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## Transportation Research Forum

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Industry Issue Paper: The Balance Between Private and For-Hire Carriage and Trends in the Use of Large Trucks (1977 to 1997)

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Source: *Journal of the Transportation Research Forum*, Vol. 43, No. 2 (Fall 2004), pp. 159-171

Published by: Transportation Research Forum

Stable URL: <http://www.trforum.org/journal>

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# The Balance Between Private and For-Hire Carriage and Trends in the Use of Large Trucks (1977 to 1997)<sup>1</sup>

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*An analysis of data from 20 years (1977 – 1997) of the quinquennial Vehicle Inventory and Use Survey (VIUS), collected by the U.S. Census Bureau, indicates that the overall population of heavy freight vehicles grew at the same rate as real GDP, just under 3% per year. However, the total miles operated by vehicles of this type grew 50% more, 4.5%, which produced a very large cumulative increase, from 46.8 billion miles in 1977 to 111.6 billion in 1997. This was because of a 34% increase in the intensity of use of heavy freight vehicles, as measured by changes in their average annual miles of operation. The key patterns underlying these aggregate changes are analyzed by examining the trajectories of several subdivisions within trucking over the period, segregating the data by private versus for-hire carriage and geographic range of service. There are a number of interesting nuances, but the main underlying trend is a sharp increase in the specialization of for-hire carriage in long-haul operations, complemented by an increasing relative dominance of private carriage in local operations.*

by **Stephen V. Burks, Kristen Monaco, and Josephine Myers-Kuykindall**

## INTRODUCTION

This paper analyzes trucking in historical context: how many heavy freight vehicles operate on the highways of the United States and how many miles do they travel per year? How do the number and annual miles vary by the geographic range of operation? Perhaps most interestingly, what meaningful trends have developed in the balance between private carriage (the transport of goods by the firm that owns them) and for-hire carriage (what would normally be called the “trucking industry”)<sup>3</sup> during the more than 20 years since the deregulation of the for-hire motor freight industry and the approximately contemporaneous beginning of the “logistics revolution?”

The answers to these questions are economically and politically significant.<sup>4</sup> Trucking is a relatively large industry—the total output of trucking services accounted for approximately 4.76% of GDP in 1997 according to an estimate by the Eno Transportation Foundation (Wilson 2000). In fact,

trucking services are an input at some stage of production to nearly every final good or service consumed in the United States. In addition to being an important intermediate good itself, trucking also utilizes significant amounts of economically important inputs. For example, in 2001 combination vehicles (i.e. powered units that pulled at least one trailer or semi-trailer) consumed 25.6 billion gallons of petroleum, or about 15.7% of the total national consumption in that year (U.S. Department of Transportation 2002).<sup>5</sup> In that year “truck driver” (for trucks of any size class) was reported as the primary occupation by 3.156 million workers, or 2.3% of all workers aged 16 years or older in the United States (U.S. Department of Transportation 2002). Further, trucking services could not be produced without the major investments made by the public in highway and bridge infrastructure; and the size and pattern of trucking operations affect expenditures in this area, at both the state and federal levels.

Trucking has public policy significance as well. The answers to the questions

addressed in this paper bear on debates of interest to the motoring public, such as those about the safety of large trucks. The 2003 revision of the Hours of Service Regulations for drivers of commercial vehicles by the Federal Motor Carrier Safety Administration depended in part on different views about the answers to these questions, as do debates about increasing the maximum size and weight of large trucks, and about their environmental impact.

To address these questions the public-use microdata sets of the Vehicle Inventory and Use Survey (VIUS) are used to examine the 20-year trends in the numbers and usage patterns of heavy freight vehicles in the United States.<sup>6</sup> This analysis determined that from 1977-1997 the capacity of the trucking fleet, as measured by the total population of heavy freight vehicles (those with a maximum legal weight of at least 26,000 lbs.)<sup>7</sup>, grew approximately at the rate of real GDP, at just under 3% per year.<sup>8</sup> However, the output of the fleet, as measured by total miles operated, grew 50% faster, at slightly more than 4.5% per year. This resulted in very large cumulative differences in total growth for the two measures. The number of heavy freight vehicles grew from 1.26 million in 1977, to 2.24 million in 1997, for a cumulative increase of 78%. However, the total miles driven rose from 46.8 billion in 1977 to 111.6 billion in 1997, for a cumulative increase of 139%, or nearly double the growth in the vehicle count.

The explanation for this disparity is that the intensity of use of heavy freight vehicles, as measured by changes in annual miles of operation, increased 34% over the period—from 37,100 annual miles, averaged over all heavy freight vehicles in 1977, to 49,900 in 1997. This increase in the intensity of use is important because it has implications for the economic productivity of these vehicles and their operators, as well as for consumption of fuel and their contribution to highway congestion, highway safety, infra-structure wear, and pollution levels.

The VIUS data further reveal that the growth in numbers and miles was not uniform across vehicle categories. When the aggre-

gate trends are disaggregated it is apparent that there has been a significant difference in the trajectory of the two main ways in which trucking services are produced, private carriage and for-hire carriage. Stated in summary form, both types of trucking operations have decreased the share of their total capacity dedicated to local service and increased the share utilized in long-haul operations. However, private carriers have shifted very modestly in this direction, while for-hire carriers have sharply and drastically shifted away from local operations and towards long-haul ones. As a result, for-hire carriage has an increasing and very dramatic specialization in long-haul operations with high average miles, while private carriage has retained a complementary specialization in local operations with lower average miles.

The balance of the paper is structured as follows. In the second section the methodology is discussed. In the third section the overall trends in private carriage are compared to those in for-hire carriage. In the fourth section the capacity and output profiles of private and for-hire carriage over three geographic ranges of operations (local, regional, and long-haul) are compared over time. In the fifth section the discussion turns to the implications of these profile changes for growth and shares in the two extremes of geographic range: local and long-haul operations. The final section concludes the paper.

## METHODOLOGY

The VIUS is one of the major benchmark surveys of the Census of Transportation. Every five years a stratified random sample of more than 100,000 truck owners is mailed an extensive survey form, which asks about many characteristics of the vehicle and how it was used during the previous year. The sampling design is based primarily on state-level truck registration information and every registered owner of any type of truck, from pickups and SUVs built on pickup truck chassis, to tractor-trailers, is sampled, with the single major exception being units of government.<sup>9</sup> Compliance with the survey is

legally required under Title 13, United States Code, and, by the same statute, individual responses are confidential. Response rates are typically 75% or better and, after any deletions required to maintain confidentiality, an approximately 100,000-case public use micro-data set results for each year. Sampling weights are provided to permit inferences about population values.

In the present analysis, for each survey year heavy freight vehicles are defined to be vehicles that have a body type that can haul freight, that are not used primarily for personal transportation, that have a maximum legal gross vehicle weight (GVW) of at least 26,000 lbs.,<sup>10</sup> and are operated on-road. Freight hauling vehicles are selected because this is the primary economic function of interest here. On-road vehicles are included to eliminate the small fraction of freight hauling that does not rely on the public highway infrastructure. Heavy vehicles are selected because they are a distinct focus of policy debate, in part because greater weight, other things equal, causes a larger impact on infrastructure and safety issues. In 1977, this selection process reduced the full sample of 96,494 cases, representing 26.2 million trucks of all kinds, to a sub-sample of 22,877 representing 1.43 million heavy freight vehicles. In 1997, the selection process reduced the full sample of 104,545 cases, representing 72.8 million trucks of all kinds, to a sub-sample of 44,228 representing 2.13 million heavy freight vehicles.<sup>11</sup>

Next, using consistent specifications across all the data years, subsets of cases were identified according to the following definitions. First, is the vehicle used in for-hire trucking or in private carriage? Second, is the usual geographic area of operation of the vehicle local (mostly within 50 miles of home base), regional (between 50 and 200 miles from home base), or long-haul (over 200 miles from home base)?<sup>12</sup>

There are at least two major advantages to using the VIUS to examine the long-run trends in heavy vehicle use. First, the VIUS provides a consistent measure of the relationship between for-hire trucking and private

carriage. Most economic analyses focus primarily on the for-hire trucking industry. But since approximately half of the physical output of trucking services in the United States is created in private carriage, for-hire-only analyses, while important, miss much that is relevant when the overall impact of commercial trucking operations is at issue.

Second, the VIUS provides a consistently defined set of heavy freight hauling vehicles across all the years of the survey, as well as across all parts of the economy in which trucking services are produced. The consistency of the data over time is a unique feature of this source of information, which no other major source of data on trucking fully matches.

## **20-YEAR TRENDS IN PRIVATE VERSUS FOR-HIRE TRUCKING**

To a casual observer one truck looks much like another, but in fact the operations that provide trucking services in the United States are meaningfully differentiated from each other on several dimensions. At the broadest level, trucking operations are broken into private carriage and for-hire carriage, based on a legal relationship: whether the carrier also owns the freight (private carriage) or is hauling it for another party (for-hire carriage). Economic regulation of trucking services was historically only applied to for-hire trucking in the United States. Private carriage has always been exempt. However, the existence of economic regulation and then its removal has affected private carriage because of the potential for the substitution of for-hire service for private carriage, and vice versa.

Economic regulation was imposed on for-hire trucking in 1935 and the statutory deregulation of interstate for-hire trucking occurred in 1980.<sup>13</sup> The regulatory regime placed a number of constraints on how for-hire firms could serve large shippers, which arguably made private carriage more economically attractive than it would have been without regulation (Rothenberg 1994). Because deregulation removed these constraints for interstate freight movements, many

## The Balance Between Private and For-Hire

industry analysts expected that for-hire trucking would grow faster after deregulation than would private carriage, and that part of this growth would represent direct substitution of for-hire operations for private ones (Campbell 1987).

An initial examination of the trends in productive capacity, as measured by the numbers of vehicles in each usage category, does not appear to support this view (Table 1, column A). In 1977 private carriers operated 778,238 heavy freight vehicles, or 61.7% of the total heavy freight vehicle fleet, while for-hire carriers operated only 482,633 units, or only 38.3% of the total. Further, vehicle counts grew substantially in both types of carriage, but the growth over the whole period in private carriage vehicles was a robust 86.5%, while the growth in for-hire vehicles was a more modest 62.7%.

Years before 1977 cannot be observed in these data, but, as indicated in Figure 1, the private carriage vehicle share grew strongly after that year, peaking in 1987. Administrative de-regulation began around 1979, and statutory deregulation occurred in 1980 (Moore 1986). The macro-economy suffered a double-dip recession in 1980-1982, but the private carrier share growth from 1977 to 1982 was the largest of any period in the sample.<sup>14</sup> If there were no prior trend towards private carriage, this pattern would suggest that deregulation played a role. After the peak

year of 1987, the private carriage share receded slightly until 1997.<sup>15</sup>

Despite the slight reversal in the 1990s, it is clear that private carriage increased its share of the vehicle count over the entire period. By 1997, the 1.451 million private carriage vehicles were 64.9% of the total fleet, as compared to the 35.1% share held by the 785,046 for-hire vehicles, an increase from the 61.7% to 38.3% split of 1977.<sup>16</sup>

The trend in total miles was different, however (Table 1, column B). In 1977 total annual miles operated by for-hire firms was 25.9 billion miles, which was 55.4% of the total heavy vehicle mileage of 46.8 billion, as compared to the 20.9 billion, or 44.6%, by private carriers. While total annual miles grew strongly in both types of carriage, the growth over the whole period was stronger in for-hire carriage, at 149.6%, as compared to 124.8% in private carriage.

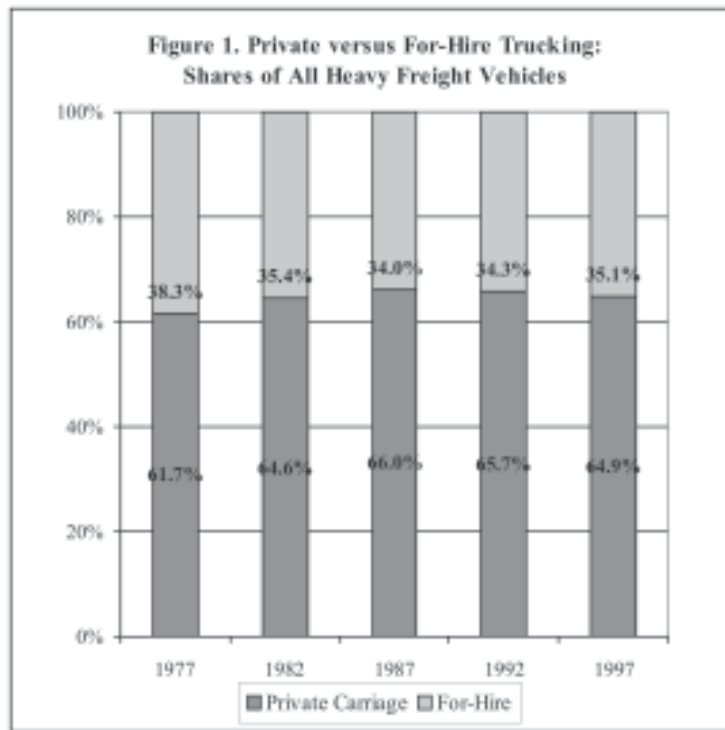
A closer look at the shares of total mileage reveals an interesting time path (see Figure 2). Coincident with deregulation and the recessions of 1980-1982, there was an initial drop in the for-hire mileage share, from 55.4% to 53.7%. However, steady growth occurred after 1982 in the for-hire share, reaching a high of 58.0% in 1997 (although the growth tapered off in the last time period).<sup>17</sup>

So, not only did for-hire carriers achieve a higher number of total miles in 1977, but their share of total miles had increased by 1997

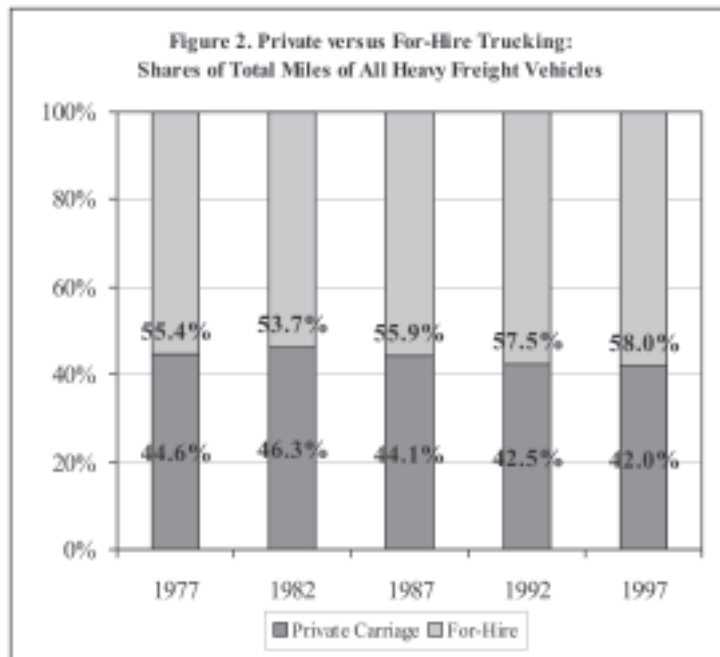
**Table 1: All Ranges of Private versus All Ranges of For-Hire Trucking: Number of Vehicles, Total Annual Miles, and Mean Annual Miles**

	A: Number of Vehicles		B: Total Annual Miles (in billions)		C: Mean Annual Miles	
	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage
1977	778,238	482,633	20.868	25.904	26,815	53,673
1982	872,861	478,412	24.900	28.884	28,527	60,376
1987	1,073,680	552,125	29.845	37.771	27,797	68,410
1992	1,163,079	607,366	33.548	45.349	28,844	74,665
1997	1,451,183	785,046	46.903	64.653	32,320	82,355

Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files, U.S. Census Bureau, U.S. Department of Commerce.



Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files U.S. Census Bureau, U.S. Department of Commerce



Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files U.S. Census Bureau, U.S. Department of Commerce

despite the fact that their share of the total vehicle population fell over the period (Figure 1). In 1997 for-hire trucks operated 64.7 billion miles, 58.0%, while private carriers only reached 46.9 billion, or 42.0%. This meant that in 1997 for-hire firms operated 37.8% more total miles than private carriers, but did it with 45.9% fewer vehicles.

These divergent trends are reconciled by the fact that the intensity of use, as measured by average annual miles per year, was not only greater in for-hire firms in 1977, but grew more rapidly over the period as well (Table 1, column C). In 1977 the average for-hire vehicle operated 53,673 miles per year, or almost exactly 100% more than the average private carrier unit, which was 26,815 miles. By 1997 the figure for for-hire firms had grown by 53.4%, to 82,355 miles per year. Private firms increased their average also, but only by a modest 20.5% over the period, to 32,320 miles. So in 1997 mean annual miles of for-hire carriers were 155% greater than private carriers.

Thus, considering capacity measured by vehicle counts, the private carriage sector grew more quickly, but examining output measured by total mileage, the for-hire sector grew faster. An examination of the time paths of the shares of these two variables suggests that deregulation may have contributed to these changes. However, examining heavy freight vehicles in the aggregate does not tell the whole story. The aggregate differences in intensity of use (mean annual miles) detailed here are driven significantly by differences in the geographic patterns of use of private and for-hire firms.

### **INCREASING SPECIALIZATION BY GEOGRAPHIC RANGE**

Private and for-hire carriers have different patterns of geographic specialization. In 1977, private carriers were more specialized in local operations and for-hire carriers had a specialization in long-haul operations. Over the next 20 years, both types of carriers shifted toward more long-haul operations with their heavy freight vehicles. However, private carriage moved modestly in this direction,

while for-hire carriage shifted very sharply to long hauls. The result was an increase in the differences in geographic specialization between the two types of carriage.

Private carriers altered their allocation of capacity by geographic range (length of haul) over the 20-year period, as their fleet size and total miles grew. In 1977 private carriers used 67% of their vehicles for local operations, 24.2% for regional work, and 8.8% for long-hauls. The proportion of local vehicles dropped modestly but steadily over the period, and the sum of the proportions utilized in regional and long-hauls rose. By 1997, private carriers still dedicated a majority of their vehicles to local operations, but the specialization was not as dramatic as it had been in 1977. The 1997 distribution was 56.2% of vehicles for local operations, 30.3% for regional work, and 13.5% for long-hauls.

The distribution of private carrier miles by geographic range followed a related pattern. In 1977, 35.7% of private carrier miles occurred in local operations, 38.4% in regional work, and 25.8% in long-hauls. The proportion of miles in local operations rose in 1982, possibly as a combined effect of deregulation and the macroeconomic recessions, and then fell modestly but steadily until 1997. The proportion of private carrier miles in long-hauls had a fairly substantial net increase over the period. By 1997 the mileage distribution was 27.8% in local operations, 38.2% in regional work, and 34% in long-hauls.<sup>18</sup>

For-hire carriers shifted capacity in the same direction, away from local operations and towards long-hauls, but to a much greater degree. In 1977 the distribution of for-hire vehicles was actually tilted slightly towards the shortest hauls, with 39.2% used in local operations, 28.6% in regional work, and 32.1% in long-hauls. As time passed the proportion dedicated to local operations fell sharply, and that used in regional work fell more modestly, while the proportion dedicated to long-hauls nearly doubled by the end of the period. By 1997, the vehicle distribution was only 13.4% in local operations, 24.7% in regional work, and a dominant 61.9% in long-hauls.



The distribution of for-hire carrier miles by geographic range follows a similar pattern, but one that is more extreme. For-hire carriers already devoted over half their total miles to long-hauls in 1977 (the distribution was 53.0% long-haul, 30.1% regional, and 16.9% local). The long-haul proportion grew over the entire period at the expense of the proportion of miles utilized regionally and locally. By 1997, more than three quarters (76.0%) of for-hire miles were generated in long-hauls, with only 5.8% from local service and 18.2% from regional operations.<sup>19</sup>

These changes in the distribution of carrier capacity and output across geographic ranges, modest for private carriage, and more extreme in the case of for-hire service, had consequences for growth and the relative shares of each type of trucking in each geographic range. Next, the two cases at the opposite ends of the distance spectrum, local operations and long-haul operations, are discussed in more detail.<sup>20</sup>

**SHARES AND GROWTH IN LOCAL AND LONG-HAUL MARKETS**

The numbers of private carriage vehicles dedicated to local operations grew by 56.4% between 1977 and 1997 (from 521,488 to 815,810), while the for-hire local fleet actually declined by 44.5% (from 189,432 to 105,190; see Table 2, column A). In 1977 private carriers accounted for 73.4% of heavy vehicles serving the local market, leaving for-

hire carriers with a 26.6% share (Figure 3). By 1997 the gap was much wider; private carriage vehicles had increased to an 88.6% share of the local fleet, while for-hire carriers operated only 11.4% of the heavy freight trucks used locally.

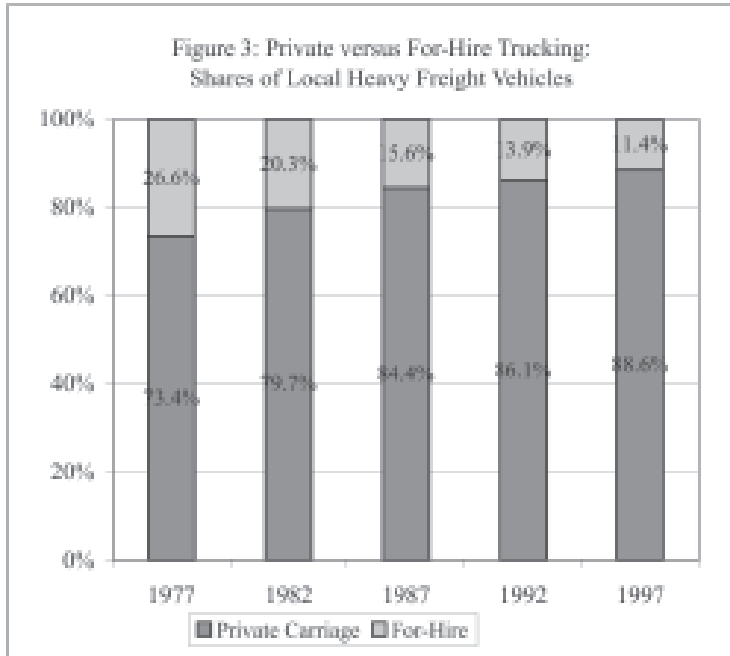
The pattern of mean annual miles operated by local vehicles is also distinct between private and for-hire carriers. (See Figure 4 for a graphical representation and Table 2, column C for a tabular one.) For-hire local vehicles averaged 23,160 miles per year in 1977 compared to 14,303 miles per year for private carriage. The for-hire number rose strongly over the period, increasing to 35,446 miles per vehicle in 1997 for total growth of 52.6%. In contrast, private carrier local vehicles exhibited a modest increase in average annual miles in 1982, to 16,007, and then maintained an essentially constant level, finishing with a 1997 value of 15,961 miles per unit for total growth of only 11.6%.<sup>21</sup> So while for-hire carriers started in 1977 with mean annual miles per truck that was 61.9% higher than that in private carriage, they ended the period with an intensity level that was 122.1% greater, essentially doubling the gap.

Output in local service, as measured by total miles operated, reflects this mixture of changes in vehicle numbers and in average miles per vehicle (Table 2, column B). Private carriage miles in local service grew strongly in every period except 1987 to 1992, starting at 7.5 billion in 1977 and rising to 13 billion miles in 1997, for a net increase over the

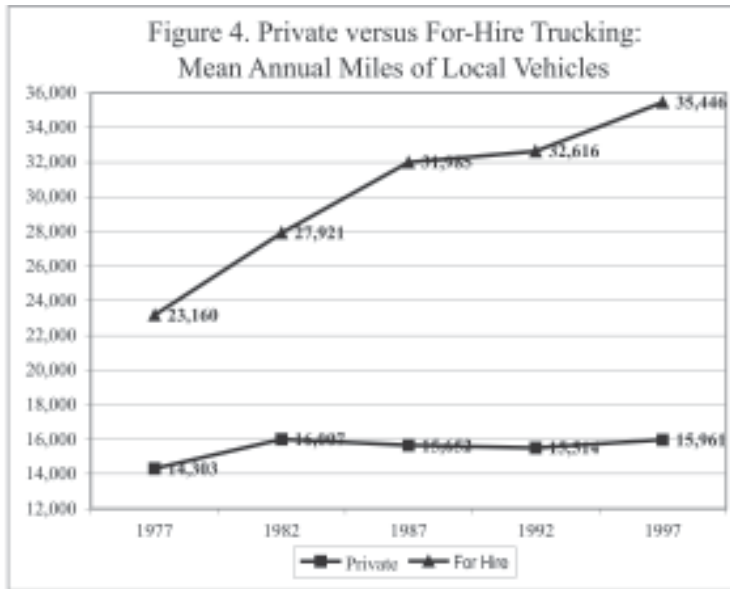
**Table 2: Local Private versus Local For-Hire Trucking: Number of Vehicles, Total Annual Miles, and Mean Annual Miles**

	A: Number of Vehicles		B: Total Annual Miles (in billions)		C: Mean Annual Miles	
	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage
1977	521,488	189,432	7.459	4.387	14,303	23,160
1982	580,233	147,977	9.288	4.132	16,007	27,921
1987	692,954	128,286	10.846	4.103	15,652	31,985
1992	713,178	115,387	11.064	3.763	15,514	32,616
1997	815,810	105,190	13.021	3.729	15,961	35,446

Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files, U.S. Census Bureau, U.S. Department of Commerce.



Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files  
U.S. Census Bureau, U.S. Department of Commerce



Source: Authors' calculations from 1977-1997 TIUS/VIUS Microdata Files  
U.S. Census Bureau, U.S. Department of Commerce

period of 73.3%. Given that the mean annual miles of local private carriage vehicles was stagnating, this growth was driven almost solely by the increase in the size of the private carriage local fleet. By contrast, for-hire carriage shows a decline from its initial local mileage level of 4.4 billion in 1977, to 3.7 billion miles in 1997, for a 15.9% reduction. This is the net result of two offsetting trends—falling local fleet size, and rising mean annual miles of local fleets. The effect of all of these trends on the shares of local mileage is that private carriers dominated local service by this measure, starting with a 63.0% share, compared to for-hire’s 37.0%, and increased that domination over the period, ending with a 77.7% share, leaving for-hire carriers with 22.3%.

The contrast between the trends in the local range of geographic use and those at the long-haul operational range could not be clearer (Table 3, column A). Looking first at capacity, the for-hire long-haul heavy freight vehicle fleet grew by an astonishing 213.7% over the period, (from 154,965 in 1977 to 486,255 in 1997), while the private carriage units dedicated to long-hauls started with a smaller base and grew by a somewhat smaller 186.4% (from 68,535 in 1977 to 196,274 in 1997). So for-hire carriers were dominant at this range of operations in 1977, with a 69.3% share (giving private carriers 30.7%). That dominance had increased a bit by 1997, when for-hire carriers had a 71.3% share (leaving 28.8% for private carriage vehicles). The time

path of the share changes suggests that there was a modest but significant discrete shift in vehicle shares towards for-hire carriage in the 1982 to 1987 period (after deregulation, during the macro-economic recovery from the recessions of 1980-1982), followed by a slight trend back towards the pre-deregulation shares.<sup>22</sup>

The mean annual miles per truck in long-haul operations follow distinct patterns in for-hire and private carriage (Table 3, column C). Both for-hire and private carrier average mileage per long-haul vehicle dropped somewhat from 1977 to 1982 (which was the last year of 1980-82 double-dip recessions). Then for-hire mean annual miles increased and grew strongly for the balance of the period, while private carrier mean annual miles fell further, bottoming in 1987 before starting to grow modestly.<sup>23</sup> For-hire carriers started with 88,574 mean miles per year in 1977 and ended the period with 101,095 miles per year in 1997, for net growth of 14.1%. Private carriers started with 78,647 mean long-haul miles per year in 1977 and reached only 81,298 by 1997 for a net growth of 3.4%. In 1977 mean annual miles of the average for-hire vehicle was 12.6% greater than the average private carriage unit, but by 1997 the gap had essentially doubled, to 24.4%.

Output in long-haul service, as measured by total miles, reflects the mixture of changes in vehicle counts and average miles per vehicle described above (Table 3, column B). For-hire firms started with 13.7 billion total

**Table 3: Long Haul Private versus Long Haul For-Hire Trucking: Number of Vehicles, Total Annual Miles, and Mean Annual Miles**

	A: Number of Vehicles		B: Total Annual Miles (in billions)		C: Mean Annual Miles	
	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage	Private Carriage	For-Hire Carriage
1977	68,535	154,965	5.390	13.726	78,647	88,574
1982	89,102	200,312	6.951	17.392	78,007	86,823
1987	103,991	277,619	7.791	24.954	74,916	89,884
1992	132,723	336,505	10.111	32.149	76,181	95,539
1997	196,274	486,255	15.957	49.158	81,298	101,095

Source: Authors’ calculations from 1977-1997 TIUS/VIUS Microdata Files, U.S. Census Bureau, U.S. Department of Commerce.

long-haul miles in 1977 and grew strongly over the entire period, ending with 49.2 billion, for overall growth of 259.1%. This strong growth performance was the joint effect of growth in both the vehicle count and in mean annual miles per truck. By contrast, private carriage grew less, starting with 5.4 billion long-haul miles in 1977 and concluding with 16 billion in 1997 for total growth of 196.3%. This more modest performance reflects a growing vehicle count combined with stagnant mean annual miles per truck.

The effect of all of these trends on the shares of total long-haul mileage is that for-hire carriers dominate in this geographic range of operations. They began with 71.8% in 1977 (giving private carriage 28.2%), and increased their share to 75.5% in 1997 (leaving private carriers with 24.5%). The time path of the share changes is similar to that in the long-haul vehicle count. It suggests that there was a modest but significant discrete shift in shares towards for-hire carriage in the 1982 to 1987 period (after deregulation, during the macroeconomic recovery from the recessions of 1980-1982).<sup>24</sup>

### CONCLUSION

Given the changes that have occurred in the trucking industry over the past 25 years, it is perhaps surprising that little research has addressed the trends in the use of heavy freight vehicles. Using the quinquennial Vehicle Inventory and Use Survey, trends were examined in both the number and utilization of heavy freight vehicles in the United States from 1977 to 1997. Using this comprehensive series of data sets allows construction of consistent measures of both heavy freight vehicle numbers and their mileage over the entire period, and allows these measures to be decomposed by type of carriage and length of haul. Generating descriptive statistics by

these operating characteristics allows discovery of important trends in how motor freight movements take place.

While the number of heavy freight vehicles on the road increased from 1.2 million in 1977 to 2.3 million in 1997 (an annual increase of 2.83%), the total number of miles driven increased from 46.8 billion to 111.6 billion (an annual increase of 4.56%) because the intensity of use of these vehicles, as measured by their mean annual miles, increased very rapidly over this period. Private carriage continued to dominate total capacity as measured by the number of vehicles, operating 62% of all heavy freight vehicles in 1977 and 65% in 1997, but for-hire carriers had the majority share of total miles with 55.3% in 1977, rising to 58.0% in 1997.

While both private and for-hire carriers shifted resources toward longer hauls over this period, private carriers did so modestly, while for-hire carriers did so sharply. As a result, private carriers retained their dominance of local operations: by 1997 they operated 88.6% of the heavy freight vehicles in local use, and these vehicles accounted for 77.7% of all local miles. In contrast, for-hire carriers intensified their dominance of long-haul operations. By 1997 they operated 71.3% of all long-haul vehicles, and those vehicles accounted for 75.5% of all long-haul miles.

The trend has thus been for long-haul for-hire operations to become relatively more important within total trucking output. The share of heavy freight vehicle miles generated by long hauls increased, rising from 40.9% in 1977 to 58.4% in 1997.<sup>25</sup> Over the same period, the share of for-hire carriers in long-haul miles increased from 71.7% to 75.5%. At 486,255 units, in 1997, long-haul for-hire vehicles made up only 21.7% of the total heavy freight vehicle fleet, but accounted for 44.1% of total fleet mileage.<sup>26</sup>

## Endnotes

1. We gratefully acknowledge the assistance of the Census Bureau, which made a special effort to retrieve the archived mainframe tapes of the older VIUS microdata sets and transfer them to CDs, as well as to provide the original documentation from these years. The University of Minnesota funded essential research assistance from Andrea Hannan, Katie Polinder, Rebecca Schlafer, and Andrew Anderson. The Sloan Foundation (through its Trucking Industry Program, initially at the University of Michigan and now at Georgia Institute of Technology) also provided support. Helpful comments were received from Thomas Hubbard, John P. Miller, and Richard Beilock. Errors remain the authors' responsibility.
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3. To illustrate, Yellow Freight and Schneider National are large for-hire firms, while Wal-Mart and General Motors are large private carriers.
4. There is, to our knowledge, no publicly available general overview that is focused precisely on the vehicles of interest here, although several general reports cover parts of the subject. See, for example, ATAF (1995) and Moore, C., Ed. (1999).
5. "Combination vehicles" is a group which is somewhat broader than, but closely related to, the truck tractor category of the present paper.
6. Before the 1997 data year the VIUS was known as the Truck Inventory and Use Survey, or TIUS.
7. See the relevant discussion and note in the next section, Methodology.
8. The compound annual growth rate figures are estimates of the linear growth rate over the period produced by a semi-logarithmic OLS regression of the dependent variable on a time trend.
9. The two biggest groups of vehicles thus excluded are vehicles owned by the USPS and military vehicles.
10. This breakpoint demarcates Class VII and Class VIII commercial vehicles from smaller ones, and is the level at which a commercial driver's license is required due to the weight of the vehicle alone. In addition, the VIUS survey design uses this weight as a major demarcation, so vehicles with this GVW or greater are sampled more heavily than are lighter vehicles, and more information relevant to the present analysis is collected about them. The major limitation this introduces with respect to freight transport is that it excludes many smaller local delivery vehicles, such as smaller United Parcel Service "package cars", and small wholesale or retail delivery vehicles.
11. Further details on the primary data source and the selection of vehicles for the analysis are available in the form of two Data Appendices from the authors upon request.
12. A boundary of 500 miles or more between regional and long-haul is often used in industry analyses, and later VIUS questionnaires add 500 miles as a possible response. But the 200-mile break point is the largest one which is available for all data years.
13. Starting in 1978 and 1979, some administrative steps were taken that loosened regulatory constraints. But the comprehensive change occurred in 1980. The deregulation of 1980 affected only interstate trucking, however. Approximately 30 states retained some form of economic regulation of intrastate carriage, and many of these regulations were not removed until a second federal deregulation pre-empted them in 1995.
14. The statistical significance of this difference is high, with a p-value  $< 0.001$ , while that of the change from 1982 to 1987 is 0.003.

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15. The change from 1987 to 1997 had a p-value of 0.041.
16. The change from 1977 to 1997 has a p-value  $< 0.001$
17. The changes over each period were statistically significant at the 1% level or better, with the exception of the 1992-1997 change, which had a p-value of 0.39.
18. The differences between the vehicle and mileage proportions are due to the differences in intensity of use, as measured by mean annual miles, across the ranges, because the mean annual miles per vehicle rise with the geographic range (length of haul) of operations.
19. As with private carriage, the difference between vehicle and mileage shares is due to the increasing intensity of use with length of haul.
20. Graphs exhibiting the trends for regional operations are available from the authors upon request.
21. The shift from 1977 to 1982 is highly significant ( $p < 0.001$ ), while the later difference (1982 to 1997) is not ( $p = 0.849$ ).
22. The only significant change between adjacent periods (from 69.2% to 72.7%) was between 1982 and 1987 ( $p < 0.001$ ).
23. Recall that for historical consistency with the divisions used in the 1977 TIUS we have demarcated long-haul use at 200 miles from home base or more. A more common current definition would put the break point at 500 miles or more; if we made this adjustment the average annual miles for long-haul vehicles would be significantly higher for the years in which this category is available.
24. Again the only significant change between periods (from 71.4% to 76.2%) was between 1982 and 1987 ( $p < 0.001$ ).
25. Total annual miles were 46.776 billion in 1977 and 111.556 billion in 1997. Total miles generated by long-haul heavy freight vehicles were 19.116 billion in 1977 and 65.115 billion in 1997.
26. See Burks et al. (2004) for a further exploration of trends within for-hire trucking.

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