The Structure of a Never Regulated Less-Than-Truckload Market in the United States

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The structure of the never-regulated, less-than-truckload transport market for Florida ornamentals is examined using concentration ratios, and the Hirchman-Herfindahl, Rosenbluth, and E Indices. The results indicate that this market is not highly concentrated relative to all US markets or to regulated trucking markets. This suggests that the long run structure of the trucking markets where regulations have been relaxed will not be highly concentrated and that economies of size may not be large. It was also found that, despite characteristics favorable to own-account carriage, it plays a minor role in ornamentals transportation relative to in regulated markets. This is consistent with the hypothesis that avoidance of problems and costs related to regulated carriage can be an incentive for firms to adnnt own-account carriage.

Introduction

One of the primary rationales given for regulating a market[1] is the existence of economies of size sufficient to result in firms which possess significant degrees of monopoly power and may collude (Kahn, Vol. I, chapter 1). Such firms could extract monopoly profits and, unless they could perfectly discriminate, impose deadweight losses on society. In theory, at least, regulatory controls could mitigate these problems. The issue of economies of size is central in the debates regarding transportation regulatory reform. With respect to motor carriage, it is generally conceded that economies of size are absent or very small for truckload operations (TL). Rather, the controversy regarding economies of size centers on less-than-truckload operations (LTL) (Wilson, chapter 2; and McLure). It could be argued that the only remaining issue of substance regarding the efficacy of motor carrier deregulation (as well as deregulation of air lines and railroads) is if the long run market structure will be highly concentrated.[2]

The rationale behind anticipating large economies in LTL but not TL operations is that the former, but not the latter, generally requires investment in terminal facilities for assembly of individual shipments into truckload lots at the origin, breakbulk facilities at transshipment points to reconfigure shipments into truckload lots for delivery to destination areas, and facilities for disassembly and local delivery at the destination. The spreading of the large fixed costs of these facilities is what is expected to give rise to the economies. Many proponents of continued and revitalized regulation assert that regulations, like those enforced prior to the Motor Carrier Act of 1980, have protected smaller LTL carriers, thereby promoting competition. In the current loosely regulated environment or in a

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[1] Throughout this article "market" appears in places where "industry" may seem to be the more natural term. Indeed, the two terms frequently are treated as synonyms. Our usage follows Brunner's distinction between the two, with the former defined by demand considerations (competing or substitutable goods and services) and the latter by supply considerations (producers of similar products, using similar technologies). For example, manufacturers of plastic spoons and wooden spoons may compete in the same market or markets, but they are not in the same industry. Unless one is addressing issues related to monopsony. market, rather than industry structure is generally of more interest as a behavioral indicator (Curry and George).

[2] The only possible exception to this statement is the question regarding the existence of a linkage between economic regulations and maintained safety standards.

completely deregulated one, they argue, regional and national markets will increasingly become dominated by a small number of very large firms.

There is evidence that this is beginning to occur. In response to eased entry controls, between 1978 and 1985 the number of motor carriers of property holding authorities (i.e., permits) for interstate cartage of regulated commodities almost doubled, from 16,874 to 33,283 (Horn). Almost all new entry, however, was by smaller carriers. The total number of Class I carriers (those with operating revenues of at least $5 million) has remained constant, the number of Class II carriers (those with operating revenue between $1 million and $5 million) has declined, and only the number of Class III carriers (those with operating revenues under $1 million) has increased (Horn). Moreover, almost all of the new entry has been primarily TL carriers. Only three new Class I, LTL carriers have entered the industry, and the largest of these has since exited (Horn).

In testimony before Congress, Silberman presented evidence of increased concentration in LTL trucking. According to his data, from 1978 to 1984 the share of industry revenue earned by the ten largest LTL firms increased from 40 to 54 percent. As ominously, over the same period, the share of total investment outlays in the industry made by these firms increased from 43 to 73 percent (Figure I). By Silberman's own admission the data overstates the degree of concentration by an unknown factor as LTL shipments handled by firms not traditionally identified as LTL firms are not included in the LTL industry totals. These are, in general, firms lacking the aforementioned assembly, breakbulk, and distribution terminal facilities. Also omitted are UPS, bus package services, and 'time-sensitive' delivery firms such as Federal Express and Airborne. If a progressively larger share of LTL freight has been captured by such firms, real concentration ratios may not be increasing or increasing as rapidly as the Silberman data indicates. Nevertheless, his results do raise serious questions regarding the eventual level of concentration in the LTL industry resulting from reduced regulatory controls.

An associated issue is the viability of private LTL operations (that is, LTL transport by the owners of the cargos). Private carriage is exempt from interstate economic regulation. Some writers have speculated that this form of carriage has developed in part to avoid the costs of employing regulated carriers (Kahn, vol. 2, pp. 18-19). This argument assumes that regulations create inefficient, high cost carriers, and/or that the regulatory system allows carriers to charge rates significantly in excess of their marginal costs. If true, without regulation more

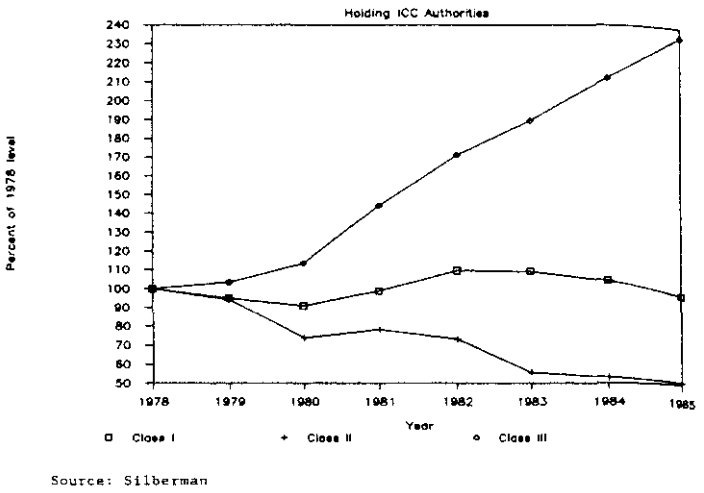


Figure 1. Changes in Motor Carriers

transportation would be relegated to specialists, that is, to for-hire carriers.

In this paper the results are presented of a study of sellers in the interstate motor carriage market for ornamentals (i.e., flowers, foliage, ferns, and bedding and landscaping plants) produced in Florida. This market has never been regulated; is long distance, indeed, national in scope; and may be characterized as primarily LTL. The central premise of this paper is that information regarding the structure and characteristics of ornamentals trucking may offer insights into the long-run structure of other LTL motor carrier industries which are now in unregulated or loosely regulated environments. The specific goals of the study are to:

1. Measure seller concentration in the market. Concentration indices employed will include concentration ratios, and the Hirschman-Herfindahl, E, and the Rosenbluth indices. Compare concentration ratios with those for regulated motor carriers.
2. Determine the shares of the market held by for-hire, and private carriers.

Previous Literature

Since the mid-1950's, there have been over a dozen major studies conducted to determine the presence of economies of size in motor carriage. Almost without exception, the studies have focused upon industry segments in which LTL traffic predominates. Those studies, such as Chow and McMullen, which also examined TL operations, not unexpectedly found constant or slightly declining econ-

[3] A good discussion of the studies **through the** late I970's may be found **in Wilson,** chapter 2.

c-mies of size beginning at very small fleet sizes. The results with regard to LTL carriage, however, are quite mixed. In general, the studies of the 1950's and 1960's; (such as Roberts, Nelson, Meyer et aj_5 and Emery) argued against the existence of economies of size. Significant economies were found in the studies carried out during most of the 1970's (for example see Ladenson and Stoga, Lawrence, and Rakowski (1977 and 1978b)).

The majority of work done towards the end of the 1970's and into the 1980's, indicates constant or only slight economies of size (for example see Rakowski (1978a); Sugrue, Ledford, and Glaskowsky; and Friedlaender). These authors stress that the results of earlier studies are open to criticism because of their failure to control for nonhomogeneous transportation services. In these later studies, nonhomogeneous services are accounted for by limiting the sample to similar firms and by including 'quality' variables such as the average length of haul and average shipment size. The importance of these controls is demonstrated by Friedlaender. Without the quality variables her results show significant economies of size, but with their inclusion no economies are indicated. Indeed, with the quality adjustments, she finds significant diseconomies of size for large levels of output.

All of the later authors are quick to point out the problems involved with measuring quality differences. Also, they recognize the problems inherent with developing cost estimates for regulated firms. Averch and Johnson showed that regulatory controls can alter the choice of technologies and factor mix by, in effect, creating shadow prices on factors that differ from those faced by unregulated firms. Work by Moore and Kim, Friedlaender and Spady, and McMullen and Stanley have demonstrated the interaction of regulations, on the one hand, and technology and factor mix, on the other hand, in motor carriage. Assuming equally-risk averse firms, Daily shows that entry restrictions are likely to promote relatively higher growth rates in larger firms. Her empirical work, for a period prior to the onset of reforms, support this view. Given these effects, the value of the economies of size studies of regulated firms regarding the post-regulation structures of LTL trucking is highly questionable.

Empirical evidence regarding the structure and performance of unregulated, long-distance LTL motor carriage is virtually nonexistent. Prior to 1980 only New Jersey and Delaware did not have economic[4] regulation of intrastate motor carriers. Research regarding trucking in New Jersey suggests that all segments of an unregulated trucking industry are highly competitive (Alien). However, the longest movements within the state of New Jersey are barely over a hundred miles. Several studies (e.g., Chow, Friedlaender, Rakowski (1978b), and Sugrue, Ledford, and Glaskowsky) indicate that the distance of the haul is an important determinant of costs, including the presence or absence of economies of size. For example, Rakowski (1978b) found economies of size for short haul, but not long haul LTL carriers. Therefore, the examination of an LTL industry that has never been regulated and which operates over sufficient distances to encompass both long and short haul carriers can contribute to our understanding of the long-run industry structure of other LTL industries.

Concentration Measures

A keystone of industrial organization literature is the premise that structure is one of, if not the leading determinant of an industry's conduct and performance. There is much interest, therefore, in ascertaining the structure of industries and the likely directions of change for that structure. The latter endeavor usually involves research to discover the presence and extent of economies of size, such as in the studies reviewed in the previous section. The former, describing an industry's current structure, seems much more straightforward than wrestling with the vagaries of economies of size estimation. Indeed if the data are available, it is a simple matter to list the number of firms by size or sales volume. This, however, misses the point of structural descriptions, namely to determine the industry's place in the spectrum of market power from monopoly to pure competition. To do this requires development and use of a weighting system that takes into account at least the number of firms and disparities among their sizes.

Clearly an industry with 1,000 equally sized firms will be closer to the competitive end of the spectrum than would an industry with 999 firms that account 20 percent of sales and one that accounts for 80 percent. However, "one of the ongoing embarrassments of economic theory is the absence of a persuasive model that links the number of firms and their relative size with the expected degree of competition in an industry" (Hause, p. 73). As yet, there are no definitive answers regarding the appropriate firm number/relative size tradeoff for gauging industry competitiveness. Almost surely this tradeoff differs from market to market, depending upon interactions with other factors such

[4] Economic regulation refers to controls over entry, rates, and operating restrictions, such as those governing permissible routings and the common carrier obligation (which prohibits carriers from discriminating among shipper/receivers). Economic regulations are distinct from those regarding safety.

as contestability/"[1] Nevertheless, most would argue that structural information provides strong clues as to the competitiveness of market.

Several concentration indices have been devised. In Table 1 is presented a glossary of the formulae for the indices discussed in this section. They differ from one another in two principal regards: data requirements and weighting of smaller or fringe firms. Often data are lacking or incomplete regarding all firms in a market. This is particularly true for smaller firms. In such circumstances, it would be desirable to have indices that are insensitive to information regarding smaller firms. The two most popular such indices are concentration ratios for the x largest firms, and the Herfindahl-Hirschman Index (HH). Concentration ratios on the x largest firms only require information regarding the market shares of those firms. HH incorporates market share information on all firms in an industry, but operationally the accuracy of information on smaller firms is unimportant.[6]

If, however, one holds the belief that smaller firms can make substantial impacts on industry competitiveness, then indices employing and sensitive to information on these firms are appropriate. Two such measures are the Gini Coefficient and the Rosenbluth Index (R). The Gini Coefficient measures the departure between the observed Lorenz Curve and that which would exist if all firms had equal market shares. In recent years the Gini Coefficient has received considerable criticism due to the fact that it does not take adequate account of firm numbers. Therefore an oligopoly with similar sized firms may be judged more competitive than an industry with a large number of different sized firms. R avoids this criticism by taking both the relative size and the number of firms into account. Use of this measure in the literature, however, has been limited due, largely, to its rigorous data requirements. Fortunately, data for the current study are complete.

A final measure presented is the E Index (E). In a sense, it is a variation of the approach employed for HH Index. With HH, the market share of each firm is squared and then summed. For the E, market share for each firm is exponentially weighted by itself and the index is formed by taking the product, rather than the summation, of the results across all firms. It is equivalent to the reciprocal of the antilog of the Entropy Index. E is not easily compared with the other measures (Marfels). The focus of the ensuing discussion will not be on this measure- rather, it is presented for the convenience of terested readers.

The Florida Ornamentals Transportation Market

Florida is the second most important ornamentals producer in the United States (California is first). The 1984 farmgate value for Florida ornamentals was three quarters of a billion dollars (Florida Crop and Livestock Reporting Service). Virtually all of the Florida's ornamentals production is shipped by truck to the rest of the United States or to Canada.

No transportation market is purely LTL or TL. Commodities such as grain and steel tend to be shipped in truckload (or larger) shipment sizes, while other commodities, such as electronics and jewelry, tend toward less-than-truckload shipment sizes. Any commodity, however, may be shipped in truckload or less-than-truckload lots. Ornamentals tend to be shipped in less-than-truckload lots.[7] Few outlets are able to handle a full truckload of foliage or ferns at one time. Relative to most agricultural products, ornamentals are high in value. Moreover, they are perishable and subject to losses from disease, pests, and improper temperature or humidity. It is not surprising, therefore, that smaller shipment lots are generally preferred.

Ornamentals require a considerable degree of special handling in transport. During most times of the year and for all but very short trips, temperatures must be controlled in transit. In addition to climate control, many types of ornamentals cannot be easily packaged or are packaged into unusual sized containers. Because of this, special racks are required for most loads to prevent losses from cargo shifts and to efficiently use the vehicle's cubic capacity.

Some carriers specialize in ornamentals transport. In traditional LTL carrier fashion, they maintain terminal facilities in Florida for assembling individual shipments into truckload lots. However, conversations with these carriers indicate that corresponding terminal facilities for breakbulk and for distribution at destination markets are not maintained. Rather, the linehaul (i.e., origin-to-destination) vehicles are employed for these deliveries.

[5] See Baumol for a discussion of con testability theory and its effect

[6] The insensitivity of HH to smaller firms is illustrated by the fact that for all carriage, HH is virtually identical using the 50 largest firms only and using all 7,479 firms (.0354596 versus .0355968). By contrast, using only the largest 50 firms, E and R are 21 and 102 times larger, respectively, than if all firms are used.

[7] This is indicated by the fact that 54 percent of the tractor-trailers carrying ornamentals had multiple stops. By contrast, in the same year only 22 percent of the 1734 produce carriers interviewed reported multiple drops.

Table 1. Concentration Measures

Name	Formula[1]	Comment
Concentration	$C_k = \sum_{i=1}^{k} P_i$ range: 0 to 1	This is the most widely used measure. It has the advantages of having a straightforward interpretation and relatively small data requirements. Its principle disadvantage is that the influence of smaller firms are essentially ignored.
Hirschman-Herfindahl Index	$HH = \sum_{i}^{n} P_i^2$ range: 1/n to 1	Unlike concentration ratios, HH accounts for the distribution market shares for all sellers. Larger firms are given proportionately greater weight. Therefore, this measure is particularly appropriate when collusive activities among larger firms is hypothesized (Yamey).
Index	$R = 1/[(2\sum_{i=i}^{n} iP_i) - 1]$ range: 1/n to 01	R is equivalent to the reciprocal of twice the area above the concentration curve.[2] It is very sensitive to the distribution of market shares among smaller firms, and is appropriate for those who feel that small firms play an important role in determining the behavior of all firms in the market place (Shepherd, p. 189).
E-Index	$E = \prod_{i}^{n} P_i^{P_i}$ range: 1/n to 1	In a sense E is a modification of HH. Each share is exponentially weighted by itself and the product of the results taken to form the index (in HH it is the sum of the square of each share). E is not readily comparable with other concentration measures (Marfels). It is included as it is among the most popular of the exotic or unusual measures currently being used and tested.

[1] n = total **number of firms**
i = number of each firm with 1 for the largest firm **and** n **for the smallest firm**
k = a number of less **than n; the k largest** firms
Pi = market share of the ith firm
II = **product of** terms
Σ = **summation of terms**

[2] **The concentration curve is formed by plotting the cumulative percent of output** (vertical **axis) against the number of leading firms (horizontal).**

It is thought by the authors that the absence of carrier-owned destination terminals is because of insufficient volumes at each urban market.

As breakbulk and destination terminals are not used by ornamentals transporters, it can be argued that they are not a pure LTL carriers. Rather, it is more akin to what is known as 'stop-off trucking'. Stop-off trucking refers to firms which employ only origin terminals from LTL cargo. Shipment sizes of the cargos handled by these firms are generally larger than for firms with breakbulk and destination terminals. Indeed, this is true for ornamentals. Whereas it is not uncommon for pure LTL firms to average 30 to 40 shipments per truckload,[8] all ornamentals carriers average between 6 and 7 drops and the average for multiple drop loads is 11 drops. It should be noted, however, that it is not uncommon for ornamentals carriers to have truckloads with large numbers of shipments. Thirteen percent of multiple drop ornamentals loads have 20 or more drops per truckload, and half of these have 30 or more drops. Therefore, while breakbulk and destination terminals are not employed, ornamentals transport is, in large measure, LTL in character—particularly multiple drop ornamentals carriage.

Indeed LTL service *is* transport service for less-than-truckload shipments and *not* transport that uses terminals. That is, the type of service delivered is what determines the market, not the technology employed to deliver the service. Nevertheless, it should be recognized that the optimum technology (i.e., use/nonuse of breakbulk and destination area terminals) may depend on average shipment size,[9] and that ornamentals transport may not be representative of carriers who specialize in handling very small shipment sizes.

This does not mean, however, that distribution terminals are never employed. A growing proportion of ornamentals are retailed through supermarket chains. Many chains utilize their refrigerated warehouses as distribution points for ornamentals along with their more traditional grocery items, thereby mitigating the problem of insufficient ornamentals volumes. However, in 5 years and over 4,000 interviews of produce and ornamentals haulers, the authors have never observed a supermarket

[a] Conversation **with James Harkins,** Executive **Director of the Regular Common Carrier** Conference, April 27, 1987,

[9] For a discussion **of the relationship between** shipment size and choice **of terminal** system **see Mandex.**

chain hauling its own ornamentals. Rather, the chains utilize for-hire carriers. From the point of view of these for-hire carriers, deliveries to a receiver-owned terminal is a TL movement.[10] Therefore, in the current study single drop interstate movements will be considered as TL and multiple drop as LTL.

Data

The two data sets employed for this study are unique both with respect to the types of information contained and their comprehensiveness. The first and most important is from information collected by Florida State Agricultural Inspectors in 1984. These data include the date, carrier firm name, loading point, vehicle size, final destination, cargo type and amount, and number of stops for *every* truck carrying ornamentals out of the Florida Peninsula in 1984.[u] In all there were 38,239 ornamentals-hauling truck passings.

The second data set is from surveys of motor carriers hauling produce or ornamentals from the Florida Peninsula from 1982 through 1986. This data set includes information similar to the above, as well as freight rates and number of pickups for about 2,000 trucks per year.[12]

Results

Is Ornamentals a Separate Transportation Market?

Ornamentals are carried primarily in the same type of equipment as is produce, refrigerated tractor-trailers, and it is known that some carriers will haul either ornamentals or produce. The volume of ornamentals shipped from Florida is barely a tenth that for produce. It may be questioned, then, if ornamentals transportation constitutes a market unto itself or if it would be better described as a part of that for produce. If the latter is the case, then an analysis of concentration in ornamentals transport would be specious.

Reasons for assuming that ornamentals transport constitutes a separate market are the need for assembly facilities (at least for LTL movements) and specialized racks to protect plants in transit. The acid test, however, is an examination of price movements for ornamentals and produce transport If freight rates for produce and ornamentals haulage are identical or closely correlated, then they can be assumed to be for essentially the same service (Stigler and Sherwin). Otherwise stated, if the ornamentals transport market is contestable by produce haulers, then the prices for ornamentals transport should be disciplined by those for produce. The empirical evidence strongly indicates that produce and ornamentals are separate markets. In Figure 2 are presented the average per mile freight rates per truckload for ornamentals and produce from Florida between November 1982 and May 1986.[u] Rates for ornamentals range from 95 to 169 percent of those for produce. For six of the twelve intraseason rate changes recorded, ornamentals and produce rates moved in opposite directions and their correlation coefficient was only .096.

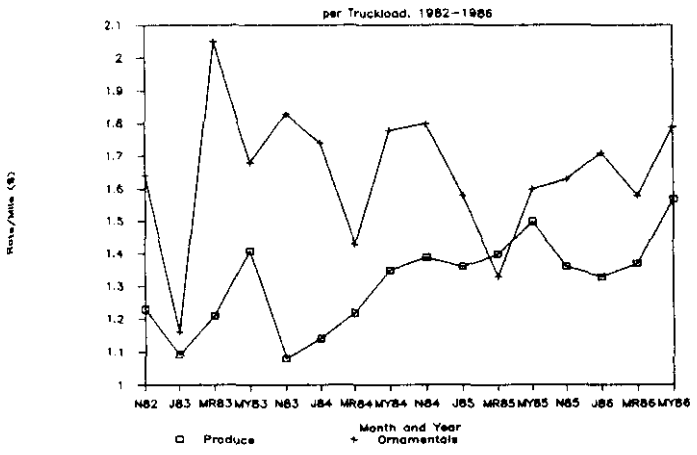
Measures of Concentration

To estimate the degree of concentration in an industry, it is first necessary to have a measure of output. However, a significant problem in transportation literature is specifying the unit of output. Spady and Friedlaender and Rakowski (1978b) have pointed out that there can be considerable differences among transport services. These differences include distance, shipment size and density, handling and monitoring, speed, and reliability. The most frequently used measure of output is distance times cargo weight, for example: ton-miles. Other variables, such as handling and speed, are ignored. The omission of these quality variables is potentially serious when aggregating the transport of car-gos as diverse as coal, diamonds, strawberries, legal documents, and human beings. However, within ornamentals transport, the variations in service quality are likely to be fairly small.

Because of its low density, the appropriateness of a weight-distance measure for ornamentals is questionable. Like pillows and ping pong balls and unlike marble and steel, the cubic capacity of a truck and not its permissible gross weight is almost always the limiting factor. Therefore, instead of a weight-distance measure, in this study a cubic capacity-distance measure is employed, CUBE-MILES (cubic foot capacity times linehaul mile-

[10] This distinction is commonly used. For example, if a carrier delivers a load of computers to a receiver who later distributes them to various stores, the movement performed by the carrier is considered to be TL. If instead, the carrier delivered the load to the stores, the carrier would be performing an LTL service.

[1,] These data are collected at Florida Agricultural Inspection Stations, which are situated along every roadway leading out of the Florida Pen-



Source: Produce Surveys, 1982-86, see Bellock and Fletcher

Figure 2. Produce/Ornamentals Rates

age).[14] It should be noted that the direct use of an output measure, rather than revenues, to calculate concentration measures is desirable because those hauling their own cargos have no explicit freight rate.

[14] Cubic capacity was estimated as follows; 1. if bed length < 10 feet (a van), 234 cubic feet; 2. if bed length > or = 10 feet, 8 (width) *8.5 (height)*length; 3, if not full, then considered to be 2/3 full (only about 5 percent of the sample was not full).

In Table 2 four measures of concentration are presented: concentration ratios, the Hirschman-Herfindahl Index (HH), the E-Index (E), and the Rosenbluth Index (R). As expected, regardless of the measure employed, the TL segment of ornamentals transport is less concentrated than that for LTL. For example, the 4-firm concentration ratio for LTL, for all shipments, and for TL are, respectively, .47, .34, and .15. The lower concentration in the TL segment may also be seen by examining their Lorenz Curves (Figure 3).

Research by Sugrue, Ledford, and Glaskowsky; Rakowski (1978b); Friedlaender and Spady; and Friedlaender suggests that economics of size may increase with the length of haul. If true, higher levels of concentration would be expected for longer movements. This was examined by segmenting the LTL shipments into short haul (500 miles or less) and long haul (over 500 miles). The results are presented in the last two columns of Table 2. Employing HH, E, and the concentration ratios up to the 100 firm level, the longer haul segment of the LTL movements does appear to be somewhat more concentrated.

Interestingly, R suggests greater concentration in the short haul segment. Unlike the other measures, R is extremely sensitive to the number and sizes of smaller firms. It may be considered a pre-

Table 2. Concentration Measures for Ornamentals Transport

Concentration Ratios (# Fi -ms)	All Shipments	Truck-load (Single Drop)	Less Than Truck-load (Multiple Drop)	LTL Under (500 Miles)	LTL Over (500 Miles)
1	.13	.07	.19	.15	.19
2	.20	.11	.30	.25	.30
3	.37	.14	.40	.31	.41
4	.34	.15	.47	.35	.48
8	.43	.22	.61	.47	.62
12	.48	.26	.65	.52	.66
16	.51	.29	.68	.55	-69
20	.53	.32	.70	.59	.71
50	.61	.43	.76	.70	.77
100	.67	.52	.80	.78	.81
200	.72	.61	.85	.86	.85
300	.76	.66	.87	.92	.88
400	.78	.69	.88	.95	.89
500	.80	.72	.90	.97	.91
ALL	1.00	1.00	1.00	1.00	1.00
Number of Firms	7,479	5,406	2,850	694	2,362
Hirschman-Hirfindahl Index	.0356	.0103	.0707	.0427	.0740
E- Index	.00393	.00144	.0134	.0101	.0148
Rosenbluth Index	.00102	.000883	.00321	.00671	.00357

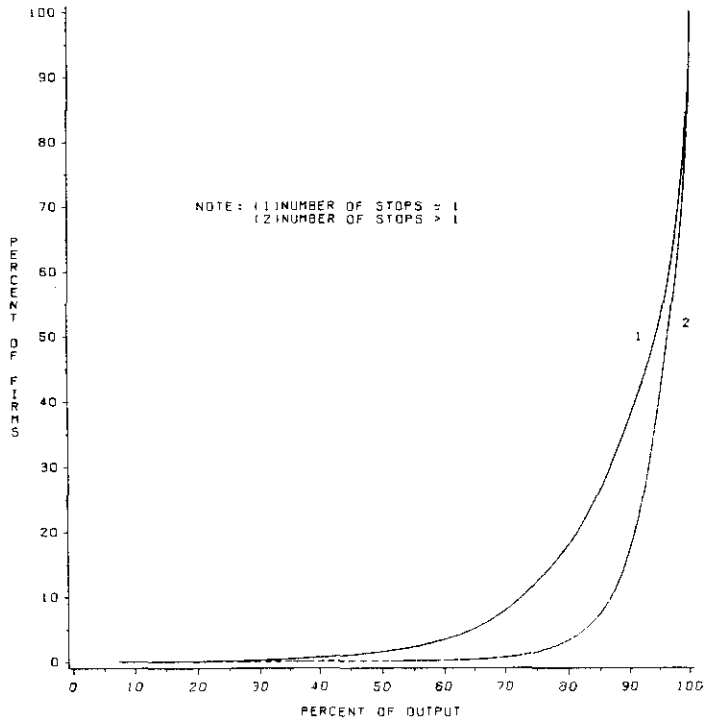


Figure 3. Lorenz Curues for Truckload (1) and Less-Than-Truckload (2)

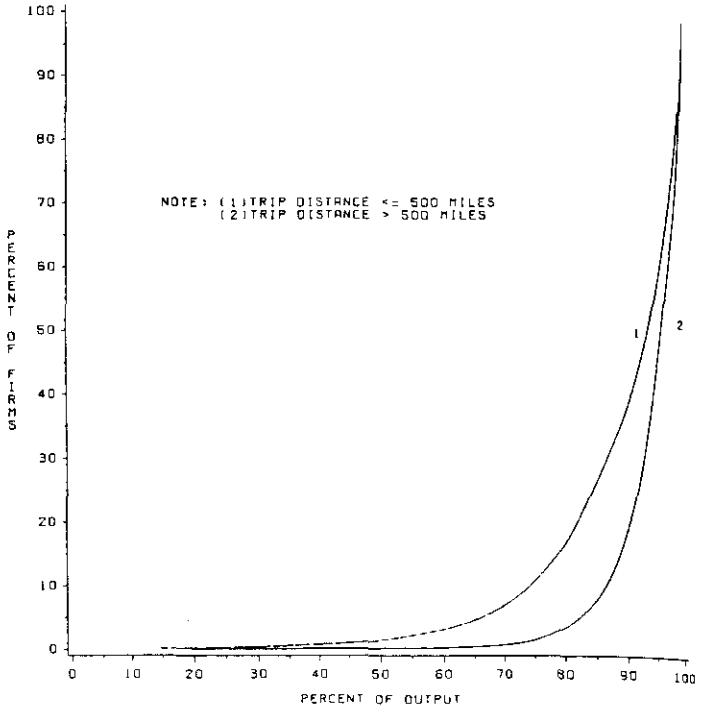


Figure 4. Lorenz Curves for Short Haul (1) **and Long Haul** (2) **Less-Than-Truckload (LE, Number of Stops > 1)**

ferred index if the assumption is held that small firms play an important role in curbing the monopoly power of large firms. With R, the larger numbers of small firms for the long haul segment outweighs the fact that it has a more concentrated grouping of large firms. With the other indices, the importance of the number of small firms is either ignored or discounted. In the current case, however, the Lorenz curve of the long haul segment everywhere lies below that for the short haul segment (Figure 4). Therefore, while it can be said that there are more smaller firms for the long haul than in the short haul segment, it seems difficult, to the authors, to assert that they are more influential and that the short haul segment is more concentrated. Nevertheless, the contradictory results between R and the other measures points up the difficulties inherent in measuring concentration, particularly for instances in which complete market information is not available.

Comparison with Regulated Transport Markets

From a policy standpoint, the critical question is whether less regulation results in higher or lower concentration levels. An indication of this may be gained by comparisons of concentration levels in the never-regulated ornamentals market with those of regulated trucking markets. Due to data limitations with regard to the latter, the discussion is limited to comparisons of concentration ratios.

The ratios for ornamentals do not appear to be exceptionally high relative to other industries in the United States. Whether using all shipments, TL, LTL, LTL-short haul, or LTL-long haul, the largest firm has less than a 20 percent share of the market (Table 2). The four-firm concentration ratios for these groupings range from .15 for TL to .48 for LTL-long haul. This compares with a weighted average four-firm concentration level for all U.S. manufacturing of .39 in 1972 (McLure).[15] Comparisons with four-firm concentration levels, reported by McLure, in regulated trucking markets also indicate that concentration levels are not unusually high in the never-regulated ornamentals trucking industry:

Region	Four- firm concemiration ratios 1980	1983
Eastern Central	40	50
Pacific Inland	48	49
Rocky Mountain	44	48
Middle Atlantic	21	28
Middle Western	22	28
Central States	20	30

It should be noted that the above ratios are based upon both TL and LTL traffic. As concentrations ratios for TL are generally lower, the levels of

[15] The concentration ratios **reported by McLure** are based **upon** revenues rather than volumes of production.

concentration in the LTL portions of these markets likely to be higher. Therefore, the above ratios re most comparable with those for all shipments in Table 2.

importance of Private Carriage

Three types of carriers are identified: specialized for-hire (SPEC), other for-hire (OTH), and private carriers (PRIV). SPEC are those for-hire carriers jcnown to devote significant shares of their carriage to ornamentals. Fifty-one firms were so identified. PRIV are ornamentals producers which also transport at least some of their ornamentals interstate. Ninety-seven such firms were identified. The remaining 7,272 firms were categorized as OTH.[16] The shares of the three types differ sharply depending upon whether all carriage or only multidrop carriage is considered. For all carriage, SPEC holds just under half of the market, OTH holds 46 percent, and PRIV holds only 5 percent:

Shares of haulage by carrier type

	All	LTL	TL
SPEC	49	63	23
OTH	46	34	68
PRIV	5	3	9

For multidrop carriage only, the market share of SPEC rises to 63 percent, while the shares held by OTH and PRIV both drop by almost a third to 34 and 3 percent, respectively. By contrast, U.S. Census data indicate that in 1977 private carriers accounted for 43 percent of all intercity truck-trailer[17] mileage in the U.S. (U.S. Census). The very low share held by PRIV for ornamentals is of some surprise. A survey of private carriers indicated the following as the four most important reasons for engaging in private carriage: unusual or complex scheduling requirements, special handling needs, special equipment needs, and rapid transit time requirements (Southern). The seasonality of supply and demand, perishability, and unusual sizes of these shipments appear to make ornamentals an ideal market for private carriage. That for-hire carriage is able to meet virtually all of the industry's needs may suggest that a large amount of existing private carriage has been regulation-induced and that, with continued deregulation, private carriage will wane in favor of for-hire. This, however, is highly speculative.

[16] The firms were categorized based upon the authors' knowledge of the firms, discussions with carriers in the industry, and two industry directories: Florida Foliage Association and Florida Nurseryman and Growers Association.

[17] Truck-trailers combinations are the dominant types for interstate transport of omamenals.

Summary and Conclusions

In this paper the results have been presented of a study of the truck transport market for Florida ornamentals. The primary significance of the study is that it represents the first examination of a never-regulated, largely LTL, interstate motor carrier industry in the United States. Information regarding the structure of this industry offers clues as to the likely long-run structure of other segments of the interstate motor carrier industry that have recently undergone regulatory reform and may soon be totally deregulated. The completeness of the data is also of interest, as it affords the unusual opportunity to calculate alternative concentration measures, such as the Hirschman-Herfindahl and Rosenbluth Indices. Indeed, in one instance the indices were contradictory regarding which was the more concentrated market. This underscores the importance of understanding the theoretical underpinnings of the alternative measures.

The results indicate that the never-regulated ornamentals trucking industry is not highly concentrated relative to all US industry or to regulated trucking markets. This finding is consistent with the bulk of recent research, such as Friedlaender and Spady, which indicates no or only small economies of size in LTL trucking. It also suggests that greatly increased concentration levels are not the necessary long-run result, in LTL markets, of the recent relaxations in motor carrier regulations. It should be recognized, however, that specific conditions in some segments of motor carriage in the U.S. may be conducive to increased concentration.

Ornamentals transport has several characteristics that appear favorable to private carriage. Despite this, private carriers were found to account for only 5 percent of all output for the ornamentals transport industry and barely 3 percent of the LTL segment of the industry. This compares to a 43 percent share for private carriage for all intercity trucking in the United States. This result suggests that reduced regulations may lead to increased use of for-hire carriers at the expense of private trucking.

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