An Analysis of Strategic and Performance Changes of Truck Carriers in the Agricultural Commodity and Food Markets

Albert J. Allen, Porfirio Fuentes, Joselito Estrada, Safdar Muhammad, and Haiyuan Wang

Trucks play a vital role in the movement of agricultural and food products from production areas to consumers and users in the United States. For example, trucks normally originate and end the trips for products going to markets. Strategic changes therefore are vital to the successful operations of trucking companies supplying carrier services to shippers in this sector, as they serve not only as competitors but in many situations as complementary carriers. This delicate balance between competition and integration of truck carriers with carriers of different modes of transportation provides shippers with a highly efficient, low-cost system of transportation (Eriksen et al. 1998). This paper provides information on the profitability, performance, and patterns of the agricultural and food-market truck carrier industry's strategic changes from 1992 to 1999.

Data and Methods

We primarily followed the methods developed by Feitler (1995) in analyzing this sector of the trucking industry in the United States. This research effort focuses on determining during which years the most firms had the greatest amount of total change and which years involved the greatest change in individual strategic dimensions. The strategic dimensions analyzed in this study are price, cost, risk, service, and size. For each of these identified dimensions, a key financial and/or operating performance measure is used as a proxy of the management decisions that constitute the essence of strategy.

Data for the financial and operating performance measures were obtained from *TTS Blue Book of Trucking Companies* published by Technical Transportation Services (1992–1999). For this analysis, those firms with missing data on any single dimension were eliminated for that specific year (see Table 1). The percentage of valid firms used for this study ranged from a high of 92 in 1992 to a low of 70 in 1996.

The cost dimension measures the firm's cost, which includes salaries, wages, taxes, and other expenses. The price dimension provides information on prices the firm charged for its transportations services. The risk dimension provides information on how well the firm's management/owner handled its financial capital. The service dimension gives information about services provided by the truck carrier. The size dimension indicates how the actions or inactions of a firm's management affect the strategic focus of firms of different sizes. Table 2 shows how the strategic dimensions were calculated for this study.

A strategic-change index was also developed for each firm in each year using the sum of yearly changes in the absolute values of each of the dimensions in Table 2. The strategic-change index was computed as the absolute values of changes in the standardized scores for individual dimensions. The strategic-change index provides an indication of how an individual firm changed its position relative to industry averages, as well as of changes in each individual dimension.

Performances for each firm are measured by that firm's operating ratio. The operating ratio is one of the major profitability measures used in the transportation sector. The lower the operating-ratio figure, the higher the surplus of revenues over expenses. The higher the operating ratio, the greater the deficit of revenues to cover operating expenses for the firm. The firm's operating ratio is measured by (total operating expenses/total operating revenues)*100. Results from this analysis show the percentage of firms changing their strategic position in each dimension from year to year as well as the average change in the standardized score from year to year. For this analysis, an individual firm's strategic change in a dimension is defined by a

Allen is professor, Fuentes is post-doctoral researcher, and Wang is former graduate student, Mississippi State University. Estrada is assistant professor, University of Texas at Brownsville. Muhammad is research assistant professor, Tennessee Sate University.

Table 1. Actual Firms, Valid Firms, and Percentage of Valid Firms.

Year	Actual Firms	Valid Firms	Percentage of Valid Firms
1992	53	49	92
1993	45	39	87
1994	45	40	89
1995	48	41	85
1996	60	42	70
1997	58	43	74
1998	55	50	91
1999	46	36	78

Table 2. Type of Strategic Change Dimensions and Representative Financial Measures Used for Study.

Dimension	Representative Financial Measure
Cost Dimension	Operating Expenses/Miles
Price Dimension	Total Revenues/Total Tons
Risk Dimension	Total Debt/Total Equity
Service Dimension	Total Salary, Wages and Fringe Benefits/Total Number of Employees
Size Dimension	Total Operating Revenues

change of 0.57 or more on a standardized score in any of the dimensions. The value 0.57 represents the grand mean of the standard deviations. Results also show the overall strategic-change index, which combines the strategic changes in each of the dimensions. Analysis of variance tests is used to indicate in which year-to-year periods the average is significantly different.

Results

The results of this study are divided into three sections. The first section provides information on the changes in the structure and profitability performances of the agricultural-commodity and food-product carriers in the United States. The second section emphasizes the changes in strategic dimensions of the carriers in this sector of the transportation industry. The last section provides an overview of the overall changes in the strategic-change index.

Changes in Structure and Profitability Performances

Table 3 provides information on the structural and profitability performance changes of for-hire agricultural-commodity and food-product carriers in the United States from 1992 to 1999.

Number of Firms: The number of firms declined from a high of 50 in 1998 to a low of 36 firms in 1999, a net decrease of 14 firms. This absolute value represents the largest year-to-year decline during the study period, implying that there was less competition for shippers' agricultural and food products between 1998 and 1999. This means that shippers in the agricultural and food-product markets had fewer options from which to choose. In total, there was a net decrease of 13 firms over the study period.

Average Number of Employees per Firm: The average number of employees declined from 87 in 1992 to 57 in 1995 and increased from 63 in 1996 to 87 in 1998 and declined to 71 in 1999. The highest

Table 3. Industry Means Used for Study.

Year	Number of Firms	Number of Employees	Revenues ($1000)	Operating Ratio %
1992	49	87	8958	99
1993	39	80	7945	100
1994	40	63	7855	97
1995	41	57	6951	99
1996	42	63	7873	99
1997	43	84	9006	97
1998	50	87	10156	97
1999	36	71	9658	96

average number of employees per firm occurred in 1992 and 1998. These two years also coincide with the largest number of firms. In total, the number of employees declined from 87 in 1992 to 71 in 1999, a net decrease of 16 employees per firm.

Average Total Revenue per Firm: The average total revenue per firm was highest in 1998 and lowest in 1995. In 1998, average revenue per firm was almost $10.1 million; in 1995 it was $6.9 million. The average total revenue per firm increased from $8.9 million in 1992 to $9.6 million 1999, a net increase of almost $700,000.

Performance: The operating ratio provides an overall assessment of a firm's profitability in the agricultural and food-products market for this analysis. Any firm in this sector with an operating ratio less than 100 will be taking in more than it is spending to provide the necessary transportation services to its customers. Trucking firm managers like to have the operating ratio as low as possible so the firm will have money left over from its operations to invest elsewhere or to reinvest in the company. In 1992 the industry was barely profitable, with the operating ratios averaging 99 percent. In 1993 the industry slipped to the break-even level of 100 percent. After that year the firms in the industry improved their profitability levels, with operating ratios falling back below 100 percent. In 1999 the industry had its highest profitability levels: an operating ratio of 96 percent, meaning that on average it cost 96 cents to generate one dollar's worth of transportation services.

Changes in Strategic Dimensions

The strategic dimensions discussed in this section include the cost, price, risk, service, and size dimensions (see Table 4). Table 5 shows firm behavior for each dimension as measured by the changes in a firm's standardized scores from one year to the next.

Cost: The average industry values for this attri-

Table 4. Means and Standard Deviations of Strategic Dimensions.

	Cost		Price		Risk		Service		Size	
Year	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
1992	1.74	2.19	40.98	43.13	0.96	1.76	31.11	10.06	8833	
1993	1.43	0.66	37.28	33.39	3.69	17.73	30.54	10.12	7876	
1994	7.10	33.08	53.47	57.41	1.81	3.71	53.74	50.21	7855	
1995	1.31	0.41	45.41	43.39	7.37	39.42	45.55	19.70	6951	
1996	1.35	0.41	55.92	75.97	0.47	5.04	47.05	18.51	7995	
1997	1.85	3.29	54.06	44.50	1.60	3.33	49.42	33.04	9006	
1998	1.52	1.10	50.16	41.41	1.55	3.08	41.26	13.43	10116	

Table 5. Standardized Score Changes for Strategic Dimensions.

	Cost			Price			Risk			Service			Size		
Year	Mean	SD	% Change	Mean	SD	% Change	Mean	SD	% Change	Mean	SD	% Change	Mean	SD	% Change
1993	0.43	0.58	7.89	0.27	0.41	7.89	0.35	0.32	10.53	0.34	0.29	2.63	0.19	0.13	0.00
1994	0.47	0.43	13.04	0.32	0.53	8.70	0.48	0.91	8.70	0.88	1.15	17.39	0.56	0.43	13.04
1995	0.52	0.40	8.00	0.28	0.26	4.00	0.60	0.91	12.00	0.44	0.32	12.00	0.28	0.28	4.00
1996	0.26	0.42	3.13	0.58	0.92	15.63	0.43	0.93	6.25	0.26	0.24	6.25	0.18	0.21	3.25
1997	0.64	0.64	17.86	0.54	0.81	15.29	0.63	1.00	10.71	0.33	0.30	3.57	0.12	0.14	0.00
1998	0.26	0.42	5.56	0.33	0.49	11.11	0.34	0.78	8.33	0.83	0.97	16.67	0.18	0.27	5.56
1999	0.46	1.08	15.38	0.48	1.09	7.69	0.28	0.26	0.00	0.80	1.16	7.69	0.23	0.38	7.69

bute show that in 1994 the industry had its highest average value, 7.10, while its lowest value occurred in 1995 with an average of 1.31. This implies that after the high costs incurred in 1994, firms went all-out to reduce their costs in order to become more profitable. In total, industry costs increased from 1.74 in 1992 to 2.86 in 1999. The ANOVA results indicate that the means of year-to-year changes in cost are not significantly different (F=1.1108, P= 0.3557).

The highest average change in firms' standardized cost-dimension scores from the previous year was 0.64 in 1997. That year, almost 18 percent of the firms' standardized cost dimension scores changed 0.57 or more. Although 1997 had the largest percentage of firms changing their standardized score on this dimension, firms changed on the cost dimension each and every year during the study period. These results suggest that firms were probing for ways to change or lower their costs in order to become more competitive in meeting their customers' transportation needs.

Price: Results show that the average price per ton increased from almost $41 in 1992 to $63 in 1999, a net increase of $22 per ton over the entire period. These results imply that firms increased prices from 1992 to 1999 most likely to compensate for the increase in costs over same period. This also means that shippers in the agricultural and food-products market had to pay higher prices for their transportation services or find alternative ways of moving their products to markets. The ANOVA analysis shows that there was no statistically significant difference (F= 0.7507, P= 0.6290) in the means of year-to-year changes in price during the study period.

Firms changed their prices throughout the study period. The greatest changes in the price dimension occurred in 1996 and 1997. The average changes for those years were 0.58 and 0.54 (15.63 and 15.29 percent), respectively. These results suggest that firms were having difficulty keeping the prices they charged their customers at low levels.

Risk: The risk dimension shows two peak years during the study—1993 and 1995. The values of the risk dimension in those years were 3.69 and 7.37, respectively, indicating that truck carriers operating in the agricultural and food-products market were taking on a large amount of debt to service their customers. In comparison, the two lowest points for risk occurred in 1996 and 1999, when the risk dimension was 0.47 and 0.39, respectively. The

low value of the risk dimension in 1996 follows the highest risk levels in the study period, in 1995. This suggests that firms were not taking on any additional risks, since they had taken on a huge amount the previous year. The ANOVA analysis indicates that the means of year-to-year changes in the risk dimension was not statistically significant (F= 0.9502, P= 0.4679).

Focusing on firm behavior as measured by the year-to-year change of firms' standardized scores, the risk dimension changed each year, ranging from 0.28 in 1999 to 0.63 in 1997, indicating a consistent yearly change in this dimension. The largest percentage of firms that changed in their risk dimension occurred in 1995, with 12 percent of the firms making changes in their risk dimension. In 1999, however, the risk dimension did not change. This may imply that firms had learned how to keep their risks to a minimum to be competitive and successful in delivering transportation services to their customers.

Service: The highest value of the service dimension occurred in 1994, with an average compensation per employee of about $53,740, while the lowest compensation was in 1993. Over the study period the average compensation per employee rose from $31,110 in 1992 to $37,400 in 1999, a net increase of $6,290. The ANOVA results indicate that means of year-to-year changes in the service dimension are statistically significant (F= 4.6772, P= 5.13E-05) at the 5% level of significance.

The largest year-to-year changes in the service dimension were in 1994, 1998, and 1999. The changes in the firms' average standardized scores in those years were 0.88, 0.83, and 0.80, respectively. The highest percentage of firms that changed in the service dimension was 17.39 percent in 1994 and 16.67 percent in 1998. These results suggest that firms continue to adjust and modify their employee compensation levels to maintain or reduce costs so that they can recruit, retain, and pay their employees well to better serve their customers.

Size: The size dimension indicates that the average size of the firms in the industry increased from $8.8 million in 1992 to almost $9.7 million in 1999. The ANOVA results indicate that the means of year-to-year changes in the size dimension was not statistically significant (F= 0.8666, P= 0.5332).

The year-to-year changes in the size dimension ranged from 0.12 in 1997 to 0.56 in 1994. This indicates that firms consistently changed their sizes during the study period. The percentage of firms that changed in this dimension ranged from 0.00 percent in 1993 and 1997 to 13.04 percent in 1994.

An Overview of the Strategic-Change Index

The strategic-change indices for all firms in the data set indicate that firms did make strategic changes throughout the study period (see Table 6). Results show that mean strategic-change indices ranged from 1.58 in 1993 to 3.20 in 1999, an increase of more than 113 percent. These results suggest that many firms in the agricultural and food-products industry may not have been able to manage their strategic dimensions at optimal levels as dictated by competitive forces in the market. The ANOVA results indicate that the means of year-to-year changes in the strategic-change index were statistically significantly different (F= 2.83753, P= 0.0111444).

Summary

This paper examined the profitability, performance, and patterns of strategic changes of truck carriers that hauled agricultural and food products for compensation during 1992–1999. Five strategic dimensions and the operating ratio were used to accomplish this objective.

Results from the study show that in 1999 firms in the industry had an average operating ratio of 96 percent. This value means that, on average, it cost 96 cents to generate one dollar's worth of transportation services in that year. Results indicate that industry costs increased steadily over the entire eight-year study period, and that costs changed each and every year during the study period. These results suggest that managers of the carriers were searching for

Table 6. Strategic-Change Indices.

Year	Mean	SD
1993	1.58	0.88
1994	2.71	1.78
1995	2.11	1.12
1996	1.63	1.34
1997	2.26	1.29
1998	1.95	1.69
1999	3.20	3.46

ways to lower their costs in order to become more competitive in this market.

Another result, based on strategic-change indices, indicates that managers used various combinations of strategic dimensions to respond to industry and/or environmental changes. These results suggest that managers of individual firms position themselves in the agricultural and food markets by matching their internal capabilities to their external environment.

References

Eriksen, Ken, J. D. Norton, and P. J. Bertels. 1998. *Transportation of U.S. Grains: A Modal Share Analysis, 1978-95*. USDA, AMS, Transportation and Marketing, Marketing and Transportation Program, Washington, D.C.

Feitler, J. N. 1995. "Measuring Firm Strategic Change in the Regulated and Deregulated Motor Carrier Industry: An Eighteen Year Evaluation," Ph. D. Dissertation, College of Business and Management, University of Maryland.

Feitler, J. N., T. M. Corsi, and C. M. Grimm. 1998. "Strategic and Performance Changes Among LTL Motor Carriers: 1976-1993." *Transportation Journal* 37(4):5–12.

Transportation Technical Services, Inc. 1992–1998. *TTS Blue Book of Trucking Companies.* New York.