

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

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

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

KENNETH CASAVANT, RON MITTELHAMMER, AND LARRY PEDERSON

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

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

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

The evaluation of these regulatory reforms is currently under way but, with the exception of the

airline deregulation experience, few studies have been completed at this time, due primarily to the lack of time since regulatory changes have occurred and the accompanying lack of data. Most studies have been national in scope and conjectural in analysis.

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

BACKGROUND

Objectives

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

Study Area

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

Table 1. Dry pea and lentil export shipments.

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

^aSeptember 1979-August 1980. ^bSeptember 1980-February 1981.

Table 2. Weighted average rates per hundredweight.

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

^aNo movement or incalculable.

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

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

Procedure and Scope of Study

A telephone survey was used to solicit data to be used in evaluating general hypotheses about modal and shipper reaction to deregulation and the resulting impacts on costs to shippers and revenues to modes. Specifically, the data received in a tele-

phone survey of all 22 processing firms in April 1981 allowed comparisons of the pea and lentil processing and transportation sectors structure and conduct before and after rail deregulation.

RESULTS

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

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

The discussion of results includes the impact of deregulation on transportation modes and a review of changes in shipper costs due to marketing versus

transportation changes during these two crop years.

Modal Effects

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

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

Rates

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

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

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

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

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

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

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

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

Volume and Market Share

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

Table 3. Volumes of dry pea and lentil shipments.

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

Table 4. Dry pea and lentil shipment volumes.

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

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

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

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

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

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

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

Revenues

Total modal revenues are presented in Table 5. Barge and truck revenues show the largest increases--68.6 and 62.6 percent, respectively. Combined with a 17.3 percent increase in total rail revenues, revenues earned by all modes increased by 33.2 percent from 1979 to 1980. Railroads realized a smaller percentage gain in total revenue than the other two modes because rail volume decreased from

1979 to 1980 while truck and barge volumes increased. In particular, the railroads experienced a reduction in short-haul (average distance of 300 miles) carriage to the West from 1979 to 1980 due to rate and service changes. Volumes moved to Gulf destinations increased; this increase was indicative of greater demand from foreign markets serviced by Gulf ports. Movements by rail to the East were relatively stable.

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

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

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

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

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

In summary, revenues for all three transportation modes increased from 1979 to 1980. Railroad revenues increased by more than 20 percent when calculated per car and by smaller percentages when calculated per hundredweight due to increased volumes loaded per car in 1980. Truck revenues were mainly generated from short-haul westbound movements for which the nature of their costs allowed them to be

extremely competitive. Barge revenues were generated from shipments by those processors closest to river ports. Truck and barge rate increases contributed to revenue increases and were possibly in response to rail rate and service changes after deregulation.

TRANSPORTATION VERSUS MARKETING EFFECTS

Changes in transportation and marketing environments changed both rates charged for shipments and volumes moved. The combination of rate and volume changes

resulted in a change in the total shipping bill. The change in the total shipping bill between 1979 and 1980 can be calculated as $P_2Q_2 - P_1Q_1$, where P_1 = 1979 rates, P_2 = 1980 rates, Q_1 = 1979 volumes, and Q_2 = 1980 volumes. The shipping-bill calculations are shown in Table 6.

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

Table 6. Dry pea and lentil shipping bill.

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

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

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

^aPotential compared with actual.

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

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

^aPotential compared with actual.

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

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

as follows: $P_{1Q2} - P_{1Q1}$. The calculations of the marketing effect are given in Table 8. The joint effect, caused by the combination of the rate and marketing effects, is the total shipping-bill change minus the rate and marketing effects. Arithmetically, calculation of the joint effect could be accomplished by subtracting the rate and marketing effects presented in Tables 7 and 8, respectively, from the total change found in Table 6.

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

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

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

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

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

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

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

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

CONCLUSIONS

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

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

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

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

1. Total revenues increased largely because of per car rates higher than the former volume-based rates and the concentration on longer hauls and larger movements;

2. Per car rates induced shippers to load more units per car, which allows rail carriers to more efficiently use their rolling stock (capital equipment);

3. Railroads appeared to emphasize long hauls, for which they are more cost efficient, and deemphasize inefficient short-haul carriage; and

4. Railroads cancelled the transit privilege; by the speed with which the transit privilege was phased out of operation, it was apparently an undesirable service to provide from the point of view of the railroads.

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

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

Airline Deregulation and Service to Small Communities

YUPO CHAN

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

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

1. To what extent has service to small communities changed as a result of deregulation?

2. What factors are responsible for this change in low-density service pattern, and how is it related to the airline-industry profile and the economics of airline route structure?

3. What is the likely future of air service to small communities based on our understanding of the explanatory factors identified in 2 above?