Railroads C

197

IMPACT OF RAIL ABANDONMENT ON AGRICULTURAL PRODUCTION AND ASSOCIATED GRAIN MARKETING AND FERTILIZER SUPPLY FIRMS

by A. R. Bunker
L. D. Hill

Contributed Paper
AAEA Summer Meetings
College Station, Texas
August 18-21, 1974

Impact of Rail Abandonment on Agricultural Production And Associated Grain Marketing and Fertilizer Supply Firms

by A. R. Bunker

Abstract

A detailed analysis of two rail line abandonments in a rural corn belt region. The study describes the impact that the abandonments have had on the operations of grain elevators, feed distributors and fertilizer distributors. Firms losing rail service are compared with nearby firms which have not lost rail service.

Impact of Rail Abandonment on Agricultural Production And Associated Grain Marketing and Fertilizer Supply Firms

by A. R. Bunker and L. D. Hill*

Introduction

The Northeast Rail Reorganization act of 1973 and the resulting U.S. Department of Transportation (USDOT) report[1] has focused considerable attention on the potential changes in rail services and the impact of these changes on firms and communities using these services. A major item in the report is the designation of "potentially excess" rail lines.[2] These rail lines totaled 15,575 miles or 25% of the total miles of track operated by Class I rail carriers in the 17 state region, including the District of Columbia. In the major grain producing states of Illinois, Indiana and Ohio the report designates 7,500 miles, or 30% of the lines, as "potentially excess."

Much of the criticism of the USDOT report has focused on the very limited analysis of the economic impact of the abandonment on shippers, on local communities, and on other carriers.[3] Some of the potential impacts identified in testimony before the Interstate Commerce Commission (ICC) are listed briefly

---

1. U.S. Department of Transportation, Rail Service in the Midwest and Northeast Region, Washington, D.C., February, 1974.

2. "Potentially excess" rail lines are those lines which are of questionable financial viability or have a low probability of financial viability. For a more precise definition see page 73 of the report.

3. Interstate Commerce Commission, Evaluation of the Secretary of Transportation's Rail Services Report, A report by the Rail Services Planning Office (RSPO) to the United States Railway Association, Washington, D.C., May 1974, pp. 11, 28-30.

* A.R. Bunker is an Agricultural Economist, Economic Research Service, United States Department of Agriculture, stationed at Champaign-Urbana Illinois. L.D. Hill is Professor of Agricultural Marketing, Department of Agricultural Economics, University of Illinois. Views expressed are those of the authors' and do not necessarily reflect those of the Economic Research Service, or of the United States Department of Agriculture, or of the University of Illinois.

below:[4]

1. Shippers who are especially dependent on rail service may experience serious economic hardship.
2. Local communities and businesses may suffer economic hardships caused by secondary impacts.
3. Those areas losing rail service may be bypassed by future growth since many commercial and industrial development plans are based on the presence of adequate rail service.
4. Alternative transportation facilities, principally road and highway improvements, will require additional investments and may increase total transport cost.
5. The effect on conservation of fuel and reduction of pollution may not be in the best interest of society.
6. Maintenance requirements for competitive transportation modes will be increased.

Most of those lines designated as "potentially excess" are located in rural areas and serve smaller rural communities. Many of these communities are served by only one rail line. In the corn belt states many of these rural communities are supported by local agri-business, such as grain elevators, fertilizer manufacturers, wholesalers and retailers, feed manufacturers and retailers, corn and soybean processors, and wheat millers, a number of which rely primarily on low cost rail transportation. Any action to reduce substantial mileage of railroad trackage will therefore have significant effects on the organization, costs and growth of agricultural firms and rural communities.

---

4. Ibid. Page eleven discusses some of these criticisms in more detail. Some of the criticisms listed here but not mentioned in the evaluation by the RSPO are taken from testimony presented at the hearings held by the ICC in response to the USDOT report.

The hypothesis, as expressed in the testimony before the ICC, that the loss of rail service would endanger the economic viability of shippers in many rural communities, and hence the viability of the community itself, has not yet been tested in an intensive agricultural production region such as the midwestern corn belt states. The objective of this study is to examine the impact of rail line abandonment on agricultural firms in the communities along two rail lines abandoned during recent years. Specifically, this paper will evaluate the impact of rail abandonment on grain elevators, feed distributors, and fertilizer distributors. There were no corn or soybean processors, and no flour millers on the rail lines studied in this report. The one feed manufacturer in the study does not provide sufficient data from which to draw conclusions.

Previous Work

Several recent studies involving rail abandonment and its impacts are reviewed in a report prepared by the Economic Research Service (ERS).[5] An additional study of importance is an expost analysis of the impact of the discontinuance of the Rutland Railroad in Vermont and New York states in 1961.[6] The study con-

---

5. Transportation in Rural America, (An Interim Report), Economic Research Service, U.S.D.A., Washington, D.C., March 1974, pp. 6-10. This is a report prepared in response to a request by the U.S. Senate and House of Representatives. Some previous studies reviewed are: Simat, Helliesen & Eichner, Inc., Retrospective Rail Abandonment Study, under contract for the USDOT; Baumel, C. Phillip, Thomas P. Drinka, Dennis R. Lifferth, John J. Miller, An Economic Analysis of Alternative Grain Transportation Systems, A Case Study, prepared for the Federal Railroad Administration, Washington, D.C., November 1973; Office for Planning and Programming, Iowa Commerce Commission, and Iowa State Highway Commission, Economic Impact of Railroad Abandonment in Iowa, A Case Study, Des Moines, Iowa, March 1973; Economics Branch, Canada Department of Agriculture, Prairie Regional Studies in Economic Geography, a series of 13 studies covering different regions in Canada, Regina, Saskatchewan, Canada; Tyrchniewicz, Edward W. and Robert J. Tosterud, "A Model for Rationalizing the Canadian Grain Transportation and Handling System on a Regional Basis," American Journal of Agricultural Economics, Vol. 55, No. 5 (December 1973), pp. 805-813.

6. Theodore, Chris A., The Economic Impact of the Discontinuance of the Rutland Railway, Boston University Bureau of Business Research.

cluded that the discontinuance of the Rutland Railroad had (1) no noticable effect on the local wage rate nor on the number of people employed, (2) only a minor effect on local trucking firms, and (3) a variable effect on shippers depending on the type of firm and its utilization of rail services. At the time of the abandonment the railroad was only a minor contributor to the economic base of the communities.

Data

The present study is an expost evaluation of the impact of rail line abandonment on grain elevators, fertilizer distributors and feed distributors. From a list of rail line abandonments in Illinois, Iowa and Indiana since 1965 two cases were selected for detailed study. Case I was a 95.4 mile section of the Chicago and Northwestern line from near Oskaloosa, Iowa to Keithsburg, Illinois abandoned in 1971. Case II was a 14.12 mile section of the Chicago, Rock Island and Pacific spur line from Guthrie Center to Menlo, Iowa, abandoned in 1969. Grain elevators, feed retailers and fertilizer distributors located on the abandoned lines (referred to as adjacent firms) were identified and surveyed. A sample of firms located on nearby rail lines (called nearby firms) were also surveyed. Data on facilities and operations of firms were collected by personal interview for a calendar year prior to abandonment (1970 for Case I and 1968 for Case II) and for calendar year 1973.[9]

Results

The results of the survey identify the central role of location and marketing patterns in determining the impact of rail abandonment on agricultural firms. In the Case I region, for example, a typical response by a grain elevator manager who had lost rail services was that the abandonment had no impact on his firm. The reason was that because of favorable prices at nearby river terminals for truck

---

9. The data reported in this paper are preliminary estimates.

grain almost no grain had moved by rail for several years prior to abandonment and was not expected to do so in the future.

On the other hand, fertilizer distributors in Case I region, who often obtain much of their product from distant sources, reported significant changes in their operations or costs or both.

Impact on Agricultural Production

The impact of rail abandonment on agricultural production was evaluated by a comparison of variables associated with adjacent firms to the same variables associated with nearby firms.[10] Two techniques were used in the comparisons. The first technique used changes in county livestock and grain production to determine if the loss of rail service shifted the relative profitablity or market access. The second technique consisted of a multiple regression model using township data on production of grain, pasture, and livestock for the independent variable. The dependent variable was a zero-one code based on the following criteria.

Township code	Classification Criteria
1	a. Township lost all rail service due to abandonment.
	b. Township is adjacent to a township which lost rail service and has no other rail service.
0	a. Township may have lost rail service but retained alternate rail service with at least one station.
	b. All other townships which have retained rail service.

The township code became the dependent variable and was regressed on:

x_1 = Percent change in corn and soybean production from 1968 to 1972.

x_2 = Percent change in land in all pasture from 1968 to 1972.

10. Throughout this report the term "adjacent" refers to those counties or firms which are located on the abandoned rail line and have lost rail service. The term "nearby" refers to those counties or firms in the region that have not experienced the loss of all rail service.

x_3 = Percent change in the index for grain consuming animal units.[11]

Case I. Table 1 gives the production levels and percentage changes from 1968 to 1972 for principal grain and livestock products. In Case I adjacent counties are compared against other counties in the South Central crop reporting district. It is apparent that grain production increased in each group about the same number of percentage points. Grain fed cattle declined more (14.2%) for adjacent counties than for nearby counties (4.1%), and hog numbers increased less for adjacent counties (11.7%) than for nearby counties (22.0%) It is apparent that nearby counties increased their livestock production relative to adjacent counties.[12] The decline in livestock production in counties adjacent to abandoned rail lines is not consistent with the hypothesis that the cash grain market is encouraged by access to low cost (i.e., rail) transportation. As will be discussed later, little feed or grain moved by rail prior to the abandonment. In the Case I region the departure of the railroad did nothing to change the transportation costs and hence the relative advantage of producing grain for domestic livestock feed vs. producing grain for export. The increase in livestock numbers for nearby counties is most likely related to factors other than railroad abandonment.

The conclusion that rail abandonment had little effect on agricultural production at the county level in the Case I region was supported by the results of the regression analysis using township data.

The result of the regression for Case I is as follows (the standard error is in parenthesis below each estimate:)

---

11. The livestock included and the factors used for computing the index of grain consuming animal units are as follows: Hogs marketed, .4088; milk cows over 2 years, 1.1046; beef cows, .085; grain fed cattle marketed, 2.2369; lambs born, .0413; commercial broilers produced, 0.0031; hens and pullets of laying age, 0.0365; turkeys raised, 0.0309. The livestock data were not adjusted for errors in reporting.

12. The nearby counties in Case I tend to represent land patterns that favor livestock production relative to the adjacent counties.

Table 1. Production of Grain and Marketing of Hogs and Grain fed Cattle for Case I and Case II. Data for 1968 and 1972 with Percent Change. 1/

	CASE I						CASE II					
	Adjacent Counties 2/			Nearby Counties 3/			Adjacent Counties 4/			Nearby Counties 5/		
	1968	1972	Percent change	1968	1972	Percent change	1968	1972	Percent change	1968	1972	Percent change
Corn and soybean production (bu. x 1000)	68,938	89,661	+30.1	16,886	22,248	31.8	8,288	11,527	+39.1	43,852	61,174	+39.5
Grain fed cattle marketed (No. x 1000) 6/	162	139	-14.2	28	26	- 4.1	22	22	- 0.4	167	149	-10.3
Hogs marketed (No. x 1000) 6/	1,371	1,531	+11.7	234	285	+22.0	134	144	+ 7.3	655	624	- 4.7

1/ Source: Iowa Annual Farm Census 1968 and 1972 (preliminary), by the Iowa Department of Agriculture, Division of Agricultural Statistics, Des Moines, Iowa.

2/ Includes the counties of Louisa, Washington, Keokuk, Mahaska, Wapello, Jefferson, Henry, and Des Moines. Since the railroad passes through minor portions of each county designation of adjacent and nearby counties is not helpful as it is in Case II where the abandoned line was entirely within one county and nearby counties retained rail service.

3/ Includes the counties of Davis, Lee and Van Buren

4/ In Case II the abandoned rail line was contained entirely within Guthrie County.

5/ Includes the counties of Audubon, Greene, Dallas, and Adair.

6/ Not adjusted for erros in reporting

$$Y = 0.509 + 0.00019\,x_1 - 0.00192\,x_2 + 0.00014\,x_3 \qquad (1)$$
$$(0.318) \quad (0.00139) \quad (0.00282) \quad (0.0020)$$
$$R^2 = .01 \qquad F_{3,62} = .173$$

In Case I it is apparent that the x variables are not strongly associated with the qualititative y dependent variable. With the exception of the intercept variable none of the estimates test significantly different from 0 at the 80% level or above. The low R^2 and F values confirm that the association of Y on x_1, x_2, and x_3 is weak. This weak association suggests that the loss of rail service had little or no impact on the type of agricultural production in the region. This suggestion is consistent with the conclusion obtained above using the county wide data.

Case II. In Case II the conclusion that rail abandonment had no impact on agricultural production does not hold. Returning to Table 1 the increase in grain production was 39.1% for Guthrie County and 39.5% for nearby counties; not a significant difference. Livestock numbers, however, have increased for Guthrie County relative to nearby counties. This increase for adjacent counties is consistent with the hypothesis that livestock production will be increased due to the relative increase in the cost of exporting grain vs. feeding it to local livestock.

The result of the regression model using township data for Case II is as follows:

$$y = -1.780 + 0.00769\,x_1 + 0.00605\,x_2 + 0.00348\,x_3 \qquad (2)$$
$$(0.318) \quad (0.00507) \quad (0.00466) \quad (0.00167)$$
$$R^2 = .30 \qquad F_{3,19} = 2.702$$

This result implies that the loss of rail service was associated with an increase in grain production (significant from 0 at the 90% level), an increase in the number of acres of pasture (significant from 0 at the 80% level), and an increase in livestock production (significant from 0 at the 95% level). In Case II where rail abandonment presumably increased the cost of grain exports relative to its use in other agricultural enterprises there seems to have been a shift away from the export of cash grain to greater domestic livestock production.

Impact on Grain Elevators

The loss of rail service to grain elevators in Case I did not reduce the volume of grain shipped because almost no grain moved by rail prior to 1970. As shown in Table 2 the adjacent firms increased their shipments of grain by 39.4% from 1970 to 1973 compared to 20.5% for nearby firms. The average absolute increase in volume was almost identical, 177,547 bushels for adjacent elevators and 176,820 bushels for nearby elevators. The greater percentage increase results because of the smaller average capacity for adjacent elevators. From 1970 to 1973 adjacent elevators increased storage capacity by 101,250 bushels (31.2% increase) while nearby elevators added 127,538 bushels (28.2% increase). The turnover for all grain increased slightly for adjacent elevators (from 1.405 to 1.489) while it decreased slightly for nearby elevators (from 1.917 to 1.800). In 1970 adjacent elevators had an average of 13.4 net payload tons of truck shipping capacity. This increased by 17.3 tons to 30.7 tons (129.1% increase) in 1973. Of the 17.3 tons of increased capacity 14.8 tons was in larger long haul vehicules (350 bushels or larger). Nearby grain elevators increased truck transport capacity from 29.6 net payload tons in 1970 to 39.2 tons in 1973, an increase of 9.6 tons (29.6%) of which 6.3 tons were of larger long haul trucks.

As might be expected from similar increases in storage capacity and in shipment volume for adjacent and nearby elevators, the expenditures for plant and equipment (Table 3) were also quite similar. Adjacent elevators spent an average of 52,614 dollars since 1970, $50,202 of which was for the expansion of their facilities, and nearby elevators spent an average of $50,361, $45,189 of which was for the expansion of their facilities.

Table 2: Selected Measures of the Operations of and Changes Made in Adjacent and Nearby Firms. 1/

	CASE I: C & NW						CASE II: C, RI & P					
	Adjacent firms 2/			Nearby firms 3/			Adjacent firms 2/			Nearby firms 3/		
	1970	1973	Percent change	1970	1973	Percent change	1968	1973	Percent change	1968	1973	Percent change
Avg. Grain Ship.(bu.)	450,342	627,889	+39.4	861,037	1037,857	+20.5	171,034	231,910	+35.6	347,500	858,330	+147.0
Avg. Feed Sales (tons)	824	1,248	+51.5	1,019	848	-16.8	750	910	+21.3	542	635	+ 17.2
Avg. Fert. Rec. (tons)	2,805	3,194	+13.9	2.123	2,586	+21.8	--	--	-- 4/	400	1,220	+205.0
Storage Capacity												
Grain (bu.) (elevators only)	320,500	421,750	+31.2	449,154	576,692	+28.2	152,500	172,500	+13.1	222,500	352,500	+ 58.4
Feed (tons) (Feed dist. only)	171	195	+14.0	250	258	- 3.1	129	129	+ 0.0	71	88	+ 23.9
Fertilizer (ton)	1,380	1,609	+16.6	1,073	1,491	+39.0	608	592	- 2.6	16	221	+1281.2
Turnover (all grain) 5/	1.405	1.489	+ 6.0	1.917	1.800	- 6.1	1.122	1.344	+19.8	1.562	2.435	55.9
Avg. Truck Cap. (tons net payload)												
Grain	13.4	30.7	+129.1	29.6	39.2	+32.6	00	4.2	+00	11.6	16.0	+ 37.5
Feed	12.3	17.8	+ 44.7	9.6	10.8	+11.8	3.0	5.0	+66.7	00	3.0	+ 00
Fert.	1.5	1.5	+ 0.0	2.8	3.4	+18.3	00	00	+00	00	2.6	+ 00

1/ Preliminary data.
2/ Those firms which lost rail service and which had no alternative service available.
3/ Includes those firms which lost service on the line indicated but had alternative service available through another carrier, and those firms in the region which had rail service.
4/ Data not available.
5/ Includes grain elevators only.

Table 3. Average Capital Expenditures for Expansion or Replacement of Plant and Equipment (excluding vehicules, fertilizer delivery equipment, and office equipment).

	CASE I 2/		CASE II 3/	
	Adjacent	Nearby	Adjacent	Nearby
Grain Total	52,614	50,361	22,218	148,166
Replacement	2,412	5,172	4,750	30,437
Expansion	50,202	45,189	17,468	117,729
Feed Total	18,245	243	4/	4/
Replacement	909	243	4/	4/
Expansion	17,400	0	4/	4/
Fertilizer Total	14,126	8,479	0	11,810
Replacement	1,000	714	0	0
Expansion	13,126	7,764	0	11,810

1/ Expenditures in year y are adjusted according to:

$$PVy = \frac{Iy}{(1+n)}t$$

Where I = Dollar investment in year y
r = .08
t = 73-y

2/ Expenditures summed since January 1, 1970
3/ Expenditures summed since January 1, 1968
4/ Data not available

For Case II grain elevators, however, the loss of rail service appears to have had a significant impact on the volume of shipments. Adjacent firms increased shipments by 35.6% while nearby firms increased shipments by 147.0%. Although rail shipments of grain originating in Guthrie Center and in Monteith (the 2 stations on the line) had declined from 107 cars in 1966 to 56 in 1967 and to only 2 in the first 9 months of 1968, the shippers reported that much of the decrease was due to poor and an inadequate supply of cars.[13] The declining nature of those adjacent grain elevators in Case II is also suggested by their low capital expenditures for plant and equipment as shown in Table 3. Adjacent firms averaged $22,218 on capital investments compared to an average of $148,166 for nearby firms.

Other factors also emphasize the declining nature of adjacent elevators when compared to nearby elevators. Storage capacity for adjacent firms increased by 13.1% compared to an increase of 58.4% for nearby firms. Turnover for all grain increased by 19.8% and by 58.4% for adjacent and nearby firms respectively and truck capacity increased from 0 to 4.2 tons for adjacent elevators compared to an increase from 11.6 tons to 16.0 tons for nearby elevators.

Impact on Feed Distributors

The most common type of feed production in both regions was a grind and mix operation usually combined with sales of complete feeds or feed ingredients. About half of the feed distributors were operated as part of a grain elevator.

Since little or no feed was shipped by rail any effects of abandonment on feed sales would be of a secondary nature. If rail abandonment altered the number of livestock raised and fed on farms this would be reflected in changed feed sales. An increase in livestock production might occur if the loss of rail ser-

---

13. Nearby shippers had the benefit of being capable of shipping in 100 ton covered hopper cars while the adjacent shippers received only box cars. Rates for covered hoppers are usually lower than rates for box cars.

vice resulted in substantially higher costs of grain transportation and hence a lower return to farmers for grain exported from the region relative to grain fed to livestock.

As discussed earlier in the section on Agricultural Production, changes in livestock production in the Case I region did not appear to be related to the rail line abandonment. The increase in feed sales for adjacent feed distributors (51.5%) relative to nearby distributors (a decrease of 16.8%) appears not to have been a result of the abandonment. Increases in feed storage capacity, truck transport capacity for feed, and the level of capital expenditures (Table 3) all parallel the increased feed sales of adjacent firms relative to nearby firms.

In Case II feed sales increased in approximately equal proportions for adjacent as well as for nearby firms. The average absolute increase was 160 tons for adjacent firms and 93 tons for nearby firms. This increase in feed sales for adjacent firms relative to nearby firms agrees with the conclusions discussed earlier that livestock feeding in those areas close to the abandoned rail line has increased. Average feed storage capacity for adjacent firms (129 tons) did not change from 1968 to 1973 but was still larger than the average feed storage capacity for nearby firms (88 tons). Truck transport capacity for both adjacent and nearby distributors was limited. Data on capital expenditures for feed firms was not available.

Although the data is limited[14] the rail abandonment in Case II does appear to have had some impact on livestock production and hence a secondary impact on feed distributors. There was no evidence of a primary impact on transport costs of feed either in Case II or in Case I.

---

14. There were only 2 usable observations for adjacent feed distributors and 2 usable observations for nearby distributors.

In areas outside the corn-belt, however, the primary impact of rail abandonment would likely be large.[15]

In midcorn belt states protein concentrates (usually soybean meal) are produced and processed in nearby locations. Short hauls from farm to processor and back to the farm (or distributor) have favored truck transport over rail transport. In addition, grain and roughage used in feeding livestock are also produced locally, usually on the same farm on which the livestock are fed. The result in this situation is that little transportation services are required and almost no rail transportation is demanded.

In areas where protein concentrates and grain for livestock feeding are not produced locally, a situation favorable to the use of rail transportation will likely exist. For example, the Boston University study of the Rutland Railroad discontinuance[16] indicated that feed distributors suffered substantially higher transport costs because their feed was often shipped considerable distances and, therefore, rail transportation was the favored (least cost) mode of shipment. The implication is that feed distributors located far from their source of supply may be serverly affected by the loss of rail service.

Impact on Fertilizer Distributors

Even though managers of adjacent fertilizer distributor firms often complained about the lack of rail service and how it had increased their costs or impaired their operations, those firms were still able to increase their receipts of fertilizer by 13.9%. Nearby firms, however, increased their receipts by 21.8% in Case I. Although firms who lost rail service were larger (average receipts of 3,194 tons in 1973) than firms with rail service (average receipts of 2,586 tons in 1973) their absolute increase in receipts was smaller (389 tons vs. 463 tons) from 1970

15. The expected secondary impact of rail abandonment on livestock feeding in feed and grain deficit areas would be a reduction in livestock feeding due to relative higher costs of feed.

16. Theodore, C.A., op. cit., p. 66.

Nearby distributors increased their storage capacity (39.0%) relative to adjacent distributors (16.6%). Most of the fertilizer distributors rely on commercial truckers for the transport of their fertilizer product. As a result the truck transport capacity for fertilizer as shown in Table 2 is very small and does not reflect the increased truck transportation requirements due to the railroad abandonment. The average net capacity of all field application equipment increased from 89.2 tons in 1970 to 100.3 tons (12.5%) for adjacent distributors and increased from 89.7 tons to 105.1 tons (18.5%) for nearby distributors.

Data for fertilizer receipts by adjacent firms in the Case II areas was not available. Of 4 adjacent firms retailing fertilizer in 1968 only 2 have retained the fertilizer enterprise and one of these is quite small. Of the 2 firms which discontinued service only one was discontinued as a result of the railroad abandonment.

In Case II nearby fertilizer distributors increased their fertilizer receipts by 205.0% from 1968 to 1973 for a 25% annual increase rate. Fertilizer distributors retaining rail service in Case I had a 6.6% annual increase rate.

As was expected most adjacent fertilizer distributors reported increased transport costs for fertilizer as a result of rail line abandonment. The amount of extra costs incurred is difficult to determine since those firms which lose rail service usually alter their sources of supply. The changes in cost to the firm for fertilizer may be either a change in the product price (or even a change in product) or a change in transport cost. One alternative open to the firm is to have the fertilizer shipped to the nearest rail station and then transferred by truck to the firms' business location. Preliminary analysis of data supplied by two firms[17] showed that transport costs for all fertilizer was more than $1,200

17. The average receipts of the two firms is larger than the average receipts of 2,805 for all firms in Case I. The transport cost does not imply that it is a true cost to the firm. While transport costs increased the product cost at the alternative source of supply may decrease.

per year, per mile distance from a rail station.

Even though much of the fertilizer was shipped by rail in each of the case abandonments, the alternative of barge-truck shipment of fertilizer for firms in Case I mitigated the adverse impact. Distributors in the Case I region indicated that in some circumstances, rather than route inbound rail shipments to nearby rail stations and then transfer by truck to their place of business, they purchased their product from wholesalers located along the river, and which in most instances had received fertilizer in by barge. This arrangement is dependent, of course, on the source of the fertilizer. For example, Potash shipments either from Canada or New Mexico are not available on barge.

Conclusion

In general the rail abandonment had only a minor impact on grain elevators in Case I. There was a tendency for nearby elevators in the western portion of Case I to use rail shipments more extensively than those nearby firms located in the eastern portion. 90 miles from the river most of the grain moved by truck to river terminals (under market conditions as existed in 1970 and 1973). At greater distances from the river the cost advantage of rail rates would limit truck shipments. The impact on grain elevators in Case II was substantial. The impact was most noticable in the relative decrease in grain shipments by adjacent firms compared to nearby firms and by the smaller capital expenditures for adjacent firms.

Fertilizer firms did suffer some reduction in their ability to compete with nearby firms. Although few firms closed, most suffered increased costs and some disruption in operations.

Feed firms did not suffer a substantial impairment of operations in either region due to the localized nature of crop and livestock production. Adjacent feed distributors in Case II appear to have been able to increase feed sales due to increased livestock production in those areas close to the abandoned rail line.

Effects of abandonment will be difficult to generalize, because of the differences in marketing and transportation patterns and in the alternatives available. Additional case study analyses may provide a basis on which to predict the impacts for firms or communities that fit into particular types. Additional research is also needed to identify the causal chain from abandonment, to cost impact, to changes in volume, services, and profits.

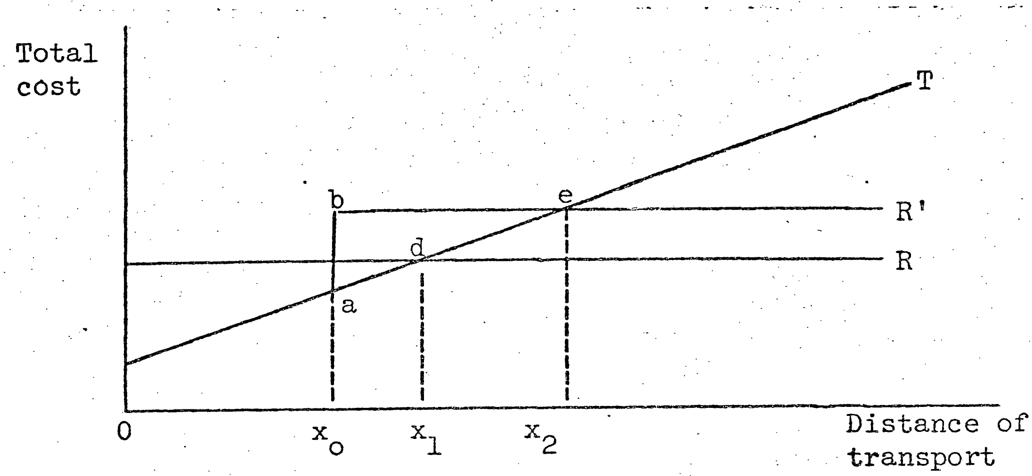
APPENDIX A

Theoretical Transport Cost Adjustments by Shippers Facing Railroad Abandonment

Due to the extensive rail and road network in the United States most shippers have a choice of serveral modes or combination of modes for the transportation of their products. The choice of a carrier mode or combination of modes is a function of several factors including the relative costs, service characteristics, physical characteristics of the products to be transported, and physical characteristics of the carrier mode. In order to simplify the theoretical analysis of mode selection it is assumed that considerations for service and physical characteristics of the product and the carrier can be valued and are included in the cost function. Also for simplicity linear cost functions are assumed.

Figure 1 illustrates the transportation cost functions that might confront a typical country shipper. For the shipper located at 0 the transport cost function is T, and the rail transport cost function is R. In this situation the shipper will use truck transportation for distances of less than x_1 and rail transportation for distances greater than x_1.

Figure 1: Theoretical cost of transporting a given quantity of products by truck, by rail and by combination of truck and rail before and after abandonment assuming constant marginal rates for rail transport.



Suppose that rail service from location 0 to location x is abandoned so that shipper 0 no longer has direct rail service. If shipper 0 still wishes to ship by rail he must ship by truck to a nearby station, x_c, and pay the transfer cost of ab. This he will do for distances greater than x_2 at a cost determined by R'. The function R' includes truck cost to x_o, transfer cost ab, and rail cost beyond x_o. Note that because of the rail abandonment the cost of transportation has increased for all points beyond x_1. The amount of the transport cost increase due to the rail abandonment is determined by the difference between cdR and ceR'. Assuming that the marginal rail cost per unit distance is equal before and after abandonment the magnitude of the cost increase is a function of the transfer cost and the distance the country shipper must travel to a rail loading point.

The loss of a rail line may not necessarily mean higher transportation costs for shippers on that line* The assembly and switching operations necessary to make up a train are normally quite expensive. In some cases trucks may perform the assembly function and then let railroads perform the line haul function. In many cases the decreased rates on line haul operations more than offset increases in costs of using trucks for the assembly functions. Figure 2 illustrates an example of a rail line abandonment that might increase, decrease or have no impact on costs depending on the distance the product is transported. This figure is similar to Figure 1 except that it is assumed that the marginal rate for shipments on R' is less than the marginal rate for shipments on R. This lower marginal rate results because of the increased utilization of resources. Increased utilization of existing resources may be possible because of the greater volume of product concentrated at x_o. Assuming a transfer cost of ab the rail transport function becomes fcR'. At points to the left of x_2 truck shipments would prevail and at

---

* See conclusions from the study by Baumel, C.P., et. al, op. cit., pp. 116-126.

points beyond x_2 rail shipments would prevail. Beyond x_3 total shipment cost would be less after abandonment than before abandonment. Increased or decreased transport costs due to the abandonment are represented by differences between fcR' and fdR. Note the simplifying but not necessary assumption that cost function R is no longer available to the shipper.

Figures 1 and 2 both represent the total cost of transporting a given quantity of product a variable distance (measured on the abscissa). The same analysis will apply to transporting a variable quantity of product (measured on the abscissa) a given distance.

Figure 2: Theoretical cost of transporting a given quantity of product by truck, by rail, and by combination of truck and rail before and after abandonment assuming changing marginal rates for rail transport.