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Shannon, J.[1] and McConnell, T.[2]
[1]Forestry Specialist, Mississippi State University Extension Service, Verona, Mississippi, 38879
[2]Associate Professor, Mississippi State University, Mississippi State, Mississippi, 39762

Mississippi Log Trucking Business Owner Assessments of Industry Challenges

Abstract

Log trucking challenges affect all owners of standing timber. A survey of Mississippi log trucking businesses assessed challenges, including driver recruitment and profitability. Eighty-four percent of respondents said hiring qualified drivers in 2021 was harder than in 2019. Driver shortages were emphasized over lacking pay and benefits. Seventy-three percent of respondents stated profits were worse in 2021 than in 2019. Direct costs were emphasized over litigation, policy, or operational management concerns. Mississippi log trucking business owners largely agreed, regardless of comparison group, on worsening labor markets, profit margins, and their contributing factors, providing increased insight into prominent timber transportation challenges.

Keywords: Failed drug tests; Insurance premiums; Log trucking profitability; Timber transportation; Truck driver shortages

Introduction

Forestry is vital to the economy in the state of Mississippi, where it had a 2023 mill delivered value of more than $1.4 billion (Mississippi State University Division of Agriculture Forestry and Veterinary Medicine 2024), which consisted of landowner stumpage value ($651 million) and the cost of timber harvest and transportation ($750

million) (Auel 2024). Trucking is the largest single cost center in the harvesting and transportation of raw wood products from logging sites to processing mills (McConnell 2020). This sector can account for more than 40% of the total price paid for delivered timber (Grebner et al. 2005).

Timber transportation differs from other trucking sectors as log trucking firms generally own fewer trucks (Conrad 2023; Derochers et al. 2025), have older fleets (Abbas and Clatterbuck 2015), operate in adverse in-woods conditions, and travel on rural roads away from interstates (Baker and Tyson 2017). Derochers et al. (2025) found that log trucking operations with smaller fleets also incurred higher per-mile costs for fuel and insurance premiums than firms in other trucking industries. Log trucks also differed from trucks used by firms in other industries in terms of fuel efficiency, cargo characteristics, equipment, and operating conditions (Derochers et al. 2025).

In the U.S. South, raw material is transported in tree-length form using five-axle truck and trailer combinations connected by a fifth-wheel hitch (Greene et al. 2007). There are two broad categories of log trucking firms: those involved in both harvesting and transporting timber, and independent contract trucking companies that do not harvest timber. Firms that own both harvesting and hauling equipment can be differentiated by whether they operate logging and trucking as a single unit or split them into separate businesses. The creation of a separate trucking business is a risk management strategy to shelter assets from potential truck accident claims and lawsuits (Shaffer and Stuart 2005). Contract trucking businesses focus entirely on hauling and are not involved in logging operations, including cutting, skidding, and loading.

The need to transport wood products safely, efficiently, and profitably is essential to ensure the sustainability and competitiveness of the forest sector in Mississippi and across the United States. Increasing input costs (trucks, tires, fuel, labor, etc.) have persistently challenged the log trucking industry for over two decades (Conrad 2018), yet the margin that covers cost, risk, and profit in Mississippi has remained stable for wood suppliers (McConnell et al. 2021). Landowner income is ultimately affected

because stumpage is the residual after subtracting harvesting and transportation costs from the delivered price paid by wood-consuming mills (Klepacka et al. 2017).

Maintaining the longevity and health of the forestry industry is crucial for rural communities' economies (Altizer 2008). Recent southeastern United States log trucking industry research has documented challenges, including aging ownership (He et al. 2021), difficulty recruiting truck drivers (Blinn and Nolle 2023; Bowman et al. 2023; Conrad et al. 2024; Knight et al. 2023), and disproportionate increases in liability insurance premiums (Clark 2021; Conrad 2017, 2018, 2023). Profitability for log trucking businesses has been strained by rising costs of fuel, equipment, insurance, and labor, leading some to go out of business (Blinn 2022; Turoski et al. 2023; Conrad et al. 2024).

Competition for qualified drivers can worsen due to many log trucking firms' inability to match the pay and benefits offered by other trucking sectors (Turoski et al., 2023). Insurance companies also often require potential drivers to be 25 years old and have at least two to three years of experience, which further constrains the pool of hirable drivers (Conrad 2018). This is exacerbated by a driver shortage across all trucking industries, reported to be over 60,000 truck drivers in 2023, and is expected to worsen partly from current drivers reaching retirement age, lack of successful recruitment of female drivers, failed drug tests, driver age constraints, and plentiful employment options (Fisher 2022).

While recent log trucking research has addressed challenges in several regions of the United States, none has explicitly focused on the issues affecting hundreds of small businesses identified by industry advocates in Mississippi, such as profitability trends, driver hiring and retention, and factors impacting business performance. Therefore, this study utilized a statewide mixed-mode survey concerning the current operating environment to explore Likert item data from log trucking business owners in Mississippi. One objective was to learn how the industry has been affected by truck driver availability and operational constraints that together impact profitability over time.

A second was to determine how responses regarding these challenges differed by various aggregated groupings of log trucking business owners.

Methods

Survey Data

Mississippi log trucking firms were surveyed in late 2022 and early 2023 using a 41 question survey reviewed and pretested by Mississippi log trucking companies, industry trade association representatives, forest operations researchers, and insurance industry professionals. The Mississippi State University Human Research Protection Program and Institutional Review ruled the study qualified for an Exemption Determination (the survey may be referenced using number IRB-22-200). Closed-ended and short-answer questions documented the company's fleet size, category costs, haul distance, and industry trends to provide a description of the Mississippi log trucking industry and to perform various group comparisons. Likert item questions were used to assess log trucking business owner perceptions regarding organizational profitability and the ability to hire truck drivers.

The mixed-mode survey, based on the Tailored Design Method, used separate survey phases to increase participation through adequate project introduction, several reminders, and multiple response opportunities (Dillman et al. 2014). A population of 1,051 firms was identified from the Mississippi Professional Logging Manager database. Mississippi Loggers Association (MLA) district meetings and a forest products manufacturer’s producer meeting in October and November 2022 constituted the first-response phase. The second survey phase, occurring in November and December 2022, involved emailing a Qualtrics online survey link to 491 businesses unable to attend an in-person meeting (Qualtrics 2022). The last survey phase reached companies unable to participate in an MLA meeting without email addresses listed in the database. A series of postcards with a quick response (QR) code was mailed to 514

log trucking firms during January and February 2023. Scanning the code allowed the survey to be completed using smartphones or other devices. Wave analysis of the separate survey phases, as described by Armstrong and Overton (1977), was conducted to assess nonresponse bias using the Kruskal-Wallis test at alpha = 0.05 in SAS 9.4.

Likert item data provided variables to explore business owner viewpoints regarding challenges impacting profitability and the ability to hire qualified truck drivers (Table 1). Statistical group comparisons were based on the use of safety technology and safety equipment (count of safety equipment and technology utilized on trucks), owner experience (years hauling and owner age), operation size (number of trucks), exposure to accidents (truck mileage per year and one-way haul distance), production level (loads per week), insurance premium, and traffic law violations (over-weight, out of service, and safety related citations).

Table 1.Variables used during statistical group comparisons. Survey questions 35, 36, 37, and 38 were dependent variables. Data were collected using a mixed-mode survey conducted during 2022-2023.

Dependent Variable	Description	Original Units
Q35PROFITS19V21	Profit comparison 2019-2021	Likert item
Q36HIRING19V21	Driver hiring comparison 2019-2021	Likert item
Q37DRIVERS	Importance of available drivers on hiring	Likert item
Q37PAY	Importance of lack of competitive pay on hiring	Likert item
Q37BENEFITS	Importance of lack of employee benefits on hiring	Likert item
Q37DRUGTEST	Importance of failed drug tests on hiring	Likert item

Q38DRIVERS	Importance of failed drug tests on hiring	Likert item
Q38FUEL	Importance of fuel prices on profitability	Likert item
Q38TRUCKRATES	Importance of truck rates on profitability	Likert item
Q38WOODSTURN	Importance of in-woods turnaround on profitability	Likert item
Q38DRIVERPAY	Importance of increasing driver pay on profitability	Likert item
Q38LAWSUITS	Importance of accident lawsuits on profitability	Likert item

Independent Variable	Description	Original Units
SAFETYTECHPRACTS	Safety technology and practices (total used)	Count
Q4YEARSHAULING	Years in business	Years
Q6TRUCKS	Number of trucks per firm	Total trucks
Q13OWNERAGE	Owner's age	Years
Q22MILES	Average total distance traveled	Miles/year/truck
Q23HAULDIST	Average one-way logging site to mill distance	Miles
Q24LOADS	Average weekly production	Loads/week
Q30PREMIUM	Inflation-adjusted average insurance premium 2019-2021	Dollars/truck

Q33ASAFETYVIO	Number of safety violations	2021 citations
Q3BSERVVIO	Number of out-of-service violations	2021 citations
Q33CWEIGHTVIO	Number of overweight violations	2021 citations

Data Preparation

Hot deck imputation was used to replace missing data and clear examples of nonresponse error. The SURVEYIMPUTE procedure with the simple random samples with replacement (SWSWR) option within SAS 9.4 was used (SAS Institute 2020). A separate data set of 85 observations was formed to analyze the impacts of law violations due to 13 instances of missing safety, weight, and out-of-service violation responses. Imputation was not performed on these data because it was unclear whether the nonresponse indicated no violation was committed or was left blank for other reasons. Independent variables listed in Table 2, except safety and out-of-service violations, were stratified into quintiles using the 20^{th}, 40^{th}, 60^{th}, and 80^{th} percentile locations as cutoff points for group comparison analyses. Safety and out-of-service violations were divided into two groups, separating those with and without citations. A safety score was calculated for comparison and grouping by summing the number of positive selections from a list of 18 examples of safety equipment and safety practices for each survey respondent.

Table 2. Independent variable groups formed using the 0.20, 0.40, 0.60, and 0.80 percentile locations as cutoff points. Safety and out-of-service violation variables were divided into two groups: those with and without citations. Data were collected using a mixed-mode survey conducted during 2022-2023.

	Percentile groups					
Variable	20	40	60	80	100	Unit
SAFETYTECHPRACTS	1-5	6	7	8-9	10-16	Safety Score[1]
Q4YEARSHAULING	1-5	6-15	16-25	26-32	33-60	Years in business
Q6TRUCKS	1-2	3	4	5-6	7-17	Total trucks
Q13OWNERAGE	27-41	42-49	50-55	56-62	63-81	Age (years)
Q22MILES	30-50	51-65	66-76	77-90	91-175	Miles (thousands)
Q23HAULDIST	30-45	46-50	51-60	61-65	66-100	Miles
Q24LOADS	10-28	29-40	41-57	58-81	82-200	Loads/week
Q29PREMIUM	4-8	9-11	12-13	14-18	19-24	Dollars (thousands)
Q33CWEIGHTVIO	0	1	2-3	4-5	6-20	2021 citations

Likert Item Analyses

Learning about clientele, whether loggers and truckers, forest landowners, or mill managers, often leads Extension and agricultural education researchers to use individual Likert items and aggregated Likert scales in surveys (Clason and Dormody 1994). Likert (1932) introduced the concept of quantifying the level of agreement to a question using five response choices that included strongly approve (1), approve (2), undecided (3), disapprove (4), and strongly disapprove (5). Likert items are individual questions that stand alone (Boone and Boone 2012). Likert item data are discrete, ordinal, and often not normally distributed, making parametric statistics inappropriate due to possible increases in type I error (Mangiafico 2016, 2019). Suitable Likert item data analysis methods, when normality assumptions are not met, include descriptive statistics with medians or modes for central tendency, frequencies for variability, and nonparametric procedures to locate group differences (Boone and Boone 2012; Mangiafico 2019).

Visual inspection and Shapiro-Wilk tests (p-values < 0.0001) verified nonnormality in all Likert item data from the log trucking business owner survey. Data transformations to address nonnormality involved raising the dependent variables to powers ranging from -3 to 3, with the power zero representing the natural logarithm; the base 10 logarithm was also tried. Shapiro-Wilk tests (p-values < 0.01) indicated that nonnormality improved but remained after applying the transformation methods.

The non-parametric Dwass, Steel, Critchlow-Fligner (DSCF) test was used to determine if attitudinal differences among log trucking business groups were present. This multiple pair-wise comparison method, formulated by Dwass (1960), Steel (1960), and Critchlow and Fligner (1991), conservatively locates group differences while including familywise error corrections to equate the probability of type I error to the chosen alpha level (Hollander 2014). The DSCF multiple comparisons procedure has been used in forestry research to study water quality best management practices (Dangle et al. 2019; Hawks et al. 2021), tree diseases (Audley et al. 2016), and wildlife habitat (Lehman et al.

2014). The DSCF test was performed using the NPAR1WAY procedure with the DSCF option (SAS Institute 2021).

Results

Survey response rate

Likert item and group analyses were carried out for n = 98 firms that completed at least 75% of the questionnaire for a usable response rate of 9.3% (98/1,051). Differences involving law enforcement citation groupings were explored using 85 observations (8.1%) due to 13 instances of missing safety, weight, and out-of-service violation responses. The response percentages from each survey mode included logger meetings (59%), email survey (33%), and QR code survey (8%). Wave analysis, as described in Armstrong and Overton (1977), screened for non-response bias through survey phase comparison. Findings did not provide evidence that nonresponse bias affected the validity of this study.

Mississippi Log Trucking Firm Characteristics

Survey participants owned 452 trucks, hauled on average 57 loads per week, employed three full-time drivers, and had a mean fleet size of approximately four trucks (Shannon et al. 2025). Most of the firms hauled roundwood only (92%), followed by firms that hauled a combination of roundwood and chips (8%), and only chips (1%). The typical log trucking business owner was 52 years old (mean) with over 20 years of experience. Participating company trucks traveled an average of 68,947 miles per year with a one-way haul distance of 57 miles, hauled timber for 46 weeks, and delivered three loads per truck daily. The business structure of Mississippi log trucking firms included single companies with logging and trucking combined (70%), companies with logging and trucking organized in separate units (18%), contract trucking firms (7%), and other forms of operational structure (5%), not provided as choices in the survey. Sixty-six percent of logging and trucking firms used independent contract hauling companies to deliver, on average, 25% of the total timber production. Log trucking companies had a

mean safety score of seven, calculated by summing the number of positive selections from a list of 18 examples of safety equipment and safety practices. The maximum safety score was 16, and the minimum was one. A comprehensive description of the Mississippi log trucking business owners that participated in the mixed-mode survey in late 2022 and early 2023 is provided by Shannon et al. (2025).

Hiring Truck Drivers

Seventy-one percent of participating Mississippi log trucking companies agreed that hiring truck drivers in 2021 was more difficult compared to 2019. Thirteen percent stated that it was slightly more difficult, while 15% said there was no change in 2021. No respondents noted that it was easier to hire drivers in 2021. Lack of qualified drivers (64%) and failed drug tests (54%), which further limit candidates, were rated as having the highest importance related to hiring qualified drivers (Table 3). Only four percent of respondents stated that qualified driver availability was of little or no importance. Factors where businesses perceive a measure of control, including lack of competitive pay (36%) and employee benefits (36%), had lower importance rankings. One categorical difference was identified through DSCF pairwise comparisons of employee benefits, with businesses classified by the number of overweight violations received. Respondents with one overweight violation disagreed with firms that received two to three citations concerning employee benefits as a barrier to hiring qualified drivers. While statistically significant, discussions with forest products industry professionals gave little clarity into the practical significance of this difference. This means that survey respondents' perceptions concerning driver availability almost wholly transcended any demographic grouping.

Table 3. Percentage of Mississippi log trucking business owner responses rating the impact of four variables on hiring qualified drivers from survey question 37. Data were collected using a mixed-mode survey conducted during 2022-2023. Summing may not equal to 100 due to rounding.

Variable	Not important (1)	Low importance (2)	Moderate (3)	Important (4)	Very Important (5)	Median
Lack of qualified drivers	2%	2%	7%	24%	64%	5.00
Failed drug tests	7%	4%	13%	21%	54%	5.00
Uncompetitive pay	4%	4%	29%	28%	36%	4.00
Lack of employee benefits	9%	9%	26%	24%	32%	4.00

5-point Likert items

Business Profitability

Seventy-three percent of respondents stated that profits were worse or slightly worse in 2021 compared to 2019. Fourteen percent stated that profits were level. Twelve percent stated that profits slightly improved in 2021 compared to 2019. Fuel prices (84%) and insurance premiums (83%) had the highest ratings regarding their impact on business profits. Factors rated slightly less included lawsuits resulting from accidents (71%), trucking rates (71%), hiring qualified drivers (70%), and mill turnaround times (65%) (Table 4). There was less agreement on the importance of road weight limits (46%), one-way haul distance (46%), and in-woods turnaround times (45%). While agreement

may have been lower, these levels were relatively high, and no categorical differences were observed among Mississippi firms. The DSCF pairwise comparisons detected four categorical differences across two independent variables (Table 5). Respondents with no overweight violations placed more importance on in-woods turnaround times impacting business profitability than firms with one overweight violation. Log trucking business owners with a safety score of between one and five believed increasing pay to hire and retain truck drivers was less important to their firms' operating successfully than those possessing a safety score of up to nine. Discussions with forest products industry professionals gave little clarity into the practical significance of these differences. This means that survey respondents’ perceptions of factors that impede their businesses' profitability were largely similar across demographic groups.

Table 4. Percentage of Mississippi log trucking business owner responses rating the impact of ten variables on profitability from a five-point Likert item survey question. Data were collected using a mixed-mode survey conducted during 2022-2023. Summing may not equal to 100 due to rounding.

Variable	Not important (1)	Low importance (2)	Moderate (3)	Important (4)	Very Important (5)	Median
Fuel Prices	1%	0%	5%	10%	84%	5.00
Insurance premiums	0%	1%	4%	12%	83%	5.00
Accident lawsuits	5%	5%	4%	14%	71%	5.00
Trucking rates	3%	0%	7%	18%	71%	5.00
Hiring qualified drivers	2%	2%	3%	22%	70%	5.00
Mill turn times	4%	1%	12%	17%	65%	5.00
Road weight limits	7%	6%	16%	24%	46%	4.00
Increasing driver pay	3%	1%	12%	38%	46%	4.00
Haul Distance	4%	4%	24%	21%	46%	4.00
In woods turn times	9%	10%	10%	26%	45%	4.00

Table 5. Dwass, Steel, Critchlow, and Flinger significant pairwise comparisons involving the importance of increasing driver pay and in-woods turnaround times on business profits based on the number of overweight citations (Q33CWGHT) received in 2021 and on safety practices score (SAFETYTECHPRACTS). Data were collected using a mixed-mode survey conducted during 2022-2023.

Dependent variable	Independent Variable	Percentile Comparison	DSCF p-value
In woods turn times	Q33CWGHT	$40^{th} < 20^{th}$	0.029
Increasing driver pay	SAFETYTECHPRACTS	$20^{th} < 60^{th}$	0.013
Increasing driver pay	SAFETYTECHPRACTS	$20^{th} < 80^{th}$	0.042
Increasing driver pay	SAFETYTECHPRACTS	$20^{th} < 40^{th}$	0.042

Mississippi Log trucking business owner groups are listed in Table 2.

Discussion

Most Mississippi log trucking companies expressed increased difficulty hiring drivers in 2021 compared to 2019. Eighty-eight percent of respondents stated that the lack of qualified drivers was an important or very important challenge to hiring drivers. Logging businesses in other areas in the United States have also expressed this concern. In 2017, 44% of Georgia logging contractors reported that a lack of qualified drivers was their largest challenge, and 72% strongly agreed that it was easier to hire truck drivers five years before 2012 (Conrad 2018). In Maine, over 50% of log trucking companies reported that it was harder to hire qualified drivers in 2016 than five years earlier (Koirala et al. 2017).

Seventy-five percent of Mississippi log trucking companies reported failed drug tests as important or very important in hiring drivers. Federal law requires employees with a commercial driver's license (CDL) to be tested for marijuana and other drug use before hiring, after an accident, randomly during employment, and when there is suspicion of drug use (Short and Pupillo 2023). Fifty-five percent of positive drug tests in 2022 were related to marijuana use across all United States trucking sectors (FMCSA 2023). Marijuana has been legalized by medical prescription in Mississippi and for recreational use in other states. Still, operating a vehicle while under its influence is illegal (Short and Pupillo 2023). A Federal Motor Carrier Safety Administration (FMCSA) 2021 Drug and Alcohol Clearinghouse summary report stated that over 80,000 drivers had a prohibited driver status due to failed drug tests, further limiting the number of available drivers (Miller 2022).

Responses to the impact of uncompetitive pay and lack of employee benefits were more restrained, with important and very important ratings of 64% and 56%, respectively. Even though Mississippi log trucking firms placed greater emphasis on driver availability and drug testing, the log trucking industry faces competition for qualified drivers across the entire trucking industry and other industries (Conrad and Blinn 2024). U.S. Bureau of Labor Statistics (BLS) data from 2012 to 2021 revealed that the average pay of log truck drivers was 18% below other trucking sectors, indicating a competitive disadvantage for talent (Turoski et al. 2023).

A new generation of workers is needed for the timber industry, including in-woods logging workers and truck drivers. However, recruiting efforts often directly compete with other sectors possessing more favorable work environments, including education, healthcare, and manufacturing (Conrad and Blinn 2024). Career pathway initiatives emphasizing the economic and environmental benefits of forestry and skill development may attract younger workers, nontraditional demographic groups, including women, and individuals currently not in the workforce.

Rising costs have been the top challenge of logging businesses in Florida, Georgia, and Minnesota (Blinn and Nolle; Conrad et al. 2024). Cutshall et al. (2000) found that logging cost changes can be impacted by weather, operation management, wood supply systems, regulatory factors, production constraints, and inflation. Between 2020 and 2022, inflation in equipment, fuel, insurance, and labor likely outpaced productivity gains and static logging rates (Baker 2022). If nominal logging costs increase faster than the nominal costs of inputs, then real logging costs are increasing. It was somewhat expected that 73% of participating Mississippi log trucking companies reported lower profits in 2021 than in 2019.

Log trucking firms have endured substantial increases in liability insurance premiums since 2012 (Conrad 2017). In Mississippi, from 2019 through 2021, the inflation-adjusted average liability insurance cost was $12,466 per truck per year (Shannon and McConnell 2025). Above inflation, average insurance premiums increased approximately 15% over this period for Mississippi log trucking survey participants. Some underlying causes were increased crash costs associated with health care, equipment repairs, and litigation (Murray et al. 2020). Since 2006, the number of accidents involving trucking companies with lawsuit verdicts over $1 million has increased, partially influencing rising insurance premiums (Smith 2020). Murray et al. (2020) analyzed 451 large jury verdicts involving trucking companies from 2006 until 2019 to understand trends in such lawsuits. In 2006, there were four judgments of $1 million; by 2013, there were 70 such cases (Murray et al. 2020). The mean verdict size also increased from $2,305,736 in 2010 to $22,288,000 by 2018 (Murray et al. 2020).

Diesel prices across the United States increased from $3.29 per gallon in June 2020 to $5.75 per gallon in June 2022 (EIA 2023). The increase in fuel costs was estimated to add $1.2 billion to the cost of hauling timber from harvesting sites to wood processing mills across the United States (Blinn 2022). Timber hauling rates increased in 2022 in response to elevated fuel prices (Baker 2022), but some log trucking firms may not have received this additional compensation (Gutierrez-Castillo et al. 2022). Labor costs increased from 2018 to 2021 for all trucking sectors (Leslie and Murray 2021, 2022). In

the southern United States, the log trucking industry's labor increased by 12%, perhaps due to competition for drivers (Turoski et al. 2023). Reported increases in hauling rates observed during the study period perhaps did not coincide with rising logging and hauling production costs (Baker 2022).

Longer haul distance reduces productivity by increasing delivery time (Stuart 2003). As one-way haul distance exceeds a standard value, timber-consuming mills often provide additional compensation to cover additional mileage (Conrad 2018; McConnell 2020). This hauling premium tends to fluctuate around 40 to 50 miles (Conrad 2018; Attreya et al. 2024). In addition, extended turnaround times at harvesting sites and timber processing mills limit production, increase costs, and reduce profitability (Barrett 2001; Dowling et al. 2010; Daniel et al. 2017). Conrad (2021) used Monte Carlo simulated log truck deliveries in the southern United States to determine that profitability decreased when mill turnaround times increased (Conrad 2021). The average turnaround time for log trucking companies in Alabama, South Carolina, and Ohio was considered reasonable at 36 minutes across harvest sites and mill woodyards (Daniel et al. 2017). The maximum mill turnaround time was 3 hours and 39 minutes, and the maximum harvesting site turnaround time was 2 hours and 10 minutes (Daniel et al. 2017). This skew disappears with central tendency measures like the average and median for data analysis, but is an ever-present bottleneck to harvesting and hauling timber (Barrett et al. 2001).

There was less agreement and more moderate views regarding the impact of road weight limits among Mississippi log trucking business owners. The lower rating by Mississippi log trucking businesses could be the result of knowledge of a 2021 Mississippi law that increased the harvest permitted legal gross vehicle weight limit to 88,000 pounds, effective on July 1, 2023, which signaled that increased payloads were forthcoming (Ulmer 2021).

This study provided insights into the challenges facing timber transportation with implications for the overall wood supply chain. Study limitations included a relatively low

usable response rate of 9.3% (98/1,051) and a group-comparison response rate of 8.1% (85/1,051). Similarly, logging contractor surveys in West Virginia had a usable data response rate of 6.2%. (Milauskas and Wang 2006) and studies in Georgia and South Carolina ranged from 15 to 41% (Conrad et al. 2018). The response rate could have been improved by supplementing the QR code phase with surveys mailed through the U.S. Postal Service. Clarification of safety, weight, and out-of-service violation questions could have also improved the usable response rate.

Conclusions

Mississippi log trucking business owners largely agreed that labor markets and profit margins worsened between 2019 and 2021. Overall,s survey respondents also agreed on factors that can impede their businesses from hiring qualified drivers and operating profitably. The majority of log trucking business owners reported the availability of drivers, failed drug tests, and lower compensation packages as important to very important factors related to hiring drivers. More emphasis was placed on driver shortages and failed drug tests, but more than 50% of respondents reported the importance of pay and benefits, acknowledging their impact on attracting qualified drivers. The rating order for factors that had important and very important impacts on business profitability included insurance premiums, fuel prices, hiring qualified drivers, trucking rates, accident lawsuits, increasing driver pay, mill turnaround times, in-woods turnaround times, road weight limits, and one-way haul distance. Business owners placed more importance on input price pressures, but more than two-thirds reported the influence of litigation, policy, or operational management.

Collectively, continued Cooperative Extension Service educational programs emphasizing business management skills and cooperation between log trucking companies and wood-consuming mills could improve outcomes. Direct management and accounting of log trucking costs and revenues by business owners could allow the negotiation of more favorable hauling rates. Wood procurement organizations and wood

processing mills can contribute to safe and efficient timber transportation by ensuring that adequate haul rates are paid to cover input costs, promoting policies that increase loaded-mile percentages, and improving delivery turnaround times. Business owner investment of these savings and profits into safety practices, safety equipment, and qualified drivers could favorably impact rising liability insurance premiums, potentially improving the outlook of long-term profitability.

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Literature Cited

Abbas, D., and W. Clatterbuck. (2015). A survey analysis of harvesting logistics in Tennessee. *European Journal of Forest Engineering* 1 (2): 84-92. https://dergipark.org.tr/en/pub/ejfe/issue/17009/281341.

Altizer, C.B. (2008). The wood supply system of the eastern United States: An analysis of the socioeconomic impacts on local and regional value chains. PhD diss., Mississippi State University. https://go.openathens.net/redirector/msstate.edu?url=https://www.proquest.com/dissertations-theses/wood-supply-system-eastern-united-states-analysis/docview/304533437/se-2?accountid=34815.

Armstrong, J.S., and T.S. Overton. (1977). Nonresponse bias in mail surveys. *Journal of Marketing Research* 14 (3): 396–402. https://doi.org/10.1177/002224377701400320.

Attreya, S., M. Crosby, S. Tanger, T.E. McConnell, and A. Polinko. (2024.) Impacts of posted bridges on log truck routing in Mississippi, USA. *International Journal of Forest Engineering 35* (3): 498-506. https://doi.org/10.1080/14942119.2024.2370213.

Audley, J., A.E. Mayfield III, S.W. Myers, A. Taylor, and W.E. Klingeman III. (2016.) Phytosanitation methods influence posttreatment colonization of Juglans nigra logs by Pityophthorus juglandis. *Journal of Economic Entomology* 109 (1): 213-221. https://doi.org/10.1093/jee/tov252.

Auel, J.B. (2024). 2023 Harvest of forest products. *Mississippi Forestry Association.* https://cdn.ymaws.com/www.msforestry.net/resource/resmgr/2023_Harvest_of_Forest_Produ.pdf. Accessed January 14, 2025.

Baker, S., and J. Tyson. (2017). The winding roads of log truck insurance. *Forisk Research Quarterly,* August 10, 2017. 4 pp. https://cdn.ymaws.com/www.ohioforest.org/resource/resmgr/Timber_Talk/The_Winding_Roads_of_Log_Tru.pdf. Accessed December 15, 2023.

Baker, S. (2022.) Inflation and logging costs. *Forisk Blog* May 17,2023. https://forisk.com/blog/2022/05/17/inflation-and-logging-costs/. Accessed January 6, 2025.

Barrett, S.M. (2001). A computer simulation model for predicting the impacts of log truck turn-time on timber harvesting system productivity. Master's Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA. http://hdl.handle.net/10919/31170.

Blinn, C.R. (2022). Impact of skyrocketing fuel prices on forest products transportation. Forest Resources Association Technical Release 22-R-38 Washington, DC. https://forestresources.org/resources/22-r-38-impact-of-skyrocketing-fuel-prices-on-forest-products-transportation/. Accessed January 6, 2025.

Blinn, C.R., and D. Nolle. (2023). Status of the Minnesota logging sector in 2021. Department of Forest Resources Staff Paper Series No. 268, St. Paul, MN: College of Food, Agricultural and Natural Resource Sciences, University of Minnesota. https://hdl.handle.net/11299/257129.

Bowman, T., J. Samuel, and K. Kozma. (2023). Characteristics and concerns of logging businesses in the Southeastern United States: Results from a state-wide Survey from Alabama. *Forests* 14: 1695. https://doi.org/10.3390/f14091695.

Boone Jr, H.N., and D.A. Boone. (2012). Analyzing Likert data. *The Journal of Extension* 50 (2): 48. https://doi.org/10.34068/joe.50.02.48.

Clark III, E.E. (2021). "Evaluating costs and challenges associated with log trucking in east central Mississippi." Professional paper. Archived at Mississippi State University College of Forest Resources, Department of Forestry. 25 pp.

Clason, D.L., and T.J. Dormody. (1994). Analyzing data measured by individual Likert-type items. *Journal of Agricultural Education* 35 (4): 31-35. https://web.archive.org/web/20170809063045id_/http://pubs.aged.tamu.edu/jae/pdf/Vol35/35-04-31.pdf.

Conrad IV, J.L. (2017). Log truck liability insurance in Georgia: costs, trends, and solutions. A report to the Georgia Forestry Association Center for Forest Policy Studies. Publication of the Warnell School of Forestry and Natural Resources University of Georgia. 47 pp. https://swpa.ag/wp-content/uploads/2017/11/GA-Log-Truck-Insurance-Report_Carroll.pdf.

Conrad IV, J.L. (2018). Costs and challenges of log truck transportation in Georgia, USA. *Forests* 9 (10): 650. https://doi.org/10.3390/f9100650.

Conrad IV, J.L. (2021). Evaluating profitability of individual timber deliveries in the US South. *Forests 12* (4): 437. https://doi.org/10.3390/f12040437.

Conrad IV, J.L. (2023). Log truck insurance premiums, claims, and safety practices among logging businesses in the US South. *International Journal of Forest Engineering* 34 (2): 204-215. https://doi.org/10.1080/14942119.2022.2124704.

Conrad IV, J.L., W.D. Greene, and P. Hiesl. (2018). The evolution of logging businesses in Georgia 1987–2017 and South Carolina 2012–2017. *Forest Science* 64 (6): 671–681. https://doi.org/10.1093/forsci/fxy020.

Conrad IV, J.L., and C.R. Blinn. (2024) Logging business challenges in the US South and Lake States. *Journal of Forestry*: fvae016. https://doi.org/10.1093/jofore/fvae016.

Conrad, J. L. IV, W.D. Greene, and P. Hiesl. (2024). Georgia and Florida logging businesses persevere through pandemic, rising costs, and uncertainty. *Forest Science* 70 (1): 47–56. https://doi.org/10.1093/forsci/fxad050.

Critchlow, D.E., and A.M. Fligner. (1991). On distribution-free multiple comparisons in the one-way analysis of variance. *Communications in Statistics - Theory and Methods* 20 (1): 127–139. https://doi.org/10.1080/03610929108830487.

Cutshall, J. B., L.A. Grace, I.A. Munn, I. A. (2000). An analysis of inflation in timber harvesting costs. In Proceedings of the Southern Forest Economics Workshop. Mississippi State University, Mississippi 265-271 pp. https://www.isfre.msstate.edu/docs/papers/0148cutshall.pdf.

Daniel, M.J., T. Gallagher, T. McDonald, and D. Mitchell. (2017). Utilization of phone application technology to record log truck movements in the southeastern U.S. Proceedings of the 2017 Council on Forest Engineering meeting, Forest engineering, from where we've been, to where we're going. Bangor, ME. 7/30 – 8/2/17. 7 p.. https://research.fs.usda.gov/treesearch/57602.

Dangle, C.L., M.C. Bolding, W.M. Aust, S.M. Barrett, and E.B. Schilling. (2019). Best management practices influence modeled erosion rates at forest haul road stream crossings in Virginia. *Journal of the American Water Resources Association* 55 (5): 1169-1182. https://doi.org/10.1111/1752-1688.12762.

Dillman, D.A., J.A. Smyth, and L.M. Christian. (2014). *Internet, phone, mail, and mixed-mode surveys: The Tailored design method*. 4th edition. Hoboken, NJ: John Wiley.

Dowling, T.N. (2010). An analysis of log truck turn times at harvest sites and mill facilities. Master's thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA, USA. https://vtechworks.lib.vt.edu/handle/10919/32156.

Derochers, J., Conrad, J. L., Bolding, M. C., Smidt, M., & Da Silva, B. (2025). Trucks-to-trucks: a comparison of the raw forest products transportation industry and other forms of commercial trucking in the US South. *International Journal of Forest Engineering 36* (2): 167–177. https://doi.org/10.1080/14942119.2024.2448936

Dwass, M. (1960). Some k-sample rank-order tests. In Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling, edited by I. Olkin, S. G. Ghurye, W. Hoeffding, W. G. Madow, and H. B. Mann, 198–202. Stanford, CA: Stanford University Press.

Energy Information Administration (EIA). (2023). Gasoline and diesel fuel update. https://www.eia.gov/petroleum/gasdiesel/. Accessed January 6, 2025.

Federal Motor Carrier Safety Administration (FMCSA). (2023). Registration and requirements for employers. https://clearinghouse.fmcsa.dot.gov/content/resources/Clearinghouse-Brochure-Employer.pdf. Accessed January 3, 2025.

Fisher, J. (2022). As recession concerns rise, driver shortage figures stall. *Fleet Owner Magazine,* October 26. https://www.fleetowner.com/operations/article/21253421/as-recession-concerns-rise-driver-shortage-figures-stall. Accessed January 4, 2025.

Grebner, D.L., L.A. Grace, W. Stuart, and D.P. Gilliland. (2005). "A practical framework for evaluating hauling costs." *International Journal of Forest Engineering* 16 (2): 115-128. https://doi.org/10.1080/14942119.2005.10702520.

Hawks, B. S., W.M. Aust, M.C Bolding, S.M. Barrett, E. Schilling and J.A. Fielding. (2022). Linkages between forestry best management practices and erosion in the southeastern US. *Journal of Environmental Management* 305: 114411. https://doi.org/10.1016/j.jenvman.2021.114411.

He, M., M. Smidt, W. Li, and Y. Zhang. (2021). Logging industry in the United States: employment and profitability. *Forests* 12 (12): 1720. https://doi.org/10.3390/f12121720.

Hollander, M., D. Wolfe, and E. Chicken. (2014). *Nonparametric statistical methods*. 3rd Edition. John Wiley and Sons. New York: DOI:10.1002/9781119196037.

Greene D.W., S. Baker, T. Lowrimore. (2007). Analysis of log hauling vehicle accidents in the state of Georgia, USA, 1988–2004. *International Journal of Forest Engineering* 18 (2):52–57. https://doi.org/10.1080/14942119.2007.10702550.

Gutierrez-Castillo, A., N. Tian, and M. Pelkki. (2022). The impact of rapid fuel costs inflation on Arkansas' logging sector. *Journal of Forest Business Research* 1 (1): 75–89. https://www.forest-journal.com/index.php/JFBR/fuel-cost-inflation-arkansas-logging#h_82303044331167177545693 3.

Klepacka, A. M., J.P. Siry, and P. Bettinger, P. (2017). Stumpage prices: A review of influential factors. *The International Forestry Review* 19 (2): 158-169. https://www.jstor.org/stable/44329699.

Knight, C.R., M.C Bolding, J.L. Conrad IV, and S.M. Barrett. (2023). Log truck transportation challenges and innovative solutions: evaluating the perspectives of truck drivers, logging business owners, and foresters. *International Journal of Forest Engineering* 1-9. https://doi.org/10.1080/14942119.2023.2273123.

Koirala A, A.R. Kizha, and B.E. Roth. (2017). Perceiving major problems in forest products transportation by trucks and trailers: a cross-sectional survey. *European Journal of Forest Engineering.* 3:23-24. https://dergipark.org.tr/en/pub/ejfe/issue/30014/325102.

Lehman, C.P., M.A. Rumble, M.A. Battaglia, T.R. Mills, and L.A. Asherin. (2016). Influence of mountain pine beetle epidemic on winter habitat conditions for Merriam's turkeys: Management implications for current and future condition. In Proceedings of the National Wild Turkey Symposium. 11: 79-87. https://research.fs.usda.gov/treesearch/50257.

Leslie, A., and D. Murray. (2021). An analysis of the operational costs of trucking:2021 update. *American Transportation Research Institute,* Arlington, VA. https://truckingresearch.org/wp-content/uploads/2021/11/ATRI-Operational-Cost-of-Trucking-2021-FINAL.pdf.

Leslie, A., and D. Murray. (2022). An analysis of the operational costs of trucking: 2022 update. *American Transportation Research Institute,* Minneapolis, MN. https://truckingresearch.org/wp-content/uploads/2022/08/ATRI-Operational-Cost-of-Trucking-2022.pdf.

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of Psychology* 22 (140): 1–55. https://psycnet.apa.org/record/1933-01885-001.

Mississippi State University Division of Agriculture, Forestry, and Veterinary Medicine. (2024). 2023. Mississippi Ag fact book. https://www.dafvm.msstate.edu/resources/ag-fact-book. Accessed December 2, 2025.

Mangiafico, S.S.(2016). Likert data. In *Summary and analysis of extension program evaluation in R.* Rutgers Cooperative Extension, New Brunswick, NJ. https://rcompanion.org/handbook/.

Mangiafico, S.S. (2019). How should we analyze Likert item data. *Journal of the NACAA* 12 (2). https://www.nacaa.com/journal/e07190d8-7364-4ace-ba77-de9c5c13a245.

McConnell, T.E. (2020). Unit costs and trends within Louisiana's logging contract rate. *Forest Products Journal* 70 (1): 50–59. https://doi.org/10.13073/fpj-d-19-00036.

McConnell, T.E., B. da Silva, C. Sun, and S. Tanger. (2021). Forest to mill price trends and relationships for Mississippi, USA timber products. *Forest Products Journal* 71(2):177-187.

Milauskas, S.J., and J. Wang. (2006). "West Virginia logger characteristics." *Forest Products Journal* 56 (2): 19. https://jingxinwang.forestry.wvu.edu/files/d/c4f8ec7b-e3f1-47b3-bc9b-97e71244ac56/wvlogging.pdf.

Miller, E. (2022). Driver drug violations increased by 10% in 2021 over prior year. *Transport Topics,* February 9. https://www.ttnews.com/articles/driver-drug-violations-increased-10-2021-over-prior-year. Accessed January 3, 2025.

Murray, D., N. Williams, and E. Speltz. (2020). Understanding the impact of nuclear verdicts on the trucking industry. *American Transportation Research Institute*. Arlington, VA. 80 p. https://truckingresearch.org/wp-content/uploads/2020/08/ATRI-Nuclear-Verdicts-One-Page-Summary-07-2020.pdf. Accessed December 4, 2023.

Qualtrics. (2022). Online survey software. Qualtrics, Provo, UT. https://www.qualtrics.com/. Accessed October 31, 2022.

SAS Institute. (2020). Version 9.4. SAS Institute, Cary, NC

SAS Institute. (2021). Multiple comparisons based on pairwise rankings. SAS/STAT User's Guide. Cary, NC: SAS Institute Inc. 7263 p.

Shaffer, R.M., and W.B. Stuart. (2005). "A Checklist for efficient trucking." Publication 420-094. Blacksburg, VA: Virginia Cooperative Extension Service. http://hdl.handle.net/10919/54904.

Shannon, J.T., and T.E. McConnell. (2025). Mississippi log trucking liability insurance premiums: A hedonic analysis. *Forest Products Journal* 75 (1). https://fpj.kglmeridian.com/view/journals/fpro/75/1/article-p8.xml.

Shannon, J.T., T.E. McConnell, J.B. Auel, S.M. Tanger, D.L. Grebner, R.K. Grala. (2025). Current status of Mississippi's log trucking industry. Forest and Wildlife Research Center, Mississippi State University, Bulletin FO475. 25 p. https://www.fwrc.msstate.edu/pubs/FO475.pdf.

Short, J., and A. Pupillo. (2023). Impacts of marijuana legalization on the trucking industry. *American Transportation Research Institute,* Atlanta Georgia. https://truckingresearch.org/2023/06/impacts-of-marijuana-legalization-on-the-trucking-industry/. Accessed January 4, 2025.

Smith, J. (2020.) Surging truck insurance rates hit freight operators. *The Wall Street Journal,* January 13. https://www.wsj.com/articles/surging-truck-insurance-rates-hit-freight-operators-11578934834. Accessed January 9, 2025.

Steel, R. G. D. (1960). A rank sum test for comparing all pairs of treatments. *Technometrics* 2: 197–207.

Stuart, W. B. (2003). Checking our foundations: Matthews' least cost model revisited. *Southern Journal of Applied Forestry* 27 (1): 30–35. https://doi.org/10.1093/sjaf/27.1.30.

Turoski, T., B. Phillips, J.L. Conrad IV, and M.C. Bolding. (2023). Log truck driver compensation lags that of general freight drivers over the past decade. Forest Resources Association Technical Release 23-R-02 Washington, DC: . https://research.fs.usda.gov/treesearch/66598.

Ulmer, S. (2021). New laws hit the books in Mississippi on Thursday. *Magnolia Tribune* June 30. https://magnoliatribune.com/2021/06/30/new-laws-hit-the-books-in-mississippi-on-thursday/. Accessed January 10, 2025.