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MOTOR CARRIER REGULATION AND ITS IMPACT ON SERVICE: AN ANALYSIS OF TEXAS FRESH FRUIT AND VEGETABLE SHIPPERS

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Recently there has been a trend toward economic deregulation of transportation by the federal government. The Airline Deregulation Act of 1978, the Staggers Rail Act of 1980, and the Motor Carrier Act of 1980 have reduced the regulatory role of the federal government and, in general, place increased reliance on the market for resource allocation. Earlier, the Motor Carrier Act of 1935 exempted from economic regulation the haulage of agricultural commodities moving in interstate commerce. In spite of the historic deregulation of agricultural motor carriage and the recent move by the federal government toward deregulation, the motor carrier deregulation question remains very important in many states.

States have varying degrees of motor carrier regulation; typically economic regulation focuses on control of the entry, routes, rates, and commodities that a carrier is permitted to transport.[1] Intrastate motor carriage is heavily regulated in Texas. Many Texas agricultural groups oppose this regulation and favor legislation that would place intrastate trucking in an environment similar to that which exists for exempt interstate agricultural motor carriage. Regulated trucking interests generally oppose the proposed legislation. Two arguments consistently forwarded by the motor carrier industry center on the issues of industry stability and service to small-volume shippers and rural communities. Trucking interests argue that an unregulated motor carrier industry produces an unstable economic environment. Constant entry and exit of firms and the continuous downward pressure on profit margins result in a deterioration of service. This unstable environment produces a motor carriage industry that provides inferior service to shippers and receivers.

Trucking interests also argue that deregulation of trucking will result in diminished service and/or higher rates to small-volume shippers and rural communities. This will place small-volume shippers at a comparative disadvantage when using unregulated motor carriage to serve existing markets. Nondiscriminatory pricing and service to all users has been a historic justification for regulating motor carriage (American Trucking Association, Inc.; Lawrence).

Several studies have researched the issue of motor carrier service to rural communities. The results indicate that motor carriers serve rural communities because it is profitable, not because of a statutory obligation to provide service (Banks and Associates; Breen and Allen; Pustay).

DEREGULATIONS' INFLUENCE ON INTRASTATE SERVICE

Three recent studies have attempted to measure shipper opinions about the deregulated motor carriage industry. On 1 July 1980, interstate regulation of motor transport expired in Florida. The Interstate Commerce Commission recently compiled a random survey to assess initial shipper and carrier reactions to deregulation (ICC). The majority of shipper respondents believe no change in quality of service resulted from motor carrier deregulation in Florida. Freeman conducted an expanded study of Florida shippers after the expiration of intrastate regulation. Results indicate that most shippers prefer deregulation and that their preference for deregulation is not affected by firm size. In 1978, Allen et al. surveyed New Jersey carriers and shipper/receivers to assess perceptions of unregulated and regulated motor carriage. They found that large-volume and small-volume shipper/receivers favor unregulated motor carriage; both groups believe the unregulated motor carrier to have lower freight charges.

This paper reports on a study designed to measure Texas fresh fruit and vegetable shippers' opinions of motor carrier service offered by the regulated intrastate and the exempt interstate motor carrier. Study objectives are (1) to determine if motor carrier regulation improves the quality of service offered to fruit and vegetable shippers, and (2) to evaluate the issue of discrimination by the unregulated or exempt motor carrier against small-volume shippers.

Texas fresh fruit and vegetable shippers are in an excellent position to contrast regulated and unregulated motor carriage. They typically arrange for transportation and employ both types of carriers. The regulated intrastate motor carrier serves in the in-state metropolitan markets, while the exempt interstate carrier serves the out-of-state markets. Nearly all shippers sell to in-state and out-of-state locations. Therefore, shippers are knowledgeable of services offered by the two types of motor carriers and are in a position to

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[1] A survey by Wales et. al. concerning in-state regulation of agricultural motor carriers found that: (1) forty states control entry by requiring some type of operating authority, (2) 31 states have power to regulate rates, and (3) 28 states regulate routes or geographic areas that may be served.

compare the quality of their services. The exempt inter-state carrier is barred by Texas statutes from participating in intra-state carriage, while the regulated carrier has little economic incentive to participate in interstate carriage. Accordingly, the carriers belong to two discrete groups.[2]

Texas is the third leading state in the production of both fresh market vegetables (including melons) and citrus. In 1980, a total of 7.6 million hundredweights of the four primary vegetable crops (cabbage, cantaloupe, dry onions, and watermelons) were shipped from Texas origins to the 41 principal cities in the U.S. Of total shipments, 30 percent went to the in-state metropolitan areas of Houston, Dallas/Ft. Worth, and San Antonio. Midwestern cities received 2.2 million hundredweights (29 percent), while the remainder was routed to eastern and other southern cities. During the same year, 1.8 million hundredweights of citrus were shipped from Texas origins to the 41 principal U.S. cities. The three Texas metropolitan areas received 39 percent of the total. Most of the remainder was shipped to western (38 percent) and midwestern (17 percent) cities. It's estimated that 98 percent of all shipments are transported by motor carrier (USDA 1981a; USDA 1981b).

TEXAS AND INTERSTATE MOTOR CARRIER REGULATION

Texas's motor carrier regulation is administered by the state's Railroad Commission. In order to provide for-hire motor freight services within Texas, a certificate of public convenience and necessity must be obtained from the Commission. In-state motor carriers of fresh fruits and vegetables are typically certified as specialized motor carriers. The carrier's authority is generally restricted to subregions of the state and allows the carrier to transport only specified commodities over irregular routes and schedules. Applications for these certificates are formally reviewed in hearings conducted by the Commission, and the applicant is required to present evidence demonstrating public convenience and necessity. If the application is protested by existing carriers, obtaining the permit may be difficult or impossible.[3]

The Commission also takes an active role in the establishment of intrastate motor carrier rates. After a rate request is initiated by a rate bureau or individual carrier, rate hearings are conducted and administered by the Commission, at which time all concerned parties have an opportunity to present evidence. If the rate is approved, the Commission issues an appropriate order establishing the new rate.

In contrast, interstate motor carriage of agricultural commodities was exempted from economic regulation by the Motor Carrier Act of 1935. Therefore, motor carriers transporting Texas's fresh fruits and vegetables in interstate commerce have unrestricted entry, no route or commodity restrictions, and rates established by market forces.

DATA AND PROCEDURES

To determine the effect of motor carrier regulation on quality of service offered to users, a survey was designed to measure the opinions of Texas fresh fruit and vegetable shippers regarding: (1) quality of service provided by the regulated and unregulated motor carriers and (2) likely outcomes of deregulating intrastate motor carriage. To isolate the effect of motor carrier regulation on quality of service provided to alternative-size shippers, the returned surveys were segregated by firm size and analyzed. A 1981 industry directory was used to identify 116 Texas firms (about 95 percent of all shippers) involved in shipping fresh fruits and vegetables. A questionnaire was mailed to each firm and 55 usable responses were returned.[4] Shipper's annual volume varied from less than 100 truckloads to over 5,000 truckloads per year.

To measure perceived differences in the quality of service provided by regulated intrastate and exempt interstate carriers, 14 quality-of-motor-carrier-service characteristics important to fresh fruit and vegetable shippers were identified. Fruit and vegetable shippers were asked to indicate whether the regulated in-state carrier or the exempt interstate carrier provided the best service for each selected characteristic, or whether similar service was provided by the two types of carriers. To measure shippers' opinions concerning likely outcomes of intrastate deregulation, a similar procedure was followed. Eight possible effects of deregulating in-state motor carriers were selected. Shippers were asked to indicate whether they believe deregulation would result in a favorable change, an unfavorable change, or no effect, or if they had no opinion regarding the possible outcome.

A 1959 U.S. Department of Agriculture study, along with input from fresh fruit and vegetable industry personnel, was used to develop the list of service attributes and list of expected deregulatory results included in the survey. Special attention was focused on identifying quality of service attributes impacted by regulation.[5] USDA personnel conducted interviews of frozen fruit and vegetable processors to assess the impact of a newly acquired exempt status for interstate motor carriage. The study identified several areas of service as critical in deciding whether or not to use exempt motor carriers for transport. The USDA also inquired into the expected effects of placing frozen fruits and vegetables on the exempt commodity list.

[2] A statistical comparison of regulated and unregulated fruit and vegetable rates revealed that Texas's regulated rates generally exceed unregulated interstate rates for comparable distances. Also, a survey of Texas's regulated intrastate carriers found that most regulated carriers believe the intrastate hauls to be most profitable. Accordingly, there appears to be no economic incentive for the regulated carriers to participate in interstate haulage (Fuller, Makus, and Lamkin).

[3] A review of applications submitted to the Commission between September 1981 and June 1982 revealed that 47 percent of the applications to transport agricultural products have been granted. Texas statute allows for sale of issued certificates; accordingly a secondary market has been established. A review of sales transactions between March 1981 and August 1982 showed certificate values ranging from $500 to $25,000 for agricultural certificates. The average value of the certificates was $4,460 (Fuller, Makus, and Lamkin).

[4] Three weeks after the initial questionnaire was mailed to the 116 fresh fruit and vegetable shippers, a follow-up letter with the same questionnaire was sent to nonrespondents. No additional effort was made to contact nonresponding shippers.

[5] Extensive interviews with shippers and industry personnel were carried out to develop a list of motor carrier service attributes that were affected by the nature of regulation.

To determine whether regulation leads to a superior quality of motor carrier service, survey results were analyzed using a normal approximation of the binomial distribution (Conover). A binomial distribution is developed by comparing each possible response (regulated intrastate carrier, exempt interstate carrier, or no difference in carriers) to another category containing the sum of the remaining two possibilities.[6] If a majority (more than 50 percent) of shippers prefer the regulated intrastate carrier for most service attributes, this provides evidence that regulation has a favorable impact on service quality. If the intrastate carrier is preferred by a majority of shippers for few service attributes, this suggests that shippers do not view regulation as yielding superior motor carrier service.

Interpreting the expected results of deregulation provides additional insight into regulation's impact on service. If a majority of shippers believe intrastate motor carrier deregulation will have an undesirable impact on service, this implies that existing regulation improves the quality of service offered by carriers. Conversely, if a majority of shippers perceive favorable results from deregulation, this supports the notion that regulation does not lead to superior motor carrier service. The Z-test will be used to determine if a majority of shippers feel deregulation will have favorable or unfavorable impacts on motor carrier service.[7]

Survey results are segregated by firm size (small or large) to evaluate the issue of service discrimination against small-volume shippers. Small-and large-shipper responses concerning the quality of service offered by regulated and unregulated carriers are compared. Differing response patterns from the two firm size groups could indicate that small-volume shippers perceive superior service as being provided by the regulated carrier. Such a result would support the argument that regulation prevents discrimination against small-volume shippers. Similar response patterns between the two firm size groups would tend to support the contention that small- and large-volume shippers receive comparable service. Similar response patterns and a preference for the unregulated carrier by both groups would provide evidence against the traditional argument that small-volume shippers are discriminated against in an unregulated environment. The chi-square test for group independence is used to determine if small-and large-volume shippers have differing response patterns.[8]

RESULTS

Quality of Service

Shipper responses to the 14 quality-of-service attributes are summarized in Table 1. The percentage of respondents preferring the regulated intrastate carrier, the exempt interstate carrier, or perceiving no difference

Table 1. Percentage of Survey Respondents Favoring the Intrastate Carrier, the Interstate Carrier, or Perceiving No Difference in Carriers Concerning Quality of Service Attributes

	Quality of Service Attribute	Intrastate Carrier	Interstate Carrier	No Difference
			-percent-	
1.	Carrier more financially responsible	14.8	24.1	61.1
2.	Trucks more readily available	17.3	63.5*	19.2
3.	Has lowest rates for services provided	13.5	73.1*	13.4
4.	Has better equipment	7.6	49.1	43.3
5.	Has more reliable service	5.6	47.2	47.2
6.	Has fewer loss and damage claims	28.3	20.8	50.9
7.	Has fewer restrictions on in-transit services	11.3	73.6*	15.1
8.	Drivers give most attention to perishable nature of product	7.6	54.7	37.7
9.	Provides best claims adjustment	7.6	32.0	60.4
10.	More willing to serve out-of-the-way markets	5.6	66.1*	28.3
11.	Shows greatest concern for shipper's problems	11.4	50.9	37.7
12.	Provides most timely service	17.0	35.8	47.2
13.	Provides prompt pick-up and delivery	11.3	35.9	52.8
14.	Shows most flexible and accommodating service	11.3	58.5	30.2

* Indicates a rejection of the null hypothesis that less than or equal to 50 percent of shippers prefer the intrastate carrier, the interstate carrier or perceive no difference in carriers (n=55).

[6] The test statistic for the normal approximation is:

$$Z = Y - p^{*}n/[np^{*}(1-p^{*})]^{1/2}$$

The test to determine a majority is:

$$H_o: p^{*}_{*} \leq 50 \text{ percent}$$
$$H_a: p^{*} > 50 \text{ percent}$$

where:

Y = number of respondents in a particular response category
p* = proportion of total responses from the null hypothesis
n = number of observations

[7] The testing procedure will be essentially the same as that used for the quality of service attributes just discussed. The only difference is that "all other" responses will include three remaining possibilities rather than two.

[8] Specifically, the null hypothesis is:

$$H_o: P_{1j} = P_{2j}$$

where;

P_{1j} = percent of small-volume shipper responses in category j
P_{2j} = percent of large-volume shipper responses in category j
j = [1(intrastate carrier), 2(interstate carrier), 3(no difference)]

The alternative hypothesis is that at least one set of percentages in the jth response category is not equal. Since the number of observations is fairly low, expected cell frequencies were small in several tests. Many authors typically argue that the chi-square approximation requires expected cell frequencies of 5 or more (Cochran). Others have argued this general rule is arbitrary and quite conservative. Conover (pg. 156) indicates that expected cell counts of 1 are acceptable under certain circumstances. Roscoe and Byars (pg. 759) specify average expected cell frequency as the critical criterion and find that even with extreme departures from a uniform distribution of responses, an average frequency of six or more is acceptable for a 5-percent test. All of the chi-square tests in this analysis meet the Roscoe-Byars criterion.

ence between carriers is listed for each service attribute. For example, 61.1 percent of the respondents found no difference regarding the attribute "carriers more financially responsible," and 63.5 percent believe that unregulated interstate carriers have "trucks more readily available."

The Z-test is used to test the null hypothesis that less than a majority of shippers prefer one carrier type or perceive no difference between carriers. A rejection of this hypothesis indicates that a majority (more than 50 percent) of fresh fruit and vegetable shippers prefer one of the carrier types or feels that the two carriers provide comparable service. This null hypothesis is rejected regarding four quality-of-service attributes (Table 1). They are "trucks more readily available," "has lowest rates for services provided," "has fewer restrictions on in-transit services," and "more willing to serve out-of-the-way markets." In each case where the hypothesis is rejected, the majority of shippers expressed a preference for the exempt interstate carrier.

Examination of the response patterns in Table 1 yields further insight on the quality of service offered by the two carrier types. For 11 of the 14 service attributes, over 50 percent of the respondents believe that superior service is provided by the exempt interstate motor carrier or that similar service is offered by the two carrier types. A larger percentage of the respondents perceive the unregulated interstate carrier's service as superior to the regulated intrastate carrier for all service attributes except one. The exception is "has fewer loss and damage claims," and 28.3 percent favor the exempt carrier. For the remaining attributes, the percentage of respondents favoring the regulated carrier ranges from 5 to 17 percent. The results indicate that shippers do not receive superior overall service from the regulated carrier, except for the service attribute "has fewer loss and damage claims."

Shipper responses to the list of expected results associated with in-state deregulation are summarized in Table 2. The percentages of total respondents believing that the result would occur with deregulation (yes), would not occur with deregulation (no), would not be effected by deregulation (no effect), or having no opinion regarding the deregulatory effect (no opinion), are listed for each of the eight expected result categories. For example, 80.4 percent of the respondents believe that in-state rates would be lowered if deregulation occurred and 65.4 percent believe that small-volume shippers would not pay higher rates (Table 2).

To identify a statistical majority, the Z-test was employed to evaluate the null hypothesis that less than or equal to 50 percent of fresh fruit and vegetable shippers have similar expectations about a particular outcome. A rejection of the null hypothesis indicates that a majority of shippers feel similarly concerning the impacts of deregulation. This null hypothesis is rejected for six of the eight expected results (Table 2). In each case, hypothesis rejection is associated with a favorable expectation regarding deregulation. A majority of shippers believes that deregulation will lead to lower rates, increased truck availability, and an increase in backhauls. Furthermore, a majority does not believe that deregulation will result in small-volume shippers paying higher rates, a loss of out-of-the-way markets, or a shortage of trucking equipment. The Z-test results provide strong evidence that fresh fruit and vegetable shippers believe deregulation would have a desirable outcome.

Table 2. Percentage of Survey Respondents Indicating the Expected Result Would Occur With Deregulation, Would Not Occur With Deregulation, Would Not Be Effected By Deregulation, or Having No Opinion About the Expected Result

Expected Result	Yes	No	No Effect	No Opinion
	-percent-			
1. In-state rates would be lowered	80.4*	1.8	7.1	10.7
2. More trucks available for in-state use	69.1*	3.6	10.9	16.4
3. Backhauls would increase on in-state hauls	67.3*	1.8	7.3	23.6
4. Small shippers would pay higher rates	7.3	65.4*	16.4	10.9
5. Loss of out-of-the-way markets	1.8	61.8*	16.4	20.0
6. Shortage of trucking equipment would occur	3.6	61.8*	25.4	9.2
7. Small shippers would get poorer service	5.4	58.3	25.4	10.9
8. Increase in loss and damage	5.4	47.3	32.7	14.6

* Indicates a rejection of the null hypothesis that less than or equal to 50 percent of shippers fall into a particular response column (n = 55).

Because Texas shippers have experience with carriers that operate in the unregulated interstate transportation market, they have informed opinions regarding possible outcomes associated with motor carrier deregulation in Texas. The survey revealed that a small percentage of the respondents have an unfavorable reaction regarding the results of deregulation. In all cases, an undesirable outcome was thought to be likely by less than 8 percent of the total survey sample. Also, the response patterns from Table 2 concerning rates, truck availability, and the impact on out-of-the-way markets are consistent with the previous discussions on service quality. Table 1 reflects that a majority of shippers find the unregulated carrier superior regarding these three service areas. Table 2 shows that shippers feel the three areas of service would be favorably affected by deregulation.

Texas fresh fruit and vegetable shippers believe that changing to a deregulated motor carriage environment would improve quality of service. Chow argues that surveys of this type tend to be biased in favor of the status quo. If this bias does exist, study results may be conservative estimates of the desirability of change.

Discrimination and Shipper Size

To determine whether regulation affects the quality of service provided to small-volume versus large-volume shippers, survey results from firms with 400 or fewer annual truckload shipments were segregated and classified as small. Firms having in excess of 400 truckloads were placed in the large-shipper category. This firm-size breakdown was based on conversations with officers of the shippers' association.

Small-volume and large-volume shipper responses

Table 3. Percentage of Small and Large Survey Respondents Favoring the Intrastate Carrier, the Interstate Carrier, or Perceiving No Difference In Carriers Concerning Quality of Service Attributes

Service Attribute	Small Shippers[a]			Large Shippers[b]			Chi-Square[c] Statistic
	Intra-State	Inter-State	No Difference	Intra-State	Inter-State	No Difference	
	-percent-						
1. Carriers more financially responsible	21.0	15.8	63.2	11.4	28.6	60.0	1.62
2. Trucks more readily available	22.2	66.7	11.1	14.7	61.8	23.5	1.37
3. Has lowest rates for services provided	27.8	55.6	16.6	5.9	82.3	11.8	5.56
4. Has better equipment	16.7	44.4	38.9	2.9	51.4	45.7	3.25
5. Has more reliable service	11.2	44.4	44.4	2.9	48.6	48.5	1.52
6. Has fewer loss and damage claims	38.9	22.2	38.9	22.9	20.0	57.1	1.89
7. Has fewer resticitons on in-transit services	11.1	66.7	22.2	11.4	77.2	11.4	1.10
8. Drivers give most attention to perishable nature of product	11.2	44.4	44.4	5.7	60.0	34.3	1.31
9. Provides best claims adjustment	16.7	27.8	55.5	2.9	34.3	62.8	3.26
10. More willing to serve out-of-the-way markets	0.0	61.1	38.9	8.6	68.6	22.8	2.72
11. Shows greatest concern for shipper's problems	16.7	50.0	33.3	8.6	51.4	40.0	0.83
12. Provides most timely service	16.7	50.0	33.3	17.1	28.6	54.3	2.63
13. Provides prompt pick-up and delivery	11.1	38.9	50.0	11.4	34.3	54.3	0.11
14. Shows most flexible and accommodating service	11.1	61.1	27.8	11.4	57.1	31.5	0.09

[a] Shippers reporting 400 or fewer annual truckloads (n = 19).
[b] Shippers reporting in excess of 400 annual truckloads (n = 36).
[c] For testing the null hypothesis that the small and large shippers feel the same regarding service provided by the two carrier types. None of the values are significant at the 5 percent level.

regarding quality of service offered by the regulated and unregulated motor carriers are presented in Table 3. For the service characteristic "carriers more financially responsible," for example, 21.0 percent of the small-volume shippers favor the intrastate carrier, 15.8 percent prefer the interstate carrier, and 63.2 percent believe that there is no difference between the two carrier types. Regarding the same service attribute, 11.4 percent of the large-volume shippers find the intrastate carrier superior, 28.6 percent favor the interstate carrier, and 60.0 percent believe that no difference exists.

The chi-square statistic was used to test whether the large-volume and small-volume shipper response distributions for each quality-of-service characteristic were statistically different. The failure to reject at the five-percent level for all service characteristics (the critical value for the five-percent test with two degrees of freedom is 5.99) indicates that small-volume and large-volume shippers feel similarly regarding service provided by the two carriers; there is no statistical indication that small-volume shippers feel differently toward regulated or unregulated carriers than large shippers.

CONCLUSIONS

Texas fruit and vegetable shippers use truck transportation almost exclusively in moving their products to interstate and intrastate markets. Intrastate motor carriers are heavily regulated by the Railroad Commission of Texas, while the interstate carriers operate under an exempt status. As a result, these shippers are knowledgeable of both motor carrier types and are in an excellent position to contrast the quality of services offered.

A survey of fresh fruit and vegetable shippers within the state was carried out to evaluate two traditional arguments supporting motor carrier regulation. The first argument centers on the effect of regulation on the quality of motor carrier service. Regulatory proponents argue that motor carrier regulation provides stability for an industry they allege to be chaotic. This stability improves service and directly benefits shippers. The second issue involves discrimination against small-volume shippers. Since unregulated carriers are not legally obligated to provide comparable service to small-volume shippers, supporters of regulation argue that this traffic segment will receive a low priority and be poorly serviced.

Criteria for evaluating performance include 14 quality-of-service attributes and 8 expected outcomes of deregulation. Survey results are statistically analyzed using a normal approximation of the binomial distribution (Z-test). Texas fresh fruit and vegetable shippers believe that service provided by the exempt interstate carrier is superior or comparable to that of the regulated intrastate carrier. In addition, these shippers strongly express an expectation that the results would be favorable if intrastate trucking were deregulated.

To analyze the issue of discrimination against the small-volume shipper, respondents are categorized as small or large based on annual shipments. The response patterns for the two groups are statistically compared using the chi-square test for group independence. For all 14 quality-of-service attributes, the test cannot identify any difference in response patterns between small-volume and large-volume shippers. The small-volume shippers do not feel that inferior service is being provided by the unregulated motor carrier.

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