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Place Discrimination in Rail Shipments of Wheat from Great Plains Origins

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PREFACE

The research on which this report was based was contributory to a regional project, Great Plains-10, "Impact of Changes in Transportation on Great Plains Agriculture with Emphasis on Grains and Livestock." Research results are reported in more detail in a Master of Science Thesis prepared by Mr. Mariska under the supervision of Dr. Anderson (19). Partial funding of the Nebraska project was provided by the Wheat Division of the Nebraska Department of Agriculture. Persons too numerous to list have assisted in the planning, research and editing underlying this report. Their help is gratefully acknowledged.

SUMMARY

The purpose of this study was to determine whether shipments of wheat by railroad from Nebraska and other Great Plains States are discriminated against relative to shipments from other wheat producing states and regions. Primary objectives were:

1. To develop a technique for measuring place discrimination.
2. To employ the technique in testing empirical data for evidence of discrimination.
3. To analyze the results and explore implications for geographically-separated wheat shippers.

Ratios of railroad revenue/out-of-pocket costs for the years 1958 and 1966 were used to compare the relative cost burden borne by wheat shipments in geographically-separated hauls. Resulting ratios range in value from less than 1 to more than 5, suggesting widespread economic place discrimination.

The Midwest tends to be discriminated against relative to most other wheat producing areas. Revenue/out-of-pocket cost ratios for wheat shipments within the Western Trunk Line Territory (roughly the Midwest) are among the highest encountered. Moreover, more than one-half of U.S. carload movements of wheat originate in this territory. Discrimination against traffic moving from Western Trunk Line to other territories is of somewhat lesser magnitude, but traffic moving out of this territory is light.

Much of the discrimination appears to be related to intermodal competition or the lack thereof. Longer hauls, for example, tend to be discriminated against relative to shorter hauls; this may be in response to more intensive truck competition for the shorter movements. While Western Trunk Line shippers are generally discriminated against relative to other wheat shippers, movements from this territory toward the Gulf Coast fare rather well. This may be a result of barge competition for Gulf Port shipments. Shipments to the West Coast also receive more favorable treatment. Intermodal competition is less likely to be the causal factor here, however. The railroads may fear a loss of traffic due to an elastic foreign demand for export wheat moving through West Coast ports.

Covered hopper car shipments are generally discriminated against compared to boxcar traffic moving under similar circumstances. Since per-unit freight rates are the same for both car types and since per-unit costs are lower for covered hopper car movements, economic discrimination against shipments moving by hopper car is inevitable. Rates, in other words, have not been

adjusted in response to lower costs for covered hopper car shipments.

Northern Great Plains States are discriminated against relative to other wheat producing states. The discrimination increases as one moves from south to north through the tier of Great Plains States. North Dakota and Montana have the highest revenue/cost ratios of all wheat producing states examined in this study. South Dakota and Nebraska have the next highest ratios. The remaining Great Plains States (Kansas, Oklahoma and Texas) are discriminated against but in much lesser degree. The reason is not clear. Greater distance of the more northerly states to major markets (less truck competition) may be a factor. Improved accessibility of southern states to barge routes may be another.

Intrastate wheat shipments are in general more disadvantaged than interstate movements. The reason is unclear; it may be due to lack of ICC jurisdiction over intrastate traffic.

Western Nebraska shippers tend to be discriminated against relative to those in eastern Nebraska for wheat hauled to major terminal markets at Omaha and Kansas City. A positive linear relationship is found between degree of discrimination and distance to these major markets. Shippers located closer to terminals probably receive the benefit of more truck competition.

Several changes occurred between 1958 and 1966. Ratios for both territorial and state-to-state shipments in boxcars generally declined during the period 1958-1966. It may be that costs increased at a more rapid pace than did freight rates. There was also more variability in revenue/cost ratios in 1958, an indication that there was more discrimination in that year. Covered hopper cars were only beginning to go into service in 1958 and so no comparisons with 1966 hopper-car results were possible.

While the overall level of discrimination was a bit lower in 1966 than in 1958, the same general pattern emerged. Discrimination against Nebraska shipments became somewhat more intense in 1966 than in the earlier year. Generally speaking, though, the same states and regions were discriminated against in each year. Thus, place discrimination tends to be persistent; it appears to be a long-term phenomenon. The potential for long-run misallocation of resources is therefore present.

Place Discrimination in Rail Shipments of Wheat From Great Plains Origins

By

Dale G. Anderson and Brian L. Mariska[1]

INTRODUCTION

The U.S. rail and truck transportation bill for farm products in 1968 was estimated at $4.8 billion (23, pp. 11-12). Shippers of wheat alone paid $235 million for railroad transportation services in 1966 (15, pp. 21-3). Freight rates have increased since 1966 so total transportation charges have no doubt gone up also.[2]

Located in mid-America, Great Plains farmers rely heavily on transportation services as a link with distant centers of consumption and input manufacturing. Farm products, including wheat, tend to be heavy and bulky relative to their value. Transportation charges, therefore, make up a substantial proportion of the products' delivered value. The ability of farmers so located to compete with producers in other regions depends in large measure on relative transportation charges.

This study was undertaken to determine whether there is discrimination in the railroad rate structure for wheat shipped from Great Plains origins as opposed to wheat movements originating in other regions of the United States. Wheat producers in the Great Plains States have frequently contended they are subjected to discriminatory rates. Since railroads have been the traditional carriers of agricultural products, since they continue to be well suited to long-distance movements of bulk commodities, and since they are regulated by public authority so as to conform to public interests, it is particularly appropriate to examine charges of rail rate discrimination.

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[1] Associate Professor and former Research Assistant, Department of Agricultural Economics, Nebraska Agricultural Experiment Station, respectively.

[2] Ex Parte 262, effective November 18, 1969, resulted in a 6 percent blanket increase in grain rates (3, p. 14). Ex Parte 265 became effective June 3, 1970, bringing an additional 6 percent increase. An interim increase of 8 percent has been granted under Ex Parte 267; rates will rise another 7 percent if carrier requests are granted.

Place discrimination, as allegedly practiced by railroads, is a classic example of third degree price discrimination. Buyers of transportation services are segmented into groups having similar demand characteristics. Each group is then charged in relation to willingness to pay. Those buyers whose demand schedules are more elastic pay less than those who have more inelastic demands. In the short run, such discrimination leads to fuller utilization of the railroad firm's fixed investment and thus yields larger revenues. So long as average total costs are covered, the practice may be profitable in the long run as well. Where some rates fail to cover full costs, however, discrimination leads to subsidization of unprofitable traffic, to misallocation of investment funds, and to a reduction in firm revenues. Short-run discriminatory practices, in other words, may lead to long-run cross-subsidization problems. Nevertheless, profit-maximization is the economic rationale underlying the practice.

Place discrimination is a variant of third degree price discrimination wherein purchasers of rail services are segmented into markets on the basis of physical location. Prerequisites for effective discrimination are: a) some degree of monopoly power on the part of the carrier, b) the ability to separate the total market into submarkets of differing demand elasticities and c) prevention of resale of the service. Each of these prerequisites is met to some extent by most railroad firms.

Great Plains farmers are especially vulnerable to rail rate discrimination. Their isolation from centers of manufacturing and product consumption forces heavy reliance on transportation media. Their resource base, especially the relatively inflexible land resource, has proven best suited to the production of the kind of heavy, bulky products which railroads are best equipped to transport. Rail costs per ton-mile are generally substantially lower than truck costs for long-haul shipments of agricultural products. Barge costs are sometimes less than for comparable rail shipments, but the limited number of water routes allows for only limited competition from this mode.

Neither is competition among railroads a mitigating factor. The Reed-Bulwinkle Act of 1948 (29) gave explicit approval to the rate-association method of rate determination and quotation. Price collusion among member firms of each of the associations is practiced under legal sanction.

The Interstate Commerce Act of 1887 (27) brought federal regulation to the rail industry in return for which railroads were exempted from certain antitrust prohibitions against monopoly. Nor does the Act of 1887 or its subsequent amendments forbid dis-

crimination, per se. Although the Act was passed in direct response to widespread complaints of railroad price discrimination, its language regarding discrimination is vague and subject to various interpretations.[3] The Act makes unlawful only "undue preference or prejudice" to persons, localities or traffic. The only explicit prohibition is that against a higher rate for a short haul than for a longer haul of which the short haul is a part.

An amendment to the original law, the Transportation Act of 1940 (28), outlines a national transportation policy which includes a charge to the Interstate Commerce Commission (created by the Act of 1887), to "recognize and preserve the inherent advantages of each mode." The act falls short of specifying cost of service as the rate-making goal, however, and refers only to the illegality of "unjust discriminations, undue preferences, or advantages, or unfair or destructive competitive practices . . ." The Commission has the task of determining what is "unjust," "undue," "unfair" and "destructive." Regulatory authorities have generally given narrow interpretation to the enactments and have taken a permissive, even laudatory, view of discriminatory practices.

It is not contended, therefore, that evidence of discriminatory pricing reported here constitutes illegal conduct on the part of rail carriers. The fact remains, however, that there is much concern over alleged economic discrimination against Great Plains wheat shippers. These shippers are affected directly by rate structures which may favor other producing areas. Long-run implications of discrimination for the overall economy and for the railroads themselves are not generally favorable.[4]

Thus, irrespective of the legality or illegality of discriminatory practices, Great Plains wheat producers in particular, and economic policymakers in general, have need for information documenting the nature and extent of discrimination. The wide latitude given to regulatory authorities by existing statutes should permit closer adherence to principles of economic optima. If the cure cannot be effected under existing law, then new enactments may be in order.

METHOD OF ANALYSIS

Examination of the proposition that economic place discrimination may exist in the rail rate structure for wheat required that attention be given to both cost of service and to the revenue derived from providing that service.

[3] For a legal history of events leading up to and immediately subsequent to passage of the Interstate Commerce Act see Hillman (5).

[4] For further discussion of these broader economic implications, see pp. 38-39.

Since the purpose of this study was to investigate discriminatory practices from an economic rather than a legal standpoint, consideration of railroad costs was crucial to the analysis. In an economic sense, rates can be deemed discriminatory only when they are not cost-justified. Differences in rates (or revenues) are not alone indicative of discrimination. Variations in cost of transportation must be accompanied by commensurate variations in revenues if economic discrimination is to be avoided. Conversely, charging two shippers in different localities the same rate would be discriminatory if costs of serving each were not the same. It was necessary, then, that both cost and revenue data in a form appropriate for geographical comparisons be assembled and that a technique be devised for making such comparisons.

Interstate Commerce Commission waybill and cost data were utilized to construct revenue/cost relationships for specific wheat shipments. Revenue/cost ratios were computed for hauls between major U.S. wheat producing and consuming areas. The ratios were constructed for territory-to-territory, selected state-to-state and selected Nebraska gathering movements. All classes of wheat were grouped together; wheat products were not considered. The magnitude of variation among resulting revenue/cost ratios gives an indication of the overall level of place discrimination. ICC data for 1966 were the latest available and form the comparisons; 1958 data were used to indicate trends.

Data Sources

It was necessary, first, to determine where wheat moves by rail, and how much was shipped from each major producing territory and state to major recipient territories and states. Rail shipping patterns from major Nebraska country and subterminal elevator locations to Omaha and Kansas City terminals were analyzed. Major shipping regions were superimposed upon the major wheat producing areas to ensure that potential as well as existing major rail hauls were included. Scarcity of traffic might, in some instances, be a reflection of elastic demand for rail transport. Adjustments in the rate structure might result in substantial alterations in traffic flows.

Shipping patterns were identified from ICC Waybill data (8, 9, 14 and 15) and Nebraska State Railway Commission records.[5] Wheat production trend data were from USDA estimates (24, pp. 50-1). Origin towns for the Nebraska gathering haul analysis were

[5] Information supplied by Mr. Harry Sundblad, Nebraska State Railway Commission, Lincoln, Nebraska, September 9, 1969.

among the largest towns in each of the 10 major wheat producing counties in western, central and eastern Nebraska.

Revenue and cost data were from published ICC sources (8, 9, 10, 14, 15 and 17). Revenues for Nebraska gathering hauls were estimated from published rates. The commission has, for several years, collected and published *Carload Waybill Statistics* which, for 1966, contains a one-percent sample of carload revenue waybills terminated by railroads for that year. Data in the *Waybill Statistics* are from a sample of audited revenue waybills for carloads terminated by line-haul operating railroads (excludes switching and terminal companies). The sample includes import, export, transit and rebilled traffic. Traffic originating in Mexico and Canada is excluded, however. Samples containing four or less carloads were omitted by the ICC in 1966 but not in 1958. The commission also deleted items containing certain multiple carload shipments in order to correct for sampling variability (6, pp. 15-8).

The commission's mileage block data (14) describe the distribution of territorial carload traffic by blocks of miles (Table 1). The mileage block distribution portrays variations in revenue characteristics of carload traffic as related to length of short-line

Table 1. Railroad territorial mileage blocks and associated ranges in miles, United States, 1958 and 1966.

Mileage block	Range (from)	Range (to)	Mileage block	Range (from)	Range (to)
0	0	24.4	600	599.5	699.4
25	24.5	49.4	700	699.5	799.4
50	49.5	74.4	800	799.5	899.4
75	74.5	99.4	900	899.5	999.4
100	99.5	149.4	1000	999.5	1199.4
150	149.5	199.4	1200	1199.5	1399.4
200	199.5	249.4	1400	1399.5	1599.4
250	249.5	299.4	1600	1599.5	1799.4
300	299.5	349.4	1800	1799.5	1999.4
350	349.5	399.4	2000	1999.5	2499.4
400	399.5	449.4	2500	2499.5	2999.4
450	449.5	499.4	3000	2999.5 and over	
500	499.5	599.4			

Source: (14, p. ii).

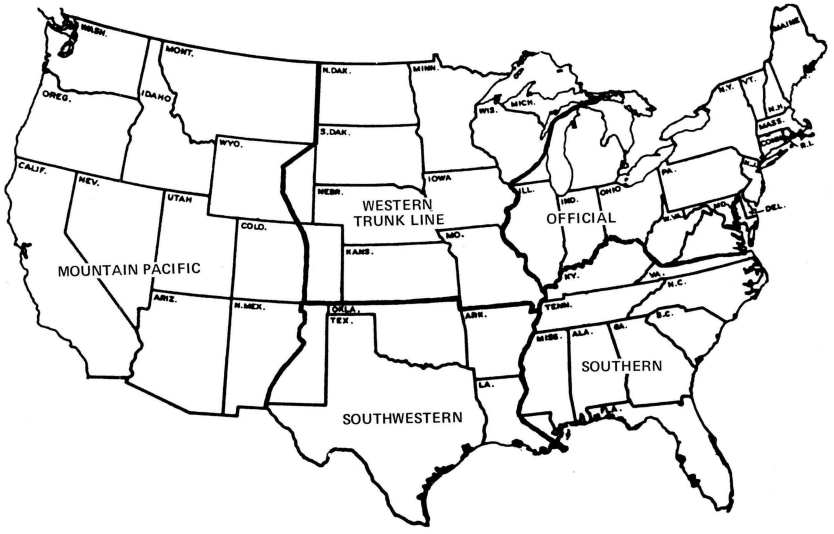

Figure 1. Rail carload revenue territories, United States, 1966. Source: (14, cover p.).

haul, commodity, territory, and whether based on an intrastate or interstate commodity rate. The commodity classification (wheat is 01137) is based on the Standard Industrial Classification used in the *1963 Census of Transportation.* Traffic is classified

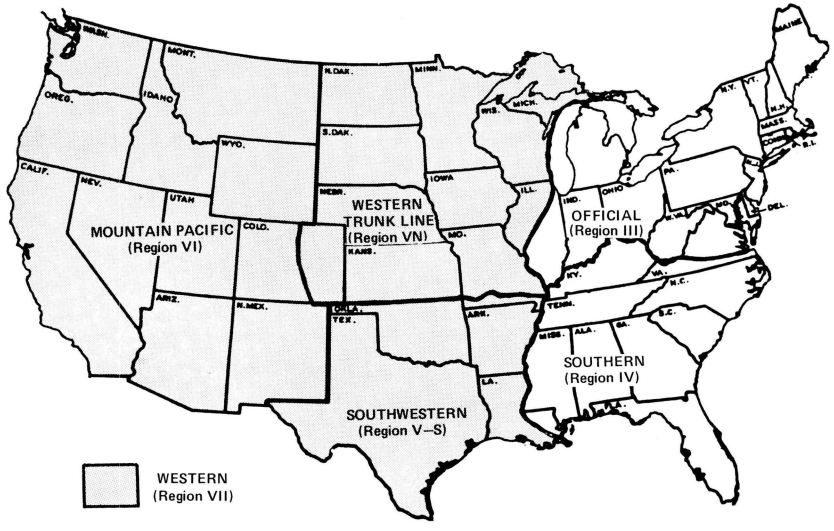

Figure 2. Rail carload cost regions, United States, 1966. Source: (17, cover p.).

within each commodity category as either intra- or interterritorial, and within these categories as either traffic moving under intrastate or interstate commodity rates.

Rail revenue and costs are reported to the commission on territorial and regional bases, respectively. Revenues and commodity movements are further broken down on a state-to-state basis. Revenue (Figure 1) and cost (Figure 2) reporting boundaries generally coincide. The slight differences which do occur were of no major consequence to this study. Approximate relationships between territories and regions along with official abbreviations for each are in Table 2. Regions I and II were omitted because combined they make up Region III. Since relatively little wheat moves into this Region, the combined Region III costs were used in this analysis.

Until recent years, the area generally west of the Mississippi River was known as the Western Territory (Region VII). What is now the WTL, SW and MTP formerly comprised the entire Western Territory. ICC Cost Scales for 1966 (17) aggregate the area roughly comprising the WTL and SW Revenue Territories for costing purposes. Cost data for Region V do not include traffic moving from Region V to Region VI. These latter outlays are reported as part of Region VI costs. Thus, Region VI cost data include values for intraterritorial shipments plus traffic moving to and from Region V. Since costs are reported to the ICC on a railroad basis and since some of the same railroads operate in both Regions V and VI, it was not possible to disaggregate the results more completely. Region V cost data were, therefore, uti-

Table 2. Railroad revenue territories and abbreviations, with associated cost regions, United States, 1966.

Revenue territory	Abbreviation	Cost region
Official	OFF	Region III
Southern	SOU	Region IV
Western Trunk Line	WTL	Northern Portion of Region V
Southwestern	SW	Southern Portion of Region V
Mountain Pacific	MTP	Region VI
Western	WEST	Region VII

Source: (17, pp. 1-3)

lized in comparison with both WTL and SW Territorial revenues; Region VI cost data were compared with revenues for MTP Territory.

Some annual Cost Scales, as in 1958 (10), contain information for only Region III, Region IV and Region VII. Official Territory in 1958 was further subdivided into the Eastern and Pocahontas Territories.

Waybill statistics for traffic and revenue on an intra- and interstate basis for certain commodity movements are also available (15). The data are in a form very similar to the territorial arrays, except that no mileage block intervals are available.

Although numerous states ship wheat, only the leading shipping and producing states were included in the present analysis. States selected, on the basis of total production and number of carloads of wheat orginated, are designated in Table 3. Shipments from selected states account for 87 percent of total U.S. movements. These states produce 78 percent of total U.S. wheat output.

Table 3. Wheat production and rail car loadings of wheat[a], selected states[b] United States, 1966.

State	Carloads shipped (number)	Total production (1,000 bu.)
Kansas	143,300	200,070
North Dakota	77,600	153,926
Nebraska	49,600	101,185
Texas	42,300	72,652
Oklahoma	39,700	98,700
Minnesota	39,400	18,318
Missouri	35,400	41,140
Montana	31,300	99,694
Washington	24,100	90,243
South Dakota	19,400	39,296
Colorado	11,800	46,332
Illinois	11,100	61,008
Total, selected states	525,000	1,022,564
Total, United States	606,800	1,311,702

[a]Based on a 1 percent sample of carload waybill originations.
[b]Selection based on rank in production and shipments.
Source: (15, pp. 21-3 and 21, p. 55).

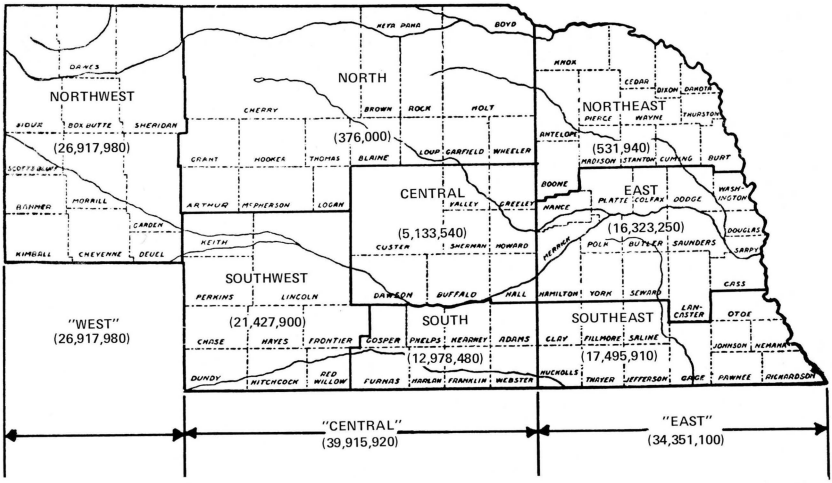

Figure 3. Wheat production bushels by crop reporting district and major area, Nebraska, 1966. Source: (24, pp. 50-1).

Nebraska wheat shipping origins were selected for an analysis of discriminatory rate tendencies for shipments to Omaha and Kansas City terminals. Nebraska was divided into "western," "central" and "eastern" areas. Boundaries were drawn along crop reporting district lines so that there was a substantial amount of production in each area (Figure 3). Within each area the larger towns having railroad service in each of the producing counties were selected as shipping origins.

Revenue Calculations

Average revenue data were from ICC publications and railroad tariffs. The data reflect revenue from line-haul freight moving on a commodity rate basis as reported on the waybills for territorial and state-to-state shipments.

Territorial revenue distributed by mileage blocks was published, for 1958 and 1966, in cents per hundredweight (8, pp. 1-4; and 14, pp. 6-8), the same units employed in the ratio comparisons. Revenue data are available on a commodity basis for intrastate as well as interstate territorial movements. In the case of territorial shipments involving intrastate and state-to-state movements, it is necessary to weight the results on the basis of the number of intrastate vs. the number of interstate carloads moving over each mileage block.

State-to-state revenue data are also available in cents per hundredweight (9, pp. 17-21; and 15, pp. 21-3). Average revenue data are published for specific intra- and interstate movements; no

Table 4. Rail freight rates for wheat, box and covered hopper cars, and associated distances from selected Nebraska origins to Omaha and Kansas City, 1966.

Area	Origin	Destinations			
		Omaha		Kansas City	
		Rate (¢/cwt.)	Distance (miles)	Rate (¢/cwt.)	Distance (miles)
Western	Sidney	44	405	44	521
	Kimball	44	442	44	558
	Hemingford	37	436	51	591
	Chappell	38½	377	40½	494
	Oshkosh	36	369	50	485
	Rushville	38	410	52	606
	Chadron	41	442	55	637
	Bridgeport	40½	453	54½	609
	Gering	41½	444	55½	560
Central	Grant	35	350	38½	497
	Ogallala	36	332	38½	448
	Hastings	20½	151	23½	261
	Imperial	36	343	40	475
	Culbertson	29½	294	33½	426
	Minden	23½	183	27½	331
	Curtis	29	278	33	426
	North Platte	28	281	36	398
	Hamlet	34½	319	38½	451
	Holdrege	24	206	28	353
Eastern	Lincoln	12	55	19	210
	Beatrice	14½	122	18½	183
	Geneva	16½	117	22	256
	Clay Center	20½	136	24½	283
	Friend	14½	92	20½	246
	Seward	12	80	20½	236
	Hebron	17½	140	21½	254
	York	14½	106	24	262
	Aurora	16½	128	25½	283
	Fairbury	16½	116	20½	185

Source: Rates and distances supplied by Mr. Harry Sundblad, Nebraska State Railway Commission, Lincoln, Nebraska, September 9, 1969. Rates include Ex Parte 223-A increases. Distances are via the most direct route of railroad travel and are rounded to the nearest mile.

aggregating or weighting procedure is needed since results were analyzed on a state-by-state basis.

Since the ICC publishes no revenue data describing specific hauls within particular states, another source was needed for the Nebraska gathering haul analysis. Rates for the year 1966 were obtained from the Nebraska State Railway Commission for wheat shipments to Omaha and Kansas City from selected Nebraska towns. It was possible to substitute actual rates for the revenue portion of the revenue/cost ratios since revenue is nothing more

than line-haul freight charges (rate times quantity shipped). Rates for 1958 were obtained by adjusting 1966 rates, using rail grain-rate conversion charts to correct for 1958-66 rate changes.[6] Although there are exceptions to the ex parte rate changes, they are relatively few and should not introduce significant error.[7] Rates and distances to Omaha and Kansas City from selected Nebraska origins for 1966 are shown in Table 4.

Cost Calculations

Many variables contribute to railroad costs, not all of which are easy to isolate. Major factors affecting the cost of providing rail freight service include the following (a given level of factor prices is assumed):

1. Size of equipment.
2. Length of haul.
3. Type of equipment.
4. Back haulage of empty cars.
5. Density of the commodities transported.
6. Susceptibility to loss and damage.
7. Special services provided.
8. Operating conditions.
9. Regularity of movement (14, pp. 60-1).

Costing studies, initiated by the ICC to make its regulatory function more manageable, are widely used by carriers and shippers as well as by the commission (9, pp. 274-6). Annual reports by each Class I railroad[8] are compiled according to detailed costing instructions and filed with the commission (17, p. 1). Data from these reports are summarized according to procedures outlined in ICC Rail Form A (13). These formulas were used to aggregate the out-of-pocket costs used in the present study. While such costs are an imperfect approximation of long-run marginal costs of transportation, they are sufficiently accurate for the present analysis (2, p. 61; and 25, p. 410). Since only relative comparisons of revenue/cost relationships were made, the magnitude of the costs is of little consequence. It is only essential that esti-

[6]Computed from a grain-rate conversion table for traffic managers, prepared by Mr. Gordon L. Ganka for the Transportation Department, Board of Trade of the City of Chicago.

[7] Verified by rate experts at the Nebraska State Railway Commission.

[8] Class I railroads are defined as railroads having annual operating revenues in excess of $5 million. Although the carload waybill statistics (used for revenue data) include all railroads having $3 million or more average operating revenues over a three-year period, comparisons should not introduce significant error.

mated cost levels, among the several territories being compared, bear the correct relative relationships toward each other.

Out-of-pockets costs are those costs ". . . which can be directly assigned to any given product or service and include direct costs for labor, material, equipment, supervision, interest, etc., incurred solely as a result of the production of the given product or service." (12, p. 2). These directly assignable expenses include those costs which could have been avoided if the service had not been rendered. Out-of-pocket costs comprise not only specific measurable costs such as platform labor required for small packages but include also a part of the common expenses, such as track wear, which vary directly with units of output. The ICC defines out-of-pocket costs as 80 percent of freight operating expenses, rents and taxes (excluding federal income taxes) plus a return of 4 percent after federal income taxes on 50 percent of the road property and on 100 percent of the equipment used in freight service (17, p. 4).

The rather arbitrary 4 percent return is intended to approximate the long-run average return realized by the carriers. Presumably, out-of-pocket costs represent long-run incremental (marginal) costs of transporting most commodities under average train operations, average switching conditions, average weight of load, average length of haul, average type of equipment, and the average empty-return ratio for the particular equipment for each region. Out-of-pocket costs are disaggregated for each year's operations for each region, for various loads, for different car types and by short-line mileage. For an explanation of procedures used in computing out-of-pocket costs see ICC Statement 6-63 (13, pp. 17-8).

Railroad carriers' operating costs are made up of terminal costs and line-haul costs. Terminal costs for a particular shipment include expenses of such operations as loading, billing and pickup. These costs do not vary with distance. Line-haul costs are incurred for variable items such as fuel and wages and vary directly with distance hauled.

The "cost scale" data used in this study are based on calculations of terminal and line-haul expenses. Although the cost scales are pre-calculated for 1966 and 1958, adjustments must be made to reflect conditions for particular hauls. An explanation of the derivation of these costs is found in Appendix A.

Ratio Calculations

Ratios of revenue/out-of-pocket costs are developed from revenue and cost data. Separate ratios have been calculated for

shipments moving in 100-ton covered hopper cars and in 60-ton common boxcars; these sizes are used most commonly for wheat shipments.[9] Hopper cars move, on the average, 95 percent filled; boxcars are loaded, on the average, to 83 percent capacity.[10] Thus, a 100-ton covered hopper car carries a pay load of 95 tons, a 60-ton boxcar only a 50-ton load.

Construction of the ratios is best explained by a sample calculation. The example which follows is for wheat shipments under commodity rates, in a 60-ton common boxcar, from WTL to OFF for the mileage block starting with 1000 miles (1000 to 1200 miles), for the year 1966:

1. **Revenue**—Revenue is 46.1¢/cwt. (from *Waybill Statistics*) (14, p. 6). Type of car is of no consequence since the value is reduced to a hundredweight basis.

2. **Out-of-pocket costs**—These costs are reported on a ¢/cwt. basis for common boxcars and other car types (17, pp. 31 and 53). The average short-line haul for wheat in 1966 from WTL to OFF was 1140 miles (14, p. 6).

Since cost data are provided only for 1000 and for 1250 short-line miles, an interpolation is necessary. It is assumed that linearity exists between the short-line-mile data and the territorial costs associated with these short-line miles. The out-of-pocket cost for the OFF part of the movement for 1000 miles is 39.2¢/cwt.; that for 1250 miles is 47.1¢/cwt. Interpolating the OFF movement data gives a cost of 43.6¢/cwt. for a shipment of 1140 miles. Interpolation for the WTL part of the haul yields a cost of 38.4¢/cwt.

Since this traffic is interterritorial, a procedure is needed to adapt the ICC's intraterritorial costs for these movements. Costs for interterritorial shipments have been weighted on a 100:0, 0:100, 75:25, 25:75 or 50:50 basis, depending on proportion of the haul in each territory. Weights are assigned based on number of carloads moved from state to state. WTL-to-OFF movements for the sample include the following state movements (15, pp. 21-3):

State-to-State	*Carloads Shipped*
Illinois to Illinois	59
Illinois to Indiana	5
Illinois to New York	13
Iowa to Maryland	7

[9] Telephone interviews with employees of Far-Mar-Co., Inc., and the Nebraska State Railway Commission, during the summer of 1969.

[10] *Ibid.*, and (1, pp. 50 and 66). The latter source reports a national average rate of boxcar utilization for all commodities of 82 percent in 1966. No data were available for covered hopper cars.

Kansas to Illinois	18
Minnesota to Illinois	10
Minnesota to Maryland	65
Minnesota to New York	14
Minnesota to Pennsylvania	17
Minnesota to Virginia	27
Missouri to Illinois	11
Missouri to Indiana	8
North Dakota to Maryland	8
North Dakota to New York	9
North Dakota to Virginia	6
Wisconsin to Virginia	12

Inspection of these data indicates that about one-half of the inter-territorial shipments move within WTL Territory, the other half within OFF. A 50:50 territorial allocation of costs has, therefore, been selected. Results of weighting by carloads for 1140 miles:

.50 x 43.6¢/cwt. = 21.8¢/cwt.
.50 x 38.4¢/cwt. = 19.2¢/cwt.
Weighted costs = 41.0¢/cwt.

3. **Ratio of revenue/out-of-pocket costs—**

Revenue = 46.1¢/cwt.
Out-of-pocket costs = 41.0¢/cwt.
Ratio = 46.1/41.0 = 1.1

Similar ratio calculations can be made for any movement using the appropriate cost and revenue (or rate) data. When constructing ratios on a state-to-state or town-to-terminal basis, it is assumed that costs for the state-to-state or town-to-terminal movements are substantially the same as costs for the region in which movements occur. No ICC cost data are available on other than a territorial basis.

Ratios for covered hopper cars have not been calculated for 1958. Only 0.6 percent of all carloads of wheat in the United States moved by covered hopper car in that year, while 14 percent of all carloads of wheat was shipped by covered hopper car in 1966 (11, p. 2; and 16, p. 1). Ratios for common boxcars are calculated for both 1958 and 1966.

Significance Tests

The ICC's "coefficient of variation" accuracy test for the one-percent waybill samples (territorial and state movements) is employed to determine the significance of computed ratios. Simple linear regression analysis is used to test significance of the relationship between ratios and distances from Nebraska towns to major terminals.

According to the commission, the one-percent sample results in an estimate which is ordinarily quite reliable. A testing procedure is nevertheless suggested. "Approximate coefficients of variation for aggregate amounts (as number of carloads) may be estimated by taking the reciprocal of the square root of the number of cars reported in any category or cell of the sample." (6. p. 22). The test applies only to the waybill statistics. Since costs are based on actual railroad cost records, no significance test is required. The $1/\sqrt{n}$ "coefficient of variation" test can thus be applied to either the ratios or to the revenue data. The result is a "confidence range" for each ratio (Appendix B).

The nature of the coefficient of variation is such that as number of carloads sampled increases, greater reliability can be placed in the results. Conversely, with smaller sample sizes, reduced accuracy of results must be expected. For example, if the number of carloads (n) is 25, the coefficient of variation ($1/\sqrt{n}$) = 20 percent. If the ratio tested = 2.0, the confidence range would extend from 20 percent less than 2.0 to 20 percent greater than 2.0, or from 1.6 to 2.4. When comparing ratios for evidence of discrimination, it is assumed that ratios having overlapping ranges are not significantly different from each other and that the existence of discrimination is not established.

Linear regression is used to test the relationship between ratios of rates to out-of-pocket costs and distance for shipments from Nebraska towns to major terminals. Ratio values are established as the dependent variable; short-line distance from point of origin to the terminal market is the independent variable. The lowest correlation coefficient of the six regressions is 0.71, indicating a rather close linear relationship between the two variables. A signifcant positive linear relationship is found for both car types and for hauls to both Omaha and Kansas City. Using a standard t-test, all regression coefficients are significant at the 99.5-percent level. The R^2 values, which indicate the proportion of variation of the dependent variable which is explained by the independent variable, range from 0.51 to 0.78.

RESULTS

Territorial Shipping Patterns

An estimated 397,400 carloads of wheat were transported by U.S. railroads in 1966. According to waybill samples drawn by the ICC, 92 percent of these cars do not cross railroad territorial boundaries (see Figure 4 for more detail). Over 50 percent of the total shipments moved within WTL Territory. Cars of wheat moving

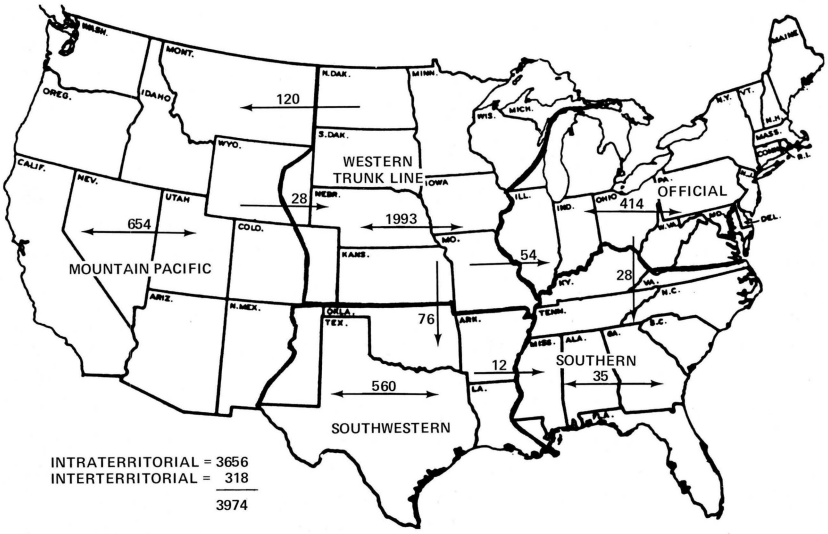

Figure 4. One percent sample[a] of rail carload shipments of wheat, by railroad territory, United States, 1966. Source: (14, pp. 6-8).
[a]Data shown represent only one percent of estimated total shipments.

within MTP, SW and OFF Territories accounted for 41 percent of all shipments. SOU Territory had the fewest wheat shipments, less than one percent of the total, which is not surprising since the southern states are not major wheat producers.

It should be emphasized that rate structures constitute one factor that may shape these shipping patterns. Elimination of hypothesized discrimination might alter the pattern.

Revenue/Cost Comparisons

Ratios of rail revenue/out-of-pocket costs have been calculated for selected territory-to-territory, state-to-state and town-to-terminal shipments of wheat in common box and covered hopper cars. In the absence of discrimination, these ratios should be identical. Conversely, degree of variation in ratio values is a measure of degree of discrimination; the higher the ratio, the greater the discrimination against the haul in question.

Due to sampling problems discussed previously, some of the tabulated results must be regarded as insignificant (see Appendix B). Unless otherwise indicated, however, all comparisons discussed in this section reflect significant differences which in turn are evidence of place discrimination. Differences in ratio values always indicate discrimination as between sample comparisons, but area (state and territory) generalizations must hinge on re-

sults of significance tests. A comparison of these ratios with each other, with weighted U.S. ratios, and with weighted state and territorial ratios reveals definite geographic patterns in rate/cost relationships.

All weightings are on the basis of number of carloads shipped, which gives an indication of the overall degree to which a state or region may be advantaged or discriminated against. Results are for the calendar year 1966. Comparisons with an earlier year, 1958, reveal important trends and are summarized in a later section (see pp. 35-37).

Territorial Shipments: Common Boxcars

Territorial ratios for 1966 vary considerably; values ranging from 0.8 to 3.3 have been encountered. The entire range of results is found in Table 5.

In general, ratios for intraterritorial hauls are lower for the very short and the very long mileage blocks than for blocks of intermediate distance.[11] WTL-to-WTL is an important exception; here, ratios generally increase with distance over the entire mileage range, indicating discrimination against the longer-haul shipments within the region.

Trends in interterritorial ratios are more difficult to discern. Ratios for several interterritorial shipments tend generally to decline with increased distance. This is the case with WTL-to-SW, WTL-to-OFF, WTL-to-MTP and MTP-to-WTL shipments. Here the discrimination is lodged against the shorter-haul shippers.

Certain mileage blocks in each of several territories have ratios either significantly greater or lower than the weighted territorial ratio of which they are a part. Mileage blocks for MTP-to-MTP, starting with 600, 700 and 800 miles, have ratios (2.4, 2.1 and 2.0) significantly higher than the weighted ratio of 1.5. Movements over these blocks are thus discriminated against relative to both longer and shorter hauls within MTP. The opposite situation exists for OFF-to-OFF movements for mileage blocks starting with 400, 600 and 700 miles; ratios here are lower than the weighted ratio. The situation is a bit different for SW-to-SW movements where mileage blocks starting with 150 and 200 have ratios which are significantly above the weighted ratio.

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[11] Ratios for adjacent mileage blocks are frequently not significantly different from each other. More-widely-separated blocks are more likely to have significantly different ratios. It is generally safer to make comparisons between blocks at opposite ends of the distance scale.

Table 5. Revenue/out-of-pocket cost ratios, wheat shipments in 60-ton common boxcars, all territories, United States, 1966.

Origin & destination[b]	Mileage block, starting with																						Weighted ratio[a]
	1	25	50	75	100	150	200	250	300	350	400	450	500	600	700	800	900	1000	1200	1400	1600	1800	2000	
MTP to MTP	1.6	1.7	1.5	2.4	1.4	1.6	1.6	1.3	1.3	1.4	1.4	1.7	1.8	2.4	2.1	2.0	1.9	2.0	1.6	1.1	....	....	....	1.5
MTP to WTL	....	....	....	....	....	....	....	....	....	....	....	....	....	2.4	2.2	....	1.9	....	....	....	....	....	....	2.1
OFF to OFF	1.4	2.0	1.9	2.1	2.2	2.0	2.3	2.4	1.8	1.9	0.9	....	1.4	1.0	0.8	....	....	....	....	....	....	....	....	2.0
OFF to SOU	....	....	....	....	....	....	....	....	....	....	....	0.9	....	....	0.9	....	....	....	....	....	....	....	....	0.9
SOU to SOU	....	....	....	....	....	....	....	1.1	....	0.9	....	0.9	1.0	....	....	....	....	....	....	....	....	....	....	1.0
SW to SOU	....	....	....	....	....	....	....	....	....	....	....	....	1.0	....	....	....	1.4	....	....	....	....	....	....	1.2
SW to SW	1.7	1.7	2.0	2.2	2.4	3.3	3.1	2.8	2.9	2.7	2.4	1.8	1.6	1.7	1.4	1.3	1.5	....	....	....	....	....	....	2.2
																							All non-WTL origins (weighted ave.)	1.8
WTL to MTP	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.7	1.4	1.3	1.3	....	1.4
WTL to OFF	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.2	....	....	1.1	1.0	....	....	....	....	1.1
WTL to SW	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.3	1.5	1.5	1.0	....	....	....	....	1.3
WTL to WTL	1.7	1.6	1.7	1.9	1.9	2.1	2.1	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4	....	....	....	....	....	....	....	....	2.1
																							WTL origins (weighted ave.)	2.0
																							U.S. wheat shipments (weighted ave.)	1.9

[a]Weighted by number of carloads shipped for each mileage block.
[b]Key to territorial abbreviations: MTP—Mountain Pacific, OFF—Official, SOU—Southern, SW—Southwestern, WTL—Western Trunk Line.
Source: (14, pp. 6-8; and 17 pp. 9-84).

WTL-to-WTL mileage blocks of 25, 50 and 100 miles have ratios significantly lower than the weighted ratio for all WTL-to-WTL movements.

Weighted ratios, combining all mileage blocks for each territorial movement, show considerable variability, ranging in value from 0.9 for OFF-to-SOU shipments to 2.2 for SW-to-SW shipments. WTL-to-WTL has one of the higher ratios, indicating that Midwestern wheat shippers are in a relatively unfavorable position. Although OFF-to-OFF and SW-to-SW have comparatively high weighted ratios (2.0 and 2.2), traffic there is much lighter than for WTL-to-WTL movements (see Figure 4). From the standpoint of weighted ratios, the SOU-to-SOU, MTP-to-MTP, OFF-to-SOU, WTL-to-OFF, WTL-to-SW, WTL-to-MTP and SW-to-SOU territorial shipments tend to be in a more favorable position than do the OFF-to-OFF, SW-to-SW, WTL-to-WTL and MTP-to-WTL.

One measure of discrimination against WTL Territory is the weighted ratio of WTL wheat shipments to all other regions including itself (2.0) compared with the weighted ratio for all U.S. shipments (1.9). Since WTL shipments constitute a substantial proportion (50 percent) of total U.S. movements, it may be more meaningful to compare the WTL ratio with that for all non-WTL movements (1.8). Discrimination against WTL origins is evident from either measure.

Figure 5 is an illustration of relationships among weighted territorial ratios compared to their simple average (no weighting

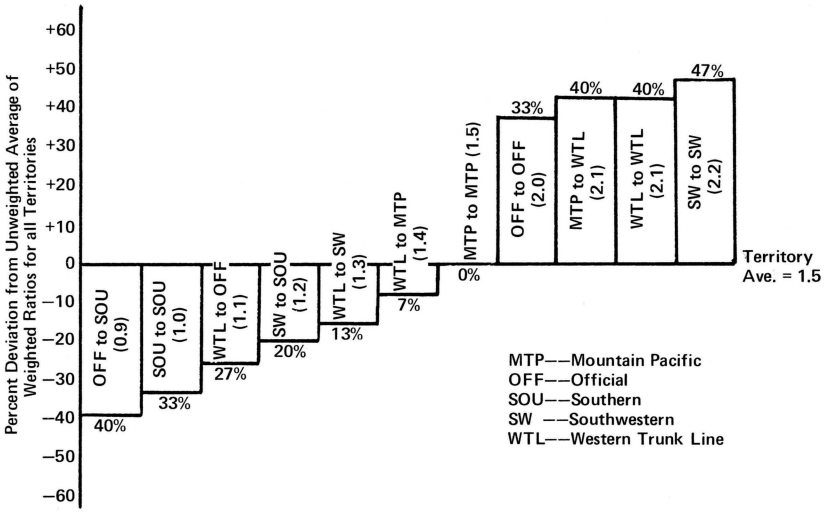

Figure 5. Territorial weighted revenue/out-of-pocket cost ratios as a percentage of the average (unweighted) ratio for all territorial shipments, 60-ton common boxcars, all territories, United States, 1966. Source: Table 5.

as between territorial movements) for all territorial wheat shipments in 60-ton common boxcars. Comparison with this simple average of all territorial ratios does not reveal the total actual impact of discrimination upon each territory; it does, however, measure the potential effect of ratio differentials. It is possible, in other words, that traffic moving from a territory which has a relatively high ratio is light compared with traffic moving from another territory. It is likely that the two variables, traffic and ratio size, are not independent. It may be that traffic is light precisely because rates (and ratios) are high. Thus, it is useful to consider relative ratio values in isolation of traffic flows.

The percentages above or below the mean are a measure of the degree of inequality and the extent of economic discrimination. It is immediately apparent that there is wide deviation from this overall average ratio. Shipments moving within Western Trunk Line Territory are discriminated against relative to those moving within and between most other territories. Shipments moving out of WTL to OFF, SW and MTP Territories fare much better, however, better even than the average of all territories.

WTL-to-WTL shipments, with a weighted ratio 40 percent above the mean of all ratios, are discriminated against in an overall sense. Other territorial hauls having weighted ratios significantly greater than the mean are OFF-to-OFF (33 percent), MTP-to-WTL (40 percent) and SW-to-SW (40 percent). OFF-to-SOU shipments receive the most favorable treatment; their ratio is 40 percent below the mean of all territorial ratios.

Territorial Shipments: Covered Hopper Cars

Patterns in covered hopper car ratios tend to parallel those previously reported for common boxcars. However, since revenues are the same for both car types (rates, except for multiple car or trainload shipments, do not vary by type of car), and since costs are usually lower for covered hopper car shipments, hopper car ratios tend to be higher than those for common boxcars for similar movements. Detailed results by mileage blocks are in Table 6.

Illustrated in Figure 6 is the relationship of territorial weighted ratios to the unweighted mean of the weighted ratios for all territorial wheat shipments in 100-ton covered hopper cars. The percentages above or below the average are an indication of the extent (as opposed to the economic impact) of place discrimination. WTL-to-WTL shipments have a weighted ratio 42 percent above the average for all territories and thus suffer discrimination. OFF-to-OFF and SW-to-SW shipments, with ratios 47 and 58 percent

Table 6. Revenue/out-of-pocket cost ratios, wheat shipments in 100-ton covered hopper cars, all territories, United States, 1966.

Origin & destination[b]	Mileage block, starting with																							Weighted ratio[a]
	1	25	50	75	100	150	200	250	300	350	400	450	500	600	700	800	900	1000	1200	1400	1600	1800	2000	
MTP to MTP	2.9	2.9	2.4	3.1	2.2	2.4	2.2	1.8	1.8	1.9	1.9	2.3	2.4	3.1	2.7	2.6	2.4	2.5	1.9	1.3	....	....	....	2.2
MTP to WTL	....	....	....	....	....	....	....	....	....	....	....	....	....	2.9	2.5	....	2.6	....	....	....	....	....	....	1.9
OFF to OFF	2.6	3.4	3.0	3.3	3.3	3.0	3.2	3.4	2.5	2.6	1.3	....	1.8	1.3	1.0	....	....	....	....	....	....	....	....	2.8
OFF to SOU	....	....	....	....	....	....	....	....	....	....	....	1.1	....	....	1.1	....	....	....	....	....	....	....	....	1.1
SOU to SOU	....	....	....	....	....	....	....	1.5	....	1.2	....	1.2	1.3	....	....	....	....	....	....	....	....	....	....	1.3
SW to SOU	....	....	....	....	....	....	....	....	....	....	....	....	1.3	....	....	....	1.9	....	....	....	....	....	....	1.6
SW to SW	3.0	2.9	3.2	3.4	3.7	4.3	4.3	3.8	3.9	3.6	3.1	2.3	2.1	2.1	1.7	1.6	1.8	....	....	....	....	....	....	3.0
																							All non-WTL origins (weighted ave.)	2.6
WTL to MTP	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.1	1.8	1.6	1.5	....	1.8
WTL to OFF	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.6	....	....	1.4	1.2	....	....	....	....	1.4
WTL to SW	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	2.8	1.8	1.8	1.3	....	....	....	....	1.6
WTL to WTL	2.9	2.7	2.8	2.9	2.9	3.0	3.0	2.8	2.7	2.8	2.9	2.9	3.0	2.9	3.0	....	....	....	....	....	....	....	....	2.8
																							WTL origins (weighted ave.)	2.7
																							U.S. wheat shipments (weighted ave.)	2.6

[a]Weighted by number of carloads shipped for each mileage block.
[b]Key to territorial abbreviations: MTP—Mountain Pacific, OFF—Official, SOU—Southern, SW—Southwestern, WTL—Western Trunk Line.
Source: (14, pp. 6-8; and 17, pp. 9-84).

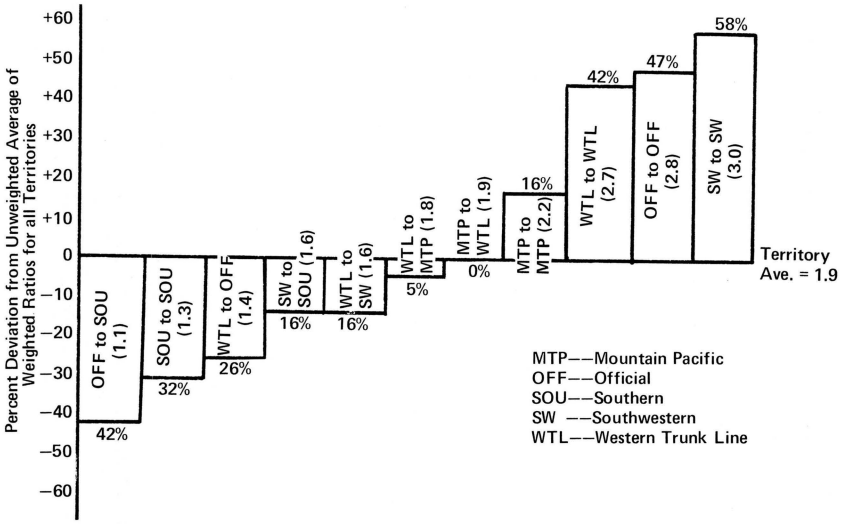

Figure 6. Territorial weighted revenue/out-of-pocket cost ratios as a percentage of the average (unweighted) ratio for all territorial shipments, 100-ton covered hopper cars, all territories, United States, 1966. Source: Table 6.

above the mean, are most disadvantaged. Movements from OFF to SOU fare best, with a ratio 42 percent below the mean. Ratios for shipments from SOU to SOU, WTL to OFF, SW to SOU and WTL to SW are all lower than the simple average of all territorial movements, indicating shippers utilizing these hauls are in a relatively favorable position.

State-to-State Shipments: Common Boxcars

Analysis of state-to-state wheat movements and associated revenue/cost ratios provides more detail than do the territorial comparisons. Results from the territorial analysis can be tested as well as amplified by using a more disaggregated approach. Table 7 provides this additional detail. Specific state-to-state results are discussed first, in order of state rank in wheat production and quantity shipped.

Ratios for Kansas-to-Colorado (2.5) and Kansas-to-Kansas movements (1.8) are significantly higher than the weighted ratio for all Kansas shipments (1.5); ratios for Kansas-to-Louisiana (1.0), to-Oregon (1.2) and to-Washington (1.1) are lower than the weighted ratio. Shipments moving toward export terminals thus are favored relative to shorter-haul movements.

Most of the North Dakota ratios are not significantly different from each other. Several of the ratios are *significantly less than*

Table 7. Revenue/out-of-pocket cost ratios, wheat shipments in 60-ton common boxcars, selected states, 1966.

Origin[a]	Destination																									
	Colo	Ill	Ind	Iowa	Kans	La	Md	Minn	Miss	Mo	Mont	Neb	NY	NC	NDak	Okl	Ore	Pen	SDak	Ten	Tex	Utah	Va	Wash	Wis	Wt. ratio[b]
Kansas	2.5	1.8	....	1.9	1.8	1.0	....	....	1.4	1.6	....	1.9	....	....	....	2.2	1.2	....	....	....	1.4	....	....	1.1	....	1.5
N. Dak.	....	....	....	....	2.6	....	1.1	2.1	....	....	2.9	....	1.2	....	2.6	....	1.6	....	....	....	....	....	1.1	1.5	2.2	2.2
Neb.	2.4	....	....	1.9	1.9	1.0	....	1.5	....	1.8	....	1.9	....	....	....	....	1.5	....	....	....	1.2	....	....	....	....	1.7
Texas	....	....	....	....	....	0.7	....	....	....	....	....	....	....	....	....	3.1	....	....	....	....	0.9	....	....	....	....	1.1
Okla.	....	....	....	....	1.6	....	....	....	....	....	....	....	....	....	....	1.4	....	....	....	....	1.1	....	....	....	....	1.2
Mo.	....	1.7	1.9	....	1.0	0.8	....	....	....	1.4	....	....	....	1.0	....	....	....	....	....	1.0	0.9	....	....	....	....	1.0
Minn.	....	1.4	....	1.8	....	1.1	1.1	1.4	....	....	....	....	1.0	....	....	....	....	1.0	....	....	....	....	1.0	....	1.6	1.3
Mont.	....	....	....	....	....	....	....	2.3	....	....	2.1	....	....	....	2.5	....	2.0	....	....	....	....	3.0	....	1.9	2.3	2.1
Wash.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.2	....	....	....	....	....	....	1.3	....	1.3
S. Dak.	....	....	....	1.9	....	....	....	1.9	....	....	....	1.9	....	....	....	....	1.5	....	1.8	....	....	....	....	1.4	2.1	1.9
Colo.	1.4	....	....	....	2.4	....	....	....	....	1.8	....	2.4	....	....	....	....	0.7	....	....	....	....	1.6	....	0.8	....	1.2
Ill.	....	1.9	1.7	....	....	.7	....	....	....	1.6	....	....	1.6	....	....	....	....	....	....	1.0	....	....	....	....	....	1.7
All selected states (weighted ave.)																										1.6

[a]Ranked by total number of carloads shipped according to (14, pp. 21-3).
[b]Weighted by number of carloads shipped to each destination state.
Source: (15, pp. 21-3; and 17, pp. 9-84).

the North Dakota weighted ratio (2.2), however: North Dakota-to-Maryland (1.1), to-New York (1.2), to-Oregon (1.6), to-Virginia (1.1) and to-Washington (1.5).

The Nebraska-to-Colorado ratio (2.4) is significantly higher than the Nebraska weighted ratio (1.7). Ratios for shipments from Nebraska to Louisiana (1.0) and to Texas (1.2) are less than the weighted ratio.

Ratios for shipments from Texas to Louisiana (0.7) and Texas to Texas (0.9) are below the Texas weighted ratio (1.1), but the Texas-to-Oklahoma ratio (3.1) is far above the weighted ratio (1.1).

Values for Missouri to Illinois (1.7), to Indiana (1.9) and to Missouri (1.4) are significantly above the Missouri weighted ratio (1.0); no destination states have ratios significantly below the weighted ratio. The Colorado-to-Nebraska ratio is 2.4, significantly greater than the weighted ratio of 1.3; Colorado-to-Oregon (0.7) and to-Washington (0.8) ratios are significantly lower than the weighted ratio. The weighted ratio for Illinois (1.7) is greater than the Illinois-to-Louisiana and Illinois-to-Tennessee ratios (0.7 and 1.0). Other shipping states have no individual ratios showing significant variation from their weighted ratio.

State-by-state weighted ratio results are described in descending order of ratio values. North Dakota has the highest of all weighted ratios (2.2); it is significantly higher than all other weighted ratios except that for Montana (2.1). The South Dakota ratio (1.9) is significantly lower than that for North Dakota but not significantly different from Montana's 2.1 value. Nebraska's ratio of 1.7 is significantly lower than North Dakota and Montana ratios but is higher than all other ratios except those for Illinois and South Dakota (no significant difference). North Dakota, Montana, South Dakota and Nebraska are disadvantaged, then, compared to other shipping states. The Kansas weighted ratio (1.5) is significantly lower than ratios for North Dakota, Montana, South Dakota and Nebraska but it is higher than those for the remaining shipping states of Minnesota (1.3), Washington (1.3), Colorado (1.2), Oklahoma (1.2), Texas (1.1) and Missouri (1.0). Thus, shippers in these latter states fare relatively well.

Illustrated in Figure 7 are relationships among the weighted state ratios compared to their simple average (no weighting as between state movements) for all selected state shipments, in 60-ton common boxcars. Comparison with this simple average of all state ratios does not reveal the total impact of discrimina-

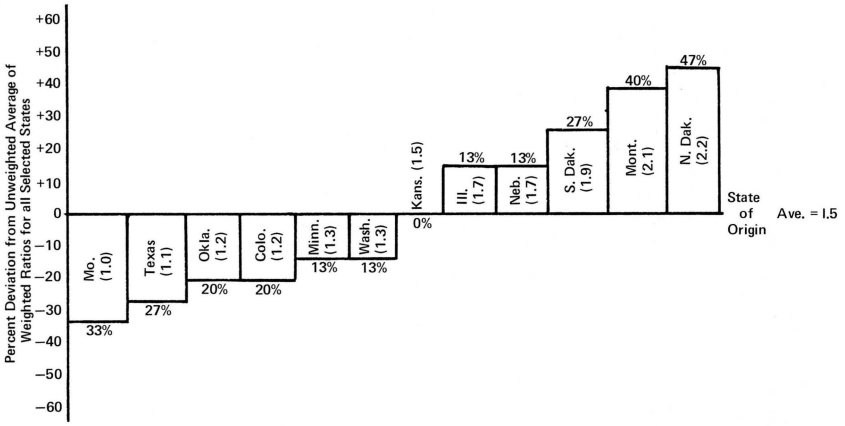

Figure 7. State-of-origin weighted revenue/out-of-pocket cost ratios as a percentage of the average (unweighted) ratio for all selected state shipments, 60-ton common boxcars, selected states, 1966. Source: Table 7.

tion upon each state, but does indicate the potential effect of ratio differentials.

North Dakota, with a ratio 48 percent above the mean of all state ratios, and Montana (40 percent above the mean) are the most disadvantaged. Other states with above-average ratios are South Dakota (27 percent), Nebraska (13 percent) and Illinois (13 percent). The weighted ratio for Kansas origins coincides with the mean value. Missouri and Texas, with ratios 33 and 27 percent below the average, fare best. Oklahoma and Colorado origins have ratios 20 percent below the mean, while Minnesota and Washington ratios are 13 percent less than the mean of all state ratios.

State-to-State Shipments: Covered Hopper Cars

Results shown in Table 8, when compared with those in Table 7, indicate that covered hopper car ratios are higher, with only one exception (Illinois-to-Tennessee), than boxcar ratios for identical hauls. This reflects the lower average cost of shipment by covered hopper cars. Other than the ratios being generally higher than those for boxcars, the same relative picture emerges as among different hauls.

The relative ratio position for each of the major wheat producing states for covered hopper car shipments is shown in Figure 8. Montana and North Dakota, with ratios 42 and 37 percent above the average, are most disadvantaged. Next in rank is Nebraska, with a ratio 26 percent above the mean. South Dakota, Kansas and Oklahoma are next with ratios 21, 11 and 5 percent

Table 8. Revenue/out-of-pocket cost ratios, wheat shipments in 100-ton covered hopper cars, selected states, 1966.

Origin[a]	Destination																										
	Colo	Ill	Ind	Iowa	Kans	La	Md	Minn	Miss	Mo	Mont	Neb	NY	NC	NDak	Okl	Ore	Pen	SDak	Ten	Tex	Utah	Va	Wash	Wis	Wt. ratio[b]
Kansas	3.4	2.3	....	2.5	2.8	1.2	....	....	1.8	2.2	....	2.6	....	....	....	3.2	1.4	....	....	....	1.6	....	....	1.4	....	2.1
N. Dak.	....	....	....	....	3.3	....	1.3	2.8	....	....	3.0	....	1.5	....	4.0	....	2.0	....	....	....	....	....	1.3	1.9	2.8	2.6
Neb.	3.4	....	....	2.6	2.6	1.2	....	2.0	....	2.4	....	2.7	....	....	....	....	1.9	....	....	....	1.5	....	....	....	....	2.4
Texas	....	....	....	....	....	0.9	....	....	....	....	....	....	....	....	....	4.4	....	....	....	....	1.2	....	....	....	....	1.4
Okla.	....	....	....	....	2.3	....	....	....	....	....	....	....	....	....	....	3.1	....	....	....	....	1.5	....	....	....	....	2.0
Mo.	....	2.5	2.6	....	1.5	1.1	....	....	....	2.2	....	....	....	1.2	....	....	....	....	....	1.3	1.2	....	....	....	....	1.3
Minn.	....	1.8	....	2.5	....	1.4	1.3	2.2	....	....	....	....	1.4	....	....	....	....	1.2	....	....	....	....	1.2	....	2.3	1.9
Mont.	....	....	....	....	....	....	....	2.8	....	....	3.2	....	....	....	3.4	....	2.5	....	....	....	....	3.9	....	2.4	2.7	2.7
Wash.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	1.7	....	....	....	....	....	....	1.7	....	1.7
S. Dak.	....	....	....	2.6	....	....	....	2.5	....	....	....	2.6	....	....	....	....	1.7	....	2.9	....	....	....	....	1.7	2.7	2.3
Colo.	2.1	....	....	....	3.2	....	....	....	....	2.3	....	3.3	....	....	....	....	0.9	....	....	....	....	2.1	....	1.0	....	1.3
Ill.	....	2.9	1.6	....	....	0.9	....	....	....	2.4	....	....	2.1	....	....	....	....	....	....	1.2	....	....	....	....	....	1.5
All selected states (weighted ave.)																										2.1

[a]Ranked by total number of carloads shipped according to (14, pp. 21-3).
[b]Weighted by number of carloads shipped to each destination state.
Source: (15, pp. 21-3; and 17, pp. 9-84).

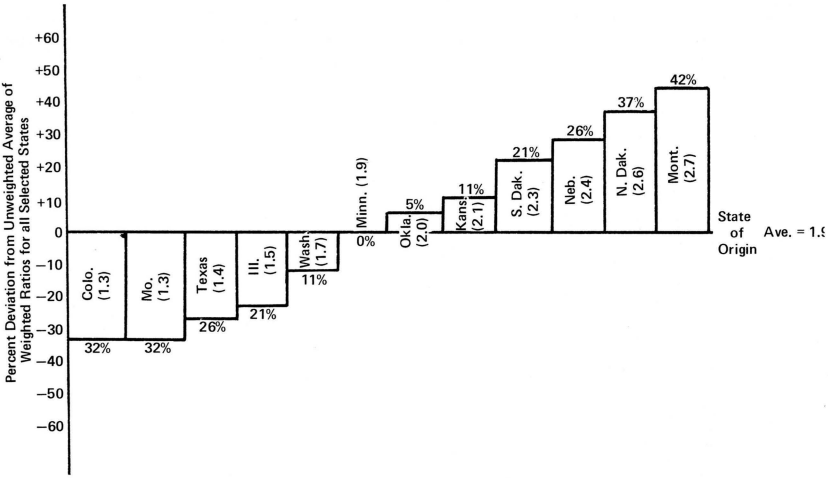

Figure 8. State-of-origin weighted revenue/out-of-pocket cost ratios as a percentage of the average (unweighted) ratio for all selected state shipments, 100-ton covered hopper cars, selected states, United States, 1966. Source: Table 8.

above the mean. The Minnesota-origin ratio lies exactly on the mean. States in the most favorable position are Colorado and Missouri (32 percent below the mean). Next in line are Texas (26 percent), Illinois (21 percent) and Washington (11 percent), all below the simple average ratio for all selected states.

Discrimination Within Nebraska

The relationship between distance in short-line miles and corresponding rate/out-of-pocket cost ratios for box and covered hopper car shipments from selected Nebraska origins to Omaha and Kansas City is illustrated in Tables 9 and 10 respectively. Origin towns within each region are ranked, in descending order, according to distance from the terminal. Because of rail line circuity some towns in the central area are closer to Kansas City than certain towns in the eastern area; some towns in the western area are closer than some in the central area. Hastings, for example, is closer in terms of short-line railroad miles than are Aurora, Clay Center and York.

Ratios tend to be related positively with distance. Linear regression analysis indicates that the ratios are, in fact, a function of distance. Results are significant at the .995 level. All results show a positive relationship with a minimum correlation coefficient (strength of linearity) of 0.7128.

Resulting functions are graphed in Figures 9, 10, 11 and 12. The function in Figure 9 (boxcar shipments to Omaha) has a

Table 9. Distances and rate/out-of-pocket cost ratios, wheat shipments in specified cars from selected Nebraska origins to Omaha, 1966.

Area	Origin	Distance (short-line miles)	Ratios	
			60-ton common boxcars	100-ton covered hopper cars
	Bridgeport	453.1	2.0	2.7
	Gering	444.0	2.1	2.8
	Kimball	442.0	2.4	3.1
	Chadron	441.9	2.1	2.8
West	Hemingford	435.6	2.0	2.6
	Rushville	410.2	2.0	2.2
	Sidney	405.0	2.4	3.1
	Chappell	377.0	1.9	2.5
	Oshkosh	368.0	2.0	2.7
	Harrisburg	....	....	....
	Grant	350.0	2.0	2.8
	Imperial	343.3	2.1	2.9
	Ogallala	332.0	2.2	2.9
	Hamlet	319.1	2.1	2.9
Central	Culbertson	294.2	1.9	2.6
	North Platte	281.0	1.8	2.5
	Curtis	278.3	1.9	2.6
	Holdrege	205.9	1.8	2.6
	Minden	183.2	1.9	2.7
	Hastings	151.2	1.8	2.6
	Hebron	139.5	1.5	2.0
	Clay Center	135.5	1.8	2.7
	Aurora	127.7	1.5	2.2
	Beatrice	122.0	1.3	1.9
East	Geneva	116.7	1.5	2.3
	Fairbury	115.7	1.5	2.3
	York	106.3	1.4	2.1
	Friend	92.3	1.4	2.3
	Seward	80.1	1.2	1.9
	Lincoln	54.7	1.3	2.1

Source: (17, pp. 9-84); distances and rates provided by Mr. Harry Sundblad, Nebraska State Railway Commission, Lincoln, Nebraska, September 9, 1969.

lower Y-intercept (lower ratio) but a higher slope value (greater ratio increase with distance) than does the one in Figure 10 (hopper-car movements to Omaha). The higher R^2 value (.78) for boxcar shipments indicates that a greater percent of the sample ratio variability is attributable to distance than is the case for hopper-car shipments ($R^2 = .51$). Although covered hopper-car shipments generally have higher ratios for comparable distances, ratio values increase with distance in both instances. The more distant shippers are thus discriminated against relative to those nearer the terminal markets.

Except that the regression lines lie somewhat higher for the Omaha destination, relationships are approximately the same as for Kansas City movements. Shippers to Omaha are thus dis-

Table 10. Distances and rate/out-of-pocket cost ratios, wheat shipments in specified cars from selected Nebraska origins to Kansas City, 1966.

Area	Origin	Distance (short-line miles)	Ratios	
			60-ton common boxcars	100-ton covered hopper cars
	Chadron	637.2	2.2	2.8
	Bridgeport	608.7	2.3	2.9
	Rushville	605.5	2.2	2.8
	Hemingford	591.2	2.2	2.8
	Gering	560.0	2.4	3.2
West	Kimball	558.0	1.9	2.5
	Sidney	521.0	2.0	2.6
	Chappell	494.0	1.9	2.5
	Oshkosh	485.0	2.4	2.7
	Harrisburg	----	----	----
	Grant	497.3	1.8	2.4
	Imperial	474.8	2.0	2.6
	Hamlet	450.6	1.9	2.5
	Ogallala	448.0	2.0	2.6
	Culbertson	425.7	1.8	2.3
Central	Curtis	425.6	1.7	2.3
	North Platte	398.0	2.0	2.6
	Holdrege	353.2	1.5	1.9
	Minden	330.5	1.7	2.3
	Hastings	261.0	1.6	2.2
	Aurora	283.3	1.7	2.3
	Clay Center	282.8	1.6	2.2
	York	261.9	1.6	2.3
	Geneva	256.3	1.5	2.1
	Hebron	254.2	1.5	2.1
East	Friend	246.0	1.4	2.0
	Seward	235.7	1.5	1.7
	Lincoln	210.3	1.4	2.3
	Fairbury	185.0	1.6	2.4
	Beatrice	183.0	1.5	2.1

Source: (17, pp. 9-84); distances and rates provided by Mr. Harry Sundblad, Nebraska State Railway Commission, Lincoln, Nebraska, September 9, 1969.

criminated against relative to those moving wheat into Kansas City. Again, ratios increase with distance, indicating discrimination against the more distant shippers. Hopper-car ratios are, again, higher than those for common boxcars.

TRENDS

An identical analysis was made for a comparative year, 1958, to investigate changes in traffic and discrimination patterns over time (19, pp. 81-95). Since relatively few covered hopper cars were in operation in 1958, only boxcar shipments were analyzed.

An estimated 410,800 carloads of wheat were transported by rail in the United States in 1958; this is slightly more than

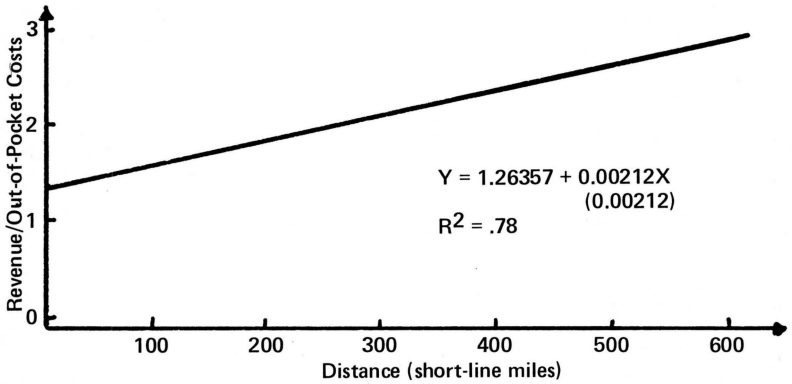

Figure 9. Regression of revenue/out-of-pocket costs against distance, 60-ton common boxcars from Nebraska origins to Omaha, 1966. Source: Table 9.

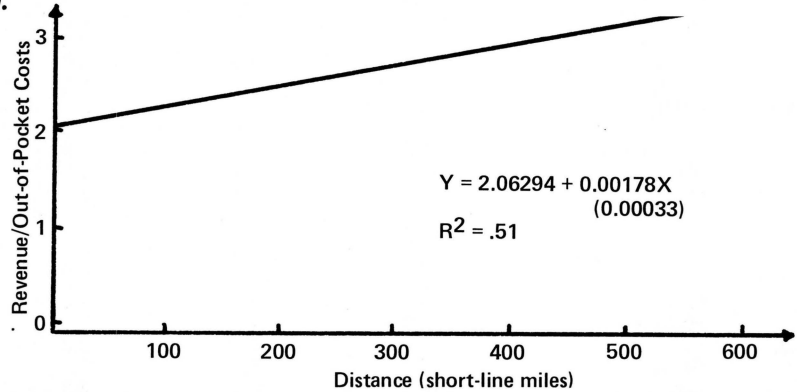

Figure 10. Regression of revenue/out-of-pocket costs against distance, 100-ton covered hopper cars from Nebraska origins to Omaha, 1966. Source: Table 9.

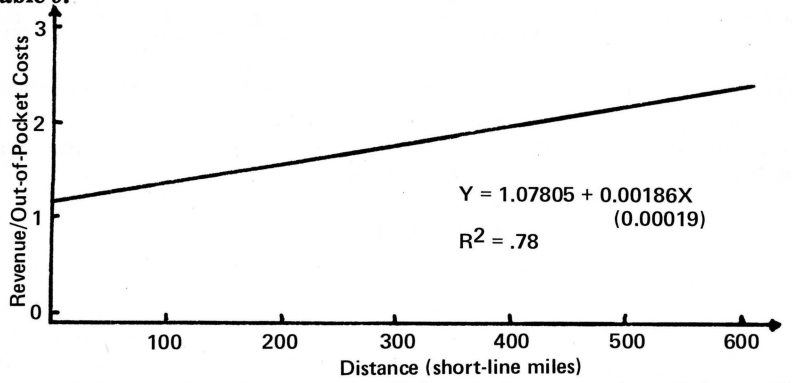

Figure 11. Regression of revenue/out-of-pocket costs against distance, 60-ton common boxcars from Nebraska origins to Kansas City, 1966. Source: Table 10.

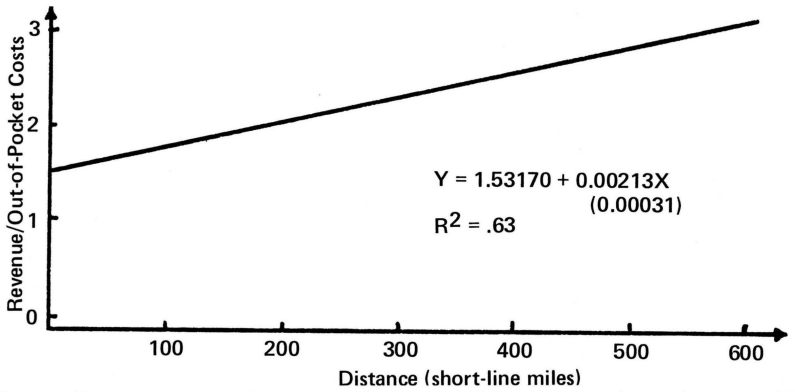

Figure 12. Regression of revenue/out-of-pocket costs against distance, 100-ton covered hopper cars from Nebraska origins to Kansas City, 1966. Source: Table 10.

the 397,400 shipped in 1966, due in part to greater amounts shipped in the larger covered hopper cars in the latter year. As in 1966, most 1958 wheat shipments did not cross railroad territorial boundaries; over 50 percent of total U.S. shipments moved within the WTL Territory.

Intraterritorial movement patterns changed very little between 1958 and 1966. Carload shipments within WTL Territory declined slightly in the latter year, due perhaps to the decline of the milling industry in this part of the country (18). Interterritorial shipments from WTL to OFF, SW and MTP Territories increased substantially between 1958 and 1966. WTL received less wheat from MTP Territory in 1966 than in 1958, but WTL shipped more wheat to MTP in 1966 than in 1958.

Ratios of revenue to out-of-pocket costs were higher than those for 1966. Variation in mileage-block ratios of 1.1 to 5.8 suggests more discrimination among different lengths of haul in 1958 as compared with 1966.

Intraterritorial ratios tend to increase with distance through the intermediate mileage blocks and decline thereafter as was true for 1966 results. Again, the exception is that ratios continue to increase with increased distance for WTL-to-WTL shipments. Relationships among interterritorial ratios are similar to those for 1966. The 1958 ratios tend, generally, to decline with distance as they did in 1966.

Shippers in the Northern Great Plains States suffered discrimination in 1958 just as they did in 1966. The disadvantage was again greatest in the most northern of these states. While place discrimination against the region had been somewhat lessened by 1966, Nebraska shippers experienced slightly more discrimination

in the latter year. Western Nebraska shippers were discriminated against in 1958 just as in 1966. The generally similar revenue/cost relationships occurring in each of these years provides evidence of the persistence of place discrimination.

ECONOMIC IMPLICATIONS

Much of foregoing evidence of discrimination appears to reflect an attempt by rail carriers to maximize revenues through value-of-service pricing. Longer hauls tend to be discriminated against relative to very short hauls, a reflection perhaps of truck competition for shorter movements. Wheat shipments from and within the relatively isolated Northern Great Plains States are discriminated against as compared with wheat moving from other producing states. Presence of barge competition for shipments from river states such as Missouri, Kansas, Nebraska and Illinois to the Gulf Coast, on the other hand, is translated into lower revenue/cost relationships.

Railroad firms may well benefit from discriminatory pricing practices in the short run. Charging higher rates in the more inelastic markets may maximize carrier revenues. Any revenues covering more than operational expenses are beneficial; but, in the long run, total cost must be recovered. Short-run discriminatory practices all too readily lead to retention and even improvement of uneconomic facilities. The railroads may find themselves pouring money into maintenance of roadway and ancillary structures and equipment that should have been abandoned long ago; cross-subsidization practices keep such services alive. At the same time, long-run discrimination can lead to loss of traffic against which discriminatory rates are lodged. This lost traffic is likely to be that which is most remunerative, that which the railroads can least afford to lose. Thus the railroads may lose their best customers, retaining only those whose revenue contributions fail to cover long-run average costs of service. The evidence suggests discrimination is not a short-run phenomenon.

The argument that short-run discriminatory prices benefit even shippers who are discriminated against, since lower rates for traffic with a more elastic demand will permit recovery of additional fixed costs, is not convincing. The argument assumes, first, that rates for the more elastic demand markets are set above the level of average variable costs and, second, that the traffic would not move if rates were higher. These assumptions may or may not be valid. The argument breaks down completely in the long run.

Farmers against whom discrimination is practiced are likely to be faced with lower product prices than competing farmers who have lower-cost transport service. Rates tend to be reflected in the farm price of wheat; other things being equal, the higher the freight rate, the lower will be the price received by the farmer. Wheat production then becomes relatively less profitable and is a relatively poorer alternative in those producing areas which are discriminated against. Other factors constant, wheat production will shift toward those areas having the more favorable rate structures. Land at the margin may be shifted from wheat production to other uses which would be poorer alternatives in the absence of the discriminatory rate structure. Resources are thus not being employed in their most efficient alternative uses.

There may be further implications for input (farm supply) markets or for agricultural product processing facilities. The shift of flour mills from the Midwest is an example of the repercussions which can follow rate adjustments (26, pp. 28-9). Resulting resource misallocation leads ultimately to higher costs of production, to higher consumer product prices, and to a lower total output of goods and services. The nation's economy is less productive than would otherwise be the case.[12]

APPENDIX A

Calculation of Cost Scale Data

"Cost scale" data, such as are used in this report, are precalculated by the ICC for certain years. See, for example, ICC Statement 2-68 (17, various pages). The cost scales can be derived for other years and can be adjusted so as to conform to particular hauls, particular car types, etc., by working forward from "unit-cost" data which are disaggregated into terminal and line-haul costs. Line-haul expense is further broken down on a way- and through-train basis.[13]

Sample carload unit costs in Table A-1 are calculated in accordance with Summary 1, Rail Cost Formula, Rail Form A, and are based on 1966 operations. Illustrated in the table is a sample calculation of terminal and line-haul (way- plus through-train)

[12] For a more complete discussion of implications of discriminatory pricing see Felton (2, pp. 58-60) and Miller (21, pp. 91-141).

[13] Way trains stop at intermediate stations to load and unload freight. Through trains do not make local stops. For a technical definition, see *Petroleum Rail Shippers Assn. vs. Alton and S.R.*, 243, I.C.C. 589, 646 and 647.

Appendix Table A-1. Sample calculation of out-of-pocket costs for a 50-ton load moving 500 short-line miles in a common boxcar (60-ton capacity) in Region V, United States, 1966.

Line No.	Item		Amount (cents)
1	Terminal: per carload		6554.98900
2	per cwt.		.46600
3	Total per cwt. (line 1 ÷ 1000) + line 2		7.02100
4	Way train: per car-mile		18.43429
5	per cwt.-mile		.01464
6	Total per cwt.-mile (line 4 ÷ 1000) + line 5		.03300
7	Through train: per car-mile		14.58359
8	per cwt.-mile		.00920
9	Total per cwt. mile (line 7 ÷ 1000) + line 8		.02385
10	Mileage: Total	500	xxx
11	Way train	61	xxx
12	Through train	439	xxx
13	Way-train cost (line 6 x 1.13) x line 11		2.27951
14	Through train cost (line 9 x 1.13) x line 12		11.83105
15	Total cost per cwt. sum of Lines 3, 13 and 14		21.10000

Source: (17, p. 197).

out-of-pocket costs in cents per hundredweight, the costs used throughout this study. The example depicts out-of-pocket costs for a 50-ton load (1,000 cwt.) moving 500 short-line miles in a general purpose boxcar in Region V. Terminal costs are calculated on a per-carload and per-hundredweight basis as reported in the unit-cost data. Average total terminal cost is computed by dividing the cost per carload by the number of hundredweights being shipped, and adding the per-hundredweight terminal expense. Way- and through-train costs are reported on a per-car-mile and per-hundredweight basis; cost per car-mile is divided by number of hundredweights shipped. Adding the per-hundredweight-mile cost figure to the above result gives the total out-of-pocket cost per hundredweight-mile.

Separating total miles into way- and through-train miles (lines 10, 11 and 12) is accomplished by subtracting average way-train mileage for each territory from the total miles shipped. The average way-train short-line miles by region are: Region III, 32;

Appendix Table A-2. Ratios of empty/loaded car miles,[a] by type of car, United States, 1966.

	Region III	Region IV	Region V	Region VI
Boxcar	.47	.42	.39	.43
Covered hopper car	1.08	.98	1.08	1.10

[a]Carload traffic only.
Source: (17, p. 197).

Region IV, 56; Region V, 61; and Region VI, 62 short-line miles (17, p. 6). Total way- and through-train costs are calculated by multiplying the total cost per-hundredweight mile (Lines 6 and 9, respectively) by 1.13 (circuity correction factor[14]) (7, pp. 5-7). The result is multiplied by the applicable way- and through-train mileage. Short-line miles are increased by 13 percent (1.13 factor) to allow for circuity of routing in estimating actual miles traveled. Adding the total terminal cost (line 3), the total way-train cost (line 13), and the total through-train cost (line 14) gives the total out-of-pocket costs in cents per hundredweight (line 15) as reported in the "cost-scale" publications.

Loss and damage claim payments data are available by commodity class (such as wheat) for the United States or by territories for a composite of all commodities. Since inclusion of the U.S. average claim payments for wheat would only increase each result by a constant amount and since the territorial data by commodity are not available, no use is made of these data. It seems unlikely that losses would vary by territory.

Costs in Table A-1 reflect regional empty-return ratios. Ratios of empty-to-loaded car-miles for general purpose box and covered hopper cars for 1966 are found in Table A-2. The unusually high ratios for covered hopper cars are due to the specialized nature of these cars. Boxcars can be utilized more readily for back-haul traffic.

[14]Circuity is the divergence from the most direct route.

APPENDIX B

Confidence Range of Revenue/ Out-of-Pocket Cost Ratios

Appendix Table B-1. Confidence range[a] of revenue/out-of-pocket cost ratios for 60-ton boxcars, territory-to-territory shipments, United States, 1966.

Origin & destination	Mileage block, starting with											
	1	25	50	75	100	150	200	250	300	350	400	450
MTP-MTP	1.1-2.1	1.3-2.1	1.1-1.9	1.7-3.1	1.1-1.7	1.3-1.9	1.4-1.8	1.1-1.5	1.1-1.5	1.2-1.6	1.2-1.6	1.2-2.2
MTP-WTL	....	....	....	....	....	....	....	....	....	....	....	....
OFF-OFF	1.1-1.7	1.7-2.3	1.6-2.2	1.8-2.4	1.9-2.5	1.6-2.4	1.8-2.8	1.4-3.4	1.3-2.3	1.4-2.4	.8-1.0	....
OFF-SOU	....	....	....	....	....	....	....	....	....	....	....	.5-1.3
SOU-SOU	....	....	....	....	....	....	....	.7-1.5	....	.6-1.2	....	.6-1.2
SW-SOU	....	....	....	....	....	....	....	....	....	....	....	....
SW-SW	1.4-2.0	1.4-2.0	1.7-2.3	1.8-2.6	2.0-2.8	2.8-3.8	2.7-3.5	1.9-3.7	1.9-3.9	2.1-3.3	1.9-2.9	1.4-2.2
WTL-MTP	....	....	....	....	....	....	....	....	....	....	....	....
WTL-OFF	....	....	....	....	....	....	....	....	....	....	....	....
WTL-SW	....	....	....	....	....	....	....	....	....	....	....	....
WTL-WTL	1.3-2.1	1.4-1.8	1.5-1.9	1.7-2.1	1.8-2.0	1.9-2.3	1.9-2.3	1.9-2.1	1.9-2.1	2.0-2.2	2.1-2.3	2.0-2.4

Appendix Table B-1. Continued.

Origin & destination	Mileage block, starting with											Weighted ratio
	500	600	700	800	900	1000	1200	1400	1600	1800	2000	
MTP-MTP	1.4-2.2	1.9-2.9	1.8-2.4	1.8-2.0	1.5-2.3	1.4-2.6	1.2-2.0	.7-1.5	....	....	....	1.4-1.6
MTP-WTL	....	1.5-3.3	1.6-2.8	....	1.3-2.5	....	....	....	....	....	....	1.7-2.5
OFF-OFF	.9-1.9	.8-1.2	.6-1.0	....	....	....	....	....	....	....	....	1.9-2.1
OFF-SOU	....	....	.7-1.1	....	....	....	....	....	....	....	....	.7-1.1
SOU-SOU	.6-1.4	....	....	....	....	....	....	....	....	....	....	.8-1.2
SW-SOU	.6-1.4	....	....	....	.9-1.9	....	....	....	....	....	....	.9-1.5
SW-SW	1.3-1.9	1.5-1.9	1.2-1.6	1.0-1.6	1.0-2.0	....	....	....	....	....	....	2.1-2.3
WTL-MTP	....	....	....	....	....	....	1.4-2.0	1.2-1.6	1.1-1.5	.9-1.2	....	1.3-1.5
WTL-OFF	....	....	.8-1.6	....	....	.9-1.3	.7-1.3	....	....	....	....	.9-1.3
WTL-SW	....	....	....	1.3-3.3	1.1-1.9	1.1-1.9	.9-1.3	....	....	....	....	1.1-1.5
WTL-WTL	2.1-2.5	1.9-2.7	1.5-3.3	....	....	....	....	....	....	....	....	2.1-2.1
											Total U.S.-U.S.	1.9-1.9

[a]Ranges are calculated by applying the ICC's "coefficient of variation" test to the ratios in Table 5. The test consists of multiplying each ratio by $1/\sqrt{n}$ (n = no. carloads shipped); the product is then added and subtracted from the ratio to give the upper and lower limits of the range, respectively (see pp. 20-21 for more detail).

Source: Calculated from data in Table 6, above, (14. pp. 6-8).

Appendix Table B-2. Confidence range[a] of revenue/out-of-pocket cost ratios for 100-ton covered hopper cars, territory-to-territory shipments, United States, 1966.

Origin & destination	Mileage block, starting with											
	1	25	50	75	100	150	200	250	300	350	400	450
MTP-MTP	2.1-3.7	2.2-3.6	1.7-3.1	2.2-4.0	1.8-2.6	2.0-2.8	1.9-2.5	1.6-2.0	1.6-2.0	1.7-2.1	1.6-2.2	1.7-2.9
MTP-WTL	....	....	....	....	....	....	....	....	....	....	....	....
OFF-OFF	2.1-3.1	2.9-3.9	2.6-3.4	2.8-3.8	2.9-3.7	2.5-3.5	2.5-3.9	2.0-4.8	1.9-3.1	1.9-3.3	1.1-1.5	....
OFF-SOU	....	....	....	....	....	....	....	....	....	....	....	.6-1.6
SOU-SOU	....	....	....	....	....	....	....	1.0-2.0	....	.8-1.6	....	.8-1.6
SW-SOU	....	....	....	....	....	....	....	....	....	....	....	....
SW-SW	2.4-3.6	2.5-3.3	2.7-3.7	2.8-3.0	3.1-4.3	3.7-4.9	3.7-4.9	2.5-5.1	2.6-5.2	2.8-3.4	2.5-3.7	1.7-2.9
WTL-MTP	....	....	....	....	....	....	....	....	....	....	....	....
WTL-OFF	....	....	....	....	....	....	....	....	....	....	....	....
WTL-SW	....	....	....	....	....	....	....	....	....	....	....	....
WTL-WTL	2.5-3.3	2.4-3.0	2.5-3.1	2.6-3.2	2.7-3.1	2.7-3.3	2.8-3.2	2.6-3.0	2.5-2.9	2.6-3.0	2.7-3.1	2.6-3.2

Appendix Table B-2. Continued

Origin & destination	Mileage block, starting with											Weighted ratio
	500	600	700	800	900	1000	1200	1400	1600	1800	2000	
MTP-MTP	1.8-3.0	2.5-3.7	2.3-3.1	2.3-2.9	1.9-2.9	1.7-3.3	1.4-2.4	.8-1.8	....	....	....	2.1-2.3
MTP-WTL	....	1.8-4.0	1.8-3.2	....	1.7-3.5	....	....	....	....	....	....	1.5-2.3
OFF-OFF	1.2-2.4	1.0-1.6	.7-1.3	....	....	....	....	....	....	....	....	2.7-2.9
OFF-SOU	....	....	.8-1.4	....	....	....	....	....	....	....	....	.8-1.4
SOU-SOU	.8-1.8	....	....	....	....	....	....	....	....	....	....	1.1-1.5
SW-SOU	.7-1.9	....	....	....	1.2-2.6	....	....	....	....	....	....	1.1-2.1
SW-SW	1.7-2.5	1.8-2.4	1.5-1.9	1.2-2.0	1.2-2.4	....	....	....	....	....	....	2.9-3.1
WTL-MTP	....	....	....	....	....	....	1.7-2.5	1.6-2.0	1.3-1.9	1.0-2.0	....	1.6-2.0
WTL-OFF	....	....	1.1-2.1	....	....	1.1-1.7	.9-1.5	....	....	....	....	1.2-1.6
WTL-SW	....	....	....	1.5-4.1	1.3-2.3	1.3-2.3	1.1-1.5	....	....	....	....	1.4-1.8
WTL-WTL	2.8-3.2	2.4-3.4	1.9-4.1	....	....	....	....	....	....	....	....	2.7-2.9
											Total U.S.-U.S.	2.6-2.6

[a]Ranges are calculated by applying the ICC's "coefficient of variation" test to the ratios in Table 6. The test consists of multiplying each ratio by $1/\sqrt{n}$ (n = no. of carloads shipped); the product is then added and subtracted from the ratio to give the upper and lower limits of the range, respectively (see pp. 20-21, above for more detail).

Source: Calculated from data in Table 5, above; and (14, pp. 6-8).

Appendix Table B-3. Confidence range[a] of revenue/out-of-pocket cost ratios for 60-ton boxcars, all selected state shipments, United States, 1966.

Origin[b]	Destination												
	Colo.	Ill.	Ind.	Ia.	Kans.	La.	Md.	Minn.	Miss.	Mo.	Mont.	Neb.	N.Y.
Kansas	2.0-3.0	1.4-2.2	....	1.3-2.5	1.7-1.9	.9-1.1	....	....	.9-1.9	1.5-1.7	....	1.5-2.3	....
N. Dak.	....	....	....	....	1.8-3.4	....	.7-1.5	2.0-2.2	....	....	1.9-3.9	....	.8-1.6
Neb.	2.0-2.8	....	....	1.6-2.2	1.6-2.2	.8-1.3	....	1.2-1.8	....	1.6-2.0	....	1.7-2.1	....
Texas	....	....	....	....	....	.5- .9	....	....	....	....	....	....	....
Okla.	....	....	....	....	1.0-2.2	....	....	....	....	....	....	....	....
Mo.	....	1.2-2.2	1.2-2.6	....	.8-1.2	.7- .9	....	....	....	1.2-1.6	....	....	....
Minn.	....	1.0-1.8	....	1.4-2.2	....	.7-1.5	1.0-1.2	1.3-1.5	....	....	....	....	.7-1.3
Mont.	....	....	....	....	....	....	....	1.8-2.8	....	....	1.8-2.4	....	....
Wash.	....	....	....	....	....	....	....	....	....	....	....	....	....
S. Dak.	....	....	....	1.3-2.5	....	....	....	1.7-2.1	....	....	....	1.3-2.5	....
Colo.	1.0-1.8	....	....	....	1.8-3.0	....	....	....	....	1.0-2.6	....	1.6-3.2	....
Ill.	....	1.7-2.1	.9-2.5	....	....	.5- .9	....	....	....	1.0-2.2	....	....	1.2-2.0

Appendix Table B-3. Continued.

Origin[b]	Destination												Weighted ratio
	N.C.	N.Dak.	Okla.	Oreg.	Penn.	S.Dak.	Tenn.	Texas	Utah	Va.	Wash.	Wis.	
Kansas	....	....	1.5-2.9	1.0-1.4	....	....	....	1.3-1.5	....	....	.8-1.4	....	1.5-1.5
N. Dak.	....	2.2-3.0	....	1.3-1.9	....	....	....	....	....	.7-1.5	1.2-1.8	2.1-2.3	2.1-2.3
Neb.	....	....	....	.9-2.1	....	....	....	1.1-1.3	....	....	....	....	1.6-1.8
Texas	....	....	2.6-3.6	....	....	....	....	.9- .9	....	....	....	....	1.0-1.2
Okla.	....	....	1.3-1.5	....	....	....	....	1.0-1.2	....	....	....	....	1.1-1.3
Mo.	.7-1.3	....	....	....	....	....	.6-1.4	.8-1.0	....	....	....	....	.9-1.1
Minn.	....	....	....	....	.8-1.2	....	....	....	....	.8-1.2	....	1.3-1.9	1.2-1.4
Mont.	....	1.6-3.4	....	1.8-2.2	....	....	....	....	2.2-3.8	....	1.7-2.1	1.6-3.0	2.0-2.2
Wash.	....	....	....	1.1-1.3	....	....	....	....	....	....	1.2-1.4	....	1.2-1.4
S. Dak.	....	....	....	1.1-1.9	....	1.2-2.4	....	....	....	....	1.0-1.8	1.3-2.9	1.8-2.0
Colo.	....	....	....	.6- .8	....	....	....	....	.9-2.3	....	.7- .9	....	1.1-1.3
Ill.	....	....	....	....	....	....	.6-1.4	....	....	....	....	....	1.5-1.9
												Total all selected states to all destinations	1.6-1.6

[a]Ranges are calculated by applying the ICC's "coefficient of variation" test to the ratios in Table 7. The test consists of multiplying each ratio by $1/\sqrt{n}$ (n = no. of carloads shipped); the product is then added and subtracted from the ratio to give the upper and lower limits of the range, respectively (see pp. 20-21 above, for more detail).

[b]Ranked by total number of carloads shipped.

Source: Calculated from data in Table 7, above, and (15, pp. 21-3).

Appendix Table B-4. Confidence range[a] of revenue/out-of-pocket cost ratios for 100-ton covered hopper cars, all selected state shipments, United States, 1966.

Origin[b]	Destination												
	Colo.	Ill.	Ind.	Ia.	Kans.	La.	Md.	Minn.	Miss.	Mo.	Mont.	Neb.	N.Y.
Kansas	2.8-4.0	1.8-2.8	....	1.7-3.3	2.7-2.9	1.0-1.4	....	....	1.2-2.4	2.0-2.4	....	2.1-3.1	....
N. Dak.	....	....	....	....	2.3-4.3	....	.8-1.8	2.7-2.9	....	....	1.9-4.1	....	1.0-2.0
Neb.	2.8-4.0	....	....	2.2-3.0	2.2-3.0	1.0-1.4	....	1.6-2.4	....	2.1-2.7	....	2.5-2.9	....
Texas	....	....	....	....	....	.6-1.2	....	....	....	....	....	....	....
Okla.	....	....	....	....	1.5-3.1	....	....	....	....	....	....	....	....
Mo.	....	1.7-3.3	1.7-2.5	....	1.2-1.8	.9-1.3	....	....	....	1.9-2.5	....	....	....
Minn.	....	1.2-2.4	....	1.9-3.1	....	.8-2.0	1.1-1.5	2.0-2.4	....	....	....	....	1.0-1.8
Mont.	....	....	....	....	....	....	....	2.2-3.4	....	....	2.7-3.7	....	....
Wash.	....	....	....	....	....	....	....	....	....	....	....	....	....
S. Dak.	....	....	....	1.8-3.4	....	....	....	2.3-2.7	....	....	....	1.7-3.5	....
Colo.	1.4-2.8	....	....	....	2.4-4.0	....	....	....	....	1.3-3.3	....	2.1-4.5	....
Ill.	....	2.5-3.3	.9-2.5	....	....	.6-1.2	....	....	....	1.6-3.2	....	....	1.5-2.7

Appendix Table B-4. Continued.

Origin[b]	Destination												Weighted ratio
	N.C.	N. Dak.	Okla.	Oreg.	Penn.	S. Dak.	Tenn.	Texas	Utah	Va.	Wash.	Wis.	
Kansas	....	....	2.1-4.3	1.1-1.7	....	....	....	1.5-1.7	....	....	1.0-1.8	....	2.0-2.2
N. Dak.	....	3.4-4.6	....	1.6-2.4	....	....	....	....	....	.8-1.8	1.6-2.2	2.6-3.0	2.5-2.7
Neb.	....	....	....	1.1-2.7	....	....	....	1.3-1.7	....	....	....	....	2.3-2.5
Texas	....	....	3.7-5.1	....	....	....	....	1.3-1.7	....	....	....	....	1.3-1.5
Okla.	....	....	2.8-3.4	....	....	....	....	1.4-1.6	....	....	....	....	1.9-2.1
Mo.	.9-1.5	....	....	....	....	....	.7-1.9	1.1-1.3	....	....	....	....	1.2-1.4
Minn.	....	....	....	....	.9-1.5	....	....	....	....	1.0-1.4	....	1.9-2.7	1.8-2.0
Mont.	....	2.1-4.7	....	2.3-2.7	....	....	....	....	2.8-5.0	....	2.2-2.6	1.8-3.6	2.5-2.9
Wash.	....	....	....	1.5-1.9	....	....	....	....	....	....	1.6-1.8	....	1.6-1.8
S. Dak.	....	....	....	1.2-2.2	....	1.9-3.9	....	....	....	....	1.2-2.2	1.7-3.7	2.1-2.5
Colo.	....	....	....	.8-1.0	....	....	....	....	1.2-3.0	....	.8-1.2	....	1.2-1.4
Ill.	....	....	....	....	....	....	.7-1.9	....	....	....	....	....	1.3-1.7
								Total all selected states to all destinations					2.1-2.1

[a]Ranges are calculated by applying the ICC's "coefficient of variation" test to the ratios in Table 8. The test consists of mulitplying each ratio by $1/\sqrt{n}$ (n = no. of carloads shipped); the product is then added and subtracted from the ratio to give the upper and lower limits of the range, respectively (see pp. 20-21 above for more detail).

[b]Ranked by total number of carloads shipped.

Source: Calculated from data in Table 8, above; and (15, pp. 21.3).

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