1979	1980	Increase (%)
East	3.70	4.11 (1226)	11.1
Gulf	3.00	3.14 (1261)	4.7
West	0.99	1.05 (1200)	6.4
Avg	2.39	3.04	27.2

The cost per hundredweight of rail shipments to the East, Gulf, and West increased by 11.1, 4.7, and 4.4 percent, respectively. These cost increases were much smaller than the 20 percent increase for railroads in per car revenue. The increased efficiency of larger volumes loaded per car contributed to lowering the cost impact on shippers.

CONCLUSIONS

Rail transportation of dry peas and lentils was deregulated for less than one year at the time of this study. Consequently, the conclusions drawn about the impacts of deregulation are certainly initial and preliminary. Yet, some specific findings should be emphasized.

Rail rates increased to all destinations after deregulation. The change in rail rate quoting from a per hundredweight basis to a per car basis resulted in smaller effective rate increases than anticipated by shippers. This was accomplished by increasing the rail-car-loading volumes for shippers, thus allocating the higher per car charges over a larger number of hundredweights. The inducement for shippers to load more units per car allowed railroads to move more product with fewer cars.

Cancellation of rail transportation privileges had a direct impact on firms that had previously used rail as a product collection tool. These shippers, who had previously benefited from or been subsidized by the availability of rail transportation, now must compete equally with the rest of the processors. As a result, the competitive environment within the dry pea and lentil processing industry changed because of rail deregulation.

To summarize, the effects of deregulation of dry pea and lentil carriage on railroads are as follows:

1. Total revenues increased largely because of per car rates higher than the former volume-based rates and the concentration on longer hauls and larger movements;
2. Per car rates induced shippers to load more units per car, which allows rail carriers to more efficiently use their rolling stock (capital equipment);
3. Railroads appeared to emphasize long hauls, for which they are more cost efficient, and deemphasize inefficient short-haul carriage; and
4. Railroads cancelled the transit privilege; by the speed with which the transit privilege was phased out of operation, it was apparently an undesirable service to provide from the point of view of the railroads.

Changes in marketing patterns had a larger impact on the shipping bill than on the rate changes that occurred after deregulation. The demand for peas and lentils changed from 1979 to 1980. Quantity demanded changed, and also the geographical distribution of markets, which was reflected by shipments being allocated to different ports. More shipments went to Gulf destinations--a more distant and more expensive movement.

Publication of this paper sponsored by Committee on Application of Economic Analysis to Transportation Problems.

Airline Deregulation and Service to Small Communities

YUPO CHAN

Although the Airline Deregulation Act of 1978 was heralded at its introduction as a positive step, there were fears that small communities would likely be abandoned by local-service and trunk carriers in preference for denser, more profitable routes. To ensure adequate service to low-density markets, a rather extensive set of regulations was worked out under the essential air service clause of the Act, which granted direct subsidy (through 1988) to commuters to serve inherently uneconomical routes. Thus, commuters who provide a majority of the service to low-density markets were actually more regulated after deregulation than before. Statistics gathered over the three years after deregulation show that the initial concerns over small-community service were by and large unfounded. In fact, service to the low-density market has increased and in many cases has improved as commuters enter new markets or replace markets previously served by locals, which continues a trend that has been established long before formal deregulation took place. Thus, commuters have been assuming the roles of the locals in the 1970s, in much the same way as the locals relieved the trunks of many of their thin-density routes in the late 1950s and early 1960s. Although there are temporary disruptions of service to selective, medium-sized communities during the transition, the process is expected to work in the long run as more newly designed flight equipment suitable for the commuter markets is further developed. Such calculated optimism is obviously predicated on the satisfactory resolution of congestion, safety, and energy problems, barring major disruption of the economy.

Although airline deregulation was heralded in 1978 as a positive step toward improving the air transportation system in the country, there were significant reservations about its impact on service to small communities (1), many of which were expected to be abandoned by trunk carriers as a result of deregulation. This paper reviews the air service to small communities before and after deregulation and tries to answer some of the following questions:

1. To what extent has service to small communities changed as a result of deregulation?
2. What factors are responsible for this change in low-density service pattern, and how is it related to the airline-industry profile and the economics of airline route structure?
3. What is the likely future of air service to small communities based on our understanding of the explanatory factors identified in 2 above?

AIRLINE DEREGULATION ACT OF 1978

The salient features of the Airline Deregulation Act of 1978 (P.L. 95-504) that have direct bearing on air service to small communities are as follows:

1. Increased flexibility for certificated airlines in entering and abandoning markets; their abandonment of smaller markets results in increased market opportunities for commuter airlines;
2. Enhanced opportunities for commuter operators by making them eligible for subsidy to provide essential air service, by making them eligible for aircraft loan guarantees, and by their inclusion in joint-fare agreements with certificated airlines; and
3. Authorization to use larger aircraft with capacities up to 60 seats, thereby enabling a commuter to serve larger markets.

It should be noted that the Act did not deregulate the commuter industry as it did the remainder of the air-carrier industry. It did just the opposite. The commuter airlines now operate in a much more constrained regulatory environment than before deregulation, as the reader can gather by reviewing the following detailed provisions that govern service to small communities.

Essential Air Service

The Civil Aeronautics Board (CAB) encourages and fosters the continuation of safe and reliable scheduled air transportation for small communities and isolated areas, establishes new subsidy programs, and makes payments to eligible air carriers for the provision of essential air transportation. Markets that generate no more than 40 passengers/day are places where subsidy is contemplated. Once the minimally required number of airline seats is determined for an essential service point, a tiered system is established to convert the seats to a frequency that depends on the size of the aircraft. Thus, lower frequencies are specified for larger aircraft and higher frequencies for smaller equipment. Although a final definition for essential air transportation service is very much determined on a case-by-case basis, this aspect of the Act could have a substantial impact on services to the 555 small communities under consideration by CAB.

Subsidy

Air carriers eligible for subsidy are to be those that either hold a certificate of convenience and necessity under the Federal Aviation Act of 1958 (as amended) or those that provide essential air service. Air carriers that hold authority issued by the State of Alaska to engage in essential air transportation are eligible to receive compensation under CAB's new subsidy program. The existing subsidy for local-service airlines remains in effect until 1985.

Eligible air-service points to receive subsidy are those points in any state, the District of Columbia, or the Commonwealth of Puerto Rico that on July 1, 1978, have been listed on the route certificate of any carrier. Minimal provisions are made for the addition of new points. All eligible points are guaranteed essential air service for a period of 10 years after October 1978 (the date of the Act).

Termination of Service

Coincidental with the development of new routes and service through the above legislation, the Act has provided somewhat liberal provisions concerning the termination of service by commuter air carriers. A commuter carrier may terminate service to nonsubsidized points after reasonable notice, but not less than 30 days. On subsidized routes a carrier may not suspend or reduce service on less than 90 days notice to CAB, the communities affected, and the state. CAB has the power to require the incumbent air carrier to continue service (with subsidy) until a replacement carrier is found.

Market Entry

The legislation allows automatic entry by a carrier at a rate of 1 route/year through 1981, with each carrier allowed to protect 1 route/year from such entry. All certificated carriers (scheduled, supplemental, and intrastate) that operate in excess of 100 million available seat miles/year (274 000/day) will be eligible for participation. Also, after January 1, 1983, a subsidized local-service carrier may be replaced on a route by a commuter or other short-haul, local-service carrier if such replacement will result in (a) a reduction in or removal of subsidy and (b) improved service.

Through Service and Joint Fare

The legislation requires that if CAB establishes a joint-fare formula for certificated airlines, this formula must be extended to joint fares between certificated air carriers and commuters. Prior to deregulation, the division (or apportionment) of the joint fare was mutually worked out on a case-by-case basis between the two participating airlines. Deregulation prescribes a more uniform allocation method based on cost prorates, i.e., an apportionment formula based on the cost of providing the service. Given the fact that the short-haul, low-density portion of the journey has a typically higher cost per seat mile than the long-haul portion, this new joint-fare formula tends to favor the commuter (compared with the previous straight mileage prorate formula). Commuters that have entered into joint-fare agreements with certificated carriers must give 90 days notice before terminating service in a market.

Larger Aircraft

Deregulation allows commuters to use larger aircraft. The freedom to use up to 60-seat aircraft--twice as large as the 1973 limit and more than three times as large as most of the aircraft in the current commuter fleet--is a very significant change. It will take time to realize the change, however, because the availability of suitable aircraft in the 20- to 60-seat category has been severely limited; the 50-seat, four-engine deHavilland Dash-7 (DHC-7) has been the only modern design in production. Deregulation has made this market much more attractive to aircraft and engine manufacturers around the world, and a substantial number of new possibilities are in various stages of commitment or serious consideration. However, it will take until the mid-1980s for new aircraft to become available.

Loan-Guarantee Program

The new legislation extends the current aircraft loan-guarantee program for five years and makes commuters and intrastate carriers eligible for the program. Congress has approved up to $650 million in loan guarantees for fiscal year (FY) 1980, with $150 million set aside for the exclusive use of commuter air carriers for up to 15 years duration toward new equipment purchases (according to L. Bond

Figure 1. Network structure paradigm.

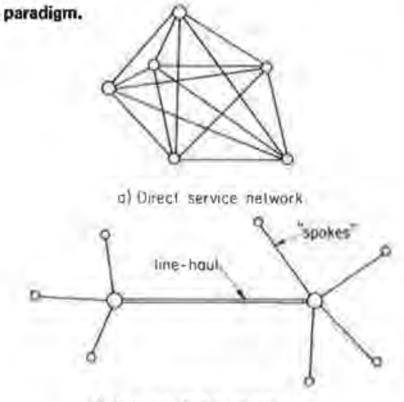
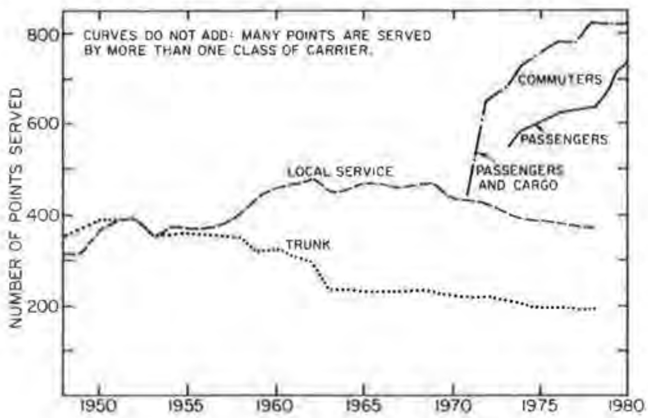


Figure 2. Points served by trunk, local, and commuter airlines.



in testimony concerning commuter airline safety and given before the Subcommittee on Oversight and Review, House Public Works and Transportation Committee, February 19, 1980). The Federal Aviation Administration (FAA), which administers the commuter-aircraft loan program, had $100 million for 1981 and has requested $100 million in the FY 1982 budget.

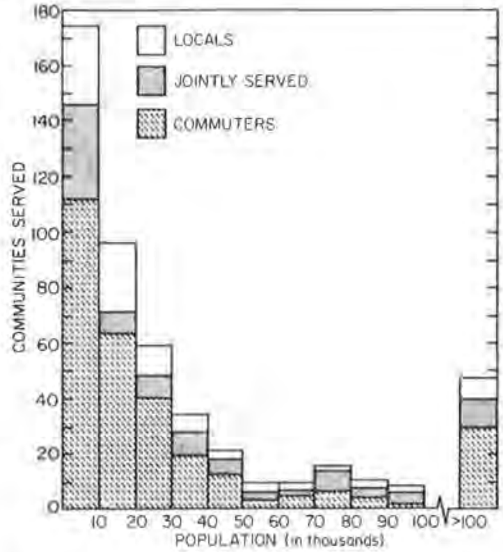
Sunset of CAB

In the spirit of deregulation, CAB regulatory authority will be reduced in stages. First, CAB domestic-route programs will be terminated at the end of 1981. Second, its regulatory authority over fares and charters will expire on January 1, 1983. Finally, CAB will cease to exist on January 1, 1985. Regulation of the small-community subsidy program will be transferred to the U.S. Department of Transportation (DOT).

NETWORK STRUCTURE AND SMALL-COMMUNITY SERVICE

It can be seen, therefore, that an elaborate set of procedures and guidelines has been put in place in the legislation to guarantee service to small communities through 1988. Are these requirements justifiable (for those who slight government regulation) or are they sufficient to ensure low-density service (for those who are concerned with service to small communities)? To answer these questions, one needs to review the dynamics of the air transportation network structure and the airline industry over the past decade in order to put the recent legislation into perspective.

Figure 3. U.S. communities served only by commuter and local-service airlines by population (Alaska excluded).



As shown in the paradigm of Figure 1, there are two idealized types of air transportation network structures: direct-service routes versus hub-and-spoke routes. Where the traffic density is heavy enough between all the origin-destination cities, direct routes are economically justifiable. In the idealized model, such service is typically provided by trunk carriers with larger equipment. In contrast, where the density is low between the origins and destinations, a hub-and-spoke network is likely to evolve, with the spokes covered by smaller equipment. This network structure allows for the aggregation (or bundling) of traffic at the line-haul link, thus allowing larger flight equipment to be used and achieving economy of scale as measured in cost per seat mile. In this latter network, the spokes are typically served by commuter airlines with the line-haul link provided by trunks. (Local-service airlines in the paradigm somehow fit in the grey area between the two idealized cases.)

Low-Density Air Service

Returning to the real world, Figure 2 (based on an internal report by J.D. Ward, Air Service to Small Communities, for the Office of Technology Assessment, U.S. Congress, 1980; and CAB Commuter Air Carrier Traffic Statistics, 1980) shows the relative points served by the commuter, local-service, and trunk airlines in North America. It also shows the relatively rapid rise in commuter service since the beginning of the decade.

Commuters typically operate on thin-density and short-stage-length routes, largely a consequence of the size of aircraft to which they have been limited by CAB rules. Eighty-seven percent of the commuter markets have stage lengths shorter than 250 miles.

Not only is the total ridership lower and the average stage length shorter compared with the trunks and most of the locals, but the traffic that moves through the airports they serve is dramatically less. The thin densities on the shorter routes also mean that the only economical aircraft would be those with relatively small seat capacity (in order to maintain a reasonable frequency of service). This also explains why only 6 percent of the markets served by the trunks and locals, with their larger and longer-range aircraft fleets, had stage lengths of less than 250 miles in 1978. Of the 2087 city pairs served by commuters in 1980, less than 500 generated more than 10 passengers/day.

Commuters pick up some 55 percent of their passengers at small-nonhub airports and 45 percent at medium and large-hub airports. These figures imply the extent to which the hub-and-spoke network system is operating; assuming balanced flows, only 10 percent of passengers are flying nonstop from nonhub to nonhub rather than spoke-hub-spoke. The successful hub-and-spoke network facilitates the flow of traffic from small communities through the air system to the destination of the traveler via connection at a hub airport. In fact, roughly 80 percent of commuter airline traffic does connect with other carriers at such hubs.

Small Versus Medium-Sized Communities Defined

In order to gain some general sense of the size of the communities that receive this low-density service, those communities that receive only service by the commuter airlines, the local-service airlines, or both are shown in Figure 3 (from the internal report by J.D. Ward).

The figure illustrates two primary points. First, local-service airlines (in addition to commuters) are providing a substantial amount of low-density service. Some 25 percent of points that receive only one class of service were getting it from local-service airlines. Second, the number of very small communities that are receiving service is surprisingly high. Two thirds of commuter-only and 62 percent of local-service-only points were less than 25 000 in population.

There is no simple characterization of the difference between a small and medium-sized community. Perhaps small points are those that generate little traffic, where profitable service is only marginal and only small aircraft (say, under 15 seats) are appropriate. On the other hand, medium-sized points are those that can usually support profitable operations, where larger aircraft are generally preferred. This boundary seems to be on the order of 10 one-way passengers/day--the situation on some 75 percent of commuter city-pair markets. Although the correlation between population and traffic generation is very poor, this crudely corresponds to the smallest city in the city-pair markets that have an approximate population of 10 000. This characterization is very rough; there are points both much smaller and much larger that generate 10 passengers/day. By this definition, the medium-sized category ranges somewhere between 10 000 and 100 000 in population.

Growth of Commuter Service

The number of passengers on commuter airlines grew at an annual rate of 11.3 percent from 1970 to 1978 (11.2 percent from 1970 to 1979 and 9.8 percent from 1971 to 1980). The rapid growth of commuters is also shown by the number of points they serve. For example, Figure 2 shows that while commuters dramatically served more markets in the past decade, the number served by trunk and local-service airlines has decreased steadily. Note that this trend began in years long before deregulation.

There are four reasons for the rapid growth of the U.S. commuter airline industry. First, a significant segment of the population lives outside of the urban areas served by trunk airlines. As incomes have risen and as more businesses have moved to smaller communities, demand has risen for air services into low-density areas. For example, the number of stations served by commuters has increased 83 percent over the past decade, mostly in the early portion.

Second, there has been a gradual withdrawal of the local-service and trunk airlines from smaller communities as they gravitate toward larger equipment and longer stage lengths. This began to occur before the implementation of the Airline Deregulation Act. Commuters often step in to fill the void created by the departure of larger carriers, thus resulting in a comparatively faster growth rate for commuter ridership. It is also interesting to review Figure 2 again to note the similarity between the commuters in the 1970s and the local-service airlines in the late 1950s. As the locals were replacing the low-density markets created by the evacuation of the trunks in the late 1950s (2), the commuters were replacing the locals and trunks in the 1970s.

Third, entry into the commuter air transportation business is relatively easy compared with the trunk and local-service airlines. Less capital is needed to acquire or lease the smaller, often second-hand, aircraft appropriate to this type of service. Until the Act, entry and exit were unregulated. As of 1980, there are about 300 commuter airlines that provide passenger service to small communities.

Finally, integration with the primary air transportation system has been improving in recent years as the symbiotic relation of the trunk and local-service airlines with the commuter airlines has been increasingly recognized and exploited to their mutual benefit. The commuters often feed passengers to the longer routes of the locals and trunks and in return they share ticket counters, gate space, baggage handling, and reservation services at reasonable costs. Under this arrangement the commuters bring business to the trunks and locals and, conversely, the long-distance leg can partly offset the cost disadvantage of the short, low-density trip segments, depending on the fare-apportionment formula between the commuters and the trunks and locals.

COMMUTER-AIRLINE INDUSTRY

In spite of its dramatic growth, statistics show the still relatively modest scale of operation of the commuter-airline industry. In 1977, the industry as a whole reported $381 million of gross revenue from passengers, freight, and mail, which represented only 2.6 percent of that year's total domestic air-carrier revenues.

The top 50 commuters carried 85 percent of the total passengers. The remaining 15 percent was carried by 217 smaller commuter airlines. The 50th carrier, by passengers carried, was 15 times smaller than the top carrier. The five largest commuter airlines carried twice as many passengers as the second largest five.

These numbers illustrate that the commuter industry is highly disaggregated and that even the largest does not make the Fortune 500. Although one can conclude that the commuters are largely made up of small-scale entrepreneurs, the biggest carriers are sizable enough that they require relatively sophisticated management that is growing closer in pattern and style to the trunk and local-service airlines. Most commuters, however, are quite small, and most of the experienced management personnel in the commuter-airline industry are largely persons who have entrepreneurial or equity interest in the success of the airline.

In the smaller airlines, one person generally runs the airline with a minimum of staff assistance. In fact, it is quite typical for the president of a commuter airline to also be the chief pilot, having the pilot group report directly to him or her. Most of the remaining employees of a typical small commuter airline are nonmanagerial or entry-level personnel with their management career ahead of them.

More and more of the larger commuters are becoming unionized. It is expected that efforts to unionize will grow as the industry grows and matures in the coming years.

Commuter-Aircraft Fleet

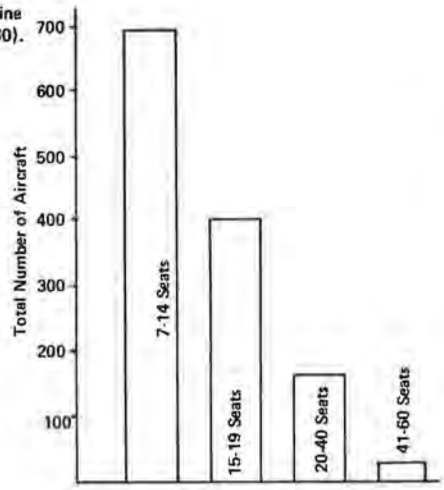
As had been pointed out, commuter airlines have been restricted since their inception as scheduled air taxis in 1952 to aircraft smaller than 12 500-lb takeoff gross weight--about 19 passengers. This restriction was for the express purpose of confining their operations to the routes that would not compete with the trunks and local-service airlines. Although the time that such competition would have been a threat to these carriers is long past, it was not until 1973 that this size limitation on the commuters was relaxed to 30-passenger aircraft.

Permission to fly aircraft up to 30 passengers--up from 19 passengers--was less significant than it might appear. First, there were no modern aircraft in this size range that have been specifically tailored to the duty cycles and requirements of the commuter market. Roughly a third of the 200 or more 19-plus-seat aircraft in the then-existing fleet were the venerable DC-3s; no other single model was represented by more than 20 aircraft. Second, FAA operating regulations require the addition of a cabin attendant at 20 seats or more, which represents an economic barrier to operate aircraft that exceed the 20-seat capacity.

Figure 4 (3) shows the nature of the 1980 commuter-airline fleet by aircraft size. It is clearly dominated by small aircraft--not a surprising circumstance given the regulatory history. Although the total number of aircraft represented in this figure is somewhat lower than the most recent fleet totals, the figure serves to illustrate the point.

The 1980 commuter-airline fleet gained 408 aircraft over 1978, of which the percentage of multiengine and turboprop in the fleet went up while the percentage of single-engine aircraft went down (4). The fleet is shifting toward larger aircraft. Given the new size freedom under the Airline Deregulation Act, this shift would probably be even more marked if suitably larger aircraft were available. In some ways, the bigger commuters are gradually evolving to become locals, many of which operate 40- to 60-seat aircraft.

Figure 4. Commuter airline fleet by aircraft size (1980).

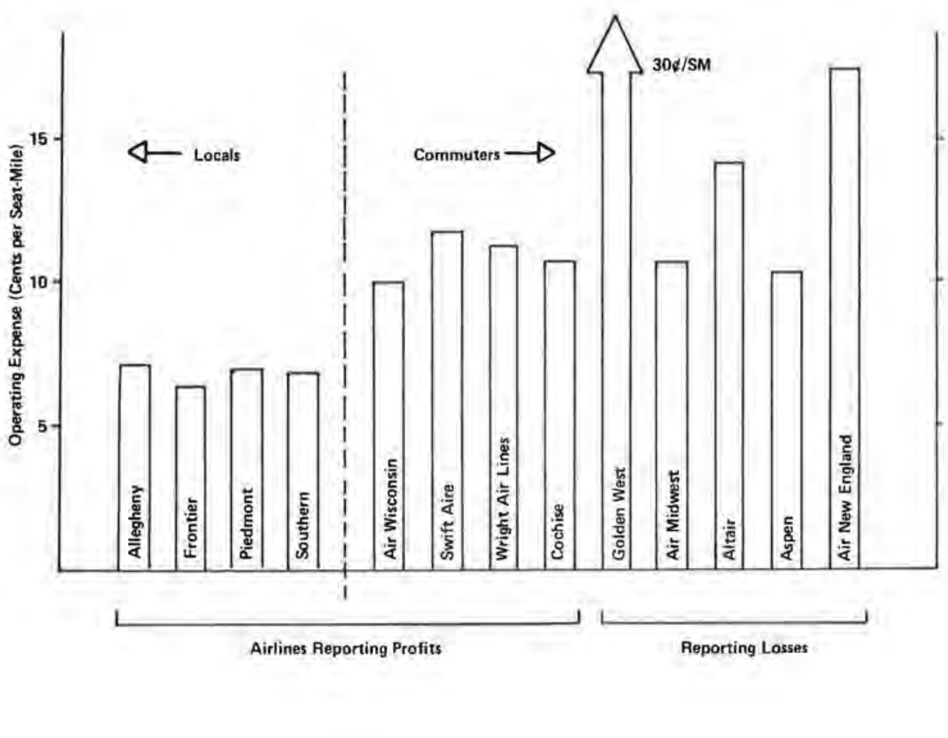


Profits and Finances

It is commonly recognized in the airline industry that as route densities and stage lengths decrease, costs per seat mile go up. It is to be expected, then, that commuter airline unit costs will be generally higher than those of either the local-service or trunk airlines and will be more sensitive to the particular route structure of individual airlines. The point is also made that costs are more variable with terminal-area delays at shorter stage lengths, so commuter costs are more variable in the face of changing operating conditions. With higher costs, the commuters' ability to make a profit at a reasonable average load factor depends on the ability to obtain higher revenue per passenger mile than the larger airlines.

The data in Figure 5 [(5), and from the internal

Figure 5. Comparison of passenger operating expenses (2nd quarter, 1979).



paper by J.D. Ward] are consistent with the above observations about costs. The figure shows the cost per seat mile for four profitable local-service airlines and nine commuter lines, four of which were profitable and five of which reported losses in the second quarter of 1979. With the costs shown, the locals were able to break even with load factors ranging from 53 percent for Southern (now Republic) to 61 percent for Allegheny (now U.S. Air). For all four, actual load factors exceeded the break-even load factors, so the airlines were profitable.

For commuter airlines there was much greater variation in revenues per passenger mile and in break-even load factors. The latter ranged from 43 percent for Air Wisconsin to 76 percent for Air New England. The very high cost of 30 cents/seat mile for Golden West was attributed to the very short stage lengths of its markets. Even with these high costs, they had the potential of being profitable: Revenues were 54.5 cents/passenger mile and the break-even load factor a reasonable 55 percent. Unfortunately, actual load factors were only 50 percent, so Golden West lost money.

The point of this is that high costs do not necessarily prevent profitability; it depends on whether reasonable load factors can also be attained at high revenues per passenger. It is true that the commuters are operating where both costs and revenues are more sensitive to external conditions than if they had longer and denser routes. The new freedom to operate larger aircraft under the Act will probably help profit stability by opening up this option.

The original investment in many commuters consists of the entrepreneur's equity position (averaging 50 percent or less of the total equity) and the investor's hard-money position. The hard-money equity investment quite often comes from a group of business people in the geographic region of the commuter airline's operation (rather than a financial giant at a remote big city) who feel that such a service will help their community grow and develop, thus helping their primary business.

J.W. Drake's paper, Estimates of U.S. Production of Light Transports for U.S. and Foreign Markets to the Year 2000 (working paper for Impact of Advanced Air Transport: Air Service to Small Communities, Office of Technology Assessment, U.S. Congress, 1980), reported an attrition rate of over 36 percent among the top 50 carriers from 1969 to 1979. The attrition rate is even greater among the smaller commuters. The dubious profitability of some commuters is both cause and consequence of typically shaky financing. As mentioned, most commuter air carriers today are capitalized on the basis of both equity investment and borrowing. In many cases, because of early losses and the comparatively capital-intensive nature of the fleet, the equity portion of the capitalization may be of negative net worth, particularly among the newer and smaller airlines.

Thus, a reasonably large proportion of commuter airlines go through one or more refinancing operations before they ultimately go out of the commuter business or become successful and stabilize their position. When such refinancing does take place, the usual pattern is for both the entrepreneur and the original investment-capital interests to subordinate their position to the new investors. The entrepreneur may lose control of the stock but in many cases may continue to have effective working control. In some instances, the new investors may simply guarantee additional loans for the company or may purchase and lease to the company more adequate or more efficient (or newer) flight equipment. In several instances, executives with extensive experience in the trunk or local-service airline business have organized as a group to purchase a controlling interest or substantially all of the equity of a commuter airline. As the Act permits larger aircraft on longer routes, this will probably improve profitability. The aircraft loan-guarantee provisions will also help financing.

SERVICE BEFORE AND AFTER DEREGULATION: LOOKING AHEAD

The new regulatory environment introduced by the enactment of the Airline Deregulation Act has permitted a readjustment over time of the market serviced by the trunks, locals, and commuters. The trunks, which receive no subsidy for low-density service, are abandoning what remains of their short-distance routes except where these short trips supply enough passengers to their high-density routes that it makes economic sense to maintain them as feeders. Although less rapidly, the still-subsidized local-service carriers are also moving away from short-distance, low-ridership service. To show why these trends are taking place, the list below gives the federal regulations that pertain to service to small communities:

- 1969 Birth of commuters
- 1972 Limit on aircraft size raised to 7500-lb payload or 30 passengers
- 1977 Air Cargo Deregulation (P.L. 95-163)
- 1978 Airline Deregulation Act (P.L. 95-504)
- 1979 Implementation of Federal Aviation Regulation (FAR) Part 135 (Safety Equipment) by FAA
- 1980 International Air Transportation Competition Act of 1979 (P.L. 96-192)
  Aviation Safety and Noise Abatement Act of 1979 (P.L. 96-193)
- 1981 CAB Sunset Provision 1--domestic route program terminated
  Prescription of FAR Part 24 (Certification Requirement) by FAA
- 1983 A subsidized local-service carrier may be replaced by a commuter on the basis of subsidy reduction or improved services
  CAB Sunset Provision 2--expiration of authority over fares and charters
- 1985 Termination of subsidy to local-service carriers
  Abolishment of CAB--small community subsidy program transferred to DOT
- 1988 Essential air service guarantee program terminates for subsidy-eligible commuters
  Exemption of noise requirements terminates for two-engine aircraft (100 seats or less) service to small communities

Small-Community Service

In the two years after airline deregulation (1979 and 1980), overall passenger traffic increased 3.9 percent annually in spite of the economic recession (compared with an average annual increase of 11.3 percent from 1970 to 1978) (data from CAB Commuter Air Carrier Traffic Statistics, 1980). Meanwhile, flights become less circuitous, with more direct nonstop and one-stop flights to nearby hubs, often scheduled at more convenient hours (6). Nonhub airports experienced a 2.4 percent decline during the 1978-1981 period (compared with a 9.2 percent increase for 1977-1978). When one isolates the nonhub to large-hub market types, there was a 0.5 percent increase from 1978 to 1981 (CAB Report on Airline Service, Fares, Traffic Load Factors, and Market Shares, 1981). Considering the generally adverse economic climate during 1979 and 1980 and the air traffic controller strike in 1981, these figures speak for themselves about the effects of deregulation on air service to small communities.

Since October 1978 (and, as of June 1979), trunk and local-service airlines have proposed dropping service to 270 cities, 79 of which had no other scheduled service. At 57 of those 79 cities, commuter airlines have come in to provide service, but often with smaller planes and occasionally with less-reliable service. However, a number of medium-sized (nonsubsidized) cities find themselves abandoned by trunks and locals and are unable to attract commuters to replace the service that they have lost (7).

Based on CAB data ending December 31, 1980, there were 816 points receiving commuter-airline service (both passenger and freight) in North America. Of these points, 738 were receiving passenger service compared to 630 points in December 1979. Although such data are approached with caution, they do imply that the commuter system has expanded since the Airline Deregulation Act. In the full year from June 30, 1978, to June 30, 1979, the number of passenger markets served (i.e., city-pair combinations where direct service exists) increased about 10 percent to a total of 1888. This again increased by 10.5 percent through December 1980 to a total of 2087 (CAB Commuter Air Carrier Statistics, 1980).

Even though there is a time lag in implementing the subsidy program, the local-service airlines still have positive incentive to stay at the current number of communities because of the availability of federal subsidy. However, note that under the Act the subsidy will be eliminated by 1985. At that time, local-service airlines are expected to exit from the smaller communities in substantially larger numbers as they gravitate toward the more profitable long-haul, high-density markets. As commuters fill the void vacated by the locals, it is speculated that the subsidy paid to commuter carriers will be lower than that paid to the present locals. This is in part due to the fact that commuters will operate comparatively smaller flight equipment, which will require less subsidy to operate profitably. To date, a number of commuters have also been reluctant to obtain subsidy--in part due to their reservation about the accompanying federal regulations. On the other hand, if service expands and the commuters' attitude changes, then such a potential reduction in subsidy may disappear.

Although it is too early to judge the efficacy of the essential air service program, three facts can be identified. First, the community's desires for service have to be reconciled with the determination by CAB of essential service--a typical problem when the party that benefits is not the party that pays. Second, there have already been cases where commuter airlines have not wanted to offer service in particular markets, even with the subsidy mentioned above, partly because the subsidy level was not high enough to provide the profit they could make with the same aircraft operating in a different unsubsidized market. Third, the subsidy program for commuters is scheduled to terminate in 1988; it is unlikely that market forces alone will keep service in all these markets if that occurs.

Given that the larger commuter aircraft will be most profitable on longer and/or denser routes, it seems natural and likely that the advent of such aircraft will precipitate more commuter service on those routes. The only deterrent to such route strengthening is competition from the certified airlines that may already be operating on such routes. By the mid-1980s, however, most of the locals and all of the trunks will probably be operating all-jet fleets, so that the differences between the new 30- to 60-passenger turboprops of the commuters and 100-plus-seat jets of the locals and trunks will determine, in large measure, the relative route structures that develop for the two classes of airlines.

From the point of view of small-community service, the commuters' new ability to move to potentially more lucrative routes may be a mixed blessing in the long run. On one hand, it may improve service for some communities because they become an easy stop in an enriched route structure. Bigger aircraft are likely to improve the profitability and financial stability of the airlines simply because they can fly more profitable routes, thus improving their ability to offer good service throughout their route structure. However, it can also create a temptation for the successful commuter to abandon its less-lucrative routes and its smaller aircraft and, therefore, its service to smaller communities--particularly when the essential air service guarantee program ends in 1988. Although such action creates an opportunity for another operator to move in, it is likely to be a less experienced and less financially stable carrier.

Interline Arrangement

The joint-fare formula between major carriers and commuters has been formalized since deregulation. Based on a cost prorate basis rather than on a straight apportionment by mileage, the CAB uniform joint-fare formula has the potential of helping the commuter-airline industry. The problem that has existed between 1978 and the present is the perceived inequities in the division of the joint fare and other arrangements. Since the cost prorate method tends to be less favorable for the trunks and locals, it is anticipated that the joint-fare formula may be subject to review. There is pressure on Congress to change or eliminate the mandate. If this effort materialized, commuters could be driven out of some markets.

In spite of the unsettled status of the joint-fare program, one thing is clear: Interline cooperation is important because of the need of the major airlines to obtain the commuter feed and because the commuter enjoys the services provided by the major carrier (such as gate space, computer reservations, and baggage handling). Also, it is critical for the traveler who makes a through trip in an integrated air network from origin to destination. Interline arrangements will therefore remain as a cornerstone for small-community service provision.

Commuter-Aircraft Fleet

Commuter airlines apparently have less preference for smaller flight equipment than prior to deregulation. For example, there has been a large demand for 50-passenger turboprop aircraft (such as the Corvair 580s), the seat capacity of which is allowed under the new Act. Some of these 50-passenger aircraft (but not a sufficient number) are available on the market since they will no longer be used to serve smaller towns by the local-service airlines. Given that the Act allows for up to 60-seat equipment, traffic trends indicate there may even be newer, more efficient, and quieter types of 30- to 60-passenger turboprop flight equipment being developed and coming on the market.

Although commuters may tend to gravitate toward larger equipment in the long run, currently some of them are bound by the essential air transportation clause to serve small communities in order to receive subsidy. In the short run, with the more lucrative longer-haul markets saturated by local-service carriers, it is less likely that small-commuter airlines will be able to enter into these long-haul markets in full scale and to cross-subsidize the thin-density markets with more lucrative ones. In the long run, however, this remains an area of uncertainty.

Loan Guarantees

During the two years after the enactment of the Airline Deregulation Act, an overwhelming number of commuters have not taken advantage of the FAA loan-guarantee program. In fact, the FY 1980 level of the loan-guarantee program--$150 million and $100 million for FY 1981--appears to be quite adequate in view of the number of applications. It is recognized, however, that if the loan guarantees were the only source of finance, a program of this magnitude (and the requested $100 million for FY 1982) might not be sufficient to provide the necessary incentive for a U.S. aircraft manufacturer to undertake the design and development of a 30- to 60-seat aircraft specifically suited for commuters. But a number of commuter airlines so far appear to have obtained private finance.

A consensus is shown (4) in the commuter-airline industry that the loan-guarantee program promises to be effective in upgrading the service by commuters to small and isolated communities. Loan guarantees encourage the aircraft manufacturer as well as the airline operator to serve these markets collaboratively. It enables both to make a favorable long-term commitment on new, well-designed equipment, which in turn can contribute to assuring an economically viable airline for these low-density communities.

Airline Industry Health

Compounded by an economic slowdown and the air controller strike, the airline industry has been reporting mixed performances since deregulation. As far as service to small communities is concerned, the picture is judged to be more optimistic. Local-service airlines have been performing well in the last two years. In the Brenner and Speas report (5), for example, all four local-service airlines--Allegheny, Frontier, Piedmont, and Southern--were profitable in the second quarter of 1979.

Until recently there have been doubts whether commuter airlines, with the disadvantage of low-density, short-haul markets, could be viable. Although there are too few commuter data to support sweeping industrywide conclusions, sample viability statistics such as net profit, revenue yield, unit cost, and load factor fall within a reasonable range. Let us review the example given earlier. Of the nine commuters surveyed by Brenner and Speas (5) since deregulation, the break-even load factor varied only five percentage points from the midpoint of 59 percent, with a low of 55 percent and a high of 64 percent (except for two cases that were the extremes) in 1979. The airline of highest profit performance achieved a break-even load factor of 48 percent; the airline of highest loss experienced a break-even load factor of 76 percent. Although such data cannot be generalized across the industry, they do provide some encouraging signs.

CONCLUSIONS

Air service to small and medium-sized communities is usually provided at a higher cost per seat mile than service to denser markets. Over the history of airline operations in this country, there has been a tendency for the mature airlines to depart from the low-density markets, preferring the denser routes. Thus, in spite of federal subsidy to low-density air service, this industrial dynamic has been going on for decades. For example, during the 1960s, the successful local-service airlines shed federal subsidy and graduated one class upward to become minitrunks while the successful commuters again graduated to eventually become mini-local-service carriers during the 1970s. At the very roots of the class structure were many owner-operators (third-level air-taxi services), some of which became commuter airlines. These industrial dynamics have been observed for years since the domestic airlines have been in place in the nation. They certainly have been going on long before the airline deregulation sentiments that culminated in the 1978 Act.

Although the Act is generally heralded as freeing the entrepreneurial operators from the weight of government regulation, note that it did not deregulate the commuter industry, which provides a substantial portion of the service to low-density markets. In fact, it did just the opposite. Commuters are more regulated in several ways, such as the following:

1. Commuters, which use to operate outside many of the regulations of CAB, are now subject to more scrutiny (particularly if they choose to become certificated carriers), and
2. An elaborate set of guidelines and regulations were drawn up to protect service to low-density markets under the small-community subsidized service program.

Perhaps the only relaxation of regulations is found in the freedom for commuters to operate up to 60-seat aircraft, which follows a trend set in 1972 to lift the limit of aircraft size to 30 passengers. Even this freedom often cannot be exercised by the commuters since there has been a scarcity of 30- to 60-seat aircraft in the country--particularly in view of the significant growth of commuter traffic over the last decade.

Although many of the factors that determine service provision to low-density markets were in place a long time before deregulation, a very positive step that came out of the Act was the aircraft loan-guarantee program. Even though the details and experiences of the recent loan-guarantee program have yet to be analyzed in depth, the availability of finance capital for a generally unstable commuter industry is significantly encouraging for the commuter operators at large.

The initial fear that low-density service would be severely jeopardized as a result of deregulation turned out to be unfounded, judging from the three years of postderegulation experience. The total service to small communities has remained steady amid economic recession and the controller strike, thus continuing a growth trend started almost a decade prior to the deregulation legislation in 1978. If there was a discontinuity of service, it often was found in the medium-sized (unsubsidized) communities. These communities are squeezed between the graduating classes of air carriers, in the sense that the locals and trunks desert them, thus leaving a void too large to be adequately filled by the commuters who are ill-equipped to assume the full roles previously played by the trunks and locals.

Thus, if history is to repeat itself, the industrial dynamics that govern the transition among commuters, locals, and trunks (by using increasing airplane sizes) will evolve. Perhaps a fourth level of air-taxi operators is lurking somewhere in the background as the successful commuters eventually gravitate toward large equipment (when it becomes available) and shed their unattractive thinner-density routes in the long run. It is conjectured that the void will be filled by the smaller owner-operators who, while financially not as proven as their bigger cousins, are nevertheless entrepreneurial.

On top of this, the essential air service provision of the Act will ensure service with subsidy through 1988, and the aircraft loan-guarantee program will also help to stabilize the financial picture of some commuters. Air carriers will come and go subject to the weeding process in the business world. This, together with the concomitant voids generated by graduating class dynamics, will introduce inconvenience to travelers at specific locations. But by and large, the process is likely to continue and the transition is likely be stabilized in the long run.

Major uncertainties that may discount my reserved optimism include the following:

1. Congestion at major-hub airports where commuters fly their passengers to connecting long-haul airlines, and
2. Safety regulations that govern commuters, which tend to be more stringent due to the accident records that accompanied commuter traffic growth over recent years.

The economy and the fuel-cost spiral are certainly significant factors, but they are not exclusive to low-density service alone and tend to affect all transportation modes. All these factors tend to put a damper on service to small communities if they are not taken into account in a timely fashion. It goes without saying that the provisions of the Airline Deregulation Act need to be monitored closely as time progresses. Among the key elements to be scrutinized is the essential air service program, particularly at the time when it is scheduled to terminate in 1988.

ACKNOWLEDGMENT

Much of the research was performed while I was a Congressional fellow at the Office of Technology Assessment, U.S. Congress, during the academic year 1979 to 1980. I was one of a team carrying out the assessment for the House Science and Technology Committee and the Senate Commerce Committee. In this paper, I draw heavily on the work of other members of the team, which included J. Andelin, L. Dickinson, J. Gibbons, R. Maxwell, D. Seidman, J. Ward, A. Webster, E. Willis, and others. After returning to academe, I received much stimulation from my colleagues at the State University of New York at Stony Brook.

The views expressed in this paper are strictly mine. They do not represent those of the U.S. Congress or the State University of New York at Stony Brook.

REFERENCES

1. J.C. Panzar. Equilibrium and Welfare in Unregulated Airline Markets. American Economic Review, May 1979, pp. 92-95.
2. M.W. Putsay. Airline Regulation and Service to Small Communities. Land Economics, Vol. 55, No. 2, May 1979, pp. 253-268.
3. Impact of Advanced Air Transport Technology: Part 3--Air Service to Small Communities. Office of Technology Assessment, U.S. Congress, 1982.
4. Commuter Airline Industry: Decade of Decision. Commuter Airline Association of America, Washington, DC, Annual Rept., 1980.
5. M.A. Brenner and R.D. Speas. The Bottom Line--On Commuter Financial Health. Commuter Air, Vol. 1, No. 4, Nov. 1979.
6. J.R. Meyer, C.V. Oster, and J.A. Gomez-Ibanez. Early Experiences with Airline Deregulation: Some Implications for Motor Carrier Regulatory Reform. Office of Policy and Analysis, Interstate Commerce Commission, U.S. Department of Commerce, 1980.
7. Simat, Helliesen, and Eichner, Inc. The Effects of Airline Deregulation upon Air Service in Appalachia. Appalachian Regional Commission, Washington, DC, 1982.

Publication of this paper sponsored by Committee on Application of Economic Analysis to Transportation Problems.

Abridgment

Marketing Bicycle Transportation: A Critique of National Comprehensive Bicycle Transportation Program

MICHAEL D. EVERETT

The U.S. Department of Transportation (DOT) bicycle transportation program, which emphasizes promotion of bicycling through advertising and education and which generally opposes separate bikeways or lanes, is reviewed. This paper finds no evidence in the existing literature and bicycle transportation experience to support the DOT position that such a program would shift substantial numbers of short-distance commuters to bicycles. This paper concludes with suggestions for DOT to improve its analysis and marketing of bicycle transportation.

In response to the National Energy Conservation Policy Act of 1978, the U.S. Department of Transportation (DOT) published Bicycle Transportation for Energy Conservation (BTEC) (1). BTEC presents a national comprehensive bicycle transportation program that strongly deemphasizes separate facilities for bicyclists and that strongly emphasizes promoting bicycling and educating bicyclists about sharing the road with motor vehicle traffic (1, p. 8; 2, pp. 33-34, 99). BTEC predicts that these policies will increase bicycle commuting from less than 0.5 million in 1975, which also included persons 14 years and older bicycling to part-time jobs, to between 1.5 and 2.5 million adult bicycle commuters by 1985 (2, pp. 83-84). This includes 15-30 percent of the 6.4 million car commuters aged 19 to 45 who do not need a car at work. Adjusting for environmental conditions further increases the proportion of the final target group shifted.

Attempting to capture such large percentages of short-distance car commuters represents an extremely ambitious marketing program that has a number of economic and social implications. This paper uses basic economic and marketing concepts along with the available literature on bicycle transportation to evaluate BTEC.

MAJOR DETERMINANTS OF SHIFTING DRIVERS TO BICYCLES

BTEC provides no support or citation for its policy conclusions and merely states the following (2, p. 69):

> The effectiveness of these program components (education and promotion in particular) in increasing bicycle use has not been evaluated to date. It is our belief, however, that the selection of these elements is based on the best available data, and they constitute a reasonable approach to increasing the use of the bicycle for transportation.

Unfortunately, rather than using the best available data, BTEC ignores most of the solid, replicative published literature on the determinants of bicycle commuting and misinterprets its own data.

BTEC rests its recommendations for promotion and education as the major determinants of future mass commuter bicycling primarily on the opinions of a panel of experts. That focus-group study, however, remains so flawed that I cannot draw any conclusions from it. [For the study and a critique, see paper by Ryan and Schermerhorn and my discussion (3).]

BTEC supports its conclusions on the ineffectiveness of separate bicycle facilities, including striped-off lanes, with a draft of the national survey by Robinson and others (4). Although this represented a well-designed survey of 16 000 households in five cities, the early drafts seriously misinterpreted the data. The final published draft concluded (4, p. 47):

> Separate facilities play an important role in people's preference for nonmotorized modes, second only to that of compact land use. The significance of facilities is further emphasized by the fact that the compact land-use scenario contains not only the very important element of short trip distances, but also the element of separate facilities for nonmotorized travel.

Compact land use and separate facilities together made the bicycle the preferred mode for 29-33 percent of the respondents (4, p. 43). Numerous other surveys also find that the overwhelming majority of existing and potential bicyclists fear traffic and want separation from high-speed, high-volume traffic (2, p. 26; 5, pp. 8-21; 6). Sophisticated multinomial logit models estimate that separation would increase bicycling substantially (7). These models have provided accurate predictions for a wide range of consumer behavior from market share for new small-packaged goods to modal choice.

Moreover, the BTEC position on minimizing separation and emphasizing education conflicts with observations where mass bicycling actually takes place, i.e., low-speed (about 20 mph, average) and/or low-volume traffic, or on facilities through heavily traveled high-speed barriers and generally along arteries over much of the heavily bicycled area. This does not mean a network of facilities exists that takes bicyclists to every destination, but only that facilities separate bicyclists from high- to moderate-speed and high- to moderate-volume traffic. Furthermore, reasonably well-controlled studies have documented specific examples of separate facilities actually increasing bicycling in the United States and Europe (6, 8-10).

BTEC also fails to review and incorporate the substantial literature on the major determinants of modal choice in general. This literature finds that relative costs, including time costs, play a major role in modal choice (11). Two studies on bicycling (12,13) find time costs quickly swamp vehicle savings costs for trips in excess of 2-3 miles. Updating the data for increased fuel costs and poor fuel efficiency for short trips did little to change these overall conclusions. Even for short trips, the net economic returns remain around 20¢-50¢/mile, or levels intuitively too low to induce many commuters to overcome their fear of traffic and other disutilities of bicycling. Observations suggest that mass bicycling takes place around campuses that severely restrict student parking, around elementary schools where students cannot drive, and in European cities where automobile ownership remains low, if separation from high-speed and high-volume traffic exists.

In summary, BTEC violates one of the major principles of successful modern marketing: Find out what the target market wants and design a product or service to satisfy that want rather than merely attempting to sell a preconceived product or service.

BICYCLE TRANSPORTATION SAFETY

Potential increases in traffic accidents associated with mass bicycle transportation, at least for the drivers who shift to bicycles, raise serious ethical questions. For example, English officials estimate that bicyclists face a fatal-accident risk 10 times greater per mile than drivers (14). Unfortunately, neither BTEC nor earlier bike-safety workshop reports (15,16) build systematically on Cross's rigorous national accident survey (17) to shed much light on these questions.

The overall shared value of most participants in the workshops emphasizes the importance of bicycle education to reduce accident hazards. Most bicycle and transportation analysts, including those who emphasize separate facilities, would strongly support education. The workshop reports, however, provide no coherent theoretical or empirical estimates on how much education would be needed to reduce accidents or the costs of education (15, pp. 32-35).

Looking at fatal accidents, the data in BTEC seem to conflict rather strongly with its conclusions that separate facilities provide ineffective countermeasures. Cross's well-regarded national survey (17) found that the largest portion of fatal accidents (nearly 40 percent) involved motor vehicles overtaking bicyclists. Most of these accidents occurred on rural-type roads (narrow two-lane roads with no shoulder and 50 percent undeveloped area along the roadside) often found on the fringes of urban areas. But substantial numbers of fatalities also occurred on wider urban-type roads, particularly after dark. Cross recommends against riding rural-type roads and against riding anywhere at night with currently available reflectors and lights. Commuter bicycling, however, involves substantial night riding during winter months, and many university communities with actual or potential mass bicycling have a number of rural-type roads that serve residential developments. Thus, it seems to me that a separate facility that removed the bicyclist from the road would eliminate this major fatal-accident category for that particular corridor.

Finally, BTEC and the workshops fail to review and analyze several readily available reports on the impact of separate bike facilities on accidents. Several European studies found that well-designed separate facilities substantially reduced most intersection accidents (18, pp. 44-47). An earlier, well-defined DOT study found well-designed bike lanes reduced bike-car conflicts (5, p. 54).

Although Kaplan in a mail-back survey of club bicyclists found more accidents on bikeways per mile than bicycling in the road (14), this may arise from greater bicycle congestion in areas that have bikeways. My observation of university campuses that have mass bicycling is a very high level of accidents on campus bikeways, but few fatalities.

I can only conclude from the available data that we do not know nearly enough about the determinants of bicycle safety to make any specific statements about the cost-effectiveness of one input over another. All inputs seem to have important roles in some situations. Blanket encouragement to shift from driving to bicycle commuting, even with a full array of inputs, probably would increase accident hazards for those who shift. For example, according to Dutch officials, even with extensive separation, education, and enforcement, bicycling carries a 3.5-fold greater risk of a fatal accident per mile than driving (14). This raises serious ethical questions of whether we should try to market bicycle transportation to masses of short-distance automobile and bus commuters.

ECONOMIC EVALUATION

BTEC estimates that its program will reduce driving by 8.3-16.5 million miles/year and generate $492-$705 million/year in savings on oil (16.4-23.5 million barrels at $30/barrel). Because the BTEC program would cost $244 million over five years, the program would generate very high payoffs on the order of 10:1 (approximately $500 million, i.e., $50 million/year). BTEC and the workshop reports, guided by the same author, strongly imply that the social costs of providing separation from moderate- to high-speed and moderate- to high-volume traffic would exceed the benefits (1, pp. 8, 22, 23; 2, pp. 33-34, 99; 16, pp. 32-36, 80-82).

BTEC's benefit/cost analysis, however, has a number of serious shortcomings, ranging from grossly inadequate data to conceptual errors. The benefit/cost analysis obviously suffers from an inability to make any reasonable prediction on bicycling and the reduction in driving that result from the BTEC program. If BTEC only generated a trickle of bicycle trips (around 1 percent of total vehicles on a given route at a given time), as seems likely from the available data, what will the $244 million over five years buy us? Would we encourage a few people to expose themselves to both greater fatal-accident risks and long-run air pollution hazards? Would such a program slow down traffic on affected traffic arteries, causing greater congestion, energy use, and air pollution?

BTEC ignores other benefit/cost analyses of bicycle transportation systems that find high returns to facilities and provide a broader set of variables for assessing both the costs and benefits of these systems. For example, one readily available study assumed from the literature that the highest per mile returns for two campus bicycle systems resulted from reductions in congestion, parking, and time costs and increases in consistent exercise (19). The major costs were the reduction in consumer surplus of drivers who lost their parking places and access to the central campus. Computer simulations generated estimates of benefit/cost ratios ranging from 7:1 to 14:1.

Conceptually, the DOT study position of rejecting separate facilities because they cost too much does coincide with the financial marketing approach: Give the market what it wants if you can do so at a profit (or a net increase in social welfare). However, the relevant economic decision rule to maximize private or social welfare directs planners to use an input as long as the present value of the long-run expected incremental benefits (change in total benefits) exceeds the present value of the long-run expected incremental costs. BTEC policies may minimize costs, but they probably also would forgo the opportunity to shift important commuter segments (for example, students) to bicycles with cost-effective facilities and programs.

CONCLUSIONS

In essence, BTEC is not a study that uses the best available data without preconceived notions or biases (2, p. 1) but, rather, a policy position that represents one group of bicyclists. As early as the 1930s and 1940s, the English recreational Cycle Touring Club used most of the same assumptions to oppose bikeways as a threat to their rights to the road and instead promoted education and minor road modifications. In England after World War II, the government did not build separate bicycle facilities but did guarantee bicylists their legal rights to the road as motor vehicle traffic grew. Bicycling declined in England to where I saw virtually none around London in 1974, and other estimates put bicycling at less than 4 percent of trips in England as a whole (6). In the Netherlands, which did develop extensive separate facilities as well as education and enforcement programs and which perhaps maintained relatively high driving costs, the bicycle still represents the major mode in terms of trips--25-35 percent (6).

A more objective and sophisticated program to market bicycle transportation would modify BTEC in several ways beyond a more objective review of the literature. First, such a program would segment the short-distance commuters into various groups (student, white collar, suburban, downtown, etc.) and would design several different bicycle transportation programs tailored to the wants and constraints (e.g., road space and ability) of each segment.

Second, a truly innovative and comprehensive program also would include road pricing (20). This would raise the price of driving cars and other vehicles with relatively high social costs compared with bicycles by charging vehicles in terms of the space (congestion), air pollution, noise, and the other external costs they impose. If prices were high enough, this theoretically could shift enough drivers to transit and bicycles to free up road space so that bicyclists could share most roads with motor vehicle traffic.

Extensive road pricing and/or facilities undoubtedly remain politically infeasible in the foreseeable future but, by presenting its program as an effective means of shifting masses of target-group drivers to bicycles (2, pp. 82-84), BTEC simply confuses and weakens our understanding of the determinants of bicycling for rational planning in some future national emergency when mass bicycling may become feasible. Also, by promoting bicycling as a safe alternative mode (1, p. 3), BTEC may actually increase traffic accidents and net social costs for the few commuters who do experiment with bicycles.

REFERENCES

1. K. Moran; Mountain Bicyclists' Association, Inc. Bicycle Transportation for Energy Conservation. U.S. Department of Transportation, April 1980.
2. K. Moran; Mountain Bicyclists' Association, Inc. Bicycle Transportation for Energy Conservation: Technical Report. U.S. Department of

Transportation, Rept. DOT P-80-092, May 1980.
3. C. Ryan and R. Schermerhorn. Public Policy and Decision-Analysis Methods: Development of the National Comprehensive Bicycle Program. TRB, Transportation Research Record 808, 1981, pp. 68-75.
4. F. Robinson, J. Edwards, and C. Ohrn. Strategies for Increasing Levels of Walking and Bicycling for Utilitarian Purposes. TRB, Transportation Research Record 743, 1980, pp. 38-48.
5. D. Smith, Jr.; DeLeuw, Cather and Company. Safety and Location Criteria for Bicycle Facilities: Final Report. FHWA, Rept. FHWA-RD-75-112, Oct. 1975.
6. Cycling as a Mode of Transportation. Transport and Road Research Laboratory, Crowthorne, Berkshire, England, 1980.
7. Transportation Issues and Answers: Choice of Travel to Work. Wisconsin Department of Transportation, Madison, 1981, pp. 22-25.
8. D.F. Lott, D.Y. Lott, and T.J. Tardiff. Evaluation by Experienced Riders of a New Bicycle Lane in an Established Bikeway System. TRB, Transportation Research Record 683, 1978, pp. 40-46.
9. S.G. Lipton. Evaluation of the Eugene, Oregon, Greenway Bicycle Bridge. TRB, Transportation Research Record 739, 1979, pp. 29-37.
10. Bikeway Demonstration Project Case Studies. FHWA, March 1981.
11. Transportation Choices for Urban Passengers: Measures and Models. Organization for Economic Cooperation and Development, Paris, France, 1980.
12. M. Everett. Commuter Demand for Bicycle Transportation. Traffic Quarterly, Vol. 28, No. 4, Oct. 1974, pp. 585-602.
13. E. Hirst. Bicycles, Cars, and Energy. Traffic Quarterly, Vol. 28, No. 4, Oct. 1974, pp. 573-584.
14. M. Everett. Bicycle Safety and Ethics. Presented at TRB Bicycle Committee Summer meeting, San Diego, CA, 1979.
15. Lawrence Johnson and Associates, Inc. Bike-Ed'77: A Conference Report. U.S. Consumer Product Safety Commission and U.S. Department of Transportation, May 1977.
16. V.S. Darago. Regional Workshops on Bicycle Safety: Final Report. National Highway Traffic Safety Administration, U.S. Department of Transportation, Rept. DOT HS-803 658, Sept. 1978.
17. K. Cross; Anacapa Sciences, Inc. Bicycle Safety Education: Facts and Issues. American Automobile Association Foundation for Traffic Safety, Falls Church, VA, 1978.
18. Bikeway Planning Criteria and Guidelines. Institute of Transportation and Traffic Engineering, Univ. of California, Los Angeles, 1972.
19. M. Everett. Benefit Cost Analysis for Labor Intensive Transportation Systems. Transportation, Vol. 6, 1977, pp. 57-70.
20. J.R. Meyer. Techniques of Transport Planning. Volume 1--Pricing and Project Evaluation, Part 2. The Brookings Institution, Washington, DC, 1971.

Publication of this paper sponsored by Committee on Application of Economic Analysis to Transportation Problems.

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