Market Structure Conduct Performance (SCP) Hypothesis Revisited using Stochastic Frontier Efficiency Analysis

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Abstract

Use of efficiency measures as a proxy for performance to test the market structure-conduct-performance (SCP) hypothesis is explored. Utilizing Battese and Coelli specification, we estimate stochastic frontier production function and SCP equations with output and efficiency measures as endogenous variables. An empirical application to U.S. trucking carries over the period 1994-2003 with emphasis on the agricultural commodity and refrigerated food products carriers is examined. Results reveal that the variables average haul, average load and market concentration significantly affected the efficiency of firms with 2-8 number of years within each firm.

Market Structure Conduct Performance (SCP) Hypothesis Revisited using Stochastic Frontier Efficiency Analysis

Market structure conduct and performance (SCP) framework was derived from the neo-classical analysis of markets. The SCP paradigm was the brain child of the Harvard school of thought and popularized during 1940-60 with its empirical work involving the identification of correlations between industry structure and performance. This SCP hypothesis has lead to the implementation of most anti-trust legislation. This was followed by the Chicago school of thought from 1960-80. They emphasized on the rational for firms becoming big, price theory and econometric estimation. During 1980-90 game theory took center stage with emphasis on strategic decision making and Nash equilibrium concept. After 1990, empirical industrial organization with the use of economic theory and econometrics lead to complex empirical modeling of technological changes, merger analysis, entry-exit and identification of market power.

There are two competing hypotheses in the SCP paradigm: the traditional "structure performance hypothesis" and "efficient structure hypothesis". The structure performance hypothesis states that the degree of market concentration is inversely related to the degree of competition. This is because market concentration encourages firms to collude. More specifically, the standard SCP paradigm asserts that there is a direct relationship between the degree of market concentration and the degree of competition among firms. This hypothesis will be supported if positive relationship between market concentration (measured by concentration ratio) and performance (measured by profits) exist, regardless of efficiency of the firm (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.

The efficiency structure hypothesis states that performance of the firm is positively related to its efficiency. This is because market concentration emerges from competition where firms with low cost structure increase profits by reducing prices and expanding market share. A positive relationship between firm profits and market structure is attributed to the gains made in market share by more efficient firms. In turn these gains lead to increased market concentration. That is, increased profits are assumed to accrue to more efficient firms because they are more efficient and not because of collusive activities as the traditional SCP paradigm would suggest (Molyneux and Forbes, 1995).

Traditionally, these hypotheses have been examined using the traditional measures of profit/profit margin as indicator of performance. In the efficiency/productivity literature there is increased emphasis on the use of efficiency as a measure to examine the economies of scale, economies of scope and both economies of scale and scope, accounting for risk, and policy implications. In this paper, we explore the use of stochastic frontier efficiency measures as a proxy for performance to test the SCP hypothesis and efficient structure hypothesis. Specifically, we will estimate stochastic frontier production function and SCP equation with output and efficiency measures as endogenous variables. An empirical application to U.S. trucking carries as a group and by individual segments over the period 1994-2003 with emphasis on the agricultural commodity and refrigerated food products carriers is examined.

Literature Overview

A number of studies relevant to the procedure used in this study have been conducted for various industries and commodities and products. The general objective of these studies was to investigate the factors that affect the structure conduct performance of the specific industries. These studies provided the basic background information needed to formulate the model used in this analysis.

In December 2005, Byeongyong and Weiss, tested the traditional structure-conduct-performance model and the efficiency structure hypothesis to examine the relationship among market structure and performance in property-liability insurers. The efficiency terms in this analysis were estimated using a stochastic frontier analysis. This analysis supported the efficiency structure hypothesis. The results found that efficient firms charged lower prices than competitors causing them to capture larger market shares which lead to increased concentration.

Positive correlations between market concentration and profitability can be explained by the structure performance hypothesis or the efficient structure hypothesis. Berger and Hannan (1989) used price information collected by the Federal Reserve System on banking institutions to examined price-concentration relationships instead of the profit concentration relationship in order to eliminate the efficient structure hypothesis as an alternative explanation of the results. The results of this analysis support the structure performance hypothesis.

Smirlock et al.(1984) tested the structure performance hypothesis and efficiency hypothesis using OLS regression of the firm's profitability against the traditional hypothesis with a proxy for relative efficiency. The firm's profitability was measured by Tobin's q which is the firm's market value divided by replacement costs of its assets, the variables used to represent the traditional hypothesis were concentration, entry barrier, and growth rates, and the proxy used for relative efficiency was the firm's market share. The results of this analysis strongly supported the efficient structure hypothesis.

Maudos (1998) analyzed the relationship between market structure and performance within the Spanish banking industry. Three different stochastic measures of efficiency were used (based on three alternative distributional assumptions for inefficiency: half-normal, normal-truncated and exponential). The results obtained support the efficient structure hypothesis and showed that market share was an inadequate proxy for efficiency.

Wilson A. Alley (1993) tested the hypothesis that Japanese banking performance is a result of efficiency and should be identified by the efficiency structure hypothesis instead of the SCP hypothesis. In the model he estimated the degree of collusion in the Japanese banking industry and found that there is a significant degree of collusion. The finding of his analysis supports the structure conduct performance hypothesis as a better means of describing the Japanese banking industry.

Kari, Jaafar, Allen, and Couvillion (2002) investigated the relationship between profitability and market power in the trucking industry that transported agricultural commodities. The aim of that investigation was to determine if the Motor Carrier Act of 1980 had produced the desired market structure. The research method was based on the SCP paradigm. Results of this study indicated that efficiency is the driving force behind performance of firms. These results suggest that the 1980 Motor Carrier Act of 1980 had produced its intended purpose in the agricultural commodities transport industry.

The general objective of a study by Allen, Shaik, Myles, and Muhammad (2005) was to estimate whether the market structure, market share, and profits of the agribusiness commodity and refrigerated food products truck carriers in the South were based on the traditional SCP hypothesis or the efficient structure hypothesis. Overall, results reveal that the profits made by the carriers were based on them being more efficient than their competitors rather than them participating in collusive activities. Thus, the results of this study support the efficient structure hypothesis and reject the SCP hypothesis. Therefore, both public and private market evaluators and watchers of the trucking industry can use the results of this analysis to find the basic economic forces that affect profits of the various firms that comprise the industry at the conduct level. Also, managers and owners of the various firms can formulate strategies to take advantage of the weaknesses of their competitors and the strengths of their firms to make profits. Therefore, the results of this study provide users with information that can be used to take advantages of opportunities in the trucking industry to meet unmet needs of shippers.

In the next section, the theoretical model to jointly estimate the efficiency measure and SCP equation is presented. This is followed by the data and construction of the variables to be used in the empirical model. The empirical application and results are presented in the next section followed by conclusions.

Theoretical Model of Structure, Conduct and Performance - Efficiency

Traditionally, the SCP hypotheses have been examined using the traditional measures of profit/profit margin as indicator of performance. This can be represented as:

(1) $$Performance = f(X, Z)$$

where X is set of SCP variables and Z are other associated variables.

The studies by Ahmed and Khababa (1999), Eriotis, Frangouli, and Ventoura-Neokosmides (2002), McDonald (1999), Ganesan (2001), Kambhampati and Parika (2003), Lee, Lee, and Lee (2000), Frech, III and Mobley (2000), and Clow and Wilson (1998) investigate the factors that affect the performance of various industries in the context of market structure and conduct. A study by Allen and Shaik (2005) revealed that the variable market share had a statistically significant impact on the net profit margin for the agricultural commodity carrier of the trucking industry in the United States.

In the efficiency/productivity literature there is increased emphasis on the use of efficiency as a measure to examine the economies of scale, economies of scope and both economies of scale and scope, accounting for risk, and policy implications. In this paper, we explore the use of efficiency measures as a proxy for performance to test the SCP hypothesis. Specifically, we simultaneous estimate stochastic frontier model and SCP model with output and efficiency measures as endogenous variables. To represent efficiency in the primal approach for a firm i, $i = 1,........,I$, the basic form of the model can be represented as

(2) $y = f(x;\beta)\cdot v - u$

where v representing firm or time specific random error which are assumed to be iid and normally distributed variable with mean zero and variance σ_V^2; u representing the technical efficiency which must be positive hence absolutely normally distributed variable with mean zero and variance σ_U^2; and y, x and β are the output, input and parameter coefficients respectively.

Comprehensive literature reviews [Forsund, Lovell and Schmidt (1980), Schmidt (1986), Bauer (1990), Greene (1993), and Kumbhakar and Lovell (2000)] on the use of stochastic frontier analysis has been evolving since it was first proposed by Aigner, Lovell and Schmidt; Meeusen and van den Broeck; and Battese and Corra in the same year, 1977. The past decade has witnessed a surge in the extension of the parametric techniques to efficiency measurement. Furthermore within the primal framework, there has been progress made on the ability to handle multiple outputs and inputs via the distance functions, adjusting for time series properties, incorporating autocorrelation and heteroskedasticity, and finally the use of Bayesian techniques in the parametric efficiency measures. Here, we utilize the Battese and Coelli model (1995) to estimate the efficiency and SCP equations.

The simultaneous estimation of stochastic frontier production function model and market structure model with output and efficiency measures as endogenous variables to examine the SCP hypothesis can be represented as

$$
(3) \qquad \begin{aligned} y &= f(x;\beta)\cdot v - u \\ u &= f(X, Z) \end{aligned}
$$

where u representing the technical efficiency is used as measures of performance in SCP model.

Data and Construction of the Variables

The variables used to satisfy the objective of this paper are obtained from *TTS Blue Book of Trucking Companies* for the years 1994-2003. The data for the input variables was divided into labor; capital, operating variable costs and operating fixed costs. The labor variables include (1) the number of drivers and helpers, (2) number of cargo handlers, (3) number of officers, supervisors, clerical and administrative staff, and (4) total number of other laborers. Capital variables include (1) number of tractors owned, (2) number of trucks owned, (3) number of tractors leased, (4) number of trucks leased, and (5) other equipment. Operating variable costs include (1) fuel, oil, and lubricants and (2) total maintenance. The operating fixed cost category is composed of (1) total operating taxes and licenses; (2) total insurance; and (3) depreciation and amortization. The output variable consists of total ton-miles, which is the measurement most commonly used according to Caves et al (1980), McGeehan (1993) and Cantos et al. (1999), given that these demand related measure of output, allow an assessment of the level of user consumption and the value they place on the service. This ton-mile output measurement assumes little or no government control on the provision of the service, otherwise measures that isolate the government regulatory measures like truck-miles, which represent the degree of capacity or service level supplied by the trucking company, are more suitable for this type of analysis Cantos et al. (2000).

Market share (***mshare***) is the share of firm i in time period t. The proportion of the market that the firm is able to capture can measure the firm's performance relative to competitors. This proportion is referred to as the firm's market share. Market share is often associated with profitability and thus many firms seek to increase their sales relative to competitors. Market share is estimated by dividing individual firm's revenue with the total industry revenue.

The market concentration (***mconc***) of firms in an industry is of interest to economists, business strategists, and government agencies. Here, we discuss one of the two most commonly used methods of measuring industry concentration: the Concentration Ratio. The other commonly used method to compute the concentration ratio is the Herfindahl-Hirschman Index (HHI). The concentration ratio is the percentage of market share owned by the largest *m* firms in an industry, where *m* is a specified number of firms, often 4, but sometimes a larger or smaller number. In our study we used the 10-firm concentration ratio. The concentration ratio often is expressed as CR_m, for example, CR_{10}. The concentration ratio can be expressed as: $CR_m = s_1 + s_2 + s_3 + \ldots .. + s_m$, where s_i = market share of the i^{th} firm.

Long-term Debt-to-Equity (**LRisk)** variable is obtained from TTS data. TTS calculates this variable by dividing long-term liabilities by total equity and represents long term risk. . This variable represents the total long-term portion of borrowed money and measures the indebtedness of a company relative to invested capital (TTS). The long-term debt of carriers is those debts that are longer than a year. If a large proportion of the total liabilities are non-current, then the amount of security needed by the firm would not be as large as would be required if they were mostly current (Clow and Wilson, 1988).

CAR is total equity divided by total assets. The equity/asset ratio measures the proportion of a company's total assets which are financed by the owner's capital rather than through debt, and therefore indicates financial position. The higher the ratio value, the more total capital has been supplied by the owner and less by creditors (Langemeier, 2005).

Average length of haul (**Ahaul)** variable is obtained from the TTS data. TTS calculates this variable by dividing total ton-miles by total tons. This variable shows how far the unit travels (one way) each time it is dispatched. The ability of trucking firms to carry agricultural commodities to long-distance markets has an impact on the competitive activity of firms. In addition, the ability of truckers to carry products to distant markets can help suppliers and truckers to find profitable and rewarding markets. Further, the shorter the distance the carrier might have to travel implies that the local or short-distance markets are sufficient for the firms to make profits by satisfying their customers.

Average load (**Aload)** variable is obtained from TTS data. TTS calculates this variable by dividing ton-miles-highway service by total highway miles operated. This variable is an index of the use of productive capacity. In addition, this index indicates the number of tons of agricultural commodities transported by each unit dispatched.

Table 1 presents the number of observations and the mean of the variables (logs) used in the stochastic frontier analysis by number of years of data for each firm; year-wise and commodity-wise. As the number of years of data for each firm increases we observe increasing trend in all the variables except the number of observations (N). In contrast over the time period, 1994-2003 and across commodity groups the mean of the output, labor, capital, OVC, and OFC remain relatively constant.

Table 2 represents the number of observations and the mean of the variables used in the structure-conduct-performance (SCP) analysis by number of years of data for each firm; yearly and by commodity group. As the number of years of data in each firm increases the average load decrease, while the market share, market concentration, CAR, long-term risk, and average haul remain relatively constant. Similar pattern of relatively constant mean is indicated for all the variables both over time and across commodity groups.

Empirical Application and Results

To estimate the production function and examine the importance of market SCP variables in explaining efficiency the Battese and Coelli specification is estimated using Frontier software. The model can be represented as:

$$(4)\quad \begin{aligned} y &= \alpha_1 + \beta_{1,1}\, Labor + \beta_{1,2}\, Capital + \beta_{1,3}\, OVC + \beta_{2,4}\, OFC + v - u \\ u &= \alpha_2 + \beta_{2,1}\, Mshare + \beta_{2,2}\, Mconc + \beta_{2,3}\, CAR + \beta_{2,4}\, LRisk + \beta_{2,5}\, Ahaul + \beta_{2,6}\, Aload + \varepsilon_2 \end{aligned}$$

where, y represents production, β represents parameter coefficients, X_1 represents labor, X_2 represents capital, X_3 represents operating variable costs, and X_4 represents operating fixed costs, and ε represents efficiency and random variables.

One of the requirements to estimate equation (4) using the Battese and Coelli specification is the presence of panel data. So, we grouped firms based on the number of years of data available in each firm. This lead to the estimation of firms with two-years, three-years, four-years, five-years, six-years, seven-years, eight-years, nine-years and a maximum of ten-years of balanced panel data.

Parameter coefficients and the significant variables indicated by bold font are presented in Table 3. Labor variable with a positive sign indicates with more labor - truck drivers and cargo handlers more output -tons per mile are realized. This was positive with the exception of the firms with 5 years of data. Capital and operating fixed cost was positive for all the firms, irrespective of the number of years of data within each firm. Operating variable cost was positive related to output with the exception of group of firms with two-, four-, seven- and eight-years of data. Time trend variable was positively related to output with the exception of group of firms with four- and six-years of data.

Table 3 reports the results of the model that show the effects of market structure, conduct and performance variables on the dependent variable efficiency. The estimated variables are generally statistically significant at the 5% level. More specifically, average haul and load are the variables that significantly different from zero at the 5% level for all grouped firms. These results imply that these variables are major factors affecting the efficiency of firms in the industry.

The results further show that the market concentration variable significantly affected the efficiency of all firms except firms with 9 and 10 years of data. While the market share variable significantly impacted all firms except firms with 4, 7, 9 and 10 years of data. Results further show that long-term risk (CAR) significantly affected the efficiency of firms with 4, 5, and 9 (4 and 5) years of data. Overall results reveal that the variables average haul, average load and market concentration significantly affected the efficiency of firms with 2-8 years of data in each firm.

Finally, the summary statistics of the efficiency measures estimated from equation (4) is aggregated by number of years of data available in each firm; year-wise and commodity-wise are presented in Table 4. Results by the number of years of data available in each firm indicate an increasing trend in the efficiency measures more number of years. This result indicates with less number of years of data and experience firms realize lower average efficiency measures. While with more experience and number of years of data higher efficiency measures are realized. On the lower end 42 and 50 percent efficiency is realized compared to 62 percent on the higher end with more number of years of data. Also with more number of years, we observe an increase in the standard deviation of the efficiency measures. For the ten year period higher efficiency measures of 56 and 57 percent were realized during 1999-2002. While the average efficiency measures was 48 and 54 percent in 1994 and 2003 respectively. Commodity-wise the efficiency measures do not seem to be different with agribusiness trucking firms realizing the second highest efficiency scores of 54.8 percent.

Summary and Conclusions

The overall objective of this study was to assess the production function and the market structure, conduct and performance (profitability) of the trucking industry in the United States by using panel data for the period 1994-2003. To accomplish the objective of this study, we estimate stochastic frontier production function and SCP model with output and efficiency measures as endogenous variables with Battese and Coelli specification to test the effects of several variables, including but not limited, to risk, concentration, market shares of the firms, and fuel expenses, on the profitability of the firms measured in terms of efficiency.

The basic premise underlying this research is that firm financial and operating performance data can be used as representative indicators of the determinants that constitute the essence of profitability from the efficiency paradigm. Therefore, each variable included in this analysis was represented by a financial and/or operating statistic. Data and information needed to accomplish the objective of this study came from the electronic copy of the Blue Book of Trucking Companies published by the Transportation Technical Services and other secondary sources.

Results from this study indicate that several variables in this study have statistically significant impact on the efficiency measures. For example, the results indicate average haul, average load and market concentration significantly affected the efficiency of firms with 2-8 years of data in each firm. The production function variables were positive related to the output with few exceptions.

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Table 1. Mean of the Production Function Variables by Number of years in each firm; by Year and by Commodity

	N	Output	Labor	Capital	OVC	OFC	Time
Number of years in each firm							
2	1062	11.270	4.276	4.121	6.646	7.015	6.052
3	1422	11.369	4.351	4.213	6.707	7.146	6.407
4	1604	11.505	4.454	4.323	6.842	7.240	6.309
5	1405	11.550	4.526	4.435	6.888	7.335	5.421
6	552	11.758	4.906	4.768	7.165	7.718	5.558
7	448	11.684	4.744	4.544	7.031	7.600	5.667
8	432	11.804	4.829	4.760	6.936	7.689	5.627
9	450	12.033	5.113	4.882	7.432	7.904	5.511
10	360	12.166	5.308	5.094	7.535	8.130	5.500
Year-wise							
1994	598	11.540	4.573	4.408	6.919	7.364	5.294
1995	619	11.565	4.627	4.470	6.961	7.432	5.520
1996	722	11.536	4.554	4.460	6.851	7.380	5.532
1997	693	11.636	4.596	4.474	6.904	7.389	5.582
1998	678	11.556	4.588	4.441	6.836	7.370	5.776
1999	719	11.506	4.577	4.436	6.918	7.343	5.869
2000	937	11.500	4.541	4.405	6.914	7.344	6.183
2001	975	11.606	4.558	4.427	6.962	7.376	6.184
2002	1006	11.564	4.584	4.402	6.886	7.375	6.324
2003	788	11.612	4.542	4.431	6.886	7.335	6.353
Commodity-wise							
Gen. Freight, LTL	799	11.611	4.944	4.730	7.083	7.679	4.537
Gen. Freight, TL	3306	11.558	4.534	4.403	6.888	7.340	6.112
Heavy Machinery	194	11.384	4.416	4.346	6.771	7.277	5.371
Petroleum Products	691	11.606	4.633	4.526	6.839	7.447	5.576
Refrigerated Solids	721	11.501	4.572	4.437	6.944	7.348	6.154
Dump Trucking	245	11.537	4.375	4.336	6.845	7.138	6.890
Agricultural Commodities	275	11.617	4.520	4.333	6.893	7.271	6.487
Motor Vehicles	127	11.739	4.632	4.504	7.066	7.486	6.961
Building Materials	503	11.601	4.431	4.248	6.844	7.259	6.779
Others	874	11.533	4.505	4.372	6.886	7.315	5.539

Table 2. Mean of the SCP Variables by Number of years in each firm; by Year and by Commodity

	N	Mshare	Mconc	CAR	Risk3	Ahaul	Aload
Number of years in each firm							
2	1062	0.887	49.538	0.365	0.635	0.575	16.614
3	1422	0.814	50.049	0.363	0.639	0.597	16.648
4	1604	0.926	49.071	0.399	0.615	0.558	16.512
5	1405	1.208	49.509	0.400	0.607	0.550	16.730
6	552	1.269	51.462	0.400	0.602	0.500	15.363
7	448	0.845	49.966	0.361	0.647	0.586	15.274
8	432	1.371	51.635	0.418	0.582	0.531	15.390
9	450	1.939	53.570	0.343	0.657	0.495	15.750
10	360	1.227	54.524	0.378	0.623	0.547	15.699
Year-wise							
1994	598	1.195	51.076	0.372	0.629	0.559	17.821
1995	619	1.203	50.755	0.385	0.617	0.548	15.803
1996	722	1.095	49.765	0.383	0.618	0.558	15.609
1997	693	0.959	50.807	0.380	0.632	0.554	16.326
1998	678	1.225	50.854	0.393	0.616	0.524	16.371
1999	719	1.000	51.432	0.372	0.632	0.558	16.003
2000	937	1.205	50.656	0.380	0.621	0.557	16.024
2001	975	0.879	49.037	0.382	0.626	0.563	16.485
2002	1006	1.147	49.791	0.397	0.612	0.577	16.270
2003	788	0.842	49.438	0.375	0.627	0.567	16.413
Commodity-wise							
Gen. Freight, LTL	799	1.132	53.518	0.397	0.603	0.499	14.357
Gen. Freight, TL	3306	0.990	49.610	0.382	0.626	0.575	16.706
Heavy Machinery	194	1.393	53.739	0.391	0.609	0.569	15.212
Petroleum Products	691	1.116	50.130	0.382	0.618	0.525	16.079
Refrigerated Solids	721	0.903	50.243	0.375	0.627	0.566	15.384
Dump Trucking	245	0.891	48.544	0.372	0.631	0.522	17.099
Agricultural Commodities	275	1.102	50.368	0.348	0.657	0.543	17.431
Motor Vehicles	127	0.795	51.142	0.333	0.679	0.590	16.770
Building Materials	503	1.105	50.746	0.369	0.640	0.610	17.543
Others	874	1.396	49.262	0.403	0.598	0.544	16.275

Table 3. Parameter Coefficient of the Production function - SCP Equation by Number of years

	Stochastic Frontier Production function Equation								
Number of years in each firm	Intercept	Labor	Capital	OVC	OFC	Time			
2	**7.723**	**0.196**	**0.351**	**-0.033**	**0.333**	**0.016**			
3	**7.237**	0.022	**0.295**	0.025	**0.503**	**0.026**			
4	**7.341**	**0.192**	0.387	**-0.016**	**0.351**	-0.003			
5	**6.937**	**-0.084**	**0.578**	**0.089**	**0.330**	**0.030**			
6	**7.271**	**0.089**	**0.575**	**0.068**	**0.216**	-0.001			
7	**6.373**	**0.124**	0.071	-0.019	**0.681**	**0.023**			
8	**6.925**	0.061	**0.469**	-0.024	**0.424**	0.008			
9	**6.090**	**0.099**	0.051	**0.285**	**0.464**	0.013			
10	**6.695**	0.012	**0.519**	**0.277**	**0.160**	0.004			
	Structure, Conduct, Performance Equation								
Number of years in each firm	Intercept	Mshare	Mconc	CAR	LRisk	Ahaul	Aload	sigma-squared	gamma
2	1.148	**-0.148**	**0.012**	1.855	1.269	**-0.954**	**-0.138**	**0.752**	**0.793**
3	2.134	**-0.126**	**0.021**	-0.813	-1.048	**-0.281**	**-0.080**	**1.087**	**0.907**
4	**2.776**	-0.006	**0.010**	**0.252**	**-0.363**	**-1.421**	**-0.133**	**0.511**	**0.735**
5	1.731	**0.032**	**0.020**	**-2.566**	**-2.775**	**-1.854**	**-0.009**	1.868	0.910
6	5.329	**-0.089**	**0.015**	-2.627	-2.850	**-1.588**	**-0.150**	**0.377**	**0.871**
7	2.078	-0.164	**0.026**	0.049	0.414	**-0.826**	**-0.245**	**0.812**	**0.835**
8	0.868	**-0.046**	**0.022**	0.300	0.507	**-0.683**	**-0.095**	**0.249**	**0.646**
9	**1.815**	-0.108	**0.009**	0.512	**1.294**	**-1.430**	**-0.177**	**0.526**	**0.819**
10	2.769	-0.036	-0.001	0.104	-0.154	**-0.467**	**-0.134**	**0.158**	**0.709**

Note: Values with bold font indicate significant at 0.05 % level of significances.

Table 4. Summary Statistics of the Efficiency measures by Number of years in each firm; by Year and by Commodity

	N	Mean	Std Dev	Minimum	Maximum
Number of years in each firm					
2	1062	0.508	0.255	0.001	0.935
3	1422	0.429	0.233	0.000	0.926
4	1604	0.566	0.257	0.003	0.945
5	1405	0.556	0.211	0.002	1.000
6	552	0.567	0.293	0.010	0.960
7	448	0.592	0.269	0.000	0.923
8	432	0.553	0.263	0.030	0.958
9	450	0.622	0.266	0.014	0.941
10	360	0.620	0.284	0.039	0.965
Year-wise					
1994	598	0.484	0.269	0.000	0.958
1995	619	0.539	0.254	0.000	1.000
1996	722	0.509	0.263	0.018	0.918
1997	693	0.552	0.269	0.003	0.965
1998	678	0.528	0.275	0.002	0.957
1999	719	0.565	0.246	0.026	0.954
2000	937	0.567	0.237	0.007	0.931
2001	975	0.573	0.257	0.029	0.944
2002	1006	0.571	0.242	0.036	0.942
2003	788	0.541	0.242	0.009	0.955
Commodity-wise					
Gen. Freight, LTL	799	0.539	0.260	0.002	1.000
Gen. Freight, TL	3306	0.527	0.259	0.011	0.952
Heavy Machinery	194	0.532	0.261	0.003	0.950
Petroleum Products	691	0.552	0.250	0.019	0.958
Refrigerated Solids	721	0.548	0.259	0.002	0.951
Dump Trucking	245	0.535	0.262	0.000	0.960
Agricultural Commodities	275	0.535	0.260	0.000	0.954
Motor Vehicles	127	0.543	0.251	0.000	0.955
Building Materials	503	0.527	0.260	0.009	0.946
Others	874	0.542	0.252	0.007	0.948