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Key advertising components and media channels for recruiting long haul drivers

Marla B. Royne
University of Memphis, mstaffrd@memphis.edu

Carol C. Beinstock
Radford University, cbienstoc@radford.edu

Tracy Anna Cosenza
University of Memphis, tracycosenza@memphis.edu

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U.S. MOTOR CARRIER HOURS OF SERVICE REGULATIONS: THEIR IMPACT ON CARRIER PROFITABILITY AND PRODUCTIVITY

Ahren Johnston
Missouri State University

ABSTRACT

This paper discusses the history of hours of service regulations for U.S. motor carriers and investigates the changes to individual carrier profitability and productivity from the last major change to those regulations in 2003. The results of the analysis indicate that operating ratio worsened and sales per employee improved, and return on assets and return on equity were unchanged due to hours of service changes. The implications of these results given the recent changes to hours of service regulations in 2011 are also discussed.

INTRODUCTION

With the major change to the Federal Motor Carrier Administration (FMCSA) Hours of Service regulations announced in December 2011(HOS, 2011), there has been increased interest in how this will impact motor carriers. Prior to the publication of the final rule, several studies regarding highway safety and the health of truck drivers were published (Hall and Mukherjee, 2008; Jovanis et al., 2005; Min, 2009; Saltzman and Belzer, 2002), but little or no research has been conducted on the impact of HOS on the profitability and productivity of individual firms. The Regulatory Impact Analysis (FMCSA, 2010) includes an estimate of the cost of reduced productivity at the macro level but not at the firm level. The estimates used to calculate reduced productivity were also called into question in a paper prepared for the American Trucking Association by Edgeworth Economics (2011). Due to the questions about research on the impact of HOS on costs and productivity at the macro level, and a lack of research at the firm level; this paper will investigate the impact of changes to HOS at the firm level, which may also add some insight into the macro-economic impact of these changes.

The last major change to HOS occurred in 2003 and went into effect in January of 2004. The 2003 HOS reduced the allowable on-duty time per work/rest cycle[1] by one hour, increased the allowable driving time per work/rest cycle by one hour, and decreased the on-duty and work time per day by two hours. However, with the addition of the 34 hour restart[2], the maximum on-duty and driving time per week were increased by 14 and 7 hours and the maximum long-term average on-duty and driving hours were increased by approximately 21 and 14 hours. These dramatic changes led to a period of uncertainty concerning the future of HOS with multiple law suits, court actions, and acts of Congress, which resulted in the issuance of the 2011 HOS.

Before the final 2011 HOS were publicized, there was discussion about decreasing the on-duty and driving hours per work/rest cycle by one to two hours, but the final rule retained the 14 hour on duty and 11 hour driving limits per

work/rest cycle from the 2003 HOS. The most significant change to the 2011 HOS is the requirement of a minimum 30 minute break after 8 hours of driving and severely limiting the use of the 34 hour restart. Under the new rule, the 34 hour restart can only be used once per week (168 hours) and must include two time periods between 1:00 am and 5:00 am. The once per week restriction is intended to allow a driver to work one long week but force him to follow that with a short week, and the 1:00 am through 5:00 am restriction is intended to allow night drivers two periods of night rest to recover (FMCSA, 2011). While these changes will not impact the maximum daily or weekly driving or on-duty times, they will restrict the maximum average weekly driving and on-duty times to a point halfway between those allowed under the 1962 HOS and the 2003 HOS. Therefore looking at the impact of the 2003 HOS changes to motor carrier profitability and productivity should give some insight into the impact of the 2011 HOS on motor carriers.

This paper investigates the actual impact of the last major change to the HOS on profitability and productivity of publicly traded motor carriers. Quarterly data from 1997-2010 for 14 publicly traded motor carriers was used. To see the impact on profitability, Operating Ratio (OR) and Return on Assets (ROA) were dependent variables in two separate models. The variable of interest was a dummy variable with a value of zero for the time periods before the change to HOS (1997-2003) and a value of one for the time periods after the change (2004-2010). Various control variables were also included to account for economic and regulatory changes that took place in the sample period. To see the impact on productivity, a similar model was tested with sales per employee as the dependent variable. Results of the estimations indicate that the 2004 HOS led to better productivity, a worse OR, and no significant change to ROA. These results would suggest that the 2011 HOS will potentially negatively impact productivity and positively impact profitability.

HISTORY OF HOURS OF SERVICE RULES

HOS were first proposed by the ICC in 1936 and went into effect in July of 1938. These rules allowed for 15 hours on-duty and 12 hours of work per day, which could all be driving or could also include other tasks such as loading, unloading, and completing paperwork. Drivers were also required to have at least 9 hours off duty each day. A limit of 60 hours on-duty in 7 days or 70 hours on-duty in 8 days was also instated. These rules resulted in protests from both organized labor and some motor carriers, so in early 1939 revised rules went into effect. These new rules reduced the required off duty time to 8 hours per day and implemented a 10 hour driving limit per day instead of the previous 12 hours of work per day. The next change came in 1962 when, for unexplained reasons, the ICC changed the rule to allow for a maximum driving time of 10 hours and on duty time of 15 hours, which could be extended to 16 hours with breaks, after 8 hours off duty, so maximum on duty and driving time per day became maximums per work/rest cycle. This change allowed drivers up to 16 hours of driving and on-duty time per day (FMCSA, 2000). The 1962 hours of service regulations increased the maximum driving time per day, but the retention of the weekly limits kept maximum and average weekly driving times the same. A driver could simply reach his 8 day on-duty limit in 5 days rather than 7 days, allowing for greater flexibility in scheduling.

The HOS remained virtually unchanged until 2003. With the ICC Termination Act of 1995, jurisdiction for HOS was given to the Federal Highway Administration (FHWA). The FHWA

was asked by Congress to re-examine HOS with a focus on public safety and driver health. An advanced notice of proposed rulemaking was issued in 1996, but no further action was taken. In 2000 jurisdiction was transferred to the Federal Motor Carrier Safety Administration (FMCSA) and a notice of proposed rulemaking was issued. In 2003 the FMCSA issued a final rule, which went into effect in January 2004. The 2003 HOS decreased maximum on-duty time to 14 hours (including any breaks), increased maximum driving time to 11 hours per work/rest cycle, and increased off duty time to 10 hours. Furthermore, the 34 hour restart was added, which allows a driver to reset the 7 or 8 day time limit effectively adding up to 14 hours to a driver's work week (Jones, 2007). The 2003 HOS led to a period of unrest and uncertainty about the future of hours of service regulations in the U.S.

The first lawsuit following the 2003 HOS was filed by the consumer advocacy group, Public Citizen, before the rule even went into effect, and the U.S. Court of Appeals for the D.C. Circuit struck down the rule in 2004 citing the fact that the FMCSA failed to take into account driver health, as required by law, when setting the 2003 HOS. Following that court ruling, Congress granted temporary relief from the ruling, and President Bush signed the Surface Transportation Extension Act of 2004, giving FMCSA a year to come up with a rule addressing the court's issues with the 11 hour driving limit and 34 hour restart. In January 2005 FMCSA issued a notice of proposed rules that make few changes to the 2003 HOS other than changes to the split sleeper berth provisions. This was subsequently published as a final rule in August 2005 and went into effect in October 2005. In 2006 Public Citizen once more filed suit in federal court arguing for different changes in the HOS, which resulted in a federal appeals court vacating two provisions of the rule in July 2007. At the request of the American Trucking Association, the court issued a 90 day stay to its mandate in September 2007. The FMCSA then issued an interim final rule in December 2007 identical to the 2005 rule, and this was subsequently issued as a final rule in November 2008. Public Citizen once more filed suit in March 2009, and a settlement was reached before the suit went to court. Therefore, despite multiple lawsuits resulting in the 2003 HOS being struck down, the 2003 HOS have remained virtually unchanged. The only change came in 2005 and mandated that 8 of the 10 hours off duty for drivers operating with a sleeper berth be taken consecutively (Jones, 2007; Munroe, 2009; Public Citizen, 2012).

As part of a settlement between FMCSA, the Teamsters Union, Public Citizen and several safety groups, FMCSA agreed to revise the HOS taking into account drivers' health and safety. The proposed 2011 HOS were released in December 2010, and the final rule was released in December 2011. The compliance date for the on-duty time and egregious violation definitions and oil field exemption[3] was February 27, 2012, and all other provisions had a compliance date of July 1, 2013. These new rules maintain a maximum 11 hours of driving time but require a 30 minute break after 8 hours of driving. The maximum on-duty time remains at 14 hours but is effectively reduced to 13.5 with the required break, unless the break is incorporated with the split sleeper berth provision. Limitations to the 34 hour restart will require that it include two periods between 1:00 am and 5:00 am and can only be used once every 7 days or 168 hours. Finally, the definition of on-duty time has been modified to not include any time resting in a parked vehicle (this could include detention

time) or up to two hours in a passenger seat of a moving vehicle following 8 hours in the sleeper berth (FMCSA, 2011). Following the publication of the final 2011 HOS, the American Trucking Association filed a petition with a federal court asking the court to review the 2011 HOS in February 2012 and filed an issue statement in March 2012. The primary issues identified are with the limitation to the 34 hour restart and the inclusion of a mandatory 30 minute break following 8 hours on-duty (McNally, 2012a; McNally, 2012b).

To help clarify the differences between the different HOS that have been in place over the last 74 years, Table 1 summarizes the HOS from 1938 – 2011. This table identifies the maximum driving and on duty time per sleep/work cycle and the potential maximum driving and on-duty time per 24 hour period. In addition the maximum driving and on-duty time possible in a single week as well as the potential maximum average driving and on-duty time is included in Table 1. These figures are based on a driver either driving the maximum allowable time, taking the minimum off duty time, and resuming driving or being on-duty the maximum allowable time, taking the minimum off duty time, and resuming driving. As shown in Table 1, the 2003 HOS reduced both the potential drive time and on-duty time per day but significantly increased the potential drive time or on-duty time per week with the introduction of the 34-hour restart, and the 2011 HOS reduced these weekly times to a point approximately midway between those allowed under the 1962 HOS and the 2003 HOS with the new limitations on the 34-hour restart. McCartt et al. (2008) report that approximately 80 per cent of drivers were using the restart provision as part of their regular schedule in 2004 and 2005, so the new limitations to this provision could have significant impact throughout the trucking industry.

ECONOMETRIC MODEL

For this study, three separate models were developed to address the impact of the 2003 HOS on motor carrier profitability as measured by operating ratio (OR), return on assets (ROA), and return on equity (ROE). A fourth model was developed to look at the impact on productivity as measured by sales per employee (SPE). All four models used the same independent variables. The variable of interest, PHOS, is a dummy variable indicating whether an observation was taken after the 2003 HOS, which went into effect in January of 2004. The impact of this regulation is difficult to predict in advance because, depending on the practices of a particular firm, the maximum driving time per day would have either been increased by 1 hour (maximum time per duty cycle) or decreased by 2 hours (maximum time per day) and on-duty time was decreased by 1 hour (maximum time per duty cycle) or 2 hours (maximum time per day). In addition to the HOS that went into effect in 2004, two other types of regulations, Ultra Low Sulfur Diesel (ULSD) requirements and stricter emissions standards, likely had impacts on motor carrier revenues and profitability and went into effect between 2004 and 2010.

ULSD was phased in between 2006 and 2010 with all 2007 and newer vehicles required to only run on ULSD. This change had an impact on the price of diesel and on the price of tractors which had to be modified in order to run with the lower lubricity of ULSD. To incorporate additional operating cost from this change into

TABLE 1:
SUMMARY OF HOS RULES

HOS	Drive Time per Cycle	Drive Time per Day	On-Duty Window per Cycle	On-Duty Time per Day	Off-Duty Time per Cycle	Max. Wkly. Drive Time	Max. Avg. Wkly. Drive Time	Max. Wkly. On-Duty Time	Max. Avg. Wkly. On-Duty Time	7(8) Day Limit	34-hour Restart
1938	12	12	12	12	9	70	61.25	70	61.25	60 (70)	No
1939	10	10	16	16	8	70	61.25	70	61.25	60 (70)	No
1962[1]	10	16	15	16	8	70	61.25	70	61.25	60 (70)	No
2003[2]	11	14	14	14	10	77	73.92	84	81.67	60 (70)	Yes
2011[3]	11	14	14	14	10	77	66	84	70	60 (70)	Limited

[1] Before the addition of the 34 hour restart the maximum time a driver could work was 60 hours in 7 days or 70 hours in 8 days (for a carrier operating 7 days per week). However, it was allowable to accumulate all 70 hours within 7 days or less and take time off duty for the remainder of the 8 days. However, the maximum average work hours per week was restricted by the 8 day driving limit to 61.25.[2] With the addition of the 34 hour restart in 2003, it would be allowable for a driver to accumulate 66 hours of driving time in 5 days, take a 34 hour break, and accumulate an additional 11 hours of driving time before week's end for a total of 77 hours in 7 days (assuming no other on-duty time). Furthermore, the maximum average long run average driving hours per week was 73.92 hours. A driver with 14 hours of on-duty time every cycle could accumulate up to 84 hours of on-duty time in a single week (66 hours of driving time) with a maximum average weekly on-duty time of 81.67 hours.[3] With the limitations to the 34 hour restart in 2011, a driver would be able to maximize daily drive time by incorporating the mandatory 30 minute break into the 2 hour portion of their split sleeper berth time. In a single day a driver could drive 8 hours, take two hours off duty, drive 3 hours, take 8 hours off duty in the sleeper berth, and drive an additional 3 hours (a driver not using the split sleeper berth provision could drive a maximum of 13.5 hours in a single day). Continuing the pattern of drive 8, rest 2, drive 3, rest 8 through 66 hours of driving time, using the 34 hour reset and continuing the pattern again would allow for a maximum of 77 hours of driving time in a single week, but would be required to take additional time off the following week for an average of 66 hours of driving time per week. A driver using 14 hours of on-duty time every cycle and a similar strategy could work a maximum of 84 hours in a single week but would be limited to 56 hours the following week for an average of 70 hours on-duty time per week. These maximum weekly and average weekly driving and on-duty times would be the same for a driver not using the split sleeper berth provision and would generally include a longer week followed by a shorter week.

the model, the percentage change in average diesel price from the previous quarter or change in diesel price (CDP) was used as an independent variable. The average diesel price may not be the same for all carriers, but the percent increase or decrease should be similar for all carriers operating in all different parts of the country. Additionally the average diesel price exhibited a high level of autocorrelation.

Stricter emissions standards were implemented for 2004 and newer vehicles, and then even stricter emissions standards were implemented for 2007 and newer vehicles and phased in through 2010. Due to the language of the law, there were modest increases in new vehicle prices in 2004 and 2007 followed by large increases in 2010. To incorporate this information into the model, the average percent change in new tractor price (CTP) was included as an independent variable. While it would be preferable to obtain the actual price per tractor from each carrier, that information was unavailable, however, tractors are sold in a competitive environment, so the average price increase or decrease should be correlated with

each individual carrier's cost of equipment. As with average diesel price, average tractor price exhibited a high level of autocorrelation, so percentage change was used in the model.

To control for general economic conditions, the percentage change in Gross Domestic Product (GDPD) for the services sector was included in the model as well as a dummy variable for any quarter that had a month classified as recession (REC). To control for the different business environments less-than-truckload (LTL) and truckload carriers operate in and the different business environments between unionized and non-unionized carriers, dummy variables were included for LTL and unionized carriers (UC). Finally, dummy variables were included for the four quarters of the year. Manufacturing shipments were considered as an independent variable, but that measure was highly correlated with the quarter of the year (Q_1-Q_4), and a better fit to the data was obtained by using the quarterly dummy variables. Firm specific dummy variables were not included in the models as indicated by a Hausman Test for random effects.

Putting these variables together resulted in the following four equations to be estimated:

$$OR = \beta_1 PHOS + \beta_2 CTP + \beta_3 CDP + \beta_4 CGDP + \beta_5 REC + \beta_6 LTL + \beta_7 UC + \sum_i \beta_{Qi} Q_i + \varepsilon \quad (1)$$

$$ROA = \beta_1 PHOS + \beta_2 CTP + \beta_3 CDP + \beta_4 CGDP + \beta_5 REC + \beta_6 LTL + \beta_7 UC + \sum_i \beta_{Qi} Q_i + \varepsilon \quad (2)$$

$$ROE = \beta_1 PHOS + \beta_2 CTP + \beta_3 CDP + \beta_4 CGDP + \beta_5 REC + \beta_6 LTL + \beta_7 UC + \sum_i \beta_{Qi} Q_i + \varepsilon \quad (3)$$

$$SPE = \beta_1 PHOS + \beta_2 CTP + \beta_3 CDP + \beta_4 CGDP + \beta_5 REC + \beta_6 LTL + \beta_7 UC + \sum_i \beta_{Qi} Q_i + \varepsilon \quad (4)$$

MODEL DATA

For this analysis, quarterly data for 14 out of 17 publicly traded motor carriers with data available from 1997-2010 was used, resulting in 56 observations per carrier and a total of 784 observations. The years 1997-2010 were chosen, so there would be an even number of observations on each side of the 2003 HOS. Landstar was excluded because it is a non-asset based carrier, and therefore, operates in a somewhat different business environment. UPS Freight and FedEx Freight were also excluded because their SEC filings don't separate out the LTL portion of their business from the express, small package, and other portions of their business. Furthermore, YRC Worldwide was excluded from the estimation of Equation 3 due to the company's negative equity in Q2-Q3 2009 and Q1-Q4 2010. Table 2 lists the 14 carriers included in the sample as well as whether they were LTL carriers or unionized (UC). For purposes of the analysis, any carrier with a significant portion of their business coming from LTL business was considered LTL because they would have made the significant capital investment in terminals required of LTL carriers.

TABLE 2:
CARRIERS INCLUDED IN SAMPLE

Company Name	LTL	Union
Arkansas Best Corporation	Y	Y
Celadon Group, Inc.	N	N
Con-way, Inc.	Y	N
Covenant Transportation Group, Inc.	N	N
Frozen Food Express Industries, Inc.	Y	N
Heartland Express, Inc.	N	N
J B Hunt, LLC.	N	N
Knight Transportation, Inc.	N	N
Marten Transport, LTD.	N	N
Old Dominion Freight Line, Inc.	Y	N
PAM Transportation Systems, Inc.	N	N
USA Truck, Inc.	N	N
Werner Enterprises, Inc.	N	N
YRC Worldwide, Inc.*	Y	Y

*Not included in Equation 3 due to negative equity in 6 quarters of the sample period.

The financial data for the carriers (total sales, cost of goods sold, total assets, total equity, and number of employees) came from Standard and Poor's Compustat North America. From this data, operating ratio (OR), return on assets (ROA), return on equity (ROE), and sales per employee per quarter in thousands of dollars (SPE) were calculated. The average tractor price was obtained from Paccar Truck's SEC filings, in which they list the revenue from truck sales and units sold. The average tractor price was calculated from this and then adjusted for inflation using the Producer Price Index (PPI) for heavy trucks obtained from the Bureau of Labor Statistics (BLS) (2012). Average diesel price was obtained from the U.S. Energy Information Administration (EIA) (2012), and it was also adjusted for inflation using the PPI, and the CDP was then calculated. GDPD was obtained from the Bureau of Economic Analysis (BEA) (2012). Data on recessions was obtained from the National Bureau of Economic Research (NBER) (2012). Table 3 lists the variables used in the analysis as well as some descriptive statistics. Dummy variables are included to show what percentage of time or carriers fall into which categories.

ANALYSIS AND RESULTS

The final four models were estimated using SHAZAM econometric software with the POOL command. This is a generalized least squares (GLS) estimator that assumes and corrects for heteroskedasticity and autocorrelation within cross sections, different values of rho for each cross section, and correlation between error terms from different cross sections. Initial testing performed by SHAZAM (Whistler et al., 20011) indicated that these assumptions were justified.

The results of the analysis are summarized in Table 4. The first R^2 reported in Table 4 is based

TABLE 3:
DESCRIPTIVE STATISTICS OF VARIABLES

Variable	Mean	Std. Dev.	Min	Max
OR	86.31	7.31	65.24	119.44
ROA	4.44	7.80	-69.32	18.24
ROE	9.64	16.15	-134.77	63.31
SPE	29.89	7.21	11.82	56.50
CTP	0.13	2.85	-7.30	12.44
CDP	1.43	9.48	-32.24	24.00
CGDP	2.34	1.77	-2.30	6.20
PHOS	0.50	0.50	0.00	1.00
LTL	0.36	0.48	0.00	1.00
UC	0.14	0.35	0.00	1.00
REC	0.20	0.40	0.00	1.00
Sources:	National Bureau of Economic Research, 2012 Paccar, Inc., 1997-2012 Standard and Poor's Compustat North America, 2011 U.S. Bureau of Economic Analysis, 2012 U.S. Bureau of Labor Statistics, 2012 U.S. Energy Information Administration, 2012			

on the residuals from the Best Linear Unbiased Predictor (BLUP), which uses the coefficients on the untransformed variables to predict but then adjusts that prediction using the residual from the previous period multiplied by rho for the particular firm in question. The second R^2 reported is based on a method described by Buse (1973) as an appropriate R^2 to use for GLS estimation. These goodness of fit measures show that Equations 1 and 3 were most effective for prediction and Equation 2 explained little of the variance in return on equity.

The most interesting result of Equation 1 was that the operating ratio for the firms in question actually worsened after the 2003 HOS, indicating that despite the fact that drivers could accumulate more driving or on-duty hours in a day or week, many of the carriers were not able to decrease their expenses relative to revenue. This appears to be the case even after accounting for tractor and diesel prices, economic growth, and recessions. The other results of Equation 1 were much as expected: an increase in equipment or fuel prices leads to a worse OR, an increase in GDP leads to a better OR, a recession leads to a worse OR, and LTL carriers and unionized carriers experience higher costs than TL or non-unionized carriers.

The estimated coefficients of Equation 2 and Equation 3 reveal that the 2003 HOS changes, tractor prices, and diesel prices have no significant impact on ROA or ROE; however, the signs of the estimated coefficients are negative, consistent with the results of Equation 1. It seems that any increased expenses or decreased revenue contributing to the higher OR are able to be accounted for by reducing assets and equity or exploiting some source of profit other than from operations. Furthermore, Equation 2 shows that LTL carriers may be able to actually achieve a slightly higher ROA than TL carriers (the sign is positive but only significant at the 0.10 level), and unionized carriers tend to have a lower ROA than non-

TABLE 4:
RESULTS OF ESTIMATION

	Estimated Coefficient (p-value)			
Independent Variable	Equation1 (OR)	Equation 2 (ROA)	Equation 3 (ROE)	Equation 4 (SPE)
PHOS	0.807	-0.806	-1.783	2.770
	(0.03)	(0.25)	(0.14)	(0.00)
CTP	0.043	-0.024	-0.038	0.046
	(0.03)	(0.63)	(0.72)	(0.14)
CDP	0.024	-0.004	0.025	0.059
	(0.00)	(0.81)	(0.48)	(0.00)
CGDP	-0.208	0.418	0.789	-0.024
	(0.01)	(0.02)	(0.02)	(0.84)
REC	0.807	-1.682	-2.832	0.724
	(0.00)	(0.01)	(0.03)	(0.09)
LTL	2.828	1.320	-0.450	4.106
	(0.01)	(0.09)	(0.83)	(0.01)
UC	7.153	-3.403	1.353	4.849
	(0.00)	(0.02)	(0.69)	(0.00)
Q1	85.149	2.972	5.094	25.198
	(0.00)	(0.00)	(0.00)	(0.00)
Q2	83.562	5.236	9.447	26.896
	(0.00)	(0.00)	(0.00)	(0.00)
Q3	83.635	4.416	8.911	27.501
	(0.00)	(0.00)	(0.00)	(0.00)
Q4	83.938	3.797	7.172	27.334
	(0.00)	(0.00)	(0.00)	(0.00)
R^2_{BLUP}	0.896	0.417	0.314	0.863
R^2_{BUSE}	0.312	0.113	0.108	0.228

unionized carriers. Equation 3, on the other hand, shows no significant difference in ROE between LTL and TL carriers or between unionized and non-unionized carriers, but this result is likely due to the fact that the largest LTL and unionized carrier was excluded from the sample. Other hypotheses confirmed by Equation 2 and Equation 3 are that a growing economy allows for higher ROA and ROE and a recession is associated with a lower ROA and ROE.

Rather than financial performance, Equation 4 deals with productivity, and the results are much as expected because longer driving times per day and week should lead to the same work being accomplished with fewer employees. Sales per employee increased after the 2003 HOS regulatory change. Tractor price increases have no significant impact on SPE. Diesel price increases have a slight impact on SPE likely due to the increase in revenues from higher fuel surcharges. GDP changes seem to have no impact on productivity, but it may be slightly higher during a recession (significant at the 0.10 level). Finally, LTL and unionized carriers tend to have higher sales per employee, most likely because of the higher prices charged to customers. These higher prices are apparently not enough to cover the additional expenses from higher capital expenses for LTL carriers and higher wages for unionized carriers because Equation 1 reveals a higher OR for LTL than for TL carriers and a higher OR for unionized carriers than for non-unionized carriers.

CONCLUSIONS

The results of this study indicate that despite motor carriers being able to increase their sales per employee after the 2003 HOS, they were unable to improve or even maintain their operating ratios. However, they were able to maintain, but not increase, profitability as measured by ROA and ROE, possibly due to a reduced need for capital investments in tractors and terminals resulting from this increased productivity. Whatever the reason for this lack of impact to ROA and ROE, it shows that publicly traded motor carriers are flexible enough to maintain these measures of profitability despite changes to federal regulations.

The applicability of these results to the impact on carriers from the 2011 HOS is somewhat unclear, but one would expect to see somewhat of a reversal due to the newly added restrictions to the 34-hour restart provision. This is based on a survey by McCartt et al. (2008), in which drivers were interviewed at weigh stations in Pennsylvania and Oregon in 2004 and again in 2005. The results of the survey indicate that approximately 80 per cent of drivers drove fewer or about the same hours per day in 2004 and 2005 as before the 2003 HOS went into effect, but approximately 80 per cent of drivers use the restart provision as part of their regular schedules. This indicates that driving hours per day were minimally impacted by the changes, but driving hours per week likely increased (necessitating the use of the restart provision). If this is the case, the restriction of the restart provision implemented in the 2011 HOS will likely decrease the hours driven per week. Therefore, assuming the same patterns hold, the implementation of the 2011 HOS in 2013 will likely result in both an improved OR and decreased SPE for motor carriers, and one would expect to see minimal impact to ROA and ROE.

The results of this study indicate that motor carriers should not be overly concerned about a loss of profitability resulting from any forthcoming reductions in maximum driving hours per day. While this will not happen in the immediate future, it could still be an issue despite the final 2011 HOS including no reduction to maximum driving time. The final rule states that if new research comes out showing improved health of drivers or safety of the general public from a reduction in maximum driving time, the rule could be modified (FMCSA, 2011). If this does occur, carriers could expect to see minimal changes to productivity and operating ratio and should be able to maintain their ROA and ROE if the same pattern is followed. The results also indicate that carriers could expect to see minimal changes to ROA or ROE from the 2011 HOS as written and a decrease to both operating ratio and sales per employee. However, it remains to be decided in court whether the 2011 HOS will stand as written or be revised yet again.

LIMITATIONS AND FUTURE RESEARCH

The most obvious limitation of this research lies in the sample size and selection. Rather than taking a representative sample of carriers, a convenience sample of publicly traded carriers were used. In the case of the motor carrier industry the publicly traded carriers are also some of the largest, but they are also a rather small group. This limitation leads to the most obvious extension for future research: to conduct the same analysis using a larger, more representative sample. Of course, future research based on a larger sample would need to be based on case study or survey data due to the fact that financial statements are not publicly available for most motor carriers.

Further limitations of the study were the use of industry averages for the price of equipment and the price of fuel due to a lack of availability of firm specific values for these measures. Using case study or survey data for future research on this matter should alleviate this problem. Finally this study used sales per employee as a measure of productivity rather than sales per driver or sales per driver hour. While these measures may be highly correlated for many carriers, there is no way to know for sure without both variables. So the most significant limitations of this research lie in sample size and selection and variables used. All of these issues stem from data availability and could be alleviated by conducting further research using case study and/or survey data to get more specific variables and a larger, more representative sample.

ENDNOTES

[1]One work/rest cycle would include the time from when a driver comes on duty until he is able to come on duty again. For a driver, driving as many hours as possible under the 2003 HOS, this is between 21 and 24 hours with up to 11 hours of driving, up to 14 hours on duty, and at least 10 hours of sleep.

[2]A driver working every day is allowed a maximum of 70 hours on duty time in 8 days (192 hours), but taking 34 hours off duty allows a driver to reset the clock as if he had not worked at all in the last 192 hours.

[3]The definition of "on duty time" was adjusted to not include time spent resting in a parked vehicle after being released from duty, "egregious" HOS violations were specifically defined as driving 3 or more hours beyond the driving time limit and subject to maximum civil penalties, and logging requirements for certain drivers at oil fields were clarified.

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AUTHOR BIOGRAPHY

Ahren Johnston is an Assistant Professor of Business at Missouri State University at Springfield, MO. He received an M.T.L.M. degree and a Ph.D. from the Sam M. Walton College of Business at the University of Arkansas. His research interests center on logistics and transportation: specifically costs, quality, and service. Email: AhrenJohnston@missouristate.edu