The Structure Performance Hypothesis and The Efficient Structure Performance Hypothesis-Revisited: The Case of Agribusiness Commodity and Food Products Truck Carriers in the South

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Selected Paper prepared for presentation at the Southern Agricultural Economics Association Annual Meetings, Little Rock, Arkansas, February 5-9, 2005.

Abstract

Two competing hypotheses on market structure and performance of firms are the traditional structure-conduct-performance (SCP) paradigm and the efficiency structure hypothesis. This paper reveals the profits made by firms in the trucking industry were because of greater efficiencies than their competitors and not because of collusive activities.

Introduction and Discussion

Truck transportation, being an important service-providing sector, represents a significant part of the U. S. economy. For example, truck transportation is the dominant mode in the United States for foodstuffs particularly those with high value and requiring controlled temperature and humidity. This sector hauls 95% of the interstate shipments of produce (Beilock and Ciello, 2004). Additionally, truck carriers play a vital role in facilitating economic activity between sectors and across regions (Lahiri and Yao, 2004). Therefore, it is very important to evaluate the market structure, market share and profits of these firms. One way to evaluate the U.S. trucking industry is to use the traditional structure-conduct-performance paradigm. In the traditional structure-conduct-performance (SCP) paradigm, increased concentration would suggest that truck carriers may have colluded or the performance of these carriers is the result of anti-competitive practices. More specifically, the standard SCP paradigm asserts there is a direct relationship between the degree of market concentration and the degree of competition among firms. This hypothesis is true if a positive relationship exists between market concentration (measured by industry concentration) and performance (measured by profits), regardless of firm efficiency (measured by market share). Thus firms in more concentrated industries will earn higher profits than firms operating in less concentrated industries, irrespective of their efficiency.

However, a competing hypothesis to the standard SCP paradigm is the efficient structure hypothesis.

The efficiency hypothesis says that an industry's structure arises because of superior operating efficiency by particular firms. This hypothesis is based on the premise that firms with low cost structures increase profits by reducing prices and expanding market shares. Therefore, a positive relationship between firm profits and market structure exists because of gains made in market share by more efficient firms. In turn, these gains lead to increased market concentration. This suggests that increased profits accrue to firms with greater efficiency and not because of collusive activities as suggested by the traditional structure-conduct-performance (SCP) paradigm (Molyneux and Forbes, 1995).

The authors expect results from this study to show whether the market structure, market share, and profits of the trucking industry as a group and by particular segments support the efficiency structure hypothesis or the traditional structure performance hypothesis. Therefore, the ability to estimate whether the market structure, market share, and profits of the trucking industry supports either hypothesis should help in understanding how truck carriers operate as a group and by particular segments. This should improve economic decisions where transportation alternatives exist.

The information or knowledge derived from this study may help agribusiness commodity and refrigerated food products carriers and other carriers of the U.S. trucking industry, policy makers, financial institutions and individuals understand whether the market structure, market share, and profits derived by these carriers are from market competitive forces or collusive activities. If the results of this analysis show that market structure, market share, and profits are the result of the efficiency structure hypothesis rather than from the traditional structure

hypothesis, then further government intervention in the trucking industry is unnecessary at any level.

Objectives of the Study

The general objective of this study is to revisit two competing economic hypotheses: (a) the structure performance hypothesis and (b) the efficient structure hypothesis. The specific objectives of the study are as follows:

1. To estimate whether the market structure, market share, and profits of the agribusiness commodity and refrigerated food products truck carriers in the South are based on the traditional structure performance hypothesis or the efficient structure hypothesis.
2. Based on the model developed for objective 1, estimate whether the market structure, market share, and profits of the U.S. trucking industry as a whole, by industry segments and regions are the outcome of the traditional structure performance hypothesis or the efficient structure hypothesis.
3. Test the traditional structure performance hypothesis and the efficient structure hypothesis using panel data for firms that operated during the entire study.

Data and Methods

This empirical study used annual and pooled financial and operating data for trucking companies in the United States for the 9-year period 1994-2002. The data was obtained from Transportation Technical Services Blue Book of Trucking Companies. Following Kari et al, 2002, the traditional and efficient structure hypothesis may be tested in the trucking industry by estimating the profit equation:

$$PFT_i = \alpha_0 + \alpha_1 CTR_i + \alpha_2 MKS_i + \alpha_3 CAE_i + \alpha_4 CAR_i + \alpha_5 DER_i + \alpha_6 DR_i + \alpha_7 DC1 + U_i .$$

In the above equation, PFT_i is net income (in million) of firms *i* and is a measure of performance. The variable CTR_i is a four-firm revenue concentration ratio by region and is a measure of market structure. The variable MKS_i is the percentage revenue market share of firm *i* and is a measure of firm efficiency. The variable CAE_i represents cash and equivalents and is a measure of how much cash and working capital are available to the carrier for short-term obligations. The variable CAR_i is capital to asset ratio and DER_i is debt to equity ratio. Both these variables reflect risk taking by the firm. The variable DR_i is a regional dummy variable that equals 1 if the firm is located in the south, and 0 otherwise. The variable *DR1* is commodity dummy that equals 1 if the firm hauled agricultural commodities, and 0 otherwise. The variable *DR2* is commodity dummy that equals 1 if the firm hauled refrigerated food products, and 0 otherwise. The variable U_i is the error term with a mean of zero and a variance of one.

In the study by Kari et al, 2002, the authors used annual and pooled data for truck carriers that hauled agricultural commodities during the period 1997-1999. In our analyses, we not only used the same carrier group but also used a longer time period (1994-2002) to test the two hypotheses. In testing the two hypotheses for the agricultural commodity carrier group, we also compared the annual and pooled data results for the periods 1994-1996 and 2000-2002 with the results obtained by Kari et al (1997-1999) to determine which hypothesis is true. Results of that study indicated that efficiency is the driving force behind performance of firms in the agricultural commodity carrier industry. The analysis was expanded to include U. S. trucking industry as a group and other industry segments particularly the refrigerated food products to test whether the market structure, market share, and profits were the results of the efficiency or the traditional structure hypothesis during the 9-year period (1994-2002).

The annual and pooled data analyses above tested the standard SCP and the efficient hypothesis based on the premise that less efficient firms would not survive over time. This is consistent with economic theory, which suggests that, in a competitive industry, inefficient firms will not compete and will be forced out of business in the long run (McMullen, 1997). Therefore, the market structure, profits and market share of the survivor firms were tested. In this analysis, a survivor firm is a firm that Motor Carrier Number (MCN) appears in the data set during the entire study. Thus, if a firm enters the data set and does not stay the entire time it does not count as a survivor in the study.

Results

The results for the annual estimates are shown in Table 1. Data in Table 1 reveals that profits made in the trucking industry were primarily impacted by the variables MKS, CAE and CAR during the study. These results imply the carriers operated in a highly competitive environment and profits made by the carriers were not because of collusive activities but the results of carriers being more efficient.

In all equations, the coefficients for the market share variables are highly significant and the coefficients for the concentration ratio are not significant except in 1997. This suggests the concentration ratio as well as the market share variable played a major role in the profits made by the carriers providing transportation services to their customers in 1997. These findings support the efficiency hypothesis and reject the structure performance hypothesis.

Results for the annual data further reveal the variable cash and equivalents (CAE) were highly significant, indicating that profits for these firms were dependent upon the amount of cash and equivalents the carriers had during the study. Also, the variable CAR, which represents the capital- to- asset ratio was highly significant in the years 1997, 2000, and 2002 indicating that

profits made by the carriers were dependent on the capital the carriers had during these periods. Results also reveal that categorizing the carriers into commodity groups and regions had no significant impact on the profits of the firms during the study.

Table 2 shows the results for the pooled estimates for the period 1994-2002. The results reveal the profits derived by the pooled firms were highly dependent on the market share variable (MKS) and the cash and equivalent variable (CAE) during the study. Similar to the annual estimates, the profits derived by truck carriers were because of economic efficiency rather than collusive activities as suggested by the structure performance hypothesis. Thus this hypothesis is rejected based on the pooled data analysis and efficient structure hypothesis is accepted.

The panel estimates for firms that stayed in the data set for the entire study are shown in Table 3. Model 1 represents the estimated profit equation without categorizing the carriers by commodity groups, regions, or years while Model 2 represents the estimated profit equation of carriers by commodity groups, regions, and years. The results from Models 1 and 2 show the market share and cash and equivalent variables had a significant impact on the profits of firms that operated during the study. Model 2 results show the variable Sdum1, which represents the 1994-1996 pooled data period, also impacted profits made by the firms. This result implies the time period in which the carriers operated played a major role in determining firm profits. These results further indicate that profits made by firms in the data set were based on them being more efficient than their competitors during the study. Thus, the results of this analysis still support the efficient structure hypothesis rather than the structure performance hypothesis.

Summary and Conclusions

This study revisits two conflicting hypothesis: structure performance hypothesis and the efficient structure hypothesis using financial and operating data obtained from the Transportation Technical Services, Inc. This study used annual, pooled, and panel data to test the two hypotheses to determine whether the profits made by firms in the trucking industry were based on greater economic efficiency or because of collusive activities during the study period.

The results reveal profits made by the carriers were based on them being more efficient than their competitors rather than them participating in collusive activities. The results also support the efficient structure hypothesis and reject the structure performance hypothesis. Therefore, both public and private market evaluators of the trucking industry can use the results of this analysis to find the basic economic forces that affect the profits of firms in the industry. Also, managers and owners of the various firms can develop strategies to take advantage of the weaknesses of their competitors and the strengths of their firms to make profits. Finally, the results of this study provide users with information that may be used to take advantages of unmet needs in the trucking industry.

References:

Beilock, Richard and Jose Del Ciello, "Refrigerated Trucking Revisited," *Journal of the Transportation Research Forum*, Volume 43, Number 1, Spring 2004, Pp. 39-53.

Kari, Fatimah, Abdul H. Jaafar, Albert J. Allen, and Warren C. Couvillion, "Market Structure, Market Share, and Profits in the Surface Freight Industry," paper presented at the 2002 Annual Meeting of the American Agricultural Economics Association, Long Beach, CA, July 28-31, 2002.

Lahiri, Kajal and Wenxiong Yao, " A Dynamic Factor Model of the Coincident Indicators for the US Transportation Sector," *Applied Economic Letters*, 2004, Volume 11, Pp. 595-600.

McMullen, B. Starr, The Impact of Deregulation on Technical Efficiency: The U.S. Motor Carrier Industry, Final Report, Oregon State University, Department of Economics, Corvallis, OR, Transportation Northwest (TransNow), Department of Civil Engineering, University of Washington, Seattle, WA, October 1997.

Molyneux, Phil and William Forbes, "Market Structure and Performance in European

Banking," *Applied Economics*, 1995, Volume 27, Pp. 155-159.

Table 1. Annual Regression Results, 1994-2002

Variables	1994 Parameter Estimates	1995 Parameter Estimates	1996 Parameter Estimates	1997 Parameter Estimates	1998 Parameter Estimates
Intercept	-0.79532 (-1.3)	-0.44195 (-0.71)	-1.4363 (-2.28)	-0.81279 (-2.54)	-0.06087 (-0.15)
MKS	0.1387 (2.73)*	0.08251 (1.98)*	0.16559 (3.64)*	0.05928 (2.59)*	0.055 (2.18)*
CTR	0.01034 (0.58)	-0.00535 (-0.26)	-0.01299 (-0.71)	0.0278 (2.66)*	0.0018 (0.15)
CAE	2.90623 (51.14)*	2.52061 (47.71)*	1.9403 (25.97)*	0.63274 (22.87)*	0.51813 (13.68)*
CAR	-0.87076 (-0.76)	-0.9329 (-0.81)	1.59148 (1.33)	1.62353 (2.92)*	1.73487 (2.67)*
DER	0.00025281 (-0.2)	0.00296 (0.47)	-0.00185 (-0.13)	0.00024197 (0.06)	-0.00339 (-0.36)
Cdum1	-0.24825 (-0.2)	0.35273 (0.27)	0.20061 (0.14)	-0.33745 (-0.5)	-0.54576 (-0.66)
Rdum3	-0.27265 (-0.53)	-0.25548 (-0.43)	0.64428 (1.14)	0.12072 (0.41)	0.50784 (1.38)

Note: t-values are in parentheses. *Significant at the 5% level.

Table 1. Annual Regression Results, 1994-2002 (Continued)

Variables	1999 Parameter Estimates	2000 Parameter Estimates	2001 Parameter Estimates	2002 Parameter Estimates
Intercept	-1.7409 (-1.49)	0.11272 (0.31)	-1.59713 (-2.51)	0.12384 (0.39)
MKS	0.31932 (3.35)*	0.16185 (4.3)*	0.80792 (11.96)*	0.26469 (7.45)*
CTR	-0.00192 (-0.05)	-0.01897 (-1.37)	0.00109 (0.05)	-0.00964 (-0.8)
CAE	4.60951 (28.88)*	0.52705 (7.62)*	1.78614 (38.39)*	0.30071 (10.02)*
CAR	-1.30639 (-0.81)	1.09321 (2.13)*	-0.59971 (-0.68)	0.78481 (2)*
DER	0.00796 (0.43)	-0.00005 (-0.08)	0.00137 (0.36)	-0.00011 (-0.06)
Cdum1	-1.5372 (-0.42)	-0.20536 (-0.24)	0.2053 (0.11)	-0.05023 (-0.06)
Rdum3	0.11843 (0.09)	0.35406 (0.95)	0.33347 (0.48)	-0.07824 (-0.24)

Note: t-values are in parentheses. *Significant at the 5% level.

Table 2. Pooled Estimates for the period 1994-2002

Dependent	Variable	DF	Estimate	StdErr	tValue	Probt
netincome 1	Intercept	1	-0.85703	0.23209	-3.69	0.0002
	MKS	1	0.26737	0.02039	13.11*	<.0001
	CTR	1	0.00364	0.00815	0.45	0.6549
	CAE	1	1.6956	0.02331	72.75*	<.0001
	CAR	1	0.18832	0.35734	0.53	0.5982
	DER	1	0.00026933	0.00109	0.25	0.8041
	Cdum1	1	-0.12959	0.58652	-0.22	0.8251
	Rdum3	1	0.26155	0.24132	1.08	0.2785

*Significant at the 5% level.

Table 3. Panel Estimates for Models 1 and 2.

Method	VarName	DF	Estimate	StdErr	tValue	Probt
Model 1						
	Intercept	1	2.092582	0.8904	2.35	0.0188
	MKS	1	0.016469	0.00682	2.42*	0.0157
	CTR	1	-0.01163	0.00981	-1.19	0.2359
	CAE	1	0.205024	0.0151	13.6*	<.0001
	CAR	1	0.768611	0.4115	1.87	0.0619
	DER	1	-0.00089	0.00388	-0.23	0.8188
Model 2						
	Intercept	1	2.436144	0.9463	2.57	0.0101
	MKS	1	0.017034	0.00685	2.49*	0.013
	CTR	1	-0.01261	0.00981	-1.29	0.1988
	CAE	1	0.204317	0.0151	13.54*	<.0001
	CAR	1	0.739718	0.4118	1.8	0.0726
	DER	1	-0.00092	0.00388	-0.24	0.8121
	Sdum1	1	-0.95568	0.2978	-3.21*	0.0013
	Sdum3	1	-0.30519	0.3374	-0.9	0.3658
	Cdum1	1	-0.33877	0.8375	-0.4	0.6859
	Rdum3	1	0.41074	0.9197	0.45	0.6552

*Significant at the 5% level.