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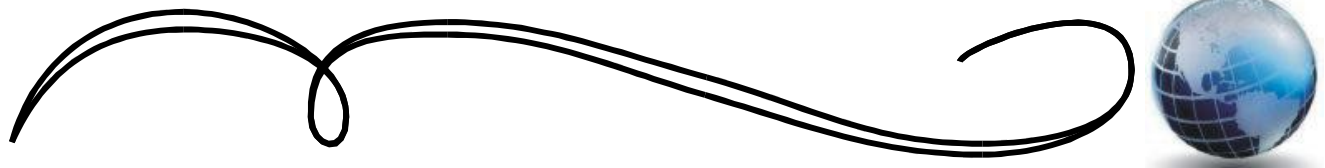
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Journal of Transportation Management

Summer Fall 2019
Vol. 30 No. 1



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Editorial Policy

The primary purpose of the *JTM* is to publish managerial and policy articles that are relevant to academics, policymakers, and practitioners in the transportation, logistics and supply chain fields. Acceptable articles could include conceptual, theoretical, legal, case, and applied research that contributes to better understanding and management of transportation and logistics. Saying that, our policy requires that articles be of interest to both academics and practitioners, and that they specifically address the managerial or policy implications of the subject matter. Articles that are strictly theoretical in nature, with no direct application to transportation and logistics activities, or to related policy matters, would be inappropriate for the *JTM*. Articles related to any and all types of organizations, and of local to global scope, will be considered for publication.

Acceptable topics for submission include, but are not limited to, broad logistics topics, logistics and transportation related legal issues, carrier management, shipper management of transportation functions, modal and intermodal transportation, international transportation issues, transportation safety, marketing of transportation services, transportation operations, domestic and international transportation policy, transportation economics, customer service, and the changing technology of transportation. Articles from related areas, such as third party logistics, purchasing and materials management, and supply chain management, are acceptable as long as they are related to transportation and logistics activities.

Submissions from practitioners, attorneys or policymakers, co-authoring with academicians, are particularly encouraged in order to increase the interaction between groups. Authors considering the submission of an article to the *JTM* are encouraged to contact the editor for help in determining relevance of the topic and material.

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Publishing Data

Manuscripts. Submit manuscripts to the editor by email attachment at taylorjohn@wayne.edu. Manuscripts should be no longer than 30 double-spaced pages and 7000 words. Guidelines for manuscript submission and publication can be found in the back of this issue.

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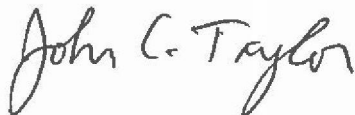
From the Editor...

Welcome to the Summer Fall 2019 issue of the Journal of Transportation Management (JTM), being Vol. 30 No 1! The issue starts with an article on the impact of recent federal trucking regulations. The second article examines airline passenger technology use. The third article discusses railroad land grants. The fourth article discusses supply chain teaching approaches. The issue concludes with an article on outsourcing criteria.

Our first article explores the impact of recent federal regulations, such as Comprehensive Safety Analysis (CSA) 2010, and Hours of Service Changes, on motor carrier profitability. Results of the analysis reveal that motor carrier profitability was declining between 2004 and 2009 but has been improving since that time. The second article examines technology preferences by millennials when interacting with airlines. One intriguing finding of this study is that using mobile devices does not rank high as one of their preferred choices. The third article discusses railroad land grants. The authors conclude that these 1800's grants continue to pay dividends to railroads to this day. The fourth article discusses approaches to teaching the undergraduate core SCM course and proposes future research on the suggestions. The last article is a conceptual and qualitative study of outsourcing criteria and the role of emotions in decision-making. The research is relevant to a variety of industries where emotions play a large role.

At the *Journal*, we are continuing to make a number of changes that will improve the visibility of JTM, and improve its position in the supply chain publishing world. These include registering and updating journal information with several publishing guides, and placing the past and current content on services that provide visibility to Google Scholar. Authors will receive summaries of downloaded articles monthly, and can examine the Digital Commons web site for data on various aspects of the publication and their articles. One year old and beyond issues will be placed into the system.

I look forward to hearing from you our readers with questions, comments and article submissions. The submission guidelines are included at the end of this issue's articles and I encourage both academics and practitioners to consider submitting an article to the Journal. Also included in this issue is a subscription form and I hope you or your library will subscribe.

A handwritten signature in black ink that reads "John C. Taylor". The signature is written in a cursive, flowing style.

John C. Taylor, Ph.D.
Editor, Journal of Transportation Management
Chair, Department of Marketing and SCM, Ilitch School of Business
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US FEDERAL REGULATIONS AND MOTOR CARRIER PROFITABILITY

Ahren Johnston

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ABSTRACT

This study explores the impact of recent federal regulations, such as Comprehensive Safety Analysis (CSA) 2010, Hours of Service Changes, Environmental Regulations, and electronic logbooks on motor carrier profitability. Quarterly data from 2004 – 2015 from U.S. publicly traded motor carriers is used to estimate the temporal trends on various financial ratios after controlling for general economic and carrier specific characteristics. Results of the analysis reveal that motor carrier profitability was declining between 2004 and 2009 but has been improving since that time.

INTRODUCTION

The Federal Motor Carrier Safety Administration (FMCSA) fully implemented its new Comprehensive Safety Analysis (CSA) 2010 in the fourth quarter of 2010, and many carriers and industry experts were concerned that it would lead to the exit of many drivers from the industry. Many carriers voiced this concern in their 2010 Annual Reports. J.B. Hunt Transport Service, Inc. said “. . . CSA 2010 could have a material adverse effect on the ability to obtain qualified drivers” (2011 a). Werner Enterprises said, “This may limit our ability to attract and retain qualified drivers” (2011 a). Arkansas Best Corporation said, “CSA regulations could potentially result in a loss of business to other carriers, driver shortages, increased costs for qualified drivers, and driver and/or business suspension for noncompliance” (2011 a) thus indicating that they were concerned about a driver shortage and a potential reduction in profitability. Old Dominion Freight Lines held a similar view and said that, “The implementation of FMCSA’s Compliance, Safety, Accountability initiative (“CSA”) could adversely impact our ability to hire qualified drivers, meet our growth projections and maintain our customer relationships, each of which could adversely impact our results of operations” (2011 a).

In addition to CSA 2010, carriers expressed concerns about new hours of service rules that had been proposed, and about Electronic On-Board Recorder (EOBR) requirements, which the

FMCSA was discussing. During the timeframe of this study, new emissions standards for heavy trucks, ultra-low sulfur diesel requirements, and fuel efficiency standards were added to the Federal Registry. These various changes likely impacted costs and profitability in some way, but it is difficult to separate the effects of any individual changes from the effect of the other changes.

While the original motivation of this study was to investigate the relationship between two specific regulatory changes, the plethora of regulatory changes that have taken place in the time frame of this study make it difficult, if not impossible, to determine the specific impact of CSA2010 and hours of service changes. Therefore, the primary motivations of this study are (1) to determine if changes in motor carrier profitability after these specific regulations were large enough to be statistically significant despite the confounding factors introduced into the regulatory environment during the time-frame in question and (2) to see the temporal changes that have occurred in motor carrier profitability as these regulatory changes have been announced and implemented.

SUMMARY OF REGULATORY CHANGES

CSA 2010

CSA 2010 (known as both “Comprehensive Safety Analysis” and “Compliance, Safety, and Accountability”) was intended to provide a means to assess how well commercial motor vehicle

carriers and drivers complied with safety rules and to better intervene with those who are not complying. CSA replaced the previous compliance review program and SafeStat, an earlier program designed to monitor and evaluate the safety of motor carriers. CSA was tested in nine states between 2008 and 2009 and was initiated nationally in December 2010. The three components of CSA are: measurement, evaluation, and intervention. Measurement and evaluation come in the form of a Safety Measurement System (SMS) which gives carriers a score on seven criteria using an algorithm that controls for the number and severity of violations and size of the fleet. Of these seven criteria, five are publicly available on the CSA website. These scores are then used to identify carriers for early intervention (Harrison et al., 2012). As the FMCSA refines their methodology for calculating these SMS scores, historical SMS scores are retroactively calculated after each update. The five publicly available measures are: unsafe driving, hours of service, vehicle maintenance, controlled substance/alcohol, and driver fitness. Two additional scores are calculated and used by the FMCSA and made available to the carriers. These are: crash indicator and hazardous materials compliance.

Although many industry analysts, industry organizations, and carriers predicted increases in driver shortages following the implementation of CSA 2010, these additional driver shortages did not seem to happen based on number of employees (Harrison et al., 2012). However, the lack of a driver shortage does not mean that carrier costs were not impacted by the rule. There may have been additional costs associated with compliance and inspections, but these may have been offset by fewer accidents and incidents as carriers try to proactively maintain low (better) scores.

Hours of Service

After remaining unchanged since 1962, hours of service rules were changed in 2003, and these changes went into effect in January 2004. These rules increased the allowable drive time per cycle and off duty time per cycle but decreased the

maximum driving time per day. Possibly the biggest change of this rule was the addition of the 34-hour restart provision, which led to an increase in maximum driving hours per week. This provision allows for a driver who has reached his/her weekly maximum driving time to “reset the clock” upon completing 34 consecutive hours off duty. Following lengthy legal battles questioning the motivation and impact of these changes, new hours of service regulations were announced in 2011 and went into effect in July of 2013. This new rule changed the maximum average hours per week a driver could theoretically achieve by placing restrictions on the 34-hour restart rule. It could only be used once per seven day period and had to include two time periods between 1:00 am and 5:00 am. This restriction increased the effective reset period to 45 hours or more depending on the driving habits of an individual driver. A second change required a 30-minute break after 8 hours of driving and could have potentially limited driving hours by 30 minutes per day, or this break could have been incorporated into the split sleeper berth allowance (Johnston, 2013). In December 2014 Congress suspended the 34-hour restart restrictions pending the submission of the CMV Driver Restart Study to Congress (FMCSA, 2016). This report was made available to Congress in March 2017, and it was determined that the restrictions to the 34-hour restart would remain suspended (FMCSA, 2017). This effectively made the new rules identical to the 2004 rules in terms of maximum driving hours per day and week with the additional restriction of a 30-minute break after 8 hours of driving.

A difficulty with determining the impact of this most recent change is that many carriers may have adhered to the 2011 rule even though a major portion was not being enforced because it was unclear when the CMV Driver Restart Study would be made available to Congress and what the results of the study would show. These changes could have impacted the productivity of drivers and increased costs and reduced profitability for carriers; however, if the presumptive goal of the rules to increase alertness of drivers was achieved, costs could have been reduced through fewer accidents and incidents. Contradictory to this

proposition, fatalities, injuries and property only crashes have been on an upward trend since 2009 or 2010. This is evident in Figure 1 which uses data from Trends Tables 4, 7, and 10 in *Large Truck and Bus Crash Facts 2015* available from the FMCSA (2017b).

Electronic Logging Devices (ELD)

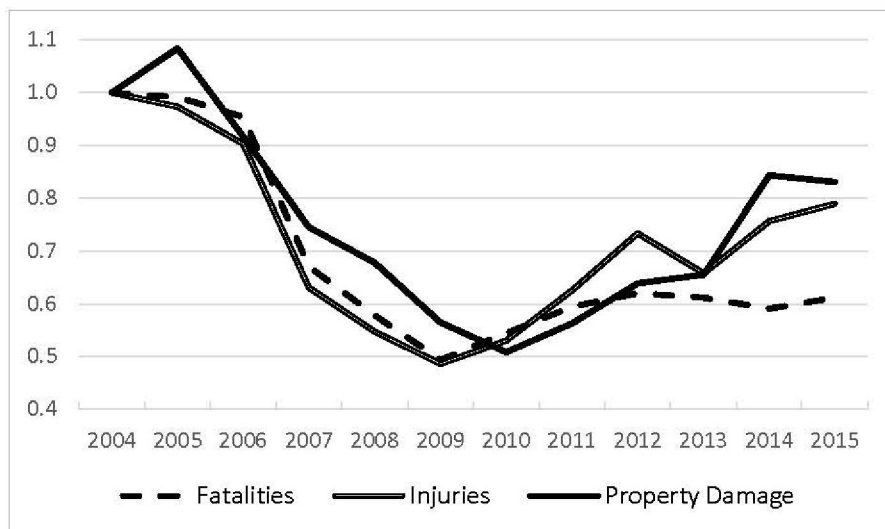
Another area of concern for carriers in their 2010 Annual Reports was the possible requirement on ELDs. In April 2010, a final rule with a June 2012 compliance date set standards and incentives for the use of Electronic On-Board Recorders (EOBRs) and requirements for the use by carriers with serious hours of service non-compliance. However, the final rule applicable to all carriers was published in the Federal Register on December 16, 2015 and required ELDs of all carriers (with a few exceptions) by December 18, 2017. Many carriers had voluntarily installed EOBR and other Automatic Onboard Recording Devices (AOBR) in advance of the rule and will have until December 16, 2019 to replace these with ELDs. Further exceptions include drivers of driveaway-towaway operations delivering the vehicle they are driving, drivers of pre-2000 model year vehicles, and drivers required to keep a Record of Duty Status (RODS) or logbook not more than 8 out of 30 days (FMCSA, 2016a). Although this rule was not in effect during

the period of this study, many motor vehicle operations began investing in AOBRs as early as 2009 when the rule was on the horizon (Heartland Express Inc., 2011; Knight Transportation, 2011; Werner Enterprises, 2011). In a conversation with an executive of a large refrigerated carrier in 2010, it was explained that with EOBRs the carrier was less likely to be audited, and if an audit did occur, it would be less costly to provide the required data. Further complicating the impact of this rule on carriers is that carriers have had between two and four years to invest in ELD's, and it is difficult to determine when they will actually make the investment.

Emissions

Much more restrictive emissions standards were phased in from 2007-2010 (EPA, 2016c). These standards reduced the amount of Non-Methane Hydrocarbons and Nitrous Oxides by 90%. These standards were required for 50% of engines for model years 2007-2009 and 100% of engines for 2010 model year trucks. There were significant increases in the price of new and used trucks in 2010 as these changes went into effect. An estimate of average tractor price was included in the model to account for this increase, but that does not necessarily coincide with when a carrier buys a new truck or if they buy a used truck.

**FIGURE 1
INJURY, FATALITY, AND PROPERTY ONLY DAMAGE CRASH RATES
PER 100 MILLION VEHICLE MILES TRAVELED INDEXED ON 2004 VALUES**



Ultra-Low Sulfur Diesel

In conjunction with the new emissions standards, the requirement for Ultra Low Sulfur Diesel was phased in between 2006-2010 (EPA, 2016b) with the allowable limit going from 500ppm down to 15ppm. This change could have impacted the price of diesel fuel, but it is difficult to say if changes are the result of the new regulation or due to other market conditions.

Fuel Efficiency

Finally, standards related to fuel economy for combination vehicles required a 20% increase in fuel economy between model years 2014-2018, and a further increase of 2.5% per year between model years 2021-2027 (EPA, 2016a). These standards likely increased the price of new tractors but also reduced the cost of operations with better fuel economy.

SAMPLE CHARACTERISTICS AND DATA SOURCES

The primary data source for this study is the (10-k) and quarterly (8-k) reports of the publicly traded motor carriers in the United States (ArcBest Corporation, 2004a-2015a, ArcBest Corporation, 2004b-2015b, Celadon Group Inc., 2004a-2015a, Celadon Group Inc., 2004b-2015b, Con-Way Inc., 2004a-2015a, Con-Way Inc., 2004b-2015b, Covenant Transportation Group Inc., 2004a-2015a, Covenant Transportation Group Inc., 2004b-2015b, Heartland Express Inc., 2004a-2015a, Heartland Express Inc., 2004b-2015b, J.B. Hunt Transport Services Inc., 2004a-2015a, J.B. Hunt Transport Services Inc., 2004b-2015b, Knight Transportation Inc., 2004a-2015a, Knight Transportation Inc., 2004b-2015b, Marten Transport Ltd., 2004a-2015a, Marten Transport Ltd., 2004b-2015b, Old Dominion Freight Line Inc., 2004a-2015a, Old Dominion Freight Line Inc., 2004b-2015b, P.A.M. Transportation Services Inc., 2004a-2015a, P.A.M. Transportation Services Inc., 2004b-2015b, USA Truck Inc., 2004a-2015a, USA Truck Inc., 2004b-2015b, Werner Enterprises Inc., 2004a-2015a, Werner Enterprises Inc., 2004b-2015b, YRC Worldwide Inc., 2004a-2015a, YRC Worldwide Inc., 2004b-

2015b). The sample included all the publicly traded motor carriers that were in business from the first quarter of 2004 through the second quarter of 2015. The second quarter of 2015 was selected as the final date because initial tests on the data revealed that a balanced panel of data would be optimal for the estimation. XPO Logistics purchased Con-Way and stopped filing reports with the SEC after June 2015, so using the second quarter of 2015 as the final date rather than the second quarter of 2016 allowed for the inclusion of Con-Way. The inclusion of Con-Way allowed for 598 total quarterly observations on 13 carriers over 46 quarters, and the exclusion of Con-Way would have allowed for a total of 600 total quarterly observations on 12 carriers over 50 quarters. This decision was made in order to maximize the sampled carriers but likely had little impact on the results. The only excluded publicly traded carrier, Frozen Foods Express, was purchased by a privately held company in June 2013 and was excluded from the sample. Frozen Foods Express was also the only refrigerated carrier in the potential sample and likely had significantly different operating characteristics than the other, primarily dry van carriers. Total annual revenue of PACCAR divided by number of units sold was obtained from the annual reports of PACCAR (2004a-2015a, 2004b-2015b), a company controlling between 21% and 29% of the heavy truck market between 2004 and 2015, and used as an estimate of new tractor price.

Information on the implicit price deflator and the growth of the services sector of gross domestic product came from the Bureau of Economic Analysis (2016a). Information on the national average diesel price came from the US Energy Information Administration (2016). Finally, information on when the US economy was in a recession was obtained from the National Bureau of Economic Research (2016a).

The companies included in the sample of quarterly observations are listed in Table 1, and descriptive statistics of the variables included in estimation are shown in Table 2.

TABLE 1
LIST OF COMPANIES INCLUDED IN THE SAMPLE

Company Name
ArcBest Corporation
Celadon Trucking
Con-Way Freight
Covenant Transport
Heartland Express
JB Hunt Transport Services
Knight Transportation
Marten Transport
Old Dominion Freight Line
PAM Transport
USA Truck
YRC Worldwide
Werner Enterprises

As can be seen in Table 2, there is a significant variation in all the variables to be included in the model, and the time span of the study included difficult times for motor carriers. It further reveals that 31% of the sample were LTL carriers and 69% were predominately truckload carriers; 15% of the sample were unionized carriers; 15% of the observations were from a recession although the services sector only contracted in 8.7% of those quarters; 41% of the observations came after the implementation of CSA2010; and only 13% and 4% of the observations came from times when the hours of service regulations were changed. The 2013 change added the requirement of a break for every 8 hours of driving, which could be incorporated into the split sleeper berth allowance for some carriers, a different definition of on-duty time, and restrictions to the 34-hour restart provision.

HYPOTHESES Due to the large number of regulatory and economic changes that occurred during the time of the study that are difficult or impossible to isolate, the following hypotheses are based on the working assumption that carriers' performance has suffered over time. This has been the generally accepted view in the trade press and amongst industry leaders. These hypotheses do not try to assign specific causes but state that the combined effect of all regulatory changes has been a decrease in financial performance.

- *Hypothesis 1: The Operating Ratio of motor carriers has increased (worsened) over time.*
- *Hypothesis 2: Return on Assets of motor carriers has decreased over time.*
- *Hypothesis 3: Return on Equity of motor carriers has decreased over time.*
- *Hypothesis 4: Net Profit of motor carriers has decreased over time.*
- *Hypothesis 5: Sales per Employee of motor carriers have decreased over time.*

The secondary hypotheses of this study are that after the implementation of CSA 2010 and HOS guidelines and rules, specifically, changed the financial performance of motor carriers in a negative way. The specific hypotheses are that:

- *Hypothesis 1a: Operating Ratio of motor carriers increased (worsened) after CSA 2010.*
- *Hypothesis 1b: Operating Ratio of motor carriers increased (worsened) after HOS changes.*
- *Hypothesis 2a Return on Assets for motor carriers declined after CSA 2010.*
- *Hypothesis 2b: Return on Assets for motor carriers declined after HOS changes.*

TABLE 2
DESCRIPTIVE STATISTICS OF VARIABLES

Measure	Standard Deviation			
	Mean		Minimum	Maximum
Operating Ratio	93.7	7.8	60.2	152.1
Return on Assets	1.1 %	2.2%	-17.3%	4.5%
Return on Equity*	2.6%	4.2%	-33.5%	15.8%
Net Income	3.3 %	5.9%	-33.5%	17.3%
Sales per Employee	\$41,185	\$9,581	\$19,137	\$76,672
Diesel Price	\$3.10	\$0.62	\$1.80	\$4.24
Tractor Price (\$000s)	\$101.52	\$9.21	\$86.03	\$118.58
GDP Growth	1.7 %	2.5%	-8.2%	5.0%
Less than Truckload	0.31	0.46	0	1
Union Carrier	0.15	0.36	0	1
Recession	0.15	0.35	0	1
CSA 2010	0.41	0.49	0	1
HOS 2013	0.13	0.34	0	1
HOS 2015 ¹	0.04	0.20	0	1

*ROE had only 552 observations rather than 598 because YRC Worldwide was excluded due to 25 quarters with negative stockholders' equity.

¹HOS 2015 indicates that the restrictions to the 34-hour restart were suspended beginning in January 2015 and continuing into the future.

- *Hypothesis 3a: Return on Equity for motor carriers declined after CSA 2010.*
- *Hypothesis 3b: Return on Equity for motor carriers declined after HOS changes.*
- *Hypothesis 4a: Net Profit for motor carriers declined after CSA 2010.*
- *Hypothesis 4b: Net Profit for motor carriers declined after HOS changes.*
- *Hypothesis 5a: Sales per Employee for motor carriers declined after CSA 2010.*
- *Hypothesis 5b: Sales per Employee for motor carriers declined after HOS changes.*

STATISTICAL MODEL

Equations

To test hypotheses 1-5 and to account for the impact of multiple regulatory changes, equations 1-5 were estimated using linear regression with variables for year and year² included to test for temporal trends. This allowed for observation of the trends in costs from year to year after accounting for recessions, the growth of the economy and various other factors. Initial testing of the data revealed that curvilinear trends would provide the best fit. Initial testing revealed that costs and financial results were significantly different in quarter 2 than for all other quarters due to the seasonality of the motor carrier industry, so a dummy variable for Q2 was included in the final models.

$$OR = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + YEAR + YEAR^2 + \varepsilon_{it} \quad (1)$$

$$ROA = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + YEAR + YEAR^2 + \varepsilon_{it} \quad (2)$$

$$ROE = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + YEAR + YEAR^2 + \varepsilon_{it} \quad (3)$$

$$NI = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + YEAR + YEAR^2 + \varepsilon_{it} \quad (4)$$

$$SPE = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + YEAR + YEAR^2 + \varepsilon_{it} \quad (5)$$

Where:

OR = operating ratio = Operating Expenses/
Operating Revenue

ROA = return on assets = Net Income/Total Assets

ROE = return on equity = Net Income/Total
Stockholder Equity

NI = net income = Net Income/Operating Revenue

SPE = sales per employee = Operating Revenue/
Number of Employees

LTL = 1 for less than truckload carriers, 0 otherwise

UC = 1 for union carriers, 0 otherwise

REC = 1 for a recession, 0 otherwise

DP = national average diesel price, adjusted for
inflation

TP = national average tractor price, adjusted for
inflation

GDP = gross domestic product growth

Q2 = 1 for the second quarter, 0 otherwise

YEAR = the year of the observation (1-14).

For an even clearer picture of what has happened
with the financial performance of these carriers for
the last 14 years, equations 6-10 were estimated using
a dummy variable for each year of observation.

$$ROA = \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \sum_{i=2004}^{2015} \beta_{Yi} Y_i + \varepsilon_{it} \quad (7)$$

$$ROE = \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \sum_{i=2004}^{2015} \beta_{Yi} Y_i + \varepsilon_{it} \quad (8)$$

$$NI = \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \sum_{i=2004}^{2015} \beta_{Yi} Y_i + \varepsilon_{it} \quad (9)$$

$$SPE = \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \sum_{i=2004}^{2015} \beta_{Yi} Y_i + \varepsilon_{it} \quad (10)$$

Where $Y_i=1$ if observation is from year i , 0 otherwise

Equations 11-15 were then developed to test hypotheses 1-5 and 1a-5a. Dummy variables were used to capture the implementation of CSA 2010 and the two successive changes to HOS regulations.

$$OR = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \beta_8 CSA + \beta_9 H2 + \beta_{10} H3 + \varepsilon_{it} \quad (11)$$

$$ROA = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \beta_8 CSA + \beta_9 H2 + \beta_{10} H3 + \varepsilon_{it} \quad (12)$$

$$ROE = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \beta_8 CSA + \beta_9 H2 + \beta_{10} H3 + \varepsilon_{it} \quad (13)$$

$$NI = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \beta_8 CSA + \beta_9 H2 + \beta_{10} H3 + \varepsilon_{it} \quad (14)$$

$$SPE = \alpha + \beta_1 LTL + \beta_2 UC + \beta_3 REC + \beta_4 DP + \beta_5 TP + \beta_6 GDP + \beta_7 Q2 + \beta_8 CSA + \beta_9 H2 + \beta_{10} H3 + \varepsilon_{it} \quad (15)$$

Where:

CSA = 1 after the implementation of CSA 2010 in the fourth quarter of 2010, 0 before

H2 = 1 for Q3 2013 – Q4 2014 (34-hour restart restrictions were in effect), 0 otherwise

H3 = 1 for Q1 - Q2 2015 (34-hour restart restrictions were abandoned), 0 otherwise

Estimation and Results

The models listed above were tested using the POOL command in SHAZAM econometric software. This technique allows for random effects from the specific carriers. Initial tests in SHAZAM indicated that the model should allow for cross-section heteroscedasticity, cross section correlation, and correct for auto correlation. The inclusion of these assumptions requires a balanced panel of data, so the time of analysis went through third quarter 2015 and Frozen Foods Express was excluded from the sample. Equations 11-15 include dummy variables for the implementation of CSA

2010 and the two changes to hours of service requirements. This methodology requires the assumption that the implementation dates were when carriers saw an impact from these regulatory changes. The problem with this assumption is that carriers knew in advance of the implementation that CSA 2010 would “go live” in the fourth quarter of 2010, so it is possible they changed their operating procedures in advance of this date in order to improve their scores on the seven criteria. Furthermore, carriers likely changed their operating procedures for the hours of service regulations that went into effect in 2013 but may have changed them any time in the two years between the announcement and the implementation date. In regards to the decision by FMCSA not to enforce the 34-hour restart restrictions, it is likely that many carriers were waiting to see the outcome of the study being prepared for Congress and made no changes to their operating procedures i.e. continued to use the restrictions on the 34-hour restart. This

would have been simpler than changing operating procedures twice in rapid succession when it was unclear if or when the 34-hour restart restrictions would be enforced.

In an effort to avoid the restrictive assumption of a strict cut-off date, account for the many other regulatory changes discussed in the summary of regulatory changes, and test hypotheses 1b-5b; equations 1-5 were used to estimate a curvilinear trend over time for each of the dependent variables. To provide a more complete picture of the changes to the dependent variables over time, equations 6-10 were estimated and included dummy variables for each year other than 2004. The coefficients associated with these dummy variables will show the changes to the various dependent variables (OR, ROA, etc.) after controlling for the economy, the type of carrier and the price of fuel and equipment.

Results of the estimation are shown in Tables 3-8 and results of Equations 1-10 are shown graphically in Figures 2-6. Common to all estimation results are the impacts of the control variables on the financial performance of carriers. The following was found:

- LTL carriers had better financial performance than TL carriers with a lower (better) operating ratio, higher return on assets, higher return on equity, higher net income and higher sales per employee.
- Unionized carriers had worse financial performance than non-unionized carriers with a higher operating ratio, lower return on assets, lower (but non-significant¹) return on equity, lower net income, and lower sales per employee.
- As one would expect, recessions hurt the financial performance of carriers resulting in higher operating ratios, lower returns on assets, lower returns on equity, lower net incomes, and lower sales per employee.
- Surprisingly, diesel price seems to have little or no impact on financial performance, but

this may be the result of the fuel surcharge, that almost all carriers use to recover additional costs associated with fluctuating fuel costs, offsetting any additional costs. Higher diesel prices were associated with higher returns on equity and higher sales per employee.

- As expected, increases in tractor prices were associated with worse financial performance: higher operating ratio, lower return on assets and equity, lower net income and lower sales per employee.
- Increases in gross domestic product growth (GDP) also helped the financial performance of carriers, and their performance was better during the second quarter of each year as compared to the first, third and fourth. Both of these factors were associated with lower operating ratio, higher returns on assets and equity, higher net income levels, and higher sales per employee.

Surprisingly, Table 3 reveals that none of the specific regulatory changes tested had a statistically significant impact on Operating Ratio (OR) (Equation 11), so Hypotheses 1a and 1b (Operating Ratio worsened) are rejected. Based on the coefficients of YEAR and YEAR² in Equation 1 the second derivative of this function with respect to YEAR is negative, so this is a concave function with a maximum value at YEAR = 7.59 (between 2010 and 2011). This maximum is based on finding the inflection point of the function where the first derivative with respect to YEAR equals zero. This leads to the rejection of Hypothesis 1 because OR was increasing but has been decreasing since the implementation of CSA 2010 and has continued to decrease with the changes to hours of service regulations. Equation 6 reveals that between 2006 and 2015 OR was higher than in 2004, but it has been declining since a peak in 2011. Figure 2 shows the percentage increase in OR over a 2004 base after accounting for the control variables. The OR trend line was about 11% higher in 2010 and 2011, but that has declined to about 6% higher in

2015 than in 2004. Because OR represents costs as a percent of revenue, these higher values represent worse financial performance on this measure. However, as carriers adjust to regulatory changes their performance seems to be returning to earlier levels.

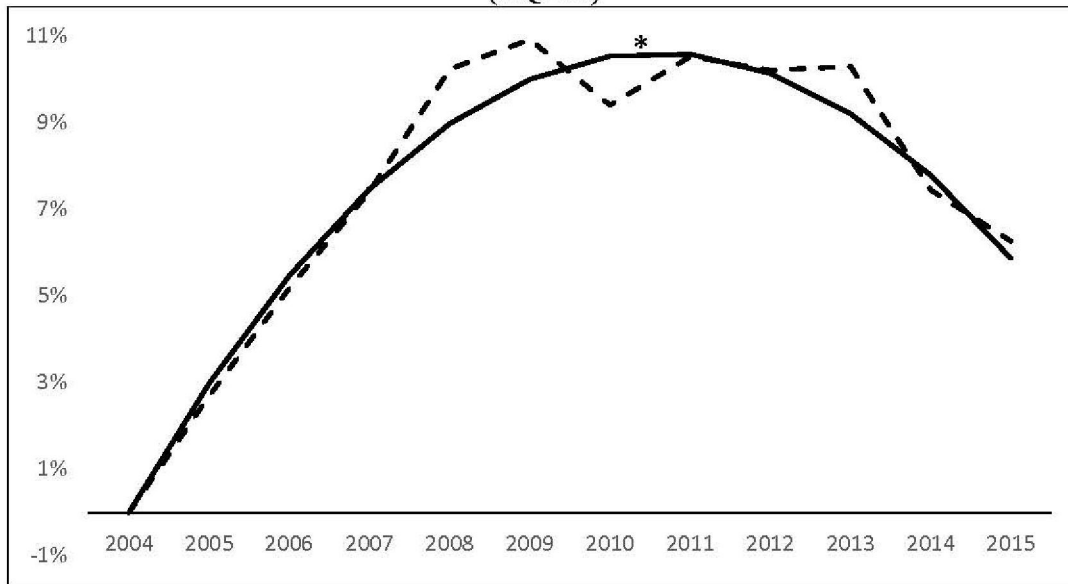
Table 4 reveals that Return on Assets (ROA) has been worse for carriers since the implementation of CSA 2010 (Equation 12), so Hypothesis 2a (CSA 2010 worsened ROA) is not rejected, but Hypothesis 2b (HOS changes worsened ROA) is rejected, indicating that the HOS regulatory changes did not impact ROA. Based on the coefficients of YEAR and YEAR² in Equation 2, the second derivative of this function with respect to YEAR is

positive, so this is a convex function with a minimum value at YEAR = 8 (2011). This minimum is based on finding the inflection point of the function where the first derivative with respect to YEAR equals zero. This leads to the rejection of Hypothesis 2 because ROA was decreasing but has been increasing since the implementation of CSA 2010 and has continued to increase with the changes to hours of service regulations. Equation 7 reveals that between 2007 and 2014 ROA was lower than in 2004, but it has been increasing since its lowest point in 2011. Figure 3 shows the percentage decrease in ROA over a 2004 base after accounting for the control variables. The ROA trend line was about 45% lower in 2011 but has increased to about 24% lower in 2015 than in 2004; however,

**TABLE 3
RESULTS OF OR ESTIMATION**

Equation 1 Buse (1973) R ² : 0.3207		Equation 6 Buse (1973) R ² : 0.3366			Equation 11 Buse (1973) R ² : 0.2538		
Variable Name/Estimate Coefficient (p-value)							
LTL	-2.5694 (0.006)	LTL	-2.5483 (0.009)	2007	5.8628 (0.002)	LTL	-2.8105 (0.002)
UC	6.0883 (0.000)	UC	6.1171 (0.000)	2008	8.1025 (0.000)	UC	6.0969 (0.000)
REC	4.2388 (0.000)	REC	3.8519 (0.000)	2009	8.6425 (0.000)	REC	4.5301 (0.000)
DP	-1.0573 (0.098)	DP	-1.1000 (0.194)	2010	7.4402 (0.001)	DP	-0.0620 (0.931)
TP	0.1372 (0.004)	TP	0.1609 (0.009)	2011	8.3327 (0.000)	TP	0.2255 (0.000)
GDP	-0.2478 (0.007)	GDP	-0.2497 (0.026)	2012	8.0805 (0.000)	GDP	-0.2784 (0.007)
Q2	-1.6562 (0.000)	Q2	-1.6477 (0.000)	2013	8.1505 (0.000)	Q2	-1.8104 (0.000)
α	78.5300 (0.000)	α	79.1980 (0.000)	2014	5.8890 (0.006)	α	74.9160 (0.000)
YEAR	3.0183 (0.000)	2005	2.1261 (0.124)	2015	4.9587 (0.021)	CSA	1.9435 (0.114)
YEAR ²	-0.1988 (0.000)	2006	4.1022 (0.013)			HOS2	-0.6590 (0.633)
						HOS3	-0.8449 (0.674)

FIGURE 2
ANNUAL CHANGES (% OF 2004 BASE) TO OR (EQ. 6) AND CURVILINEAR TREND
(EQ. 11)



this difference is not statistically significant. Carriers have had worse performance on this measure since 2006, but as they adjust to regulatory changes their performance seems to be returning to earlier levels.

Table 5 reveals that Return on Equity (ROE) was not impacted by the implementation of CSA 2010 or the HOS regulatory changes (Equation 13), so Hypotheses 3a and 3b (ROE worsened) are rejected. Based on the coefficients of YEAR and YEAR² in Equation 3, the second derivative of this function with respect to YEAR is positive, so this is a convex function with a minimum value at YEAR = 6.9 (between 2009 and 2010). This minimum is based on finding the inflection point of the function where the first derivative with respect to YEAR equals zero. This leads to the rejection of Hypothesis 3 because ROE was decreasing but has been increasing since the implementation of CSA 2010 and has continued to increase with the changes to hours of service regulations. Equation 8 reveals that between 2008 and 2009 ROE was lower than in 2004, but it has been increasing since its lowest point in 2010. Figure 4 shows the percentage decrease in ROE over a 2004 base after accounting for the control variables. The ROE trend line was 64 and 65% lower in 2009 and 2011, but has increased to 17% lower in 2015 than

in 2004; however, this difference is not statistically significant. Carriers have had worse performance on this measure since 2004, but as they adjust to regulatory changes their performance seems to be returning to earlier levels. One additional thing to note in regards to ROE is that YRC Worldwide, the worst performing carrier of the sample, was omitted from these estimations related to ROE due to a negative stockholder equity for over half of the sample period. The exclusion of this carrier could have potentially, but not necessarily, skewed the results with the random effects model.

Table 6 reveals that Net Income (NI) has been worse for carriers since the implementation of CSA 2010 (Equation 14), so Hypothesis 4a (CSA 2010 worsened NI) is not rejected, but Hypothesis 4b (HOS changes worsened NI) is rejected, indicating that the HOS regulatory changes did not impact Net Income. Based on the coefficients of YEAR and YEAR² in Equation 4, the second derivative of this function with respect to YEAR is positive, so this is a convex function with a minimum value at YEAR = 7.19 (between 2010 and 2011). This minimum is based on finding the inflection point of the function where the first derivative with respect to YEAR equals zero. This leads to the rejection of Hypothesis 4 because Net Income was decreasing

**TABLE 4
RESULTS OF ROA ESTIMATION**

Equation 2 Buse (1973) R ² : 0.2745		Equation 7 Buse (1973) R ² : 0.3148			Equation 12 Buse (1973) R ² : 0.2602		
Variable Name/ Estimate Coefficient (p-value)							
LTL	0.0092 (0.042)	LTL	0.0094 (0.043)	2007	-0.0146 (0.030)	LTL	0.0087 (0.020)
UC	-0.0257 (0.000)	UC	-0.0261 (0.000)	2008	-0.0240 (0.001)	UC	-0.0259 (0.000)
REC	-0.0150 (0.000)	REC	-0.0138 (0.000)	2009	-0.0224 (0.004)	REC	-0.0159 (0.000)
DP	0.0012 (0.580)	DP	0.0027 (0.297)	2010	-0.0133 (0.086)	DP	-0.0008 (0.717)
TP	-0.0004 (0.012)	TP	-0.0005 (0.004)	2011	-0.0218 (0.003)	TP	-0.0006 (0.000)
GDP	0.0008 (0.004)	GDP	0.0006 (0.105)	2012	-0.0274 (0.000)	GDP	0.0008 (0.005)
Q2	0.0046 (0.000)	Q2	0.0047 (0.000)	2013	-0.0219 (0.002)	Q2	0.0050 (0.000)
α	0.0581 (0.000)	α	0.0580 (0.002)	2014	-0.0134 (0.081)	α	0.0532 (0.003)
YEAR	-0.0080 (0.001)	2005	0.0003 (0.955)	2015	-0.0115 (0.138)	CSA	-0.0070 (0.070)
YEAR ²	0.0005 (0.005)	2006	-0.0063 (0.289)			HOS2	0.0044 (0.314)
						HOS3	0.0041 (0.508)

**FIGURE 3
ANNUAL CHANGES (% OF '04 BASE) TO ROA (EQ.7) AND CURVILINEAR TREND (EQ.12)**

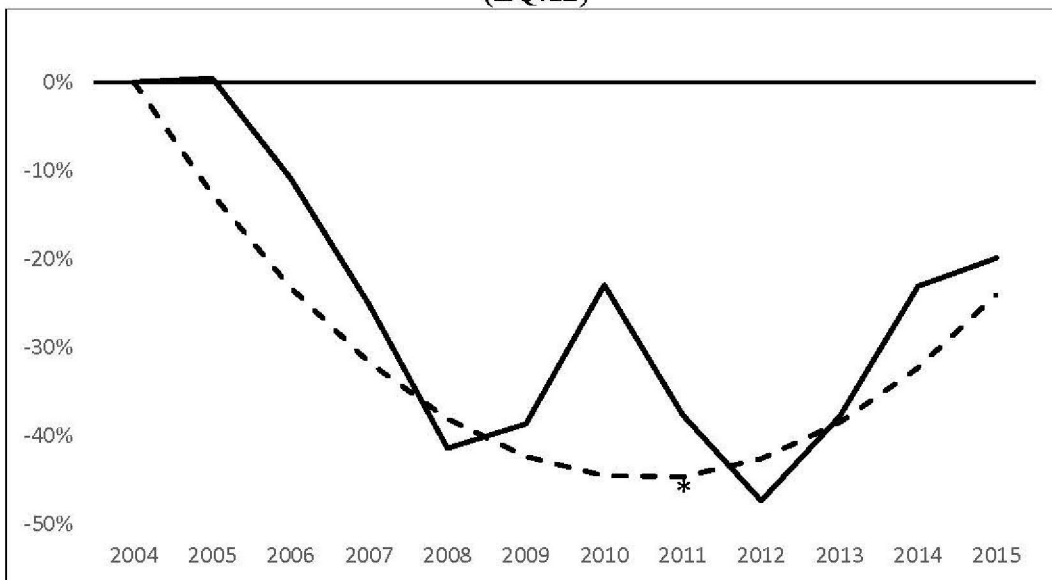
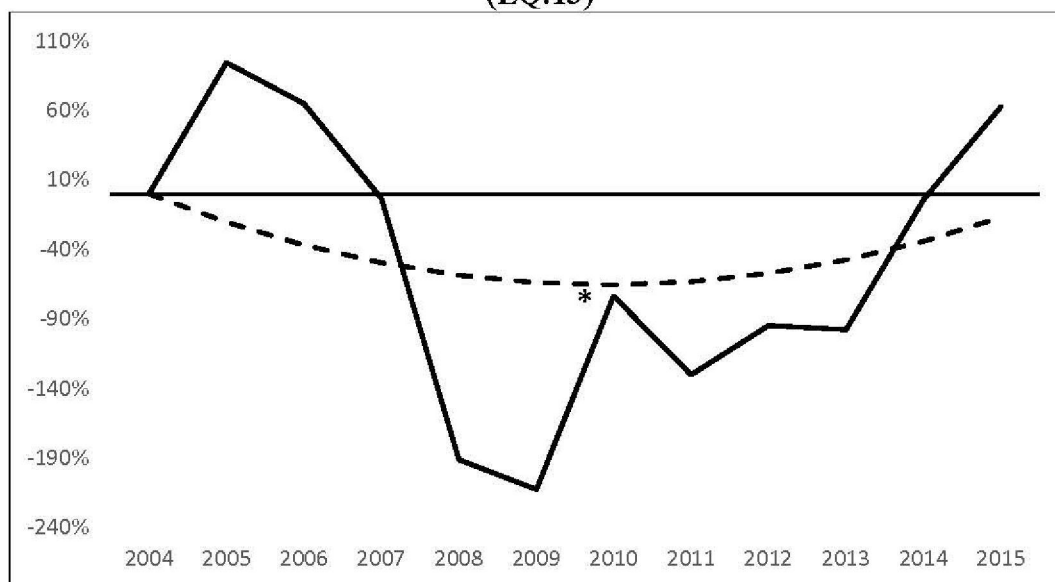


TABLE 5
RESULTS OF ROE ESTIMATION

Equation 3 Buse (1973) R ² : 0.1883		Equation 8 Buse (1973) R ² : 0.2432			Equation 13 Buse (1973) R ² : 0.1800		
Variable Name/Estimate Coefficient (p-value)							
LTL	0.0274 (0.046)	LTL	0.0276 (0.030)	2007	-0.0005 (0.972)	LTL	0.0271 (0.046)
UC	-0.0084 (0.536)	UC	-0.0083 (0.514)	2008	-0.0287 (0.048)	UC	-0.0083 (0.550)
REC	-0.0178 (0.016)	REC	-0.0144 (0.034)	2009	-0.0320 (0.043)	REC	-0.0207 (0.005)
DP	0.0126 (0.005)	DP	0.0149 (0.004)	2010	-0.0110 (0.485)	DP	0.0109 (0.024)
TP	-0.0007 (0.029)	TP	-0.0006 (0.084)	2011	-0.0196 (0.194)	TP	-0.0010 (0.005)
GDP	0.0017 (0.002)	GDP	0.0014 (0.046)	2012	-0.0142 (0.347)	GDP	0.0017 (0.003)
Q2	0.0085 (0.000)	Q2	0.0082 (0.000)	2013	-0.0147 (0.317)	Q2	0.0092 (0.000)
α	0.0514 (0.150)	α	0.0150 (0.691)	2014	-0.0006 (0.969)	α	0.0583 (0.149)
YEAR	-0.0107 (0.052)	2005	0.0142 (0.126)	2015	0.0094 (0.561)	CSA	-0.0072 (0.467)
YEAR²	0.0008 (0.060)	2006	0.0098 (0.420)			HOS2	0.0081 (0.424)
						HOS3	0.0149 (0.286)

FIGURE 4
ANNUAL CHANGES (% OF '04 BASE) TO ROE (EQ.8) AND CURVILINEAR TREND (EQ.13)



but has been increasing since the implementation of CSA 2010 and has continued to increase with the changes to hours of service regulations. Equation 9 reveals that between 2007 and 2013 Net Income was significantly lower than in 2004, but it has been increasing since its lowest point in 2010 and 2011. Figure 5 shows the percentage decrease in ROA over a 2004 base after accounting for the control variables. The Net Income trend line was 41% lower in 2010 and 2011, but has increased to 20% lower in 2015 than in 2004; however, this difference is not statistically significant. Carriers have had worse performance on this measure since 2007, but as they adjust to regulatory changes their performance seems to be returning to earlier levels.

Table 7 reveals that Sales per Employee (SPE) was not impacted by the implementation of CSA 2010 or the HOS regulatory changes (Equation 15), so Hypotheses 5a and 5b (Sales per Employee worsened) are rejected. Based on the coefficients of YEAR and YEAR² in Equation 5, the second derivative of this function with respect to YEAR is positive, so this is a convex function with a minimum value at YEAR = 7.79 (between 2010 and 2011). This minimum is based on finding the inflection point of the function where the first derivative with respect to YEAR equals zero; however, the coefficients associated with YEAE and YEAR² were statistically non-significant. This leads to the rejection of Hypothesis 5. Equation 10 reveals that SPE was significantly lower than in 2004 only in the year 2006, and it has been generally increasing since its lowest point. Figure 6 shows the percentage decrease in SPE over a 2004 base after accounting for the control variables. SPE was about 5% lower in 2011 and has increased to about 3% lower in 2015 than in 2004; however, this difference is not statistically significant. Carriers have had fairly consistent performance on this measure with a statistically significant decrease only in 2006.

CONCLUSION

The results of this study suggest that, despite the concerns carriers' expressed in their annual reports, CSA 2010, hours of service changes, and electronic

logging devices have all been threats that the large publicly traded motor carriers have been able to deal with effectively while going through a massive recession. This is a very important finding and counter to what most observers inside and outside of the motor carriers thought would be the case. In essence, it seems that these carriers saw some beneficial impacts from the regulations, and/or were able to drive other efficiency gains despite these regulations.

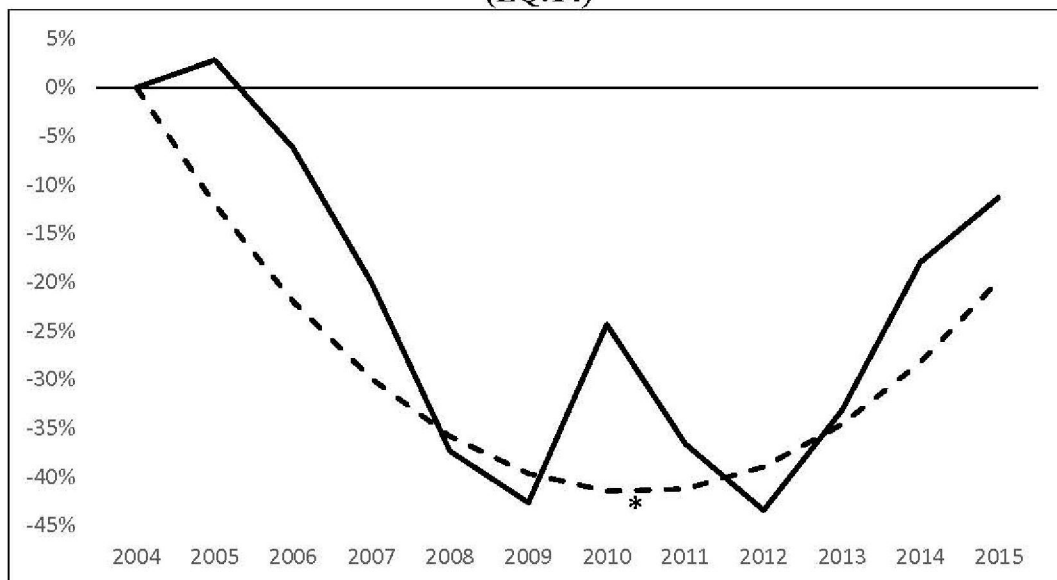
However, large publicly and privately held motor carriers represent a small portion of motor carriers and a relatively small portion of motor carrier revenues. An interesting direction for future research would be to see how these changes impacted smaller carriers. This study also excluded bankrupt carriers because none of the publicly traded motor carriers underwent bankruptcy during the time frame of this study; however, many small and medium sized carriers went bankrupt during the "great recession" (and YRCW would have gone bankrupt were it a smaller carrier). This would be another interesting factor to incorporate into future studies if one were able to attain the appropriate data.

The overall result of all the estimations is that the financial performance of carriers, as measured by operating ratio, return on assets, return on equity, and net income, declined after the implementation of the HOS changes that went into effect in 2004 but has been improving since the recession and the implementation of the 2011 changes to HOS regulations. This is most clearly illustrated by the results of Equations 1-10 which show a statistically significant curvilinear trend and annual differences over 2004 values. These results are shown graphically in Figures 2-5. These results indicate that despite all the regulatory changes that have gone into effect or will be going into effect between 2004 and 2023 and the difficulty motor carriers have had trying to increase prices (Wilson, 2014), they have been able to adjust to the changes and improve their financial performance. An alternative

TABLE 6
RESULTS OF NI ESTIMATION

Equation 4 Buse (1973) R ² : 0.2942		Equation 9 Buse (1973) R ² : 0.3397			Equation 14 Buse (1973) R ² : 0.2717		
Variable Name/Estimate Coefficient (p-value)							
LTL	0.0200 (0.068)	LTL	0.0192 (0.066)	2007	-0.0248 (0.080)	LTL	0.0200 (0.042)
UC	-0.0567 (0.000)	UC	-0.0574 (0.000)	2008	-0.0462 (0.003)	UC	-0.0567 (0.000)
REC	-0.0336 (0.000)	REC	-0.0307 (0.000)	2009	-0.0528 (0.001)	REC	-0.0368 (0.000)
DP	0.0045 (0.358)	DP	0.0065 (0.275)	2010	-0.0301 (0.061)	DP	0.0002 (0.969)
TP	-0.0011 (0.004)	TP	-0.0012 (0.006)	2011	-0.0453 (0.004)	TP	-0.0017 (0.000)
GDP	0.0019 (0.003)	GDP	0.0015 (0.049)	2012	-0.0537 (0.001)	GDP	0.0021 (0.003)
Q2	0.0110 (0.000)	Q2	0.0110 (0.000)	2013	-0.0410 (0.007)	Q2	0.0120 (0.000)
α	0.1419 (0.000)	α	0.1238 (0.004)	2014	-0.0222 (0.162)	α	0.1679 (0.000)
YEAR	-0.0187 (0.001)	2005	0.0035 (0.734)	2015	-0.0140 (0.382)	CSA	-0.0169 (0.060)
YEAR ²	0.0013 (0.002)	2006	-0.0077 (0.540)			HOS2	0.0098 (0.335)
						HOS3	0.0144 (0.317)

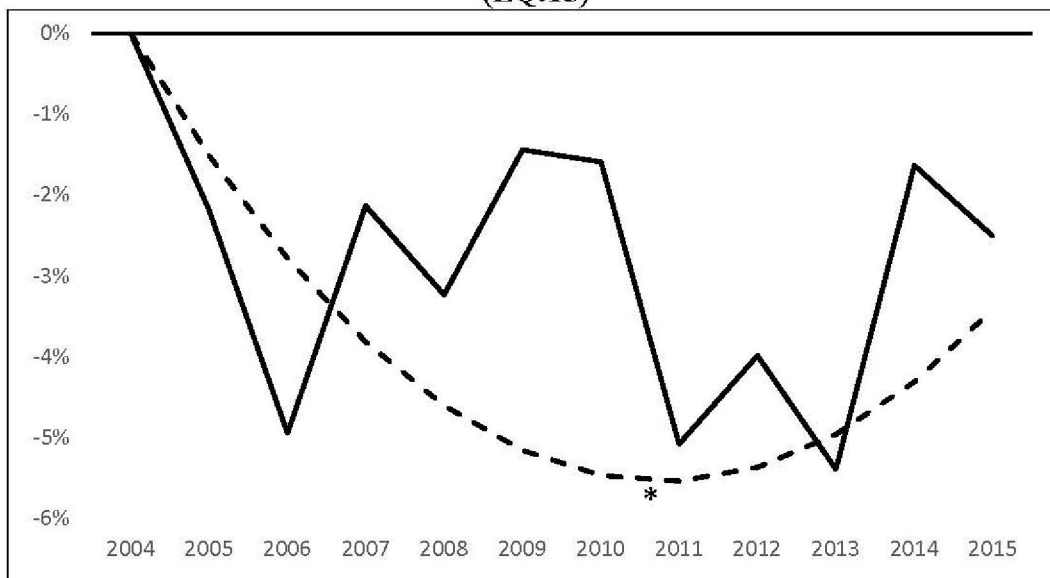
FIGURE 5
ANNUAL CHANGES (% OF '04 BASE) TO NI (EQ.9) AND CURVILINEAR TREND (EQ.14)



**TABLE 7
RESULTS OF SPE ESTIMATION**

Equation 5 Base R ² : 0.4453		Equation 10 Base R ² : 0.4676			Equation 15 Base R ² : 0.4651		
Variable Name/Estimate Coefficient (p-value)							
LTL	3,784.70 (0.189)	LTL	3,788.60 (0.238)	2007	-970.77 (0.463)	LTL	3,773.10 (0.009)
UC	-5,150.50 (0.075)	UC	-4,781.70 (0.143)	2008	-1,473.60 (0.323)	UC	-9,750.40 (0.000)
REC	-1,365.50 (0.055)	REC	-1,303.70 (0.054)	2009	-656.36 (0.677)	REC	-1,595.90 (0.038)
DP	4,999.70 (0.000)	DP	5,096.70 (0.000)	2010	-724.15 (0.654)	DP	4,776.20 (0.000)
TP	-125.89 (0.000)	TP	-181.30 (0.000)	2011	-2,311.90 (0.140)	TP	-150.77 (0.000)
GDP	119.64 (0.043)	GDP	145.19 (0.038)	2012	-1,815.40 (0.252)	GDP	131.52 (0.040)
Q2	827.93 (0.000)	Q2	824.74 (0.000)	2013	-2,453.80 (0.115)	Q2	940.80 (0.000)
α	41,522.00 (0.000)	α	45,523.00 (0.000)	2014	-744.18 (0.657)	α	43,111.00 (0.000)
YEAR	-763.87 (0.156)	2005	-994.98 (0.262)	2015	-1,141.00 (0.512)	CSA	-1,365.70 (0.148)
YEAR ²	49.00 (0.226)	2006	-2,250.90 (0.051)			HOS2	1,130.60 (0.270)
						HOS3	317.80 (0.826)

**FIGURE 6
ANNUAL CHANGES (% OF '04 BASE) TO SPE (EQ.10) AND CURVILINEAR TREND (EQ.15)**



explanation is that one of the regulatory changes since 2009 has somehow led to an improvement in the financial performance of motor carriers. It is certainly conceivable that electronic logbooks or more fuel-efficient tractors could lead to better efficiency. Emissions regulations likely increased costs with no benefit to profitability, but hours of service changes could have potentially led to more productive drivers who were better rested. These possibilities are beyond the scope of this study but could provide direction for future research.

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AN EXPLORATORY STUDY OF AIRLINE PASSENGER TECHNOLOGY USE: A CUSTOMER EXPERIENCE PERSPECTIVE

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ABSTRACT

Airline passengers have many choices and preferences in the way they interact with airlines. This creates numerous challenges for airlines. This research examines technology preferences by Millennials when interacting with airlines. Seven common airline interaction scenarios were evaluated using repeated measures Analysis of Variance with data collected from an online survey. The results show that Millennial generation airline passengers vary their preferences for technology when interacting with airlines. One intriguing finding of this study is that using mobile devices does not rank high as one of their preferred choices.

INTRODUCTION

It is not enough for airlines to compete on market share, flight schedules, or inflight amenities. Competing on service, and more specifically, customer experience where replication is more difficult, can be a differentiator among airline competitors. Chauhan and Manhas (2014) explain that customer experience begins from a set of interactions between a customer and an organization, which then provokes a reaction. Customer experience links customer feeling and reactions to customer satisfaction and loyalty (Otto and Ritchie, 1996). Etihad Airways believes that customer experience is central to achieving differentiation among airlines and provides for future profitability and growth for the airline (Laming and Mason, 2014). Many other airlines are following suit. Airlines for America reports that U.S. airlines invested \$20 billion in 2017 to enhance customer experience (Airlines 4 America, 2017). In a bid to improve the passenger experience even more, information technology spending by airlines in 2018 is expected to reach \$24.3 billion (Airports Council International, 2017).

For airlines, technology appears to be their “go to” approach to improving customer experience, and for good reason. It has been established that self-service technologies can create positive outcomes, such as providing more value to customers through better service quality (Meuter et al., 2000) and enhanced customer experience (Åkesson, Edvardsson, and Tronvoll, 2014). Self-service

technologies can make information seeking, transactions, and other communication faster and more convenient. However, as Inversini (2017) points out, mobile technology can provide benefits to passengers only if the customers’ journey and mobile touchpoint (interaction between the customer and company’s mobile technology) are identified. While services and information provided through mobile and self-service solutions are an integral part of the customer experience, traditional information and service distribution systems cannot be deemed unimportant. Before implementing or expanding self-service technologies, firms must better understand the customer and technology relationship (Meuter et al., 2000).

With so many passenger – airline interaction possibilities, airlines may not understand the passenger – technology relationship very well. Even though airlines are investing enormous sums of cash in technology to improve customer experience, overall customer satisfaction has not improved. In fact, compared to other industries, the airline industry remains at the lower end of customer satisfaction. In a well-established yearly customer satisfaction survey, the airline industry achieved a score of 73 out of 100 in 2017, ranking 41st out of 44 industries (ASCI 2018). The low ranking is not an anomaly either; it is similar to past years. Consider the following scenario. An airline passenger can interact with an airline via telephone, email, chat, social media, kiosk, mobile app, website, and face-to-face with employees. An airline passenger might prefer to investigate flight

schedules via a website using a laptop, then purchase the ticket via a website using a desktop, whereas the same passenger might prefer to check-in for a flight using a mobile app on a smartphone, and then use the telephone when locating lost luggage. At the same time, other passengers might prefer to use entirely different interaction mediums for the same scenario. Airlines might consider improving customer experience by better integrating and aligning the technology in the interactions between airlines and passengers. For example, if consumers prefer to speak to airline representatives about lost luggage, rather than investing large sums of capital in to lost luggage mobile app communications technology, airlines might invest in technology that provides clear directions and answers via telephone prompts and recordings, as well as implementing intelligent call routing and monitoring software to reduce wait times. Implementing technology that consumers prefer, airlines increase the likelihood of creating positive feelings and improving passenger satisfaction.

The consequence of airlines not knowing their passengers' preferences could mean allocating inappropriate amounts of resources to various touchpoints that could jeopardize their customer experience efforts. Even more so, airlines may inadvertently create an environment where customers become frustrated with the medium choices that airlines have made available. Consumer frustration can lead to ill will, jeopardizing customer satisfaction and loyalty initiatives, and increasing negative word-of-mouth comments. Therefore, it is important for airlines to understand the mediums customers prefer for different kinds of consumer – airline interaction. As pointed out by Laming and Mason (2014), in order to implement an appropriate customer journey, measuring consumer behavior at each touchpoint is necessary. If airlines can uncover which interaction mediums that customers prefer at each touchpoint, higher customer satisfaction rates may result.

This paper examines which interaction medium passengers prefer to use when interacting with airlines given specific touchpoints along their customer journey. Scenarios were developed

considering several technology use and adoption theories. Further, the Millennial generation is the target population of this research since this generation is now America's largest generation and their purchasing power is important to company executives, marketers, and researchers (Henderson, 2016). Considering that the Millennial generation is often portrayed as heavy users of technology and have been labeled as "digital natives" who are "native speakers" of the digital language of computers and the Internet (Prensky, 2001), the insights from this research could bring true understanding to decision makers about this generation's preferences for how they want to interact with airlines.

Consequently, this paper sets out to answer the following research question:

- *RQ1*: Which mediums do Millennials prefer when interacting with airlines?

The remainder of this article is organized as follows: Literature review and scenario development, Research methodology, Data analysis and results, Discussion, and Conclusion.

LITERATURE REVIEW

Airline Customer Experience

Surprisingly, there is very little customer experience academic research in air transport. Much of the current literature comes from practitioner and consultant white papers (Accenture, 2016; IBM, 2017). A study by Chauhan and Manhas (2014) explored customer experience among three airlines in India, though the study did not evaluate airline-passenger interactions or the use of technology during the customer journey. Laming and Mason (2014) examined customer experience in airlines in Europe, Middle East and Asia from a service quality perspective by asking passengers to rate their service experience. Again, this study did not evaluate airline-passenger interactions or use of technology during the customer journey. A study by Inversini (2017) examined mobile touchpoints in an airport scenario. From a set of five activities and five information sources, activities that passengers would

engage in and which information sources they used during an airport journey were identified. Two other closely related studies were conducted, one by Lu, Choi, and Tseng (2011) and one by Castillo-Manzano and López-Valpuesta (2013). Even though these studies were constrained to the check-in touchpoint, they investigated factors that influence air travelers' choice of check-in medium, whether it be the conventional ticket-counter, kiosk, or web check-in.

Airline Technology Adoption and Use

A number of studies have been conducted related to the adoption and use of specific airline technology. The Technology Acceptance Model (TAM) developed by Davis (1989), suggests that behavioral intentions are driven by perceived usefulness and perceived ease of use. TAM has been used to explain the use of airline technologies such as flight ticket booking applications (Suki and Suki, 2017), online check-in service (Lin and Filieri, 2015), self-service airport kiosks (Ku and Chen, 2013) and online airline ticket purchases (Ruiz-Mafe, 2009). Similar to TAM, Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003), has been used to examine travelers intentions to use biometric e-gates in airports (Morosan, 2016), websites to purchase airline tickets (Escobar-Rodríguez and Carvajal-Trujillo, 2013), and service mobile apps, including airline mobile apps (Leon, 2018).

Further, the Information System (IS) Success Model (DeLone and McLean, 1992) suggests that information quality leads to system use. When information quality is better, users find the output information to be more helpful and are willing to use the information system more frequently (Chen and Tsai, 2017). Information quality is defined as the degree to which the user believes that the information has the attributes of accuracy, timeliness, usefulness, completeness, and relevance (DeLone and McLean, 2003; Kim, Xu, and Koh, 2004; Lin and Lee, 2006). Several research studies demonstrate the ways in which information quality affects a user's intention to use technology. In the air transport domain, Brida, Moreno-Izquierdo, and Zapata-Aguirre (2016) found that the information

that is provided by information and communication technologies influences satisfaction in an airport setting. Additionally, Elkhani, Soltani, and Jamshidi (2014) found that information quality leads to satisfaction with airline websites in an e-ticketing context and Forgas et al. (2012) revealed that information quality significantly influences airline website e-quality.

Another framework, Task-Technology Fit (TTF) has guided several technology adoption studies related to tourism and travel (D'Ambra and Wilson, 2004; Kim et al., 2010). TTF is the degree to which a technology assists an individual in performing his or her tasks (Goodhue and Thompson, 1995). It suggests that task and technology characteristics affect individual performance through task-technology fit. Thus, as the fit between the technology and the task it supports becomes better, the greater the likelihood a specific technology will be used and the greater the likelihood that the user's satisfaction with the interaction and with the firm will be higher.

Based on the literature review, this study sets out to make several important research contributions. While the theoretical frameworks are useful in explaining the significance of latent constructs and their influence on technology use and adoption, they do have some limitations for practical use. They have not been particularly useful to decision makers who are deciding which technology to implement along the customer journey and they do not capture users' preference of technology when multiple technologies are available. Therefore, the first contribution of this research is to add to the limited airline customer experience literature investigating interactions at various touchpoints along an airline customer journey. This research will help to guide airline decision-makers about which technology choices to offer and implement at each touchpoint in a customer journey. Second, this research examines the Millennial generation in the United States. The Millennial generation is the largest generation in the United States and one that has significant purchasing power. Previous airline customer experience papers were conducted outside of the United States and did not examine Millennials. In summary, the results

of the study will provide a more complete view of the customer journey and will provide guidance to airline management for interaction medium implementation and resource allocation, thus improving customer experience and satisfaction scores.

RESEARCH METHODOLOGY

Data Collection Instrument and Sampling Method

The theories in the literature review in some regards have commonality and are the backdrop for developing the seven scenarios in this study. The scenarios were developed with different levels of complexity, structure and ambiguity, and information requirements. Further, the survey was developed to measure the likelihood of respondents using a particular interaction medium in each of the scenarios. The interaction mediums (*desktop_website*, *laptop_website*, *mobile device_mobile app*, *mobile device_website*, *kiosk*, *telephone*) were selected because of their pervasive use in customer – airline interactions. Subjects were asked how likely they were to use a particular interaction medium using a 5-point Likert scale anchored by 1 (*extremely unlikely*) to 5 (*extremely likely*). The survey was pretested on several representative subjects. Only non-substantive changes were necessary.

The online survey was distributed in 2016 and was directed toward participants who are residents of the United States, those who have flown on at least one commercial airline flight in the previous 12 months, and who are categorized as Millennials (those born in years 1980 through 2004) (Weinbaum, Girven, and Oberholtzer, 2016). Data were collected from undergraduate junior and senior level students from a public university in the southeast region of the United States. The survey was voluntary, though students were offered extra credit for completing the survey. The survey returned 677 total responses. Twenty-four responses were excluded since the birth year in these responses was prior to 1980. Thus, 653 responses remained, a net response rate of 96.5%.

Data Analysis Method

The survey data were analyzed using repeated measures ANOVA to explore the differences in interaction medium among the seven scenarios. Repeated measures ANOVA is appropriate when dependent variables are nominal categorical and independent variables are continuous, and when respondents are observed over several instances.

Data Analysis

Of the 653 respondents, 62.3% ($n = 407$) were male and 37.7% ($n = 246$) were female. The years the respondents were born ranged from 1981 to 1998 with 73.4% of them born in the years 1993 to 1995. The survey showed good reliability with a Cronbach's alpha reliability coefficient of .879 (Nunnally 1978).

RESULTS

Following is an overview of the results, and a review for each scenario.

Overview of Results

Interaction medium analysis investigates passenger preferences for a medium given the task that confronts the customer. Table 1 provides an overview of the rankings and identifies which interaction medium is more likely to be selected in each of the seven scenarios. Customers are more likely to use a laptop and less likely to use the telephone to speak with a reservation agent when purchasing an airline ticket. Alternatively, a customer is more likely to use the telephone and less likely to use a desktop computer when rectifying a frequent flyer mileage error.

Each of the seven scenarios was analyzed using repeated measures ANOVA. Tables 2 and 3 provide the mean and standard deviation of each interaction medium for each task. Table 2 list the scenarios that are simpler for passengers to accomplish, while Table 3 lists the more complex scenarios. Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated ($p < .001$) for each of the seven scenarios therefore; the Greenhouse-Geisser correction was used.

TABLE 1
INTERACTION MEDIUM LIKELIHOOD RANKING

Interaction Medium	Ticket Purchase	Flight Information	Check - in	Frequent Flyer Mileage Correction	Seat Change	Lost Luggage Information	Departure Ticket Change
Desktop -Website	2	4	5	6	6	5	5
Laptop - Website	1	1	4	2	1	4	1
Mobile Device - Mobile App	4	3	1	4	3	3	4
Mobile Device - Website	3	2	3	3	4	2	3
Telephone	5	5	6	1	5	1	2
Kiosk	-	-	2	5	2	-	-

Note: 1 = more likely; 6 = less likely

TABLE 2
INTERACTION MEDIUM PREFERENCE (SIMPLE TASKS)

Interaction Medium	Ticket Purchase	Flight Information	Check-in
	Mean (SD)	Mean (SD)	Mean (SD)
Desktop -Website	3.43 (1.470)	3.28 (1.433)	2.63 (1.480)
Laptop - Website	4.60 (0.760)	4.58 (0.762)	3.52 (1.393)
Mobile Device - Mobile App	3.00 (1.308)	3.57 (1.183)	4.02 (1.225)
Mobile Device -Website	3.01 (1.306)	3.70 (1.155)	3.83 (1.252)
Telephone	2.01 (1.285)	1.98 (1.242)	1.93 (1.225)
Kiosk	-	-	3.91 (1.254)

TABLE 3
INTERACTION MEDIUM PREFERENCE (COMPLEX TASKS)

Interaction Medium	Frequent Flyer Mileage	Seat Change	Lost Luggage Information	Departure Ticket Change
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Desktop -Website	3.04 (1.506)	2.95 (1.528)	2.51 (1.459)	3.30 (1.542)
Laptop - Website	3.95 (1.231)	3.95 (1.232)	3.28 (1.479)	4.36 (0.938)
Mobile Device - Mobile App	3.33 (1.365)	3.71 (1.263)	3.53 (1.407)	3.44 (1.321)
Mobile Device -Website	3.34 (1.344)	3.68 (1.253)	3.68 (1.344)	3.45 (1.309)
Telephone	4.10 (1.235)	3.00 (1.486)	3.81 (1.424)	3.56 (1.423)
Kiosk	3.23 (1.528)	3.89 (1.195)	-	-

Scenario 1 - Ticket Purchase

Scenario 1 assesses the likelihood of using a particular interaction medium when purchasing an airline ticket by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when purchasing an airline ticket [F(2.887, 1879.208) = 417.382, $p < .001$]. LSD post hoc tests showed that there were

significant differences ($p < .001$) between all interaction mediums when purchasing airline tickets except for the non-significant ($p > .10$) difference between mobile devices-mobile app (mean = 3.00; SD = 1.308) and mobile devices-website (mean = 3.01; SD = 1.306). Ticket purchasers are more likely to use laptops (mean = 4.60; SD = 0.760) to purchase tickets over all other mediums, and they are less likely to use the telephone (mean = 2.01; SD = 1.285).

Scenario 2 - Seeking Flight Information

Scenario 2 assesses the likelihood of using a particular interaction medium when searching for flight information by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when searching for flight information [$F(3.001, 1953.799) = 446.672, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between all interaction mediums when searching for flight information. Passengers searching for flight information are more likely to use laptops (mean = 4.58; SD = 0.762), mobile devices-website (mean = 3.70; SD = 1.155) or mobile devices-mobile app (mean = 3.57; SD = 1.183). They are less likely to use the telephone (mean = 1.98; SD = 1.242).

Scenario 3 - Check-in

Scenario 3 assesses the likelihood of using a particular interaction medium when checking in for a flight by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when checking in for a flight [$F(3.911, 2546.124) = 308.380, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between all interaction mediums when checking in for a flight except between mobile devices-mobile app (mean = 4.02; SD = 1.225; $p = .120$) and kiosk (mean = 3.91; SD = 1.254; $p = .120$), and mobile devices-web (mean = 3.83; SD = 1.252; $p = .280$) and kiosk (mean = 3.91; SD = 1.254; $p = .280$). Passengers' checking-in for a flight are more likely to use a mobile device-mobile app (mean = 4.02; SD = 1.225), and are less likely to use the telephone (mean = 1.93; SD = 1.225).

Scenario 4 - Frequent Flyer Mileage Correction

Scenario 4 assesses the likelihood of using a particular interaction medium when contacting an airline to correct frequent flyer account mileage by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when contacting an

airline to correct frequent flyer account mileage [$F(3.804, 2476.382) = 77.061, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between interaction mediums when contacting an airline to correct frequent flyer account mileage except for the following: Desktop (mean = 3.04; SD = 1.506) and kiosk (mean = 3.23; SD = 1.528) was significant at $p = .018$; and laptop (mean = 3.95; SD = 1.231) and telephone (mean = 4.10; SD = 1.235) was significant at $p = .036$. Further, non-significant comparisons ($p > .10$) occurred between mobile device-mobile app (mean = 3.33; SD = 1.365) and mobile device-web (mean = 3.34; SD = 1.344); mobile device – mobile app (mean = 3.33; SD = 1.365) and kiosk (mean = 3.23; SD = 1.528); and mobile device-web (mean = 3.34; SD = 1.344) and kiosk (mean = 3.23; SD = 1.528). Passengers contacting an airline to correct their frequent flyer account mileage are more likely to use the telephone (mean = 4.10; SD = 1.235) or laptop (mean = 3.95; SD = 1.231) and are less likely to use a desktop computer (mean = 3.04; SD = 1.506).

Scenario 5 - Seat Change

Scenario 5 assesses the likelihood of using a particular interaction medium when making a seat change by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when making a seat change [$F(3.888, 2530.844) = 81.555, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between interaction mediums when making a seat change except for the following significant and non-significant comparisons: Mobile device – mobile app (mean = 3.71; SD = 1.263) and kiosk (mean = 3.89; SD = 1.1195) was significant at ($p = .005$). Non-significant comparisons occurred between desktop (mean = 2.95; SD = 1.528) and telephone (mean = 3.00; SD = 1.486); between laptop (mean = 3.95; SD = 1.232) and kiosk (mean = 3.89; SD = 1.263); mobile device – mobile app (mean = 3.71; SD = 1.263) and mobile device-web (mean = 3.68; SD = 1.253). Passengers making a seat changes are more likely to use a laptop (mean = 3.95; SD = 1.232) or a kiosk (mean = 3.89; SD =

1.263), and are less likely to use the telephone (mean = 3.00; SD = 1.486) or a desktop computer (mean = 2.95; SD = 1.528).

Scenario 6 - Lost Luggage Information

Scenario 6 assesses the likelihood of using a particular interaction medium when obtaining information about lost luggage by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when obtaining information about lost luggage [$F(2.952, 1921.894) = 99.754, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between all interaction mediums when obtaining information about lost luggage except there was a non-significant difference between mobile devices-web (mean = 3.68; SD = 1.344; $p > .10$) and telephone (mean = 3.81; SD = 1.424; $p > .10$). Passengers obtaining information about lost luggage are more likely to use the telephone (mean = 3.81; SD = 1.424) and are less likely to use a desktop computer (mean = 2.51; SD = 1.459).

Scenario 7 - Departure Ticket Change

Scenario 7 assesses the likelihood of using a particular interaction medium when making a change to departure day and time by comparing the mean values of each interaction medium. The results indicate that there is a significant main effect in the likelihood of using a particular interaction medium when making a change to departure day and time [$F(3.023, 1968.049) = 78.888, p < .001$]. LSD post hoc tests showed that there were significant differences ($p < .001$) between all interaction mediums when making a change to departure day and time except for the following significant comparison. Desktop (mean = 3.30; SD = 1.542) and telephone (mean = 3.56; SD = 1.423) was significant at ($p = .001$). Non-significant ($p > .10$) comparisons occurred between desktop (mean = 3.30; SD = 1.542) and mobile device-web (mean = 3.45; SD = 1.309); mobile device-mobile app (mean = 3.44; SD = 1.321) and mobile device-web (mean = 3.45; SD = 1.309); and between mobile device-mobile app (mean = 3.44; SD = 1.321) and telephone (mean = 3.56; SD = 1.423). Passengers

making a change to their departure day and time are more likely to use a laptop (mean = 4.36; SD = 0.938) or a telephone (mean = 3.56; SD = 1.423), and are less likely to use a desktop computer (mean = 3.30; SD = 1.542).

DISCUSSION

Interaction Medium Discussion

Even though airlines are spending enormous amounts of money on technology and customer experience enhancements, passenger satisfaction is habitually low. This may be an indication that airlines are not allocating appropriate technology to each touchpoint. While aggregate or construct results as provided in previous research is useful in some situations, it is not as useful when attempting to improve the customer experience when enhancing the passenger journey at each touchpoint. Disaggregate results from several touchpoints rather than aggregate results from fewer touchpoints are more beneficial. Disaggregate results shed light on preconceived notions and can help management make appropriate operational decisions that improve the passenger journey at each touchpoint.

The insights from exploring interaction medium preferences become important for allocating resources and for focusing attention to the appropriate touchpoints to create better customer experiences. This study uncovers Millennials' preferred interaction mediums relative to the touchpoints in their journey. Millennials vary their interaction medium preferences and ironically, they prefer interaction mediums other than mobile technology in the most common interactions with airlines. One of the most glaring insights from this study is that mobile technology is not the be-all-end-all solution for passenger interactions with airlines.

Largely, Millennials prefer to use a website via a laptop for structured – rule based transactional tasks like ticket purchases and searching for flight information. Additionally, they prefer a website via a laptop for more ambiguous tasks such as Making Seat and Departure Ticket Changes. When airlines are developing their websites, it would be wise for them to focus on the tasks that passengers often

undertake. Where rule based tasks are concerned, clear and intuitive process steps should be the focus. For less structured and ambiguous tasks, a collaborative and multidisciplinary team of airline employees ought to consider all possible outcomes that a passenger might encounter and then incorporate each of these possibilities into the website design. Information quality is of the utmost importance when customers are accomplishing less structured and ambiguous tasks.

Millennials were however, likely to choose a mobile device-mobile app for Checking-in for a Flight. This could be due to the ease of use of the technology or the mobility of Millennials, where access to a laptop and desktop computer is less likely, and certainly, using a mobile device ought to be quicker than calling a reservation agent by telephone. Interestingly, in the scenarios that this study examined, mobile apps ranked in the middle for preference. Even more, using mobile devices is not the preferred medium for any of the tasks explored in this study except for Checking-in for a Flight. Passengers would consider checking in for a flight a simple task, though of the three simple tasks in this study, Checking-in for a Flight was viewed as more difficult than the other two tasks. When airlines develop mobile apps, the ease of use for the check-in feature ought to be a high design priority. Therefore, if airlines want to improve customer experiences when customers use mobile devices, they ought to prioritize the user design of the check-in functionality and at the same time, when introducing secondary functionality; it should not interfere with the check-in process.

Surprisingly, Millennials prefer the telephone for tasks that appear more ambiguous and seem to require human intervention to accomplish, such as making a frequent flyer mileage correction, obtaining lost luggage information, and even making a departure ticket change. Speaking to live agents via telephone can reduce the time to achieve a desired outcome from a task that does not involve a routine answer. Further, the preferred use of the telephone dispels some preconceived notions that Millennials prefer mobile apps and mobile technology to all else. In an attempt to contain costs, airlines reduce

call center overhead and headcount, while implementing technology as a replacement. However, human call center support is relevant for certain passenger tasks. Airlines have a great opportunity to improve customer experience in the areas of call centers.

Telephone calls from passengers happen because passengers have encountered an issue or problem along their journey where human assistance is necessary. Airlines could focus more on preventing lost luggage and making it easier to correct frequent flyer mileage. Further, airlines could make it more difficult to make frequent flyer mileage errors in the first place. Reducing these errors would reduce incoming calls, reduce the need for additional headcount, and improve the passenger experience. Additionally, since it appears that the telephone is highly preferred to correct frequent flyer mileage issues, to obtain lost luggage information, and to change a departure ticket, the remaining call center employees ought to be trained chiefly in these areas to swiftly and accurately resolve these issues.

CONCLUSIONS AND FUTURE RESEARCH

This study contributed to the current research in a number of ways. First, this research added to the limited customer experience literature in the airline industry. Second, this study provided a holistic view of the passenger journey, identifying the interaction mediums that Millennials in the United States are likely to choose at each touchpoint. Last, this study provides insights and guidance for airline managers about where to invest resources and which interaction channels ought to be their focus. Using seven scenarios that were developed with varying degrees complexity, structure and ambiguity, and information requirements, this study set out to answer the research question: 1) Which mediums do Millennials prefer when interacting with airlines? The insights and guidance provided in the study could assist airlines in improving their customer experience and passenger satisfaction.

While this study contributed to the current literature in a number of ways, future research could extend this study even more. Since this study examined the

Millennial generation, a longitudinal study examining changes in their interaction preferences could be insightful. Additionally, other interaction mediums such as chat, text, Twitter, virtual assistants, and even video conferencing could be studied. Also, future research could examine each touchpoint further. Research could uncover passenger satisfaction with each touchpoint and determine how well airlines are performing at each one. Last, researchers could seek to understand reasons behind interaction medium preferences. Passengers might choose an interaction medium because of ease of use, usefulness, information quality, access, convenience or because there is no better alternative. Understanding these factors could improve passenger experience even more.

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APPENDIX 1

Seven Scenarios

1. Before purchasing an airline ticket, I search for flight information such as available fares, departure and arrival times. During this pre-purchase phase to find information, I am likely to use ...
2. When I make the actual purchase of an airline ticket, I am likely to use ...
3. When I check-in for my flight, I am likely to use ...
4. After my flight is over, I notice that my luggage has been lost. I am likely to obtain information about how to resolve this situation by ...
5. After purchasing my airline ticket and getting a seat assignment, I decide later that I want to change my seat assignment. To make the actual seat assignment change, I am likely to do this via ...
6. After purchasing my airline ticket, I decide later that I want to change my departure day and departure time. To make the actual ticket changes, I am likely to do this via ...
7. After my flight is over, I notice that my frequent flyer mileage has not been applied to my account. I am likely to contact the airline to resolve this situation by ...

BIOGRAPHY

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LEVERAGING RAILROAD LANDS GRANTS AND THE BENEFITS ACCRUING IN THE NEW ECONOMIC LANDSCAPE

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ABSTRACT

Unlike most companies, the major railroads in the United States have proven highly resilient to the vicissitudes of the market. We argue that this is due neither to the unique nature of rail haulage nor to superior management acumen. Rather this solidity is due to an immense wealth transfer to the railroads in the nineteenth century that has dramatic impacts in the present. Moreover, the government protection and encouragement that rail grants represent did not end in the nineteenth century. It continues and represents an intangible asset that, while not on railroads' balance sheet, is very real indeed.

INTRODUCTION

Fluctuations in corporate fortunes are a part of life nearly as certain as death and taxes. In an invariable cycle, companies establish themselves, rise to prominence, are eventually taken for granted as a central part of the economy, and then fall on rough times. Sears, Roebuck and Company continues its slide toward bankruptcy which has included the closure of 400 stores over the last two years and discharging over 200,000 employees over the last 15 years. Sears was founded in 1886 (Britannica Online, 2018). General Electric (GE), part of the first ever Dow Jones Index in 1896, and the only company that remained part of the Dow Jones Industrial Average (DJIA) since it was formed in 1907, has now fallen on very hard times. GE was recently delisted from the DJIA. (Bird, 2018). This is the ebb and flow of business.

So why is it that the railroads, with over 170 years of history in the U.S., continue to stand strong? Is it the superior intellect of railroad management, fortuitous timing or just blind luck? In an era when a black box can start your vehicle located in the parking garage, how is it that something as low tech as a diesel-electric locomotive running over tens of thousands of miles of rail is still a formidable industry?

The answer to this question lies in federal land grants. Ostensibly in an effort to connect the Louisiana Purchase to the eastern United States and render it amenable to settlement, the federal government granted large swathes of land to the transcontinental railroads. This fact is well known to historians but forgotten in the modern age. Many know that over 130 million acres were granted to the railroads in the 1800s. Most people, however, fail to inquire as to what these companies did with the land and what impact these grants have in the present.

The truth is that railroads are not, as we usually envision them, primarily railroads. Rather, they are diversified conglomerates with railroads making up only a part of their portfolio. Much of the rest of their portfolio is comprised of land and mineral holdings that insulate them from the vicissitudes affecting a single industry. Moreover, unlike many conglomerates, the nature of railroads' holdings serves primarily as a buffer or insulator rather than as yet another sector that is subject to its own ups and downs.

This paper is structured as follows. First, we describe a brief history of the federal land grants to railroads, focusing on land grants served by two railroads west of the Mississippi River. We then examine the impact these grants have had upon the plight of railroads in the present day. Finally, we conclude and offer observations on the role that the

close relationship of rail with government will play in the future.

ANCIENT HISTORY: THE FEDERAL LAND GRANT TO RAIL- ROADS

Up to 1850, railroad development and usage was largely confined to the east coast of the U.S. Congress, however, was determined to open the ‘frontier’ west of the Mississippi River and the extension and establishment of railroads in the west was encouraged with extensive subsidies. The primary incentive employed by Congress was land grants. From the 1850’s through the early 1870’s railroads were granted over 130 million acres of land out of the public domain (Kammer, 2017). To put that in context, California contains only around 101 million acres (Land Acreage, 2018).

These grants were not an entirely straight forward transfer of fee simple title. The terms varied depending upon the act under which the land was granted. For example, the Pacific Railroad Act of 1862 did not include mineral rights while the Pacific Railroad Act of 1864 enlarged the amount of land granted to railroads and granted full rights to all minerals underneath that land (Cox, 2018). Each congressional act also had strings or obligations attached to it. The obligations sometimes included a timeframe for a given section of railroad completion or a demand that a certain parcel of land be returned to the public domain if it was not utilized for railroad construction. In some instances, the railroad could and did sell off pieces of land in order to generate capital for railroad construction.

Under land grant legislation passed by Congress from 1850 to 1870, today’s Burlington Northern Santa Fe Railroad (BNSF) would have approximately 50,000,000 acres and the Union Pacific Railroad (UPRR) would have approximately 33,000,000 acres. (Kammer, pp. 405) About 1/3 of this total two railroad amount (28 million acres) was eventually returned to the government.

While, land grants and other government subsidies directly funded only 18,738 miles of railroad, these

government incentives had a knock-on effect. Between 1850 and 1887 the national railroad system grew from 9,000 miles to 87,000 miles. Furthermore, according to an Interior Department Auditor on Nov. 1, 1880, the total value of land grants to railroads was \$391,804,610 but the total investment made by railroads in 1880 in the U.S. was \$4,653,609,000 (Henry, 1945).

HARD TIMES: 1950-1980

Despite the buffer that land grants provided, rail companies fell on hard times in the 1960s and 1970s. However, the insulation from markets that government officials had provided did not end there. The original land grants continued to provide insulation for their recipients but government largesse was extended in other ways during the rough times. Most notably, the Interstate Commerce Commission (ICC) worked assiduously to constrain competition with and competitive pressure between rail companies.

Nevertheless, in 1957 the number of passengers carried by air finally exceeded those carried by rail. By 1978 railroads carried less than 1% of passenger traffic. The 1970s saw a host of railroad bankruptcies—Penn Central in 1970, Ann Arbor in 1973, Rock Island in 1975, among others. Interestingly, none of these companies had large, government granted, land holdings to buffer them. Burlington Northern, with their massive land grants, did suffer a \$1.1 billion loss from ‘discontinued operations.’ However, they did not go into receivership like others.

It is not entirely clear what drove the railroads on such hard times. It is possible that it was simply the economic cycle hitting rail particularly hard or it may be that, insulated from the market through government grants, managers became complacent and slow to react to change. It also could have simply been that the railroads faced a new and, in certain segments of the haulage market, institutionally superior competitor, the trucking industry—which also received subsidies in the form of government provided rights of way. Two things are clear, however. First, rail companies had already had an

extremely impressive run between 1850 and 1950. Second, the true historical asset of the rail companies, government insulation, was far from exhausted.

A prime example of continued government insulation is the Rail Passenger Service Act of 1970. This act created Amtrak with an initial subsidy of \$200 million. Today, Amtrak receives approximately \$1.3 billion annually in federal subsidies. Another example is the passing of the Railroad Revitalization and Regulatory Reform Act of 1976. Congress also passed the Staggers Act in 1980. This act effectively deregulated the railroads and allowed them to shed unprofitable routes. Additionally, consolidation within the industry and the displacement of several thousand employees across the nation increased their competitiveness with the trucking industry. Additionally, and rather exceptionally, in many cases of railroad spin-offs, if cash was to be paid-out, the Internal Revenue Service ruled that distribution to be tax-exempt (Ziembra, 1990).

RECENT HISTORY: THE LEVERAGING OF LAND ASSETS AND DIVERSIFICATION

After over 100 years of sitting on the land assets acquired in the early days of railroad construction and extension, rail companies began to leverage and diversify their assets in the last decades of the twentieth century. There was a veritable flurry of divestments, spinoffs, mergers, and acquisitions by rail companies, very few of them even tangentially related to the management of rail networks or haulage of freight.

In 1989, Burlington Resources spun-off a portion its timber assets and created a new company called Plum Creek. Plum Creek raised over \$500 million and purchased 2 million acres of railroad grant lands from its parent, Burlington Resources. In 1999, Plum Creek recast itself as a real estate investment trust (REIT). Additional capital was raised and the result was a \$3.8 billion merger with Georgia-Pacific becoming the second-largest private timberland owner in the country. By 2005, Plum Creek was the largest private landowner in the country (Jamison, 2007).

In 1997, Kinder Morgan purchased Santa Fe Pacific Pipeline for \$1.16 billion. The pipeline subsidiary was part of Santa Fe Pacific, which was a unit of Burlington Northern Santa Fe railroad. The acquisition included 3,300 miles of pipeline in several Western states. The BNSF railroad has thousands of miles of right-of-way in several Western states. The pipeline transported 1 million barrels a day of gasoline and jet fuel serving California, Arizona and other states (Ewing, 1997).

In 2000, Anadarko Petroleum Corporation purchased Union Pacific Resources Group (UPRG) for \$4.4 billion. The sale included 1.2 million acres of surface holdings formerly associated with the Union Pacific land grant. UPRR is the parent company of UPRG. Anadarko averages \$1 million per day in taxes and royalties to the state of Wyoming. The company has made over \$3 billion in investments in Wyoming and has also granted almost \$3 million to the University of Wyoming in recent years (Research/Outreach Partner, 2015).

Burlington Resources was created as a stand-alone company by its parent, Burlington Northern Railroad. In 2005, Burlington Resources had revenues of \$1.5 billion and 2,200 employees. It was sold to ConocoPhillips in 2006 for \$35.6 billion (Pirog, 2007).

The list could go on, producing multiple pages of instances such as those listed above. The point here, however, is that railroads are extracting value from land grants, and these actions help bolster their balance sheet and insulate them from the vagaries of the market. However, they are not currently, nor have they ever been fully insulated. In fact, railroads were struggling to survive in the 1960's – 1970's.

Railroads have a longer and deeper history with the federal government than other transportation modes—with the possible exception of canals. Beyond the relationships with individual members of Congress, key agencies work with the railroads and have for decades. These include the Federal Railroad Administration, the Surface Transportation Board and the Pipeline and Hazardous Material Safety Administration.

The tight relationship with the federal government and the importance this relationship is highlighted by the case of Catellus. Catellus was a real estate subsidiary spun-off by Santa Fe Pacific Corp. ProLogis then purchased Catellus and a key driving factor for the merger was that Catellus, "...has a huge inventory of land and expertise at getting government approvals for new construction (Vincent, 2005)." Good government relations is an intangible asset.

NEW MARKETS

Forty (40) % of the 'ton miles' of U.S. freight is transported by rail. This compares to 33% for trucks and .3% for air (Davidson, 2014). Much of the newer freight is intermodal containers and the transport of crude oil. While rail's share of freight transport has remained relatively constant, the volume has increased dramatically, particularly for intermodal shipping.

As the U.S. has developed an increasing appetite for imported goods, many of those goods arrive by container ship on our coastlines. In 1980, intermodal shipping was approximately 3 million carloads per year. By 2013, 14 million carloads were being moved by rail. Today, railroads have hundreds of intermodal terminals across the country that receive, process and distribute containers. Much of the Intermodal traffic is of domestic origin, with United Parcel Service (UPS) earning 1st place as the largest domestic Intermodal shipper.

A second relatively new opportunity is the transport of crude oil. With the advent of directional drilling and fracking, over 1 million bb/day is transported by rail from interior states, such as Colorado and North Dakota, to refineries located along the nation's coastlines. To date, pipeline capacity is insufficient to address the increased volume, therefore railroads are necessary to fill that transport need.

AMATURE INDUSTRY? (VALUATION VERSUS IMPORTANCE)

For 2017, (BNSF) reported an 'operating income' of \$7.3 billion (BNSF's 2017 Financial Perfor-

mance), far less than Facebook's annual profit of around \$20 billion (\$4.99 billion 1st quarter, 2018) (Cherney, 2018). For the 2nd quarter of 2018, (UP) reported 'revenue' of \$5.7 billion (UPRR News Release, 2018) while for the 1st quarter of 2018, Verizon reported 'revenue' of \$31.8 billion (Salinas, 2018).

Two questions should be kept in mind for the reader. First, if Facebook ceased operations tomorrow, what would be the impact on our economy? While there would certainly be some disruption in many people's social lives, contrast this disruption with the impact that a complete halt in the transportation of crude oil from the western 2/3 of the nation would have if BNSF abruptly discontinued operations. The relatively slight size of railroads' profits and revenues belies their importance for the economy.

Secondly, with 170 years of railroad history compared to 25 years of social media/wireless communication, the strategic importance of the railroads for American macroeconomic health far outstrips the importance of other contemporary economic juggernauts.

CONCLUSION

Five Class I railroads (CSX Transportation, Kansas City Southern, Norfolk Southern, Union Pacific and Burlington Northern Santa Fe) generate almost 90% of total railroad revenue (Berridge, 2015). With some geographical overlap, they are essentially five regional monopolies. They hold an incredible strategic position in land-based transportation. They may not have the glitz and glamour of other Wall Street firms, but the probability of their being supplanted by another form of transport is not on the horizon.

This perspective on the railways is not terribly contentious. However, what is often overlooked is that the railways have been able to draw upon a huge asset base of federal land grants dating back to 1850. Moreover, the special relationship with the federal government that those grants represent has also served them well for a century and a half,

serves them well in the present, and is likely to continue to serve them for the foreseeable future

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BIOGRAPHY

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TEACHING SUPPLY CHAIN MANAGEMENT: A PROPOSAL FOR FUTURE RESEARCH ON USING REAL WORLD SPORTS AND OTHER ANALOGIES

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ABSTRACT

Teaching supply chain management (SCM) to undergraduates that are not Supply Chain Management majors can be difficult. This often is the case when teaching a business school core course that all majors must take. The motivation of these non-SCM students is sometimes just to pass and move on to their major course of study. Using a number of cases and examples from the real world that the students can relate to may help increase attention and learning. The increased interest level may give students a better understanding of supply chains. This article discusses approaches to teaching the core course with real world applicability, and suggests future research to examine the possible benefits.

TEACHING SCM TO NON-MAJORS

A customer drives up to a local fast food restaurant orders lunch and drives off. As long as the transaction happens without any issues, such as the restaurant is out of soda or potatoes for French fries, the customer does not think about what has to happen for everything to be in place to satisfy the demand. For those of us that have worked in or taught Operations and Supply Chain Management (OSCM), we have a passion for the field which leads us to think about all the behind the scene activities that happen to provide products and services to customers. It is sometimes difficult to translate our interest to the students that we see in our classes. Especially when those students are non-SCM majors taking a required business school wide core course in Operations and Supply Chain Management.

After spending 20 plus years in the OSCM field, one can see the value of the field. Often students believe that supply chain management (SCM) and supply chains (SC) are only found in manufacturing industries and are not part of service industries or non-profit organizations. Yet, as supply chain instructors and professionals, we know that this could not be further from the truth. All organizations have some sort of supply chain and by extension need a form of supply chain management. For example, McDonald's has a very extensive SC that

is needed to provide a product and a service. Museums such as the Detroit Institute of Arts have unique and very precise logistics functions, e-lending companies like Quicken Loans have extensive indirect purchasing functions, and Internet services companies like Google and Facebook also have very significant overall supply chain management functions. Students also do not often realize how extensive and important the purchasing (merchandising) role is in large retail chains, along with the extensive supply chains of suppliers that are required.

MAKING SCM CONTENT MORE RELEVANT TO STUDENTS

I taught Integrated Supply Chain Management at a large Midwestern University for several years. At this school supply chain management is one of three classes along with Integrated Marketing Management and Integrated Financial Analysis that make up the integrated undergraduate business core curriculum. All students in the College of Business must take all three of these classes at exactly the same time regardless of their major. For some of these students it will be the only time they will be exposed to SCM, Marketing and Finance. The students in these three courses are arranged into groups and each group chooses a company to study and develop a growth strategy. The strategy must be operationalized across all three disciplines if it is going to be accepted. This allows for students to

gain a better understanding of the way the three disciplines interact in the real world.

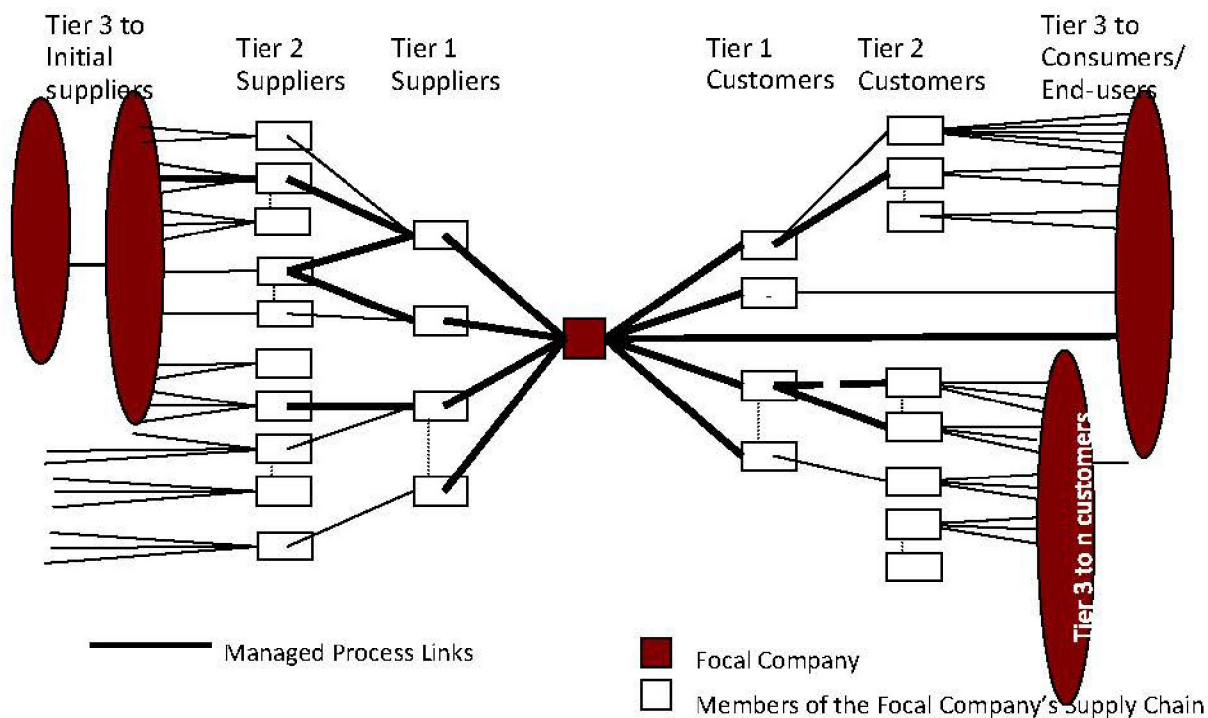
With a large number of students taking the Supply Chain Management course to fill their degree program requirements, I have used variety methods to keep their interest and get a number of supply chain management points across. I have used videos that illustrate examples of supply chains and supply chain management. One video from Arizona State University illustrates the making of Bottled Water, describing needs in terms of materials, facilities, transportation and cash (2010). Another shows Wal-Mart's response to market changes and information flow to suppliers (Galletta, 2012). I also use products to demonstrate the concept of a supply chain. For example, I have brought in to class a yoyo to get the students to think about everything that goes into the manufacturing of the yoyo, e.g., the plastic, string, and packaging. This is followed by a discussion of the logistics of getting the product to customers using through direct selling, distributors, and retailers. We also discuss the placement of inventory, how much, who holds it, and where it is held. These examples help, but I still

have trouble getting through to the students that are not going to pursue a degree in Supply Chain Management.

Figure 1 illustrates a typical supply chain with a focal company or Original Equipment Manufacturer. The suppliers at the various tiers provide products and services to the Original Equipment Manufacturer. The solid black lines depict the management of the suppliers by the buyers. Each buyer manages its suppliers; Tier 1 suppliers manage the Tier 2 suppliers, and the Tier 2 suppliers manage the Tier 3 suppliers. From this model a definition of Supply Chain can be derived. A supply chain consists of sourcing material, manufacturing a product or providing a service, and delivering the product or service to the customer. There is also the flow of information up and down the supply chain and then the flow of funds in terms of payments from the customers and payments to the suppliers.

There are a lot of tools that faculty have used over the year. I am suggesting several. These include for instance the MIT beer game, which helps students see the need for an integrate supply chain with

**FIGURE 1
TYPICAL SUPPLY CHAIN**



communication across the nodes in order to balance manufacturing and minimize swings in inventory (MIT Beer Game, 1992). The Association for Business Simulation and Experiential Learning has also had many papers on teaching SCM topics over the years (Seethamraju, 2012; Pasin, 2011). Another approach that has been used involves Eli Goldrat's book "The Goal," which has been used very successfully to help teach theory of constraints approaches to SCM majors and non-majors alike (Goldratt, 1984).

However, even with the simulations, books, games, explanations, videos, and product examples many students still have a hard time understanding Operations and Supply Chain concepts. As mentioned earlier, for some students this is the only exposure to the concepts and perhaps their primary goal is to pass the class and move on to more specialized coursework in their majors. But the standard text material is very dry and hard for students to relate to, especially if they are not Supply Chain Management Majors.

A PROPOSED REAL WORLD ANALOGY APPROACH TO TEACHING CORE SCM

One way to make the material more relevant to students is to discuss it in a context they are more familiar with. One example of this developed from an interest in baseball and provided an opportunity to talk about supply chain tiers in a sports medium. While I was watching game 7 of the 2016 World Series I thought about how both teams, Cleveland and Chicago constructed their teams to compete in the Fall Classic, and how they were really involved with multiple tiers and a supply chain they had to manage. The point of this example is to put supply chain concepts into terms that most students can relate to. From here the various concepts and approaches to supply chain management can be discussed in the context of this baseball enterprise. The result in my classes, and hopefully it will be found on a broader scale, will be that students pay more attention to the material and are more likely to learn the basic concepts of supply chain management.

The sports analogy is also useful when discussing supply chain metrics. For example, the New England Patriots have the most wins in the last 10 years with 122, the Indianapolis Colts (110 wins) and the Pittsburgh Steelers (101 wins). The teams with the least wins are the Cleveland Browns (53 wins), St. Louis Rams (49 wins) and the Oakland Raiders (47 wins). (Chase, 2015). Measuring the SC performance in terms of wins, playoff appearances, and Super Bowl wins is an indicator of success. This complements the typical SC metrics of inventory turns, inventory-carrying costs and on time delivery.

The performance of sports teams leads into the discussion of the use of Big Data to measure the effectiveness and efficiency of supply chains. For example, for several years the use of data analytics has improved the performance of many baseball teams. The term sabermetrics is the analysis of baseball games, especially the in game activities to measure performance. By describing the use of the metrics in baseball it is then easier to translate SC metrics, inventory turnover, and on time delivery for example. The students see a real world application, use of data in baseball to improve the performance of teams. It also helped that this year's World Series teams use of sabermetrics is very aggressive. The Los Angeles Dodgers have one of the largest analytics departments and the Houston Astros one of the most aggressive teams in using analytics (Fink, 2017).

It is also may prove to be useful to use an example of a service supply chains, and this example has worked for me. For example, McDonald's is providing a service with a physical product. The McDonald's supply chain needs the raw material, hamburger meat, potatoes, and bread for example. We also have the management of the service side with the number of employees scheduled and the logistics of delivering the product to the customer. The service industry is still using inputs as a transformation process to provide an output. In some cases the input is the information provided by the customer. If one goes to the Doctor, the patient provides information about his/her symptoms so that the Doctor can make a diagnosis and provide

treatment. The preferred output in this case is a healthy patient. The same can be true when enlisting the service of an Accountant to complete your taxes. Data regarding income, investments, and receipts enable the Accountant to complete taxes for filing. As a professor, I can also be thought of in terms of supply chain. Students are the inputs and the transformation process is the teaching and providing the information for them to learn about a particular topic. The output for me has been that students learned the concepts of a particular subject and can apply those concepts, and hopefully this will be found to be the case in a broader sample with future research.

COMPARISON OF APPROACHES AND PROPOSED FUTURE RESEARCH TO TEST THE CONCEPT

Comparing test scores from one semester when I did not use the sports examples, vs. when I did, scores went from 23.51 to an average of 24.54. The small sample size indicates improvement in the sections I teach the results indicate statistical significance. An improvement but perhaps a better indicator is comments from my colleagues that teach in the Core program. Over the last several semesters both the Finance and Marketing faculty have expressed an improvement in the quality of the applications in supply chain sections of the Core projects. While this is very qualitative, it does show that my colleagues recognize that students are gaining a deeper understanding of the concepts of supply chains and the application of the concepts.

This paper reports on the experiences at one school with one faculty member. The approach is presented as a concept that requires extensive testing in a broader setting during future research. The concept could be tested over two semesters with a set of 5-6 faculties from several schools participating. The approaches mentioned could be used in one semester and not in the second semester. The experiences across several schools and faculty would allow for a

better understanding of the value, or lack thereof of this approach.

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BIOGRAPHY

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**A CONCEPTUAL AND QUALITATIVE STUDY OF OUTSOURCING CRITERIA AND THE
ROLE OF EMOTIONS IN DECISION-MAKING:
THE CASE OF EQUINE SPORTS TRANSPORTATION OUTSOURCING**

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ABSTRACT

For years, transportation outsourcing was considered a formal transaction-cost economics decision with little or no consideration for additional factors. This limiting perspective provides the stimulus for the current qualitative study, which examines additional factors affecting the transportation decision. For this article, the equine industry is studied in order to gain a better understanding of additional factors that go into decision-making. In-depth interviews with horse owners and trainers in the equine industry revealed that, in addition to a detailed cognitive assessment of transporter capabilities, the outsourcing decision involves a considerable emotional component. These findings could be noteworthy for a number of industries, such as household goods, museums, fine art (paintings, statues, sculptures), antique furniture (including pianos), collectibles of all kinds, and other high involvement luxury items.

INTRODUCTION

This article examines the role of emotion in transportation outsourcing decisions. Previous research on supply chain outsourcing decisions, especially in the B2B realm, has focused on cognitive, quantitative factors. The equine industry is the setting for this research into non-quantitative factors in the transportation outsourcing decision.

The equine industry is quite large and an important industry in its own right. The American Horse Council (AHC) states that the economic impact of the equine industry surpasses 102 billion dollars. A report ordered by AHC and conducted by Deloitte Consulting LLP provides more specific numbers to further illustrate the importance of the industry in Table 1.

As might be expected, there are no academic studies examining supply chain relationships among participants in the horse industry and the potential impact of these relations on industry dynamics. The current manuscript suggests that one of the reasons for the lack of research related to this industry can be attributed to its high level of complexity. In such a context, introducing the idea of an equine supply

chain becomes a necessity in order to streamline the investigative process and provide a background for the study into non-cognitive elements of transportation outsourcing decisions. Consequently, defining this particular type of supply chain becomes the first research objective.

The natural transition from investigating a particular industry toward a broader conceptualization within the supply chain research domain provides for the development of the second area of interest, namely, identifying relationships involved among the various participants. More specifically, investigating factors affecting the equine transportation outsourcing decision, both cognitive and emotional, will lead to insights into more generalizable conclusions. Next, a conceptualization of the outsourcing decision will be offered supported by insights from industry participants in an in-depth interviews context. Finally, applicative and academic value of the paper is discussed and limitations of the research are acknowledged.

TABLE 1
THE EQUINE INDUSTRY IN NUMBERS*

<ul style="list-style-type: none"> • There are 9.2 million horses in the United States.
<ul style="list-style-type: none"> • 4.6 million Americans are involved in the industry as horse owners, service providers, employees and volunteers. Tens of millions more participate as spectators.
<ul style="list-style-type: none"> • 2 million people own horses.
<ul style="list-style-type: none"> • The horse industry has a direct economic effect on the U.S. of \$39 billion annually.
<ul style="list-style-type: none"> • The industry has a \$102 billion impact on the U.S. economy when the multiplier effect of spending by industry suppliers and employees is taken into account. Including off-site spending of spectators would result in an even higher figure.
<ul style="list-style-type: none"> • The industry directly provides 460,000 full-time equivalent (FTE) jobs.
<ul style="list-style-type: none"> • Spending by suppliers and employees generates additional jobs for a total employment impact of 1.4 million FTE jobs.
<ul style="list-style-type: none"> • The horse industry pays \$1.9 billion in taxes to all levels of government.
<ul style="list-style-type: none"> • Approximately 34% of horse owners have a household income of less than \$50,000 and 28% have an annual income of over \$100,000. 46% of horse owners have an income of between \$25,000 to \$75,000.
<ul style="list-style-type: none"> • Over 70% of horse owners live in communities of 50,000 or less.
<ul style="list-style-type: none"> • There are horses in every state. Forty-five states have at least 20,000 horses each.*

* Source: Deloitte Consulting LLP Report, 2005

EQUINE SUPPLY CHAIN OVERVIEW

A supply chain can be defined as “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from a source to a customer.” (Mentzer, et al., 2001). Furthermore, this definition differentiates among diverse types of supply chains along degrees of complexity, leading to “direct, extended, and ultimate supply chains.” A direct supply chain, for example, consists of a focal company, its supplier, and immediate customer (Mentzer, et al., 2001). The extended one adds one more tier of intermediaries on the supplier and/or customer side. Along “the (same) upstream and/or downstream flows of products, services, finances, and/or information,” these authors go on to include in the ultimate supply chain all the organizations involved from “the ultimate supplier to the ultimate customer.” Given this definition, it is worth mentioning three important points applicable to the current study:

1). Supply chains involve not only organizations but individuals as well. This point is particularly relevant in the equine industry since, naturally, the personal component is much more pronounced when horse-breeding is discussed. Table 2 illustrates how the equine supply chain can be categorized as “ultimate” as well.

2). The “products or services flow” within the supply chain must be adapted to include the specific nature of the horse itself. Horses are surprisingly fragile and susceptible to a variety of serious illnesses. As a result, participants in the equine industry are subject to state and federal regulations regarding the health and safety of horses, including vaccination requirements and provision of evidence that horses participating in competitive sports are not suffering from illness.

TABLE 2
MAJOR PARTICIPANTS IN THE EQUINE INDUSTRY*

Equine Supply Chain Categories	Activities and Participants
1. Professionals/para-professionals	Veterinary, dental technicians, research centers, farriers, and saddlers
2. Land-based business	Livery and dealing yards, racecourses, maintenance
3. The Trade	Transportation, horse feed, breeding, riders, retail (clothing, food, etc.)
4. Event organizations	Media, sponsors, public relations (PR), permanent show grounds
5. Financial services	Specialist equine insurance
6. Workforce training and education	On the job training, formal qualification
7. Associations	Breed association, training association, lobbying association, charities
8. Outsourcing	3PLs (Third party logistics service providers)

*Adapted from: *The Equine Industry: The British Study, 2004*

3). The conventional meaning of “customer” in the supply chain must be further explained. Since the sports nature of horse-breeding is outside the scope of the current research in terms of spectators, leisure activists, etc., the general definition of the customer in the equine supply chain must include the horse itself.

The above-mentioned specificities related to the equine industry provide for the following definition: The equine supply chain is a type of “ultimate supply chain that encompasses suppliers, owners/managers, and associated infrastructure and professional service with the ultimate task of ensuring the horses’ well-being.”

TRANSPORTATION OUTSOURCING IN THE EQUINE INDUSTRY

Since transportation is often considered “the single largest element of logistics costs,” (Bowersox, et al., 2010), the current research will focus on that aspect of the equine supply chain to better understand the dynamics involved. Many equine businesses are outsourcing transportation and logistics activities to third-party providers in attempts to build both capacity and manage costs (Thompson, 2013).

Formal requirements and conditions for the horse and for the equipment of the transporter must be met. For example, horses shipping to Canada are required to carry federal health papers. Any horse crossing state lines also must carry health papers issued within the past 30 days by a licensed veterinarian. Additionally, best practices for shipping horses follow well established equine management practices. For example, horses need free access to quality hay and regular stops for water to avoid potentially life-threatening colic episodes. Additionally, horses expend significant energy maintaining their balance while in transport and scheduled rest periods are critical to their well-being. Horses are generally unloaded every 18 hours to allow them to rest in a stall for an extended period. Even shorter trips require the carrier to stop to allow the horses to rest every eight hours. When using an external transporter, the professionals involved in the equine industry face another challenging task: the design of an optimal contract that includes the well-being of the horse and recognizes the emotional attachment owners and others feel toward the animal. Granted that capacity restrictions of the transporter, equipment shortcomings, lack of experience, and adequate network coverage may affect the choice of a partner company along cognitive evaluation criteria, the

experiential component in the decision-making process must be accounted for as well (De Boer, et al., 2006).

THE ROLE OF EMOTION

Examining outsourcing decision-making, De Boer, et al. (2006) focus on organizational behavior drivers combined with cognitive models. Mello et al. (2008) go a step further by including "... personal factors, such as experience and self-interest, and cultural factors, such as organizational values and norms, as inputs to the process." Still, these authors acknowledge that the personal factors depicted in their research have a rational background often linked, although indirectly, with outsourcing related measurable outcomes. The three general categories used to illustrate "personal", i.e., motivation, confidence-building, and disposition toward outsourcing, were linked to firm-related outcomes such as job security, ease of doing business, saving money, and abdicating responsibility for an existing problem (Mello, et al., 2008). What is missing is reaching beyond the rational personal motivation to consider "irrational biases," like emotions, that play an additional role in the decision-making process (Gaudine and Thorne, 2001).

Research over the past two decades suggests that emotions significantly impact decision-making in all interpersonal contexts (e.g., Bagozzi, Dholakia, and Basuroy, 2003; Rajasekhar and Vijayasree, 2012). In the marketing literature, for example, it is widely accepted that emotions play a key role in consumer decisions (Laros and Streenkamp, 2005). Research in business to business (B2B) contexts, however, has generally placed little emphasis on the impact of emotions on buyer-seller relationships (Zehetner, 2012). An exception to this emphasis on rational-utilitarian decision-making is in research examining family businesses. Conceptual and empirical research in family firms has found that emotion plays a key role in family business decision-making (Bee and Neubaum, 2014; Bjornberg and Nicholson, 2012; Morris, Allen, Karatko, and Brannon, 2012). Movement away from strictly rational-utilitarian approaches to the study of B2B decisions is also found in personal selling research, where scholars

have found sellers to be impacted by call anxiety (Belschak, Verbeke, and Bagozzi, 2006), shame and embarrassment (Verbeke and Bagozzi, 2002), and mood states (George, 1998). Despite this recognition of emotional factors in buyer-seller relationships, few studies have specifically examined the role of buyer emotions in B2B decisions.

A small number of studies, examining emotions in B2B marketing, have included a buyer-side perspective. Both Hook, Chatham, and Wilding (2002) and Wilding (1999) emphasize that emotions and "soft skills" are significant factors in purchasing decisions. A qualitative study by Zehetner (2012) found that many emotions impact professional buying decisions. This research found a broad range of both positive emotions (e.g., excitement, joy, fun) and negative emotions (e.g., anger, annoyance, tension) impacting various aspects of buyer decision-making. In a study specifically examining outsourcing decisions in the hotel industry, Donada and Nogatchewsky (2009) report that both positive emotions and economic factors (e.g., switching cost) affect outsourcing decisions. These studies, although limited in both number and context, suggest that including emotional factors can complement existing models of purchasing and outsourcing that generally focus on only rational-utilitarian aspects of decision-making.

The current research acknowledges that including the feelings of practitioners as human beings when operational decisions, including outsourcing, are discussed, can be a challenging task. In fact, traditional models of logistics and supply chain management decision-making processes try to control for such externalities when optimal solutions are considered. At the same time, Valentine and Hollingworth (2012) warn that not including personal emotions may result in a loss of formal validity in presenting a final solution to a business problem. Although these authors' findings relate specifically to approaching ethical dilemmas in operations management research, the same reasoning can be applied to supply chain management and logistics studies, including the case of transportation outsourcing. With the notable exception of Gaski and Ray (2004), who consider

alienation among participants in the distribution channel, there is no existing research that specifically accounts for human emotions, including personal attachment and love toward the “product,” in the supply chain. The current study addresses this gap by introducing such psychological-level factors as important considerations when tactical and strategic operational decisions are discussed. Moreover, it responds to a long-forgotten call for considering social-sciences, including individual psychology-based research, in the quest to more fully understand the dynamics involved in logistics (Stock, 1996).

While the tangible aspects of the outsourcing decision are well-developed, the emotional aspects lack similar attention. A key contribution of this study is to consider potential emotive factors impacting supply chain B2B decisions. For this reason, following an industry with a deeper level of personal involvement on both managerial and owner levels is selected as a research background. It is hoped that study will serve as a stimulus for future research examining the role of emotions in other supply chain contexts.

METHODOLOGY

Qualitative research methodology was used to develop an assessment tool or a frame of reference to help evaluate transportation outsourcing decisions in the equine industry. Specific factors involved, including the role of emotions in outsourcing decisions, were detailed. As previously discussed, little written material was identified covering emotions in supply chain management in general and logistics in particular. In this context, the exploratory form of investigation is deemed most appropriate (Yin, 2003). Davis-Sramek and Fugate (2007) concur:

”Qualitative research attempts to develop a body of knowledge about a particular research interest and differs from quantitative (where one might use frequency tables) in that it seeks to capture the individual’s point of view and secure rich descriptions.”

Following, when intangible factors affecting logistics decision-making, such as emotions, are discussed, it becomes paramount to focus the research on individual respondents’ perceptions rather than on generalizability of findings.

Personal, semi-structured interviews with owners and trainers involved in the equine industry served as the primary method to gain a better understanding regarding the role of emotions in transportation outsourcing decisions. The use of depth interviews is not new to the field of logistics inquiry and, in fact, has become a normative qualitative research tool in “. . . clarifying practitioner views on (outsourcing) and its antecedents or drivers” (Golicic and Mentzer, 2005).

The participants in the research were selected by applying a purposive sampling in selecting cases of interest (Davis and Mentzer, 2006). Due to the specific nature of the equine industry within the broader context of supply chain operations, efforts were made to select participants on at least two levels in each venue: 1) Horse owners with the personal involvement and knowledge of the key role of transportation in their business, and 2) Trainers (managers or operations executives) responsible for day-to-day equine program development and implementation, including horse transportation. After identifying the main criteria for inclusion, a list of potential candidates was developed. A referral system was applied (Davis and Mentzer, 2006), where three experts from the equine industry helped to identify venues with extensive horse show, horse breeding, and racing involvement. The sampling process was constrained by limitations regarding geography and time; only venues within a day’s driving distance from the researchers’ location were included. Such convenience sampling is acceptable with a qualitative case study approach (Pagell, 2004).

Nine horse owners, four of whom were also trainers, were identified as meeting the established criteria. Table 3 provides some characteristics of participants in the research.

TABLE 3
CHARACTERISTICS OF THE PARTICIPANTS/INTERVIEWEES

Participant	Participant's Title	Job Characteristics & Years of Experience
Number 1	Owner and Trainer	Horse Shows, 35 years
Number 2	Owner	Horse Shows, 5 years
Number 3	Owner	Horse Shows, 20 years
Number 4	Owner and Trainer	Horse Shows, Breeding, 48 years
Number 5	Owner and Trainer	Horse Shows, 43 years
Number 6	Owner	Horse Shows, Transportation, 20 years
Number 7	Owner	Horse Shows, Racing, Breeding, 21 years
Number 8	Owner and Trainer	Horse Shows, 10 years
Number 9	Owner	Horse Shows, 6 years

The current research combines information gathered from practitioners with existing research in order to fully understand the topics of interest (Yin, 2003). According to Yin (2003), such dual sourcing allows for a more precise formulation of "... what is known on the topic ... (and) to develop sharper and more insightful questions about the topic." Developing a perceptual instrument, which helps to assess the outsourcing decision, became an iterative process moving back and forth between the two sources of information. The Interview Guide contains the questions used to register the potential similarities and differences among the respondents to better capture the nuances of the phenomenon under investigation (Appendix 1). The interviews were audiotaped and impressions and notes from the visits were shared with the other researchers. The audiotapes were professionally transcribed and verbatim scripts provided to the research team. Data were qualitatively analyzed by the three individual researchers to ensure increased trustworthiness of findings. The topics emerging from the interviews were then compared and detailed among the researchers to avoid any

potential individual bias, which can be present in qualitative research setting (Davis-Sramek and Fugate, 2007).

In the next section, the motives and behaviors of the participants in the research are discussed to help extend our understanding regarding the relationship between personal feelings and emotions and transportation outsourcing program development and implementation.

FINDINGS

Findings from interviews of participants in the equine industry revealed three themes related to transportation outsourcing decisions. First, rational-utilitarian motives play a role in the decision-making process. Horse owners and trainers recognize that cost, convenience, and the functional capabilities of transporters are critical factors in determining the best approach to moving horses. According to Interviewee No. 1:

“[...] transporters are expensive, and they’re not always consistent in their care. And they’re not always consistent in their routes. So to get somebody to come transport on a specific date costs four to five times what it costs me to do it myself.”

Why do many owners and trainers outsource horse transportation? For Interviewee No. 8, the answer is simple: “It actually ends up being cheaper.” Another Interviewee (No. 6) indicated that “cost and convenience” are key factors to be considered when making transportation outsourcing decisions. Interviewee No. 4 also identified cost as a key factor, but added that functional capabilities of transporters are also important. “There are too many ... haulers that don’t know a lot about horses,” the interviewee stated. Interviewee No. 7 summed up the views of all nine interviewees in explaining that relationships with transporters and “love of horses” are important considerations, but “we are not millionaires.”

A second theme emerging from interview responses concerned the trustworthiness of those charged with horse transportation and the need for relationships with those transporters. Both Interviewee No. 6 and Interviewee No. 9 emphasized the need to establish a “relationship” with a transporter prior to outsourcing horses for transport. Similarly, Interviewee No. 5 indicated that horses must be transported by a “very trustworthy person.” This interviewee added that transportation outsourcing only happens when the transporter is “a friend.” Interviewee No. 4 indicated that length of the relationship with a transporter is important and “there are only two haulers that I would recommend that I trust that we’ve had throughout the years.” Continuing this theme of trustworthiness and relationship, Interviewee No. 7 declared that “there are people that I would not put a horse on a truck with.” While these factors may be considered emotional aspects of decision making, the emotional aspects here seem to be focused on the people involved in the transportation function (and potential outsourcing of that function). With the third identified theme, discussed below, the emotional focus is on the horses being transported.

A third theme emerging from the interviews suggests that horse owners and trainers often have a strong emotional attachment to their horses and that emotions play a significant role in transportation outsourcing decisions. Eight of the nine interviewees indicated that transportation decisions involve emotional aspects. In two interviews (Interviewee No. 6 and Interviewee No. 9), horses were referred to as “my babies.” Similarly, Interviewee No. 5 described the following relationship with horses:

“My horses are my kids. All my kids have four legs. They are my horses. I have a very big emotional attachment with my horses. They are family to me.”

The interviewee added that in any transportation outsourcing decision, “The wellbeing of the animal is the primary concern and money is secondary.” Interviewee No. 7, criticizing the lack of emotional involvement with some people involved in horse transport, declared that “people can be money minded.” Interviewee No. 2 stated that “we have a very emotional tie” with our horses and “[horse] safety is always top of the list” among factors to consider when making transportation decisions. Echoing the emotional concerns of many interviewees, Interviewee No. 3 said, “We are very attached to our horses and we like to know exactly what’s happening.”

As indicated by these interviews, transportation outsourcing decisions in the equine industry are affected by economic, relational, and emotional factors. As one would expect from any business operation, rational-utilitarian economic factors (particularly costs) and relationships among supply chain participants are important. For this industry, however, emotions focused on the special or unique value of horses also appear to play a key role in outsourcing decisions. Given that all the interviewees indicated that love of horses and a passion for involvement with horses were the primary reasons for their involvement in the industry, this finding is certainly not unexpected.

IMPLICATIONS, LIMITATIONS, AND CONCLUSIONS

Supply chain management and logistics are challenges in all industries and organizations. The prevailing approach to resolving supply chain issues has always been narrowly focused on resource accumulation and allocation within organizations. Moliterno and Wiersema (2007) claim that an organization's capability to modify its resource base, including decisions on selling off assets, is the basic mechanism to enhance competitiveness and performance. While the current research supports this notion, it goes a step further to include specific intangible considerations in an effort to further develop a supply chain model. This is consistent with broader research findings suggesting that business endeavors require much more than tangible resources and technological capabilities to be successfully completed. Pitsis, et al. (2003), for example, examining a sports project related to the 2000 Olympic Games in Sydney, found that projected feelings, personal concerns, and social construction issues had to be included to ensure project completion. Consideration of emotional factors in supply chain management finds its confirmation within the specific case of the equine industry. The current research reveals that equine transportation involves a unique set of decision criteria when compared to most cargo. Horses have delicate physical systems that make them susceptible to illness and injury during transport. The relatively high economic value of a horse suggests that precautions during transport are critical to preserve an owner's investment. But many owners have an attachment to their horses that transcends economics. In other words, many owners have an emotional bond with their horses. This emotional factor, along with economic and relational factors, impacts transportation outsourcing decisions.

The decision to outsource equine transportation certainly involves the more traditional factors of cost and capability. However, the current research suggests that emotional attachment also factors into the transportation of horses and other cargo. It seems likely that transport decisions for fine art

(paintings, statues, sculptures), antique furniture (including pianos), collectibles of all kinds, and other high involvement luxury items include an emotional component. Companies such as Fine Art Shippers, based in New York, focus their efforts on these types of products (not horses) and approach transportation services with significantly different emphases than transporters of standard (or more traditional) products. With greater insight into customers' decision processes, professional equine transporters and transporters of other high involvement-high value products will be better able to provide services valued by customers. In the specific case of horse transport, the most successful transporters are likely to be those able to ensure owners and trainers that well-being of horses, not cost, is the primary concern. Insight into the role of emotion in the decision-making process, while derived from the equestrian industry, may provide direction for examining additional outsourcing decisions with cargos that have substantial emotional value to the customer.

Overall, this study introduces the idea of emotion in outsourcing transportation using the equine industry as a case study. The emotional element, currently missing from the supply chain literature, is expected to be relevant for various decision-making contexts that include an emotional component. The findings underline the need for a more holistic perspective on transportation service offerings that goes beyond economic and technological readiness to include an understanding of customers' behavioral motives.

Following the information received from in-depth interviews, the current research can be defined as exploratory in nature. A quantitative empirical study is needed to test the proposed relationships among the various participants in the equine supply chain, their competencies, the processes involved, and the accompanying relationships. Focusing on one aspect of a firm's operations, i.e., transportation, limits the generalizability of the suggested framework. However, by focusing on one specific facet within the equine supply chain, the current research provides a starting point for both practitioners and academics to further consider the complexities and challenges involved in successfully managing the

industry's dynamic supply chain. Future research may lay the groundwork for better understanding not only of the equine industry per se, but to wider economic, cultural, and personal aspects of logistics and supply chain management.

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APPENDIX 1: INTERVIEW GUIDE*

I. Opening

1. Introductions of interviewer and interview participant
2. Overview of purpose of the study – overview of the equine industry as a business – using the outsourcing of transportation as a background
3. Assurance of anonymity
4. Permissions to audiotape

II. Demographic Data

1. Company background
2. Titles of interview participants

III. Discussion Topics

Related to your (Horse Racing) business:

1. How would you describe the equine industry as a business? What are some of the specific business transactions involved?
2. How would you describe your role in the equine industry? (Prompts: owner ; trainer; groom; barn manager; parent/friend; rider)
3. How would you describe your reasons to get involved in the equestrian industry?
4. How many different venues related to the horse industry do you visit per year? (How many miles per year do they travel?)
5. Do you outsource any of your horse-related business activities?
6. How was your horse(s) transported to these events? (Prompts: personal and/or professional carrier)
7. What was the basic reason this transportation method was selected? (Prompts: cost; equipment or lack thereof; value; safety ...)
8. Do you have a dedicated/preferred method for transportation?
9. How many people are involved in the decision to outsource or not in evaluating the different alternatives?
10. What resources are dedicated to transportation relative to other areas of the related business?
11. If someone else is transporting the horses, how would you describe the nature of your relationship? (Prompts: arms-length; contractual; relational; partnership)
12. Would you use a third party logistics service provider (commercial carrier) to transport your horse(s) in the future?
13. How would you describe how valuable the horse is to you?
14. Do you benchmark your business decisions against your competitors in the industry?
15. How would you describe the main factors affecting your decision making related to the horse industry?

*Adapted from Genchev et al. (2010)

BIOGRAPHIES

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Guidelines for Journal of Transportation Management Submission/Publication

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Book:

Coyle, John J., Bardi, Edward J., and Novack, Robert A. (2004), *Transportation*, 6th ed., Cincinnati, OH: South-Western College Publishing.

Website:

Wilson, J. W. (2003), "Adapting to the Threat of Global Terrorism: Reinventing Your Supply Chain," [On-line]. Available: <http://georgiasouthern.edu/coba/centers/lit/threat.doc>. Created: 11/01/02, Accessed: 11/12/03.

MANUSCRIPT SAMPLE**A FRAMEWORK FOR EVALUATING SUPPLY CHAIN PERFORMANCE**

Terrance L. Pohlen, University of North Texas

ABSTRACT

Managers require measures spanning multiple enterprises to increase supply chain competitiveness and to increase the value delivered to the end-customer. Despite the need for supply chain metrics, there is little evidence that any firms are successfully measuring and evaluating inter-firm performance. Existing measures continue to capture intrafirm performance and focus on traditional measures. The lack of a framework to simultaneously measure and translate inter-firm performance into value creation has largely contributed to this situation. This article presents a framework that overcomes these shortcomings by measuring performance across multiple firms and translating supply chain performance into shareholder value.

INTRODUCTION

The ability to measure supply chain performance remains an elusive goal for managers in most companies. Few have implemented supply chain management or have visibility of performance across multiple companies (Supply Chain Solutions, 1998; Keeler et al., 1999; Simatupang and Sridharan, 2002). Supply chain management itself lacks a widely accepted definition (Akkermans, 1999), and many managers substitute the term for logistics or supplier management (Lambert and Pohlen, 2001). As a result, performance measurement tends to be functionally or internally focused and does not capture supply chain performance (Gilmour, 1999; *Supply Chain Management*, 2001). At best, existing measures only capture how immediate upstream suppliers and downstream customers drive performance within a single firm.

Table 1 about here

Developing and Costing Performance Measures

ABC is a technique for assigning the direct and indirect resources of a firm to the activities consuming the resources and subsequently tracing the cost of performing these activities to the products, customers, or supply chains consuming the activities (La Londe and Pohlen, 1996). An activity-based approach increases costing accuracy by using multiple drivers to assign costs whereas traditional cost accounting frequently relies on a very limited number of allocation bases.

$$y = a^2 - 2ax + x^2$$

REFERENCES

Manrodt, Karl (2003), "Drivers of Logistics Excellence: Implications for Carriers," In I. W. Wilson (Ed.), *Logistics and Transportation Yearbook 2003* (pp. 126-154) Englewood Cliffs, NJ: Prentice-Hall, Inc.

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