

Impact of September 11, 2001 on the Profitability Performance of the U.S. Trucking Industry

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Abstract

Using an econometric model the economic impact of the September 11, 2001(9/11) terrorists' attacks on the U.S. homeland on the trucking transportation sector in the United States is examined. Also, the econometric model was modified to show how this event may have inflicted economic damage on the industry by regions.

Truck transportation, along with barges and railroads, facilitate a highly competitive market that bridges the gap between U.S. agricultural producers and domestic and foreign consumers. Trucks often compete head-to-head as suppliers of transportation services with barges and railroads for agricultural and non-agricultural product movements. Despite a high degree of competition in some markets with other modes of transportation, trucking carriers also serve as beginners and enders for most shipments of other modes of transportation. Thus, this balance between truck carriers serving as competitors and integrators provides shippers in this country with a highly efficient, low-cost transportation system that is second to none in the world, (Marathon, VanWechel and Vachal, 2004).

The September 11, 2001 (9/11) terrorists attack on the twin towers of the World Trade Center, the Pentagon, and, in an apparent failed attempt to crash another plane at a high-profile Washington, D.C. target have had an enormous financial, as well as emotional, impact on the citizens of the United States. The other plane crashed in a field in southern Pennsylvania. As a result of these terrorists' acts more than 3,000 U.S. citizens and foreign nationals died.

Of the many industries that have undergone financial changes as a result of the terrorists attack on the U.S. homeland, the trucking industry has been one of the least industries empirically analyzed to determine how the profitability of this industry have been impacted since those attacks. Most of the work that has been done has been on the air carrier industry since this

industry was impacted directly by the terrorists and to a lesser extent the railroad industry. However, to the authors' knowledge very little, if any, empirical analyses have been conducted by researchers to measure the impact of the September 11, 2001 terrorists' attack on the U.S. homeland on the profitability of the trucking industry as a whole, by regions or by segments. Therefore, this research effort is expected to bridge that information gap.

This paper will present an analysis of a time series/cross-sectional database for the trucking industry that covers the time period from 1994 through 2003. This time period will allow the empirical analysis to cover at least two years after the terrorists attack on the U.S. homeland. The specific objective of this study is to measure the impact of the September 11, 2001 (9/11) terrorist attack on the profitability of the U.S. trucking industry.

Methodology and Data

In the empirical analysis proposed for accomplishing objective of this study, annual and pool data will be used. The time period for the annual and pool data comprise the years 1994 to 2001(pre-9/11) and 2002 to 2003 (post-9/11). This approach will capture the impact of 9/11 on the profitability of the carriers entering or exiting industry on an annual and pool basis. Further, an analysis will be conducted to measure the impact of the disaster event (9/11) on carriers that operated in the industry during the entire 10-year study period. For additional analyses, the United States will be divided into four regions: West, South, Midwest, and the Northeast. The disaster event (9/11) is expected to impact the profitability of the carriers differently by locations. By putting the carriers into regions, this will allow the authors to test this hypothesis. The hypothesis posed here is that the profitability of carriers located farther away from the impact region (New York City) and surrounding areas would be less adversely impacted than

those carriers closer to the impact region. Overall, these analyses would allow the researchers to show how the 9/11-disaster event may have impacted the profitability of the carriers differently by regions, segments, and as an aggregated group.

The data needed to accomplish the objectives of this study came from the *Blue Book of Trucking Companies*, published by the Technical Transportation Services, for the time period 1994 to 2003. This database contains financial and operating information on the U.S. trucking industry by segments. To determine the impact of profitability of the carriers as a result of the disaster event (9/11), the following model is posed:

$$(1) \quad PFT_i = \alpha_0 + \alpha_1 CTR_i + \alpha_2 MKS_i + \alpha_3 CAR_i + \alpha_4 DER_i \\ + \alpha_5 DSO + \alpha_6 Disaster\ Event + \alpha_7 DSO | Disaster\ Event + U_i$$

where,

PFT= Net income (in million).

CTR = The concentration 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 CTR_m , for example, CTR_{10} . The concentration ratio can be expressed as: $CTR_m = s_1 + s_2 + s_3 + \dots + s_m$, where s_i = market share of the i^{th} firm (Allen and Shaik, 2005).

MKS = Market 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 revenues (Allen and Shaik, 2005).

DER = Long-term Debt-to-Equity. This 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 = Capital-to-asset ratio. This ratio is a measure of the financial soundness of a firm. As a general rule, the higher the ratios the more sound the firm. A firm with a high capital-to-asset ratio is protected against operating losses more than a firm with a lower ratio, although this depends on the relative risk of loss at each firm (Fitch, 1993). The capital-to-asset ratio is estimated by dividing individual firm's capital by its total assets.

The variable DSO_i is region dummy variable that equals 1 if the firm is located in the Northeast, and 0 otherwise. The variable $Disaster\ Event_i$ is the dummy variable that equals 1 if the time period is 2002-2003, and 0 otherwise. The variable U_i is the error term.

Empirical Model

The linear model, which includes the aforementioned variables in equation 1, was chosen as the functional form for estimating the effects of the independent variables on the dependent variable net income. The following three regression models are estimated to examine the regional

(equation 2) impact, disaster event (equation 3) impact, and the interaction of regional and disaster event impact of 9/11 (equation 4) on net income:

$$(2) \quad PFT_i = \alpha_0 + \alpha_1 CTR_i + \alpha_2 MKS_i + \alpha_3 CAR_i + \alpha_4 DER_i + \alpha_5 DSO + U_i$$

$$(3) \quad PFT_i = \alpha_0 + \alpha_1 CTR_i + \alpha_2 MKS_i + \alpha_3 CAR_i + \alpha_4 DER_i + \alpha_7 Disaster\ Event + U_i$$

$$(4) \quad PFT_i = \alpha_0 + \alpha_1 CTR_i + \alpha_2 MKS_i + \alpha_3 CAR_i + \alpha_4 DER_i + \alpha_5 DSO + \alpha_6 Disaster\ Event + \alpha_7 DSO | Disaster\ Event + U_i$$

Results

Tables 1-5 presents the summary statistics of the variables used in the regression analysis by year. The summary statistics include the number of observations, means and standard deviations for all the trucking firms used in this analysis. In this section of the study, the authors will limit the discussions to the means of the variables used in the regression analysis.

Results for the variable net income show that the means ranged from a low of 1.80 in 2000 to a high of 4.01 in 1999, Table 1. These results imply that the firms in the trucking industry did not generate that much net income in 2000 as they did in the previous year 1999. Results also show that the means of the net income declined from 2.76 in 2001 to 1.92 in 2002. These results imply that the net income of the trucking carriers declined after the terrorists attack on the United States. However, the trucking companies started to recover in the year 2003 as the net income increased from 1.92 in 2002 to 2.34 in 2003.

Table 1 Means and Standard Deviations of the Variable Netincome, 1994-2003

| Year | No. of Firms | Means | Std |
|------|--------------|-------|-------|
| 1994 | 337 | 3.40 | 23.38 |
| 1995 | 293 | 2.83 | 22.81 |

| | | | |
|-----------|------|------|-------|
| 1996 | 336 | 1.85 | 16.82 |
| 1997 | 343 | 2.49 | 7.85 |
| 1998 | 352 | 3.05 | 8.13 |
| 1999 | 370 | 4.01 | 38.45 |
| 2000 | 476 | 1.80 | 10.60 |
| 2001 | 435 | 2.76 | 32.72 |
| 2002 | 427 | 1.92 | 8.31 |
| 2003 | 377 | 2.34 | 9.64 |
| All Years | 3746 | 2.61 | 20.70 |

The means of the variable MshareR are shown in Table 2. Results show that the market share of the firms increased from 3.12 percent in 1994 to 3.72 percent in 2003. These results reveal that the market share of the firms increased from 1994 to 2003. The results further show that the terrorists attack on the United States in 2001 had no adverse impact on the market share of the trucking carriers in 2002 (year after the terrorists attack on the United States) as the market share remained the same in 2002 as it did in 2001. In the year 2003, market share of the carriers did increase as the number of firms declined from 435 in 2001 to 377 in 2003. Thus result could imply that the remaining carriers in the industry replaced the exiting carriers by providing the necessary transportation services needed by customers that had been previously served in the industry by the firms that exited from the industry after the terrorists' attack of 2001.

Table 2 Means and Standard Deviations of the Variable MshareR, 1994-2003

| Year | No. of Firms | Means | Std |
|-----------|--------------|-------|------|
| 1994 | 337 | 3.12 | 8.87 |
| 1995 | 293 | 3.52 | 9.32 |
| 1996 | 336 | 3.29 | 9.23 |
| 1997 | 343 | 2.98 | 8.08 |
| 1998 | 352 | 3.12 | 8.39 |
| 1999 | 370 | 2.98 | 7.56 |
| 2000 | 476 | 3.10 | 8.01 |
| 2001 | 435 | 3.37 | 8.83 |
| 2002 | 427 | 3.37 | 8.19 |
| 2003 | 377 | 3.72 | 8.54 |
| All Years | 3746 | 3.25 | 8.47 |

Table 3 shows that the means of the variable Mconcr increased from almost 49 in 1994 to 61.50 in 2003. This result implies that the competitive structure of the industry declined over the study period. The result could further imply that the industry became more concentrated in 2003 than it did in the year the 1994. This means that the shippers in the industry had less carrier options in terms of the number of firms from which to select and may be able to adversely impact some shippers with less service at high rates. In addition, the concentration increased slightly from 56.80 in 2001 to 57.70 in 2002 the year following the terrorists attack on the United States.

Table 3 Means and Standard Deviations of the Variable Mconcr, 1994-2003

| Year | No. of Firms | Means | Std |
|-----------|--------------|-------|-------|
| 1994 | 337 | 48.92 | 23.40 |
| 1995 | 293 | 50.63 | 23.73 |
| 1996 | 336 | 49.04 | 24.75 |
| 1997 | 343 | 50.88 | 22.31 |
| 1998 | 352 | 55.50 | 15.45 |
| 1999 | 370 | 61.05 | 17.01 |
| 2000 | 476 | 55.77 | 16.58 |
| 2001 | 435 | 56.80 | 15.55 |
| 2002 | 427 | 57.70 | 15.27 |
| 2003 | 377 | 61.50 | 16.07 |
| All Years | 3746 | 55.11 | 19.45 |

The capital-to-ratio means reveal that the ratio increased from 0.36 in 1994 to 0.38 in 2003, Table 4. This result implies that the carriers in the industry became slightly more financially sound over the study period. This result could mean that the carriers were protected less in 1994 from operating losses than they were in 2003. The results further imply that the terrorists' attack of September 11, 2001 on the United States had no adverse impact on the industry a year later as the capital-to-asset remained at 0.40 in 2001 and 2002. However, the ratio

did decline slightly in the year 2003 implying that the carriers had less protection from losses in this year than they did in 2001 and 2002.

Table 4 Means and Standard Deviations of the Variable CAR, 1994-2003

| Year | No. of Firms | Means | Std |
|-----------|--------------|-------|------|
| 1994 | 337 | 0.36 | 0.19 |
| 1995 | 293 | 0.35 | 0.19 |
| 1996 | 336 | 0.35 | 0.20 |
| 1997 | 343 | 0.36 | 0.24 |
| 1998 | 352 | 0.38 | 0.28 |
| 1999 | 370 | 0.39 | 0.48 |
| 2000 | 476 | 0.37 | 0.44 |
| 2001 | 435 | 0.40 | 0.51 |
| 2002 | 427 | 0.40 | 0.53 |
| 2003 | 377 | 0.38 | 0.26 |
| All Years | 3746 | 0.38 | 0.37 |

The means of the variable DER increased from 4.55 in 1994 to 9.00 in 2003, Table 5.

This result reveals that the trucking carriers in this industry increased their long term risk over the study period. Results also reveal that the long-term debt-to-equity ratio increased from 4.95 in 2001 to 11.40 in 2003 reflecting an increase in long-term risk a year after the terrorists attack on the United States. Although the long-term-to-equity ratio increased a year after the terrorists attack on the United States, it did decline in the year 2003 to 9.00 from 11.40 in 2002.

Table 5 Means and Standard Deviations of the Variable DER, 1994-2003

| Year | No. of Firms | Means | Std |
|-----------|--------------|-------|--------|
| 1994 | 337 | 4.55 | 23.12 |
| 1995 | 293 | 4.15 | 9.83 |
| 1996 | 336 | 5.95 | 23.73 |
| 1997 | 343 | 5.73 | 19.16 |
| 1998 | 352 | 3.67 | 9.82 |
| 1999 | 370 | 5.62 | 22.67 |
| 2000 | 476 | 25.57 | 300.17 |
| 2001 | 435 | 4.95 | 19.12 |
| 2002 | 427 | 11.40 | 113.62 |
| 2003 | 377 | 9.00 | 54.11 |
| All Years | 3746 | 8.72 | 116.10 |

Table 6 reports the results of the models used for estimating the analysis. The estimated variables are generally statistically significant at the 5% level. More specifically, MshareR, MconcR, and CAR are variables significantly different from zero at the 5% level in the regression equation that contains the time dummy variable. These results imply that these variables are major factors affecting the net income of the carriers in the trucking industry as a result of the terrorists' attack on the United States. The insignificant variables for the regression equation that contains the time dummy are DER and year2. These results imply that these variables were not major factors affecting net incomes as a result of the terrorists' attack on the United States.

The results indicate that if the MshareR increased by 1 unit, the net income would increase by 0.4 units. Since the t-value was 1.96, a significant statistical relationship does exist for this variable in the analysis. The variable MconcR, which represents the concentration ratio, is significantly different from zero at the 5% level of significance. A negative relationship exists between net income and MconcR. This result shows that if the MconcR variable is increased by 1 unit, net income would decrease by 0.01. The CAR variable represents the capital-to-asset ratio. Results from this variable indicate that there is a positive relationship between this variable and net income. The coefficient value of positive (1.1992) means that net incomes increase by almost 1.20 units for each unit increase of CAR.

Table 6 Net Income Regression Results for the period, 1994-2003

| Variables | | | | |
|------------------------|-----------------|---------------|---------------|--------------|
| With Time Dummy | Estimate | StdErr | tValue | Probt |
| Intercept | 0.6545 | 0.3904 | 1.68 | 0.0936 |
| MshareR | 0.4042 | 0.0180 | 22.44 | <.0001 |
| MconcR | -0.0155 | 0.0067 | -2.30 | 0.2130 |
| CAR | 1.1992 | 0.4082 | 2.94 | 0.0033 |
| DER | 3.07E-06 | 0.0001 | 0.04 | 0.9703 |

| | | | | |
|--|-----------------|---------------|---------------|--------------|
| year dum2 | -0.1318 | 0.2849 | -0.46 | 0.6436 |
| With Regional Dummy | Estimate | StdErr | tValue | Probt |
| Intercept | 0.7208 | 0.3913 | 1.84 | 0.0655 |
| MshareR | 0.4047 | 0.0180 | 22.50 | <.0001 |
| MconcR | -0.0152 | 0.0067 | -2.27 | 0.0231 |
| CAR | 1.1723 | 0.4084 | 2.87 | 0.0041 |
| DER | 6.31E-06 | 0.0001 | 0.08 | 0.9390 |
| regdum | -0.7002 | 0.3324 | -2.11 | 0.0352 |
| With Time, Regional and Interaction Dummy | Estimate | StdErr | tValue | Probt |
| Intercept | 0.7581 | 0.3929 | 1.93 | 0.0537 |
| MshareR | 0.4049 | 0.0180 | 22.47 | <.0001 |
| MconcR | -0.0149 | 0.0067 | -2.20 | 0.0276 |
| CAR | 1.1667 | 0.4084 | 2.86 | 0.0043 |
| DER | 3.39E-06 | 0.0001 | 0.04 | 0.9672 |
| year dum2 | -0.2498 | 0.3079 | -0.81 | 0.4173 |
| regdum | -0.8761 | 0.3764 | -2.33 | 0.0200 |
| year dum2*regdum | 0.7954 | 0.8011 | 0.99 | 0.3208 |

Results for the regression equation (3) that contain the regional dummy variable are similar to the results found in regression equation two that contains the time dummy variable. The results indicate that in addition to the significant variables found in regression equation two, the variable regdum is statistically significant at the 5% level of significance. A negative relationship exists between this variable and net income. This result implies that if this variable increased by 1 unit, net incomes for the trucking carriers would decrease by 0.70.

Regression equation (4) that contains the variables MshareR, MconcR, CAR, DER, and time, regional and interaction dummy variables show similar results as those found in regression equations two and three. In this equation, variables DER, year dum2, and year dum2*regdum are insignificant variables while the other variables are significant factors affecting the net incomes of the carriers for this analysis. Although the values of the variables found in this equation are

slightly different from those found in regression equations two and three, the interpretation of the results of this regression is basically the same as those found in regression equations two and three. Though not statistically significant, the negative sign on the year dummy and regional dummy indicate the terrorists attack had affected the northeast region and year after 2001 in U.S. trucking industry.

Summary and Conclusions

The overall objective of this study was to assess the impact of the September 11, 2001 terrorists' attack on the United States homeland on the net income of trucking carriers in the United States. The objective of this study was accomplished by using three regression models with data for the time period 1994-2003 coming from the electronic copy of the Blue Book of Trucking Companies published by the Transportation Technical Services and other secondary sources. The first model used net income as the dependent variable with market shares of the firms, concentration ratios, capital-to-asset ratios, long-term debt-to-equity ratios, and a time dummy as the independent variables. The second regression equation model had the same variables except it did not include the time dummy variable but included a regional dummy variable. The final regression model contained the time, regional, and interaction dummy variables in addition to the variables found in the regression models aforementioned.

One of the results from the study reveals that the mean values of the net income variable declined from 2.76 in 2001 to 1.92 in 2002. These results imply that the net income of the trucking carriers declined after the terrorists attack on the United States. However, the trucking companies started to recover in the year 2003 as the net income increased from 1.92 in 2002 to 2.34 in 2003.

Another result from this study indicates that the terrorists' attack of September 11, 2001 caused several variables to have statistically significant impacts on the net income of trucking carriers in the industry. More specifically, the MshareR, Mconcr, CAR, and the regdum variables in the regression models used in this analysis were statistically significant at the 5% level of significance. These results imply that these variables are major factors affecting the net income of the carriers in the trucking industry as a result of the terrorists' attack on the United States. For example, one result indicates that if the MshareR increased by 1 unit, the net income would increase by 0.4 units.

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