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Is the U.S. labor market for truck drivers broken?

The trade press covering the U.S. trucking industry often portrays the U.S. labor market for truck drivers as dysfunctional, citing persistent driver shortages and high levels of firm-level turnover and predicting significant resulting constraints on the supply of motor freight services. We use three techniques to investigate the labor market for truck drivers. First, using data from the Occupational Employment Statistics survey of the U.S. Bureau of Labor Statistics, we delineate the structure of the driver workforce. Second, using data from the Current Population Survey, we describe the occupations and industries from which drivers come and to which drivers go when they change occupations, and statistically analyze these entries and exits. We find relatively high rates of occupational attachment among drivers, and importantly, we also find that truck drivers respond in the expected manner to differences in earnings across occupations. Finally, we point out that the issues discussed by the industry are concentrated in one segment of the overall market, that for drivers in long-distance truckload (TL) motor freight, which contains between one-sixth and one-fourth of all heavy and tractor-trailer truck drivers. These findings suggest a more nuanced view of this labor market. As a whole, the market for truck drivers appears to work as well as any other blue-collar labor market, and while it tends to be "tight," it imposes no constraints on entry into (or exit from) the occupation. There is thus no reason to think that, given sufficient time, driver supply should fail to respond to price signals in the standard way. The persistent issues localized in the TL segment are not visible in the aggregate data and require a distinct analysis.

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How does the labor market for truck drivers compare with the labor markets for other occupations with similar human capital requirements? The most prominent story about the market for drivers is that told by the American Trucking Associations (ATA), an organization representing firms that are central industry participants. The ATA has been arguing systematically since 2005 that firms hauling freight face a shortage of truck drivers, and discussion within the industry of a shortage actually dates to the late 1980s.[1] Stories about a persistent driver

shortage—and its potential effects on the larger economy—have also appeared periodically in major media outlets, most recently in 2018.[2]

The consistent position of major industry stakeholders that there is a long-standing shortage of drivers poses a puzzle for empirical labor economics. Economists think of a shortage as a type of disequilibrium that normal market forces will tend to moderate and eventually remove, other things equal. A sound theoretical foundation for labor *surpluses* has long been recognized in the concept of efficiency wages, according to which employers maximize profit by holding pay above the market-clearing level, creating a surplus of job seekers and queues for such "good jobs."[3] Shortages, however, are harder to understand.

A shortage is generally alleviated in the short run by price (i.e., wage) increases and in the longer run by the development of new supply in response to higher wages. While it is not unusual for any specific market to be out of equilibrium at a point in time, it is unusual for a market to be consistently out of equilibrium in the direction of a shortage over more than a decade. This disequilibrium suggests either some unusual and persistent causal factor at work, such as a skills mismatch or a regulatory constraint preventing workers from entering employment or changing occupations, or a misapplication of economic terminology in describing the business situation.

Labor economists have addressed the problem of how to identify "occupational labor shortages" in various settings, starting with research by David Blank and George Stigler, who offer the following definition relevant to the current question: "the quantity of labor services in question that is demanded is greater than the quantity supplied at the prevailing wage."[4] In her turn-of-the-century review of previous work, Carolyn Veneri argues that no single criterion based in standard governmental data sources can be used to identify an occupational shortage.[5] However, she suggests that there are some signs that would indicate a "tight" labor market, which in turn could make it appropriate to speak of a shortage. These signs are (a) increasing wages relative to alternative employment opportunities for potential job seekers, (b) lower unemployment rates than in alternative employment opportunities, and, sometimes, (c) employment levels that are either rising or holding steady, but not falling.

In this article, we examine the state of the labor market for truck drivers, using publicly available nationally representative data collected by agencies of the U.S. government on employment, earnings, and occupational mobility. We first describe the structure of the occupation—there are three detailed occupational categories which fall within the broader occupation of truck driving—and identify the number of drivers engaged in the different types of truck driving. Second, we compare the earnings of truck drivers and their unemployment rates with those of a broad group of related occupations requiring similar human capital, to look for signs of a tight labor market. Third, we ask whether the labor market for this occupation operates in the manner predicted by economic theory. We tabulate the occupations and industries from which individuals entering truck driving originate and the occupations and industries to which individuals exiting truck driving go. We then present an econometric model of entries and exits, analyzing how differences in earnings and hours affect movements into and out of truck driving, to see if these are consistent with economic theory.

We find some indicators suggesting that the market for truck drivers has been tight over the period from 2003 through 2017: wages in the occupation have been strong relative to those in similar occupations and employment numbers have been robust by the same standard. But we also find indicators of normal labor

market behavior. Individuals who migrate into and out of truck driving come from occupations that either allow on-the-job contact with truck drivers or have similar human capital and job-skill requirements. In addition, entries and exits respond in the standard way to differences in earnings, controlling for hours. Surprisingly, the occupational attachment of truck drivers is actually a bit higher than that of some other blue-collar occupations. This finding suggests that the market for truck drivers works about as well as that for other blue-collar occupations, and that, broadly speaking, we should expect that if wages rise when the labor market for truck drivers is too tight, the potential for any long-term shortages will be ameliorated. We conclude by noting that the labor supply issues highlighted by the industry are concentrated, by the industry's own account, in one specific segment of the market—that for drivers in for-hire long-distance truckload (TL) motor freight. A more specific analysis of this segment is needed, but is not feasible with the data used in the present article.

The remainder of the article is organized as follows. The next section provides background on the number and types of truckers, the regulations surrounding truck driving, and the size of the market for trucking services. The section that follows displays the employment and earnings patterns of truck drivers relative to those of other blue-collar workers. The section after that first describes how Current Population Survey (CPS) data can be used to analyze the labor market for truck drivers and then presents the patterns of occupations and industries from which drivers come and to which they go. The next section presents econometric models of exits from and entries into truck driving, to evaluate the effects of earnings on these movements. The following section returns to the industry's perception of a driver shortage and places it into the context of our analysis. The final section concludes.

How many truck drivers are there, and how important is trucking?

Truck driving is a large, predominantly male occupation, with relatively low educational requirements for entry and distinctive rules governing the terms of employment. According to data from the U.S. Bureau of Labor Statistics (BLS) Occupational Employment Statistics (OES) survey, a nationally representative survey of nonfarm business establishments, there were approximately 1.75 million heavy and tractor-trailer truck drivers in the United States in 2017, along with 877,670 light truck or delivery services drivers and 427,000 driver/sales workers.[6] The occupation is characterized by modest levels of education; the mode is a high school degree. There are low returns to additional education and to firm tenure for heavy and tractor-trailer truck drivers.[7]

Drivers who are engaged in any aspect of interstate transportation are not subject to the Fair Labor Standards Act's overtime provisions, which govern the majority of other private and public sector occupations. The hours of these workers are governed by the Federal Hours of Service regulations, which limit drivers to approximately 60 hours of work over a 7-day period and do not require a time-and-a-half pay premium for weekly hours over 40.[8] Most tractor-trailer drivers work far in excess of 40 hours per week.[9]

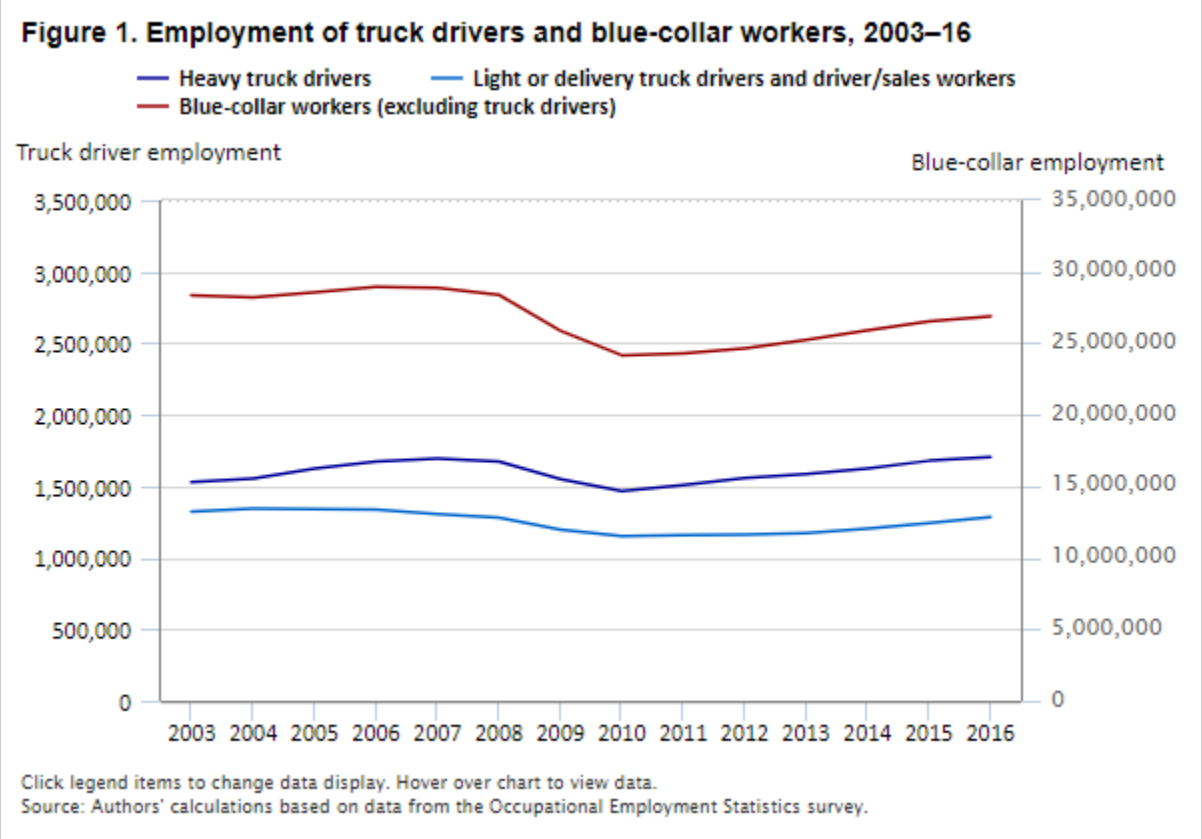
Truck driving is important not only because it is a large occupation, but also because it provides critically important services to the U.S. economy. Trucks were estimated to have hauled 61 percent of the total freight (by value) transported in the United States in 2016, and this activity accounted for an estimated 3.5 percent of U.S. gross domestic product.[10] These estimates include both the for-hire trucking industry (firms providing motor freight services to customers who are shippers and receivers) and private carriage (firms hauling their own freight as an internal function within some other primary line of business).[11] Trucking is the primary mode of

freight transportation within the United States and a crucial component of international trade. In 2016, 65 percent of the value of goods transported between the United States and its neighboring countries (Canada and Mexico) was carried by truck.[12]

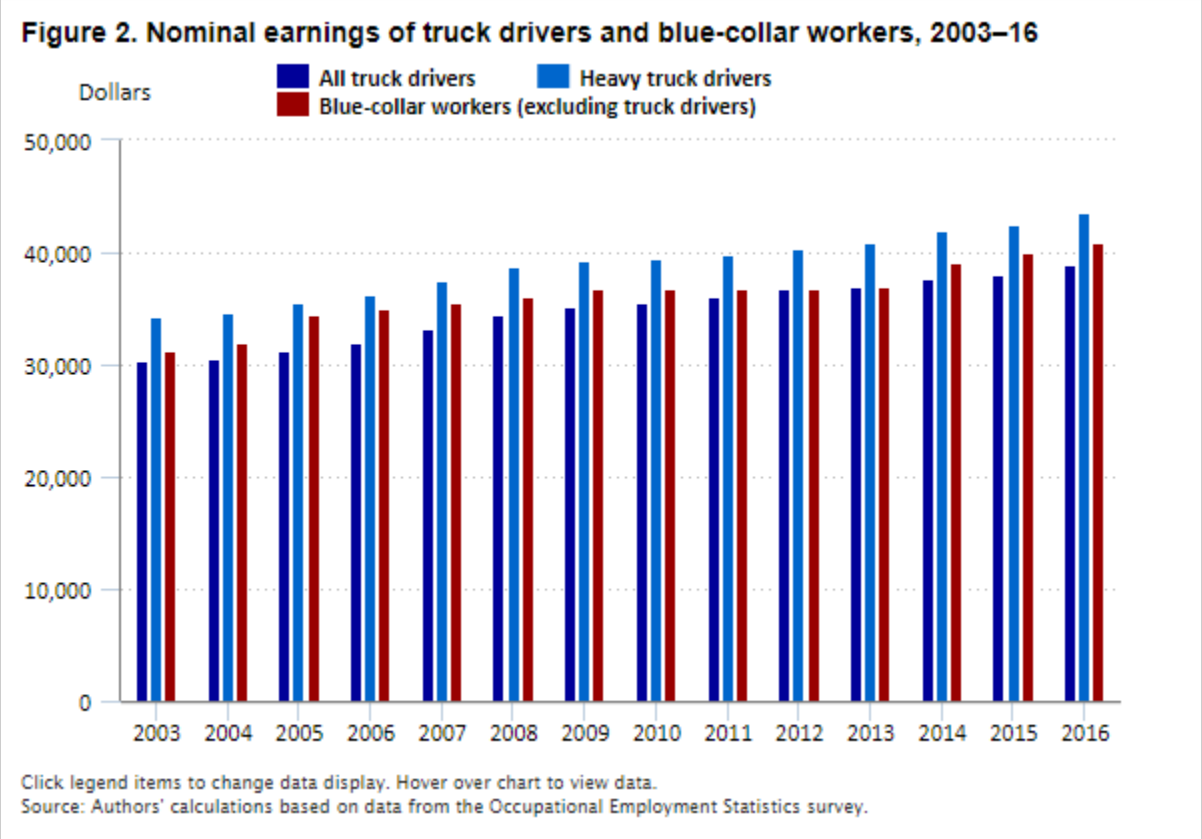
Employment and earnings: truck drivers versus other blue-collar workers

We use OES estimates to examine the employment and earnings of truck drivers relative to those of other workers.[13] The OES survey uses the Standard Occupational Classification (SOC) system to identify occupations, allowing us to analyze the three types of drivers identified above: heavy and tractor-trailer truck drivers (shortened to “heavy truck drivers” in several places below), light truck or delivery services drivers (shortened to “light or delivery truck drivers” below), and driver/sales workers.

Figure 1 presents employment of heavy truck drivers relative to that of light or delivery truck drivers and driver/sales workers combined. Heavy truck drivers account for roughly half of total truck driver employment. Although truck driver employment dipped during the 2007–09 recession, by 2013 it was roughly back to its 2003 level—there were approximately 2.9 million truck drivers in 2003 (1.5 million heavy truck drivers) and 2.8 million truck drivers in 2013 (1.6 million heavy truck drivers). By 2016, the total number of truck drivers was almost 3.0 million (1.7 million heavy truck drivers). Blue-collar employment (which we define as including construction, production, and transportation and material moving occupations, but excluding truck drivers and installation, maintenance, and repair workers) was estimated at 28.3 million in 2003, 25.2 million in 2013, and 26.9 million in 2016. The stability of trucking employment over the past 14 years provides some evidence of a tight labor market for truck drivers—the demand for drivers has remained strong while the demand for workers with low levels of education has declined substantially in other sectors.



This picture of a relatively tight labor market is supported by the earnings estimates from the OES survey.[14] The bars in figure 2 represent the level of nominal earnings. While it appears that truck drivers are at an earnings disadvantage relative to nondriving blue-collar workers, this disadvantage is only evidence of an earnings gap between light or delivery truck drivers and driver/sales workers, on the one hand, and blue-collar workers, on the other; point estimates of the earnings of heavy truck drivers exceed those of other blue-collar workers throughout the period. In summary, driver employment is stable or slightly increasing over time, and it is associated with earnings that are increasing in nominal terms and strong relative to those in other occupations with similar educational requirements. This picture is consistent with a labor market in which overall supply is responding to growing overall demand.



The main advantage of the OES survey is its large sample size, which allows us to obtain reliable estimates of employment and earnings at a detailed occupational level. However, the survey lacks other information about workers' characteristics. To further examine the dynamics of the labor market for truck drivers, we turn to data from the CPS.

Analyzing the labor market for truck drivers with the use of CPS data

Before continuing our analysis, we describe the data used in the next section of this article in more detail. We use data from the CPS public-use microdata files for the period 2003–17. Using the structure of the CPS and its Outgoing Rotation Groups (ORGs) files, we create "short panels" of individuals who are observed twice (exactly 12 months apart) when they are asked questions about their occupation and employment. We call the first observation "period 1" and the second observation "period 2."[15] We restrict our sample to men ages 20 to 65. We use 20 years of age as the lower bound, because 21 years is the minimum qualifying age for obtaining a commercial driver's license in interstate transportation.[16] We use only men because the occupation of truck driving has a very small share of women (less than 5 percent over the period in question). In the male sample, there are approximately 22,000 men reporting the occupation of truck driver, or slightly over 4 percent of the total sample for which occupational codes are present.

The advantage of using the CPS data is that we can examine individual characteristics. The disadvantage is that we cannot tell whether an individual is a heavy and tractor-trailer truck driver, light or delivery truck driver, or

driver/sales worker, because these three SOC categories are aggregated into a single CPS category (driver/sales workers and truck driver). To the extent possible, we attempt to remove drivers not operating heavy and tractor-trailer trucks from the sample of truck drivers. Light or delivery truck drivers and driver/sales workers are different from heavy truck drivers.[17] We rely on two sources of auxiliary information: the 2002 Vehicle Inventory and Use Survey and the industry-occupation matrix produced by BLS.[18] Using these sources, we drop observations in industries that have few heavy truck drivers.[19] Wholesale trade and retail trade both have a minority of heavy truck drivers among all truck drivers employed, but that minority adds up to approximately 15 percent of all heavy truck drivers.

Finally, we reconsider how to categorize drivers in the CPS sample by industry. According to formal definitions, trucking operations come in two types: for-hire carriers, who haul freight as their primary business, and private carriers, who provide trucking services within a firm that is engaged in another primary line of business.[20] In this article, we do not distinguish between for-hire and private carriage in the way this is typically done, which is based on whether a driver's census industry is "truck transportation" or not.[21] Instead, we use a more general distinction between, on the one hand, for-hire drivers identified as those employed at establishments in transportation (two-digit North American Industry Classification System [NAICS] codes 48-49, which include all of "transportation and warehousing") and, on the other, private-carriage drivers identified as those employed at establishments in all other industries.[22] After adjusting the identification of which drivers are for-hire drivers and which are private-carriage drivers, we are left with the distribution of industries shown in table 1.

Table 1. Industry distribution of truck drivers in the Current Population Survey

Industry	Percentage of truck drivers
Agriculture	1.4
Mining	1.6
Utilities	0.5
Construction	6.3
Manufacturing	8.6
Wholesale trade	11.9
Retail trade	10.8
For-hire carriage (broad version)	53.4
Administration, support, waste management, and remediation	5.6

Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003–17.

There is a great deal of literature examining why workers switch jobs. While the types of switching and the models addressing it vary across studies, job switching is generally linked to individual preferences, individual abilities, and available opportunities.[23] However, the literature focusing specifically on truck drivers is limited. Two previous nonacademic studies for the ATA focused on the role of alternative job opportunities (such as those in unskilled construction work) in the labor supply of truck drivers, but this question has not been well examined within the academic literature.[24] Using data from the National Longitudinal Survey of Youth 1997, Jonathan James has modeled multiple scenarios, including occupational clustering and occupational cycling, and has found a correlation between laborer and driver jobs within transportation.[25]

We first examine the patterns of industry and occupational mobility visible in CPS ORG data for truck drivers and then analyze whether typical factors, such as differences in earnings and hours, predict moves into and out of the occupation. All of our analyses consider for-hire and private-carriage drivers separately, since these two groups differ systematically. Drivers in for-hire trucking are more likely to be engaged in long-haul trucking, whereas those in other sectors are more likely to be engaged in short-haul trucking.[26] As can be seen in table 2, the hours and wages of these drivers are substantially different (data are for drivers who are employed full time).

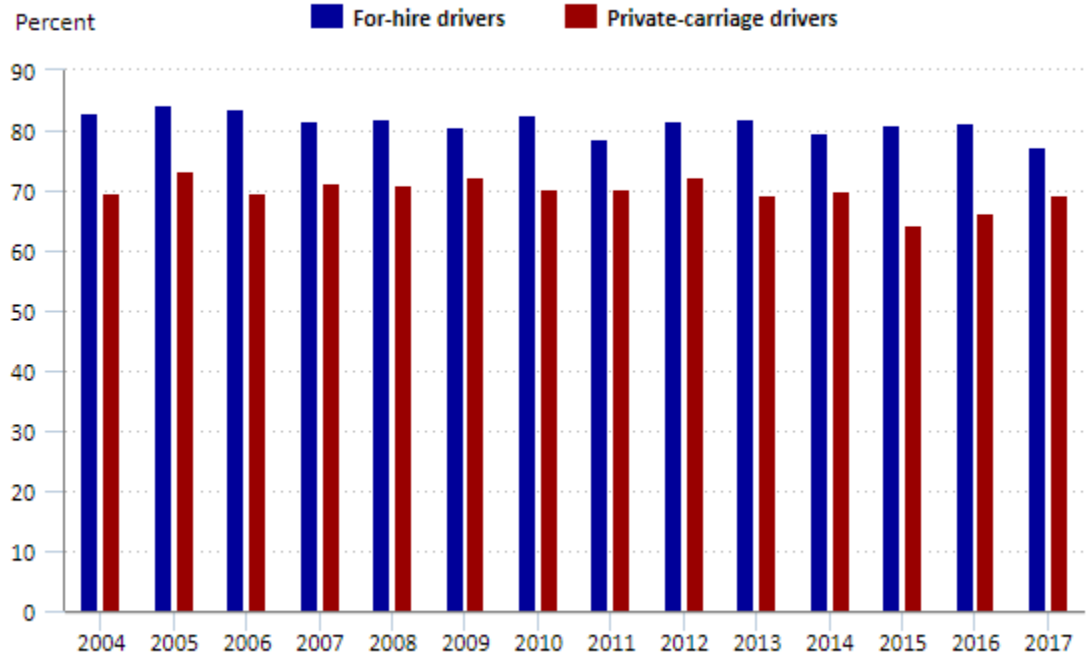
Table 2. Characteristics of workers who initially report full-time employment as a truck driver

Characteristic	For-hire drivers	Private-carriage drivers
Real hourly wage	$20.5 (9.5)	$18.7 (8.2)
Usual hours	48.8 (11.2)	45.5 (8.8)
Union (percent)	18.8	16.9
White, non-Hispanic (percent)	64.3	65.6
Black, non-Hispanic (percent)	14.8	11.5
Other race, non-Hispanic (percent)	3.1	2.7
Hispanic (percent)	17.8	20.2
Less than high school diploma (percent)	12.7	15.4
High school diploma (percent)	56.4	56.9
Some college, associate or vocational degree (percent)	25.8	23.2
College degree or higher (percent)	5.1	4.4

Note: Standard deviations are presented in parentheses for continuous variables.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003–17.

Recalling that CPS ORG data allow us to observe the occupation and employment status of the same individuals twice (1 year apart, in period 1 and period 2), we see in figure 3 substantially different patterns of occupational retention in the two segments. Compared with for-hire drivers, truck drivers employed in private carriage in period 1 are substantially less likely to remain truck drivers in period 2. Over the entire timespan, roughly 82 percent of those who were for-hire drivers in period 1 remained for-hire drivers in period 2. The corresponding figure for private-carriage drivers is 71 percent. Across all drivers in the sample, the 1-year occupational migration rate is 22 percent. This finding is in line with that of Gueorgui Kambourov and Iourii Manovskii, who find occupational mobility of 18 percent at the relatively detailed "three-digit" level, using Panel Study of Income Dynamics data across all workers for an earlier period (1969–97).[27] If their findings are restricted to workers with demographics similar to those of truck drivers (high school education or lower and ages 35 to 40), three-digit occupational migration is still 18 percent. This indicates that the pattern for all drivers is similar to that for workers in the overall economy.

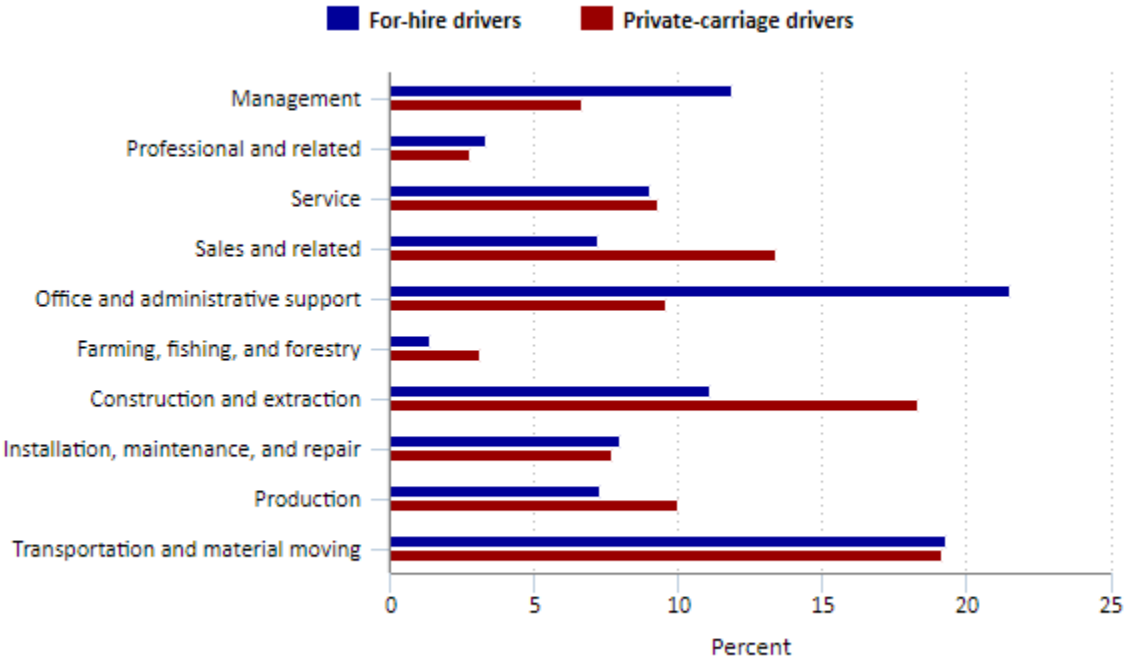
Figure 3. Percentage of truck drivers who retain their occupation in period 2, 2004–17



Click legend items to change data display. Hover over chart to view data.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003–17.

Trucking operations in for-hire trucking draw truck drivers from similar occupations as do trucking operations in private carriage (all other industries), with a few differences. (See figure 4.) Both segments draw from construction and extraction occupations, but the proportion drawn by private carriage is approximately 50 percent higher. Another key occupation is nontrucking transportation and material movers (roughly 19 percent for both segments), which is not surprising given that freight handlers are more likely to come into contact with truck drivers, making them more familiar with the occupation. Somewhat surprising is the number of truck drivers (especially among for-hire drivers) who are originally managers or executives. The largest single three-digit occupation reported within this group is “managers, all other,” followed by chief executives and transportation managers. A look at the industries of origin for former managers who became truck drivers shows the most common industries to be trucking and related transportation services. Interestingly, the largest single occupation from which for-hire trucking draws drivers is office and administrative work; the proportion drawn to private carriage from this occupation is less than half as large. This difference may reflect the fact that office and administrative personnel in for-hire firms have greater contact with drivers than do those in trucking operations situated in other industries.

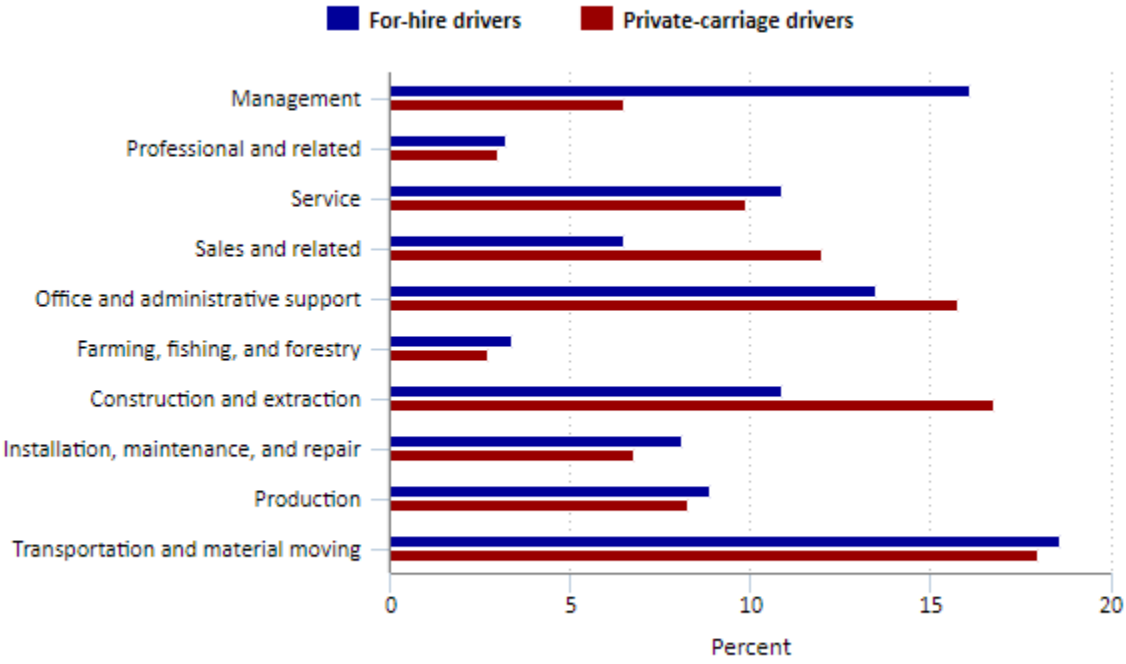
Figure 4. Percentage of workers who enter truck driving, by initial occupation departed



Click legend items to change data display. Hover over chart to view data.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003-17.

The occupations truck drivers come from and leave for have a similar profile. (See figure 5.) This fact leads us to believe that these jobs (particularly those in production, construction, office and administration, and transportation and material moving occupations) represent a reasonable occupational set from which potential drivers could be recruited. These findings are broadly in line with an analysis of data from the BLS Occupational Requirement Survey, which shows that the job skills required by heavy truck drivers are likely to be found in the occupations from which drivers come and to which they go.[28] These occupations may serve as a benchmark for the level of pay and hours that might attract workers into truck driving. They also suggest that differences in earnings and hours may be among the factors that predict switches between these occupations and truck driving, if the labor market is operating normally.

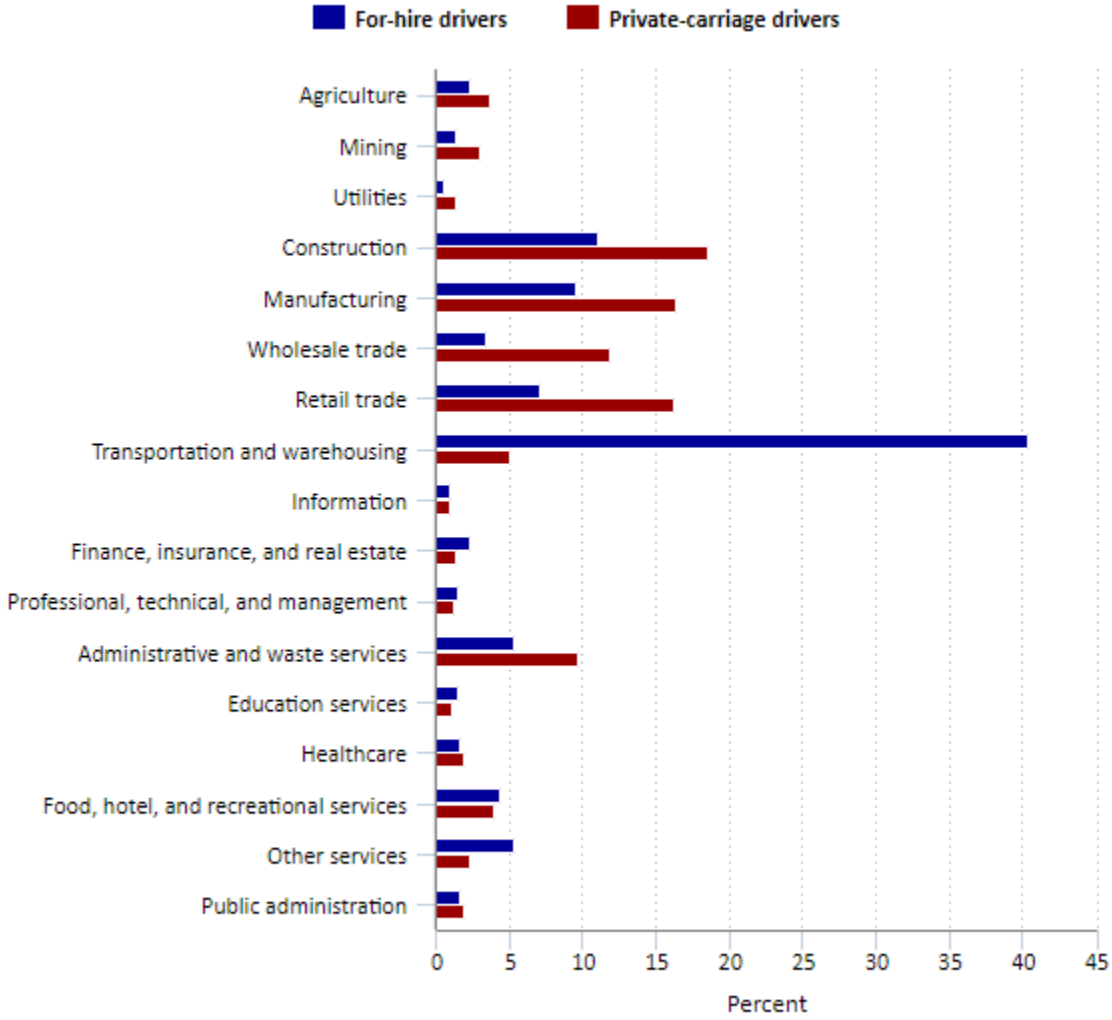
Figure 5. Percentage of workers who leave truck driving, by occupational destination



Click legend items to change data display. Hover over chart to view data.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003-17.

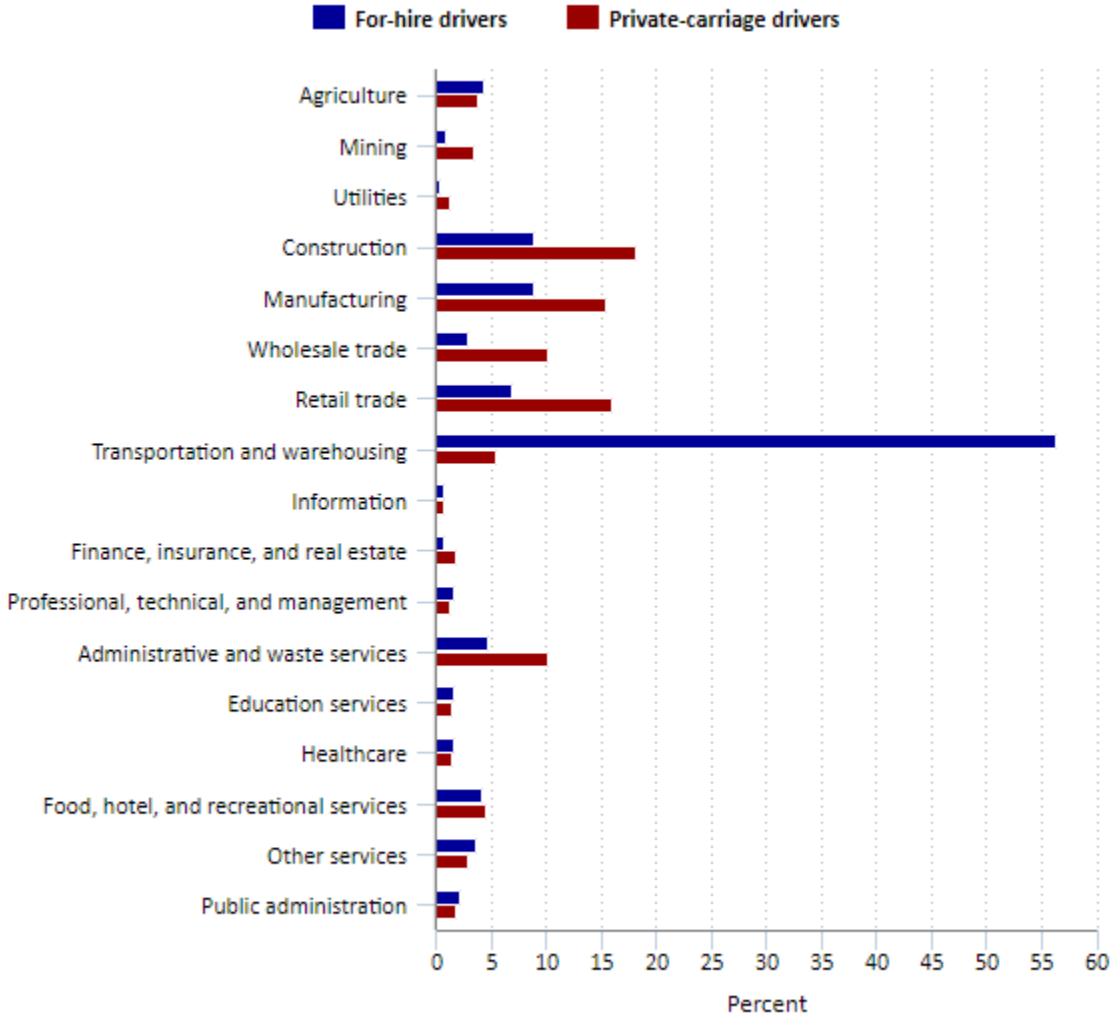
We next examine the industries from which drivers come (figure 6) and to which they go (figure 7). Not surprisingly, two-fifths of the individuals entering truck driving in the for-hire segment originally worked in another occupation within transportation and warehousing. The most common occupations these individuals leave are laborers and freight, stock, and material movers; transportation managers or supervisors; dispatchers; and truck and bus mechanics (these total approximately 55 percent of the three-digit occupational codes). Over half of those leaving for-hire truck driving leave for another occupation in transportation and warehousing, and the distribution of occupations workers enter is remarkably similar. It appears that firms in the for-hire segment might most productively recruit from other areas within their firm or from their competitors, attracting workers handling freight at terminals or docks in the transportation and warehousing industries.

Figure 6. Percentage of workers who enter truck driving in period 2, by initial industry departed



Click legend items to change data display. Hover over chart to view data.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003-17.

Figure 7. Percentage of workers who leave truck driving, by destination industry in period 2



Click legend items to change data display. Hover over chart to view data.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003-17.

Private carriage draws many drivers from the wholesale trade, retail trade, manufacturing, and construction industries. The detailed occupations in retail trade from which drivers come include salespersons, cashiers, stock clerks, and laborers. The occupations of laborers and stock handlers appear sensible job alternatives to truck driving, because private-carriage drivers, laborers, and stock handlers often interact at loading docks.

Together, the construction and manufacturing industries are the source of more than a third of entries into truck driving in private carriage and a fifth in for-hire carriage. The detailed construction and manufacturing occupations that truck drivers enter and exit are similar for both for-hire and private carriage. The construction jobs include laborers, operating engineers, carpenters, and highway maintenance workers. The manufacturing jobs include laborers, sales representatives, supervisors, assemblers, and machinists.

To complete the analysis, we examine the extent of migration between for-hire and private carriage. That is, among individuals who report working as truck drivers in both periods, how many change industry segments?

The answer is that there is relatively little interindustry migration of truck drivers. Ninety-one percent of individuals who remain truck drivers in both periods—but who started in the for-hire segment in period 1—are still working in the for-hire segment in period 2. The figure for private-carriage drivers remaining in private carriage is 88 percent.

In sum, although the inability to fully distinguish heavy truck drivers from light or delivery truck drivers and from driver/sales workers is a limitation in the CPS data, the patterns of occupational and industrial mobility observed in the data are sensible. They depict a labor market that stands in natural relationships with other occupations and industries.

CPS econometric models of occupational in- and outmigration of truck drivers

We now turn to the question whether differences in earnings and hours predict occupational changes for truck drivers as we would expect if the labor market is operating normally. Do individuals in this occupation arrive and depart for the usual reasons?

Exit from truck driving

We first examine the occupational outmigration of truck drivers, modeling the probability that an individual employed as a truck driver in period 1 is no longer working as a driver in period 2. We only consider individuals who are employed in both periods and who are in the occupation of truck driving in the first period of observation. The dependent variable is binary and takes a value of 1 if the individual has left truck driving and 0 otherwise. Explanatory variables include standardized age and its square, marital status, race and ethnicity, union status (whether an individual is a union member or covered by a collective bargaining agreement), education, census region, and fixed effects for year of observation. The estimation for drivers in private carriage also includes two-digit NAICS industry controls and the percentage of heavy trucks used in the industry (calculated with data from the 2002 Economic Census-Vehicle Inventory and Use Survey).[29] We use this last variable as a proxy for the likelihood that the individual is employed as a heavy and tractor-trailer truck driver, as opposed to a light or delivery truck driver or a driver/sales worker, recalling that we cannot distinguish these occupational segments within the CPS category of truck driving.

We use two specifications to examine the role of earnings and hours in affecting the probability of individuals leaving the occupation. In the first specification, we include standardized real weekly earnings and weekly hours, both from period 1, as explanatory variables. We hypothesize that individuals will be more likely to leave trucking to find a better combination of hours and pay elsewhere, which means that, all else constant, higher earnings in period 1 should reduce the probability of leaving.

In the second specification, we want to factor in an individual's expectation regarding his or her pay and hours in period 2. For earnings, we want to capture a "reasonable" expectation about the potential earnings increase or decrease an individual would face. To do so, we first calculate the expected period-2 earnings as the average weekly period-1 earnings for the occupation to which the individual moves.[30] For individuals who remain drivers, we first obtain the distribution of occupations to which movers actually switched and then calculate a weighted average of the period-1 earnings of these occupations. The average is weighted by the proportion of movers

who chose each occupation, to generate the expected earnings stayers would have faced had they exited driving. This calculation is used to create two indicator variables for earnings. The first, “expected earnings increase,” takes a value of 1 if the expected period-2 earnings are at least 15 percent higher than the period-1 earnings and 0 otherwise. The second, “expected wage decrease,” takes a value of 1 if the expected period-2 earnings are at least 15 percent lower than the period-1 earnings and 0 otherwise. The reference (omitted) group is “no expected earnings change,” which includes all cases in which the expected period-2 earnings are within ±15 percent of the period-1 earnings.[31]

For hours, in the second specification, we follow a procedure analogous to that for wages. For movers, the expected hours are those in period 1 for the occupation to which these individuals switch. For stayers, the expected hours are computed as an average of the period-1 hours of all the occupations to which movers switch, weighted by the proportions of movers choosing each occupation. We use these values to compute a difference: expected period-2 hours less actual period-1 hours. This variable can be negative (if expected period-2 hours are less than current hours), zero (if hours in both periods are the same), or positive (if expected period-2 hours are greater than period-1 hours). A one-unit increase in this variable means that the expected hours difference is larger, that is, that the expected period-2 hours have become an hour greater than period-1 hours.

Both specifications seem relevant: a truck driver may leave the occupation because of earnings dissatisfaction and get a job in a different occupation, only to find that the new job does not pay more. Thus, controlling for initial conditions, which is the purpose of the first specification, is important. Likewise, under the second specification and the assumption that workers switching occupations have sufficient information, the difference in earnings and hours will more completely identify workers who are leaving truck driving in order to achieve better economic outcomes.

The estimated odds ratios for the earnings and hours measures are presented in table 3. In the first specification, individuals with higher initial weekly earnings are less likely to leave driving in period 2. A one-standard-deviation increase in weekly earnings decreases the likelihood of leaving for-hire truck driving by 16 percent and private carriage by 25 percent. The relationship between hours and the probability of leaving driving is also negative—a one-standard-deviation increase in initial weekly hours makes an individual 21 percent less likely to leave for-hire truck driving and 9 percent less likely to leave private carriage. Additionally, private-carriage truck drivers have a lower likelihood of leaving if they are in an industry with a higher percentage of heavy trucks. Individuals working in an industry whose percentage of heavy trucks is one standard deviation higher are only 25 percent as likely to leave truck driving as those at the mean. This suggests that heavy and tractor-trailer truck drivers are less likely to leave the broad CPS category of trucking than light or delivery truck drivers and driver sales workers.

Table 3. Probability of exiting truck driving between period 1 and period 2

Variable	For-hire drivers		Private-carriage drivers	
	Specification 1	Specification 2	Specification 1	Specification 2
Standardized usual hours (period 1)	0.779***	—	0.908**	—

See footnotes at end of table.

Table 3. Probability of exiting truck driving between period 1 and period 2

Variable	For-hire drivers		Private-carriage drivers	
	Specification 1	Specification 2	Specification 1	Specification 2
	(-5.52)	—	(-2.14)	—
Standardized weekly earnings (period 1)	0.844***	—	0.747***	—
	(-1.67)	—	(-2.58)	—
Expected earnings increase	—	1.17	—	1.41***
	—	(1.34)	—	(3.71)
Expected earnings decrease	—	1.01	—	0.981
	—	(0.06)	—	(-0.18)
Expected difference in hours (expected – current)	—	1.03***	—	1.009*
	—	(5.84)	—	(1.93)
Standardized percentage of heavy trucks	—	—	0.267***	0.267***
	—	—	(-18.09)	(-18.32)
Observations	5,465	5,465	6,202	6,202

*$p < .10$, **$p < .05$, ***$p < .01$

Note: Results are presented as odds ratios (ORs) from logit models (OR < 1.00 reduces the chance of exit, OR = 1.00 indicates no effect, and OR > 1.00 increases the chance of exit). Robust *z*-statistics are shown in parentheses. The number of observations reflects the number of truck drivers in the period-1 sample.

Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003–17.

In the second specification, an expectation of an earnings increase is positively associated with the odds of leaving truck driving, but only statistically significant in private carriage. In private carriage, an expected earnings increase predicts a 41-percent increase in the probability of leaving.

The difference in expected hours is positively related to the likelihood of leaving truck driving for both for-hire and private-carriage drivers (see specification 1 in table 3). The point estimate for for-hire carriage is a 3-percent increase in the chance of leaving for a 1-hour increase in the gap. The private-carriage estimate is smaller, indicating almost a 1-percent increase in the chance of leaving for a 1-hour increase in the gap. These effects are not large, as the mean value for drivers who leave is 0.

Entry into truck driving

We next turn to estimating the probability of individuals entering truck driving. The subsample used for this estimation is different from that of the exit model, which included all (and only) individuals who were drivers in period 1. Here we only include workers who changed occupations between periods. To find these workers in the CPS, we compare three-digit occupations between the two periods and designate individuals who change occupational codes as "movers." Some of the movers may, in fact, be those who still work the same job but were coded differently in both periods. To overcome this difficulty, we consider "large" occupations (those with at least 1,000 observations in the dataset).

Using this subsample, we first examine whether truck drivers are more or less likely to switch occupations between periods than individuals in other occupations. We estimate a logit model of changing occupations across all occupations.[32] We include the same controls as in the exit model, along with a series of three-digit occupational dummies, with truck drivers as the reference (i.e., omitted) group. Surprisingly, we find that the

odds ratios estimated for most occupations are greater than 1, which indicates that men working in all other occupations in period 1 are more likely than truck drivers to leave their occupation in period 2. As a robustness check, we restrict the sample to those with a high school education or less, since these workers may be less likely to migrate between jobs because of reduced opportunities. Again, we find that individuals in other occupations are more likely than truckers to leave for a different occupation. This result provides additional evidence that the mobility patterns of truck drivers are not out of step with those of other blue-collar jobs. While some parts of the occupation may have high turnover at the firm level (i.e., quitting from a specific motor carrier to switch to another, while staying a driver), truck drivers as a group appear to have higher levels of occupational attachment than other occupations requiring similar human capital.

Next, we estimate the probability of individuals entering truck driving, conditioned on the fact that they changed jobs between the two periods (i.e., among the sample of movers). Do individuals enter this occupation for the usual reasons? Again, we estimate the models separately for for-hire and private carriage. The specification is similar to the exit model—explanatory variables include individual characteristics, location, and industry controls. The focus, again, is on the role of earnings and hours in the likelihood of individuals entering truck driving. Earnings variables compare actual period-1 income with the average period-1 earnings in trucking. This comparison is based on the same argument as that underlying the exit model, accounting for what individuals considering entry into trucking might reasonably expect to earn as drivers.

Higher initial pay reduces the odds of entry into truck driving in period 2, while higher initial hours increase the odds of entry, for both the for-hire and private-carriage specifications. (See table 4.) This result suggests that those entering truck driving see it as a way to increase their income (hence, the pay effect) and were initially working longer hours than the mean in their period-1 occupation (making the relatively long hours of driving more tolerable). The point estimates for the difference in hours suggest a slight reduction in the likelihood of entering trucking as the hours gap increases.

Table 4. Probability of entering truck driving in period 2 among occupational switchers

Variable	For-hire drivers		Private-carriage drivers	
	Specification 1	Specification 2	Specification 1	Specification 2
Standardized usual hours	1.120**	—	1.115**	—
	(2.24)	—	(2.47)	—
Standardized weekly earnings	0.652***	—	0.639***	—
	(-3.64)	—	(-4.80)	—
Expected earnings increase	—	1.285**	—	1.318**
	—	(2.06)	—	(2.85)
Expected earnings decrease	—	0.846	—	0.566***
	—	(-1.12)	—	(-5.15)
Difference in usual hours (period 2 – period 1)	—	0.991	—	0.992*
	—	(-1.55)	—	(-1.69)
Observations	85,977	85,977	86,298	86,298

*$p < .10$, **$p < .05$, ***$p < .01$

See footnotes at end of table.

Note: Results are presented as odds ratios (ORs) from logit models (OR < 1.00 reduces the chance of entry, OR = 1.00 indicates no effect, and OR > 1.00 increases the chance of entry). Robust *z*-statistics are shown in parentheses. The number of observations reflects the total number of occupational switchers.
Source: Authors' calculations based on data from the Current Population Survey Outgoing Rotation Groups, 2003–17.

By contrast, expectations of earnings increases are positive, substantial, and statistically significant in both for-hire and private carriage. An expectation of an earnings gain increases the likelihood of entering a driving job in for-hire transportation by 29 percent and in private carriage by 32 percent. In addition, an expectation of a wage decrease reduces the likelihood of entering a private-carriage driving job by 44 percent.

In summary, an econometric analysis of entry into truck driving and of exit from trucking to other occupations shows the patterns predicted by economic theory. Exits from truck driving are encouraged when alternate occupations have higher earnings, holding hours constant. For workers accustomed to high hours in trucking, high hours in a target occupation are not a barrier to departing trucking, but earnings have a larger effect. More importantly, higher earnings in truck driving increase occupational entry, especially among individuals who are willing to work longer hours for higher weekly income. Accounting for the fact that hours tend to be relatively high in truck driving, we find nothing surprising about how economic incentives appear to work in this labor market.

Why do motor carriers perceive a shortage of truck drivers?

How, then, do we reconcile the finding that truck driving is a relatively stable occupational choice (with migration driven in a predictable way by earnings and hours) with the view from managers in the trucking industry that the labor market for truck drivers has a serious and persistent shortage? We suggest that the occupation of truck driving is actually a composite of labor market segments, and that one segment in particular, long-distance truckload (TL) motor freight, is a "secondary market." Arguably, the long-distance TL segment has high levels of competition, similar average costs across all scales of production, and a very limited ability to differentiate prices in the product market. These characteristics result in labor market conditions in which individual firms are forced to accept high turnover as a cost-minimizing response to their competitive position in the market for their outputs.[33]

In its most recent driver-shortage report, the ATA distinguishes between high turnover rates and a labor market shortage, but it also argues that the shortage is concentrated in the long-distance TL segment and empirically linked to high turnover.[34] Other industry stakeholders also see high turnover, along with anecdotal evidence from carrier managers reporting "unseated trucks," as the key evidence for a driver shortage.[35]

The persistently high turnover presents TL-segment managers, who employ between one-sixth and one-fourth of all heavy and tractor-trailer truck drivers,[36] with a real business problem: managing recruitment and retention when many individuals entering the occupation in this specific part of the trucking industry find the working conditions and earnings to be unattractive.[37] One empirical indicator of the magnitude and persistence of this issue comes from the ATA survey of carriers, which shows that, between 1995 and 2017, the annual turnover rate at large TL carriers averaged 94.0 percent and that at small TL carriers averaged 79.2 percent. In contrast, the rate at firms in a different segment, less-than-truckload carriers, which were surveyed between 2000 and 2017, averaged only 11.7 percent. In the wake of the 2007–09 recession, in the first quarter of 2010, the annual

turnover rate at large TL carriers bottomed out at 39 percent and that at small TL carriers hit 35 percent, both of which are still very substantial percentages by the standards of blue-collar occupations.[38] Further, the problem of managing recruitment and retention becomes harder to solve when the industry has a lagged pricing response to a positive demand shock, because much TL freight moves under contracts, and aside from a spot market, freight rates do not adjust upward quickly. This lagged response has occurred twice postrecession, in 2014 and again in 2018.[39]

However, economists would not regard high turnover rates and the associated problems of recruiting and retaining drivers in this part of trucking as a long-term shortage. Nor would they call these conditions a “broken market,” except to the extent that one might use that term for a secondary labor market segment, since the high turnover that marks such a segment is an indicator that the jobs in it are unattractive to many potential employees.

The high turnover in this segment does not show up in the analysis of the present article for two reasons. First, drivers in the long-distance TL segment are a fraction of the total number of heavy and tractor-trailer truck drivers. Second, CPS data only give us an indirect look at firm-specific turnover.

Conclusion

The occupation of truck driving is often portrayed by the industry and in the popular press as beset by high levels of turnover and persistent “labor shortages.” Our analysis of OES data agrees that the labor market for heavy and tractor-trailer truck drivers shows markers of a “tight” labor market over the period since 2003—employment in the occupation has been resilient, and nominal annual wages have persistently exceeded those of other blue-collar jobs with similar human capital requirements. While we do use ATA data to identify one segment of the trucking labor market (long-distance TL motor freight) that has experienced high and persistent turnover rates for decades, the overall picture is consistent with a market in which labor supply responds to increasing labor demand over time, and a deeper look does not find evidence of a secular shortage.

Using data from the CPS, we modeled exit from and entry into the occupation, finding that occupational migration among drivers is similar in magnitude to that in other blue-collar occupations. Examining the short panels in the CPS ORG data, we cannot see cycling in and out of occupations for individuals over their careers. However, the occupations from which drivers come and to which they go—construction, production, and nontrucking transportation jobs—are similar, providing evidence that drivers consider the earnings and hours of these jobs as alternatives to trucking.

Econometric models of in- and outmigration of drivers support this conclusion. Drivers with higher earnings and hours in period 1 are less likely to leave driving in period 2. Those who enter driving in period 2 tend to have lower earnings and higher hours in their initial job. Perhaps most surprising, a basic model of moving between occupations shows that truck drivers have lower occupational migration than other workers with similar education levels. This suggests that, in the aggregate, the labor market for truck drivers works about as well as the labor markets for other blue-collar occupations.

SUGGESTED CITATION

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NOTES

1 *Top industry issues 2005* (Arlington, VA: American Transportation Research Institute, 2005), p. 7; *The U.S. truck driver shortage: analysis and forecasts* (Lexington, MA: Global Insight, Inc., May 2005); Bob Costello, *Truck driver shortage analysis 2017* (Arlington, VA: American Trucking Associations, October 2017), pp. 1–13; J. F. Casey, “An assessment of the truck driver shortage,” *Transportation Executive Update*, vol. 1, no. 1, 1987, pp. 20–23; J. A. Cooke, “Women, minorities seen ending driver shortage,” *Traffic Management*, February 1989, p. 17; and J. Mele, “Driver shortage: crisis or challenge?” *Fleet Owner*, 1988, pp. 73–84.

2 See, for example, Heather Long, “America has a massive truck driver shortage. Here's why few want an $80,000 job,” *The Washington Post*, May 29, 2018; and Nathaniel Meyersohn, “Truck driver shortage sends shipping costs sky-high,” *CNNMoney*, May 14, 2018.

3 Glen Cain, “The challenge of segmented labor market theories to orthodox theory: a survey,” *Journal of Economic Literature*, vol. 11, no. 4, 1976, pp. 1215–1257; and Andrew Weiss, *Efficiency wages: models of unemployment, layoffs, and wage dispersion* (Princeton, NJ: Princeton University Press, 1990).

4 See David M. Blank and George J. Stigler, “The demand and supply of scientific personnel” (New York: National Bureau of Economic Research, 1957), p. 23.

5 Carolyn M. Veneri, “Can occupational labor shortages be identified using available data?” *Monthly Labor Review*, vol. 122, no. 3, March 1999, p. 15.

6 Heavy and tractor-trailer truck drivers fall under Standard Occupational Classification (SOC) code 53-3032, light or delivery truck drivers under SOC code 53-3033, and driver/sales workers under SOC code 53-3031. According to OES definitions, only the first of these categories requires a commercial driver’s license. The labor force of truck drivers also includes self-employed drivers (owner-operators), who make up about 10 percent of the workforce of heavy and tractor-trailer truck drivers. Data limitations prevent the further inclusion of these individuals in the analysis of this article.

7 Dale L. Belman, Kristen Monaco, and Taggert J. Brooks, *Sailors of the concrete sea: a portrait of truck drivers' work and lives* (Lansing, MI: Michigan State University Press, 2005).

8 Formally, firms with weekend operations may assign drivers up to 70 hours work time over 8 days; firms closed on weekends generally use 60 hours over 7 days. However, drivers who make very aggressive use of the currently permitted “34-hour restart” provision of the rules can actually work up to approximately 80 hours per week, although relatively few do so; see “Summary of hours of service regulations” (Federal Motor Carrier Safety Administration), https://www.fmcsa.dot.gov/regulations/hours-service/summary-hours-service-regulations.

9 Belman, Monaco, and Brooks, *Sailors of the concrete sea*.

10 *Freight facts and figures 2017*, figure 5-2 (U.S. Department of Transportation, Bureau of Transportation Statistics, 2017), p. 111; and *Pocket guide to transportation 2018*, tables 2-1 and 2-2 (U.S. Department of Transportation, Bureau of Transportation Statistics, 2018), pp. 1–69.

11 Federal statistical agencies assign industry codes according to the primary line of business.

12 *Pocket guide to transportation 2018*, table 3-3.

13 Although we present the estimates on figures with a time dimension, the OES is not intended to be used as a time series; our focus is primarily on the relationship between truck drivers and other occupations.

14 Wages for truck drivers are a weighted average of the three detailed SOC codes.

15 For a more complete description of the matching process, see appendix A in Stephen V. Burks and Kristen Monaco, "Is the U.S. labor market for truck drivers broken? An empirical analysis using nationally representative data," IZA Discussion Paper 11813 (Bonn, Germany: IZA—Institute of Labor Economics, September 2018).

16 We want the dataset to contain those who are eligible to become drivers in interstate transportation by their second observation. In addition, some states allow those ages 18 to 20 to operate heavy and tractor-trailer trucks in intrastate-only transportation.

17 "53-3032 Heavy and tractor-trailer truck drivers," *Occupational Employment Statistics* (U.S. Bureau of Labor Statistics), https://www.bls.gov/oes/current/oes533032.htm; "53-3033 Light truck or delivery services drivers," *Occupational Employment Statistics* (U.S. Bureau of Labor Statistics), https://www.bls.gov/oes/current/oes533033.htm; and "53-3031 Driver/sales workers," *Occupational Employment Statistics* (U.S. Bureau of Labor Statistics), https://www.bls.gov/oes/current/oes533031.htm.

18 "Table 1.8 2016–26 industry-occupation matrix data, by occupation" *Employment Projections* (U.S. Bureau of Labor Statistics), https://www.bls.gov/emp/tables/industry-occupation-matrix-occupation.htm.

19 For a more detailed description of how observations are selected for dropping, see appendix B in Burks and Monaco, "Is the U.S. labor market for truck drivers broken? An empirical analysis using nationally representative data."

20 Stephen V. Burks, Michael Belzer, Quon Kwan, Stephanie Pratt, and Sandra Shackelford, *Trucking 101: an industry primer*, Transportation Research Circular E-C146 (Washington, DC: Transportation Research Board, 2010).

21 The three-digit North American Industry Classification System code for truck transportation is 484.

22 Our results are generally not sensitive to this distinction. Results based on the more conventional separation of for-hire versus private carriage as drivers in trucking versus nontrucking industries are available from the authors upon request. For a comparison of our approach with the conventional one, see appendix C in Burks and Monaco, "Is the U.S. labor market for truck drivers broken? An empirical analysis using nationally representative data."

23 See Ann P. Bartel and George J. Borjas, "Wage growth and job turnover: an empirical analysis," in Sherwin Rosen, ed., *Studies in labor markets* (Chicago, IL: University of Chicago Press, 1981), pp. 65–90; Jacob Mincer and Boyan Jovanovic, "Labor mobility and wages," in Sherwin Rosen, ed., *Studies in labor markets* (Chicago, IL: University of Chicago Press, 1981), pp. 21–64; Audrey Light and Kathleen McGarry, "Job change patterns and the wages of young men," *Review of Economics and Statistics*, vol. 80, no. 2, February 1998, pp. 276–286; Lalith Munasinghe and Karl Sigman, "A hobo syndrome? Mobility, wages, and job turnover," *Labour Economics*, vol. 11, no. 2, April 2004, pp. 191–218; Derek Neal, "The complexity of job mobility among young men," *Journal of Labor Economics*, vol. 17, no. 2, April 1999, pp. 237–261; and Jonathan James, "Ability matching and occupational choice," Working Paper 1125 (Federal Reserve Bank of Cleveland, 2011). A tendency for job switchers to experience wage decreases after switching jobs is typically seen as either evidence of a poor initial match (the worker has low ability) or the result of tenure disruptions lowering wages (in a typical human capital model). The latter is often dismissed in models that find that firm or industry tenure is less important for earnings than total occupational experience; see Gueorgui Kambourov and Iourii Manovskii, "Rising occupational and industry mobility in the United States: 1968–97," *International Economic Review*, vol. 49, no. 1, 2008, pp. 41–79; and Neal, "The complexity of job mobility among young men."

24 Debra Christenson, Ron Aames, Jon Hughes, and Mike Kinney, *Empty seats and musical chairs: critical success factors in truck driver retention* (Washington, DC: The Gallup Organization, October 1997); and *The U.S. truck driver shortage*.

25 James, "Ability matching and occupational choice."

26 Stephen V. Burks, Kristen Monaco, and Josephine Myers-Kuikindall, "The balance between private and for-hire carriage and trends in the use of large trucks (1977 to 1997)," *Journal of the Transportation Research Forum*, vol. 43, no. 2, 2004, pp. 159–171.

27 Kambourov and Manovskii, "Rising occupational and industry mobility in the United States: 1968–97."

28 Mauri Gittleman and Kristen Monaco, "Truck driving jobs: are they headed for rapid elimination?" (working paper presented at a 2017 conference sponsored by the Industry Studies Association).

29 "2002 Economic Census-Vehicle Inventory and Use Survey" (U.S. Census Bureau, December 2004), https://www.census.gov/library/publications/2002/econ/census/vehicle-inventory-and-use-survey.html.

30 We use period-1 earnings because they are a proxy for what would be observable at the time the individual decides to switch to the period-2 occupation.

31 The results are not particularly sensitive to the threshold used. Results assuming 5-percent, 10-percent, and 20-percent changes are available from the authors upon request.

32 Because of the size of the output, results are not presented in this article and are available from the authors upon request.

33 Stephen V. Burks, Jeffrey Carpenter, Lorenz Götte, Kristen Monaco, Kay Porter, and Aldo Rustichini, "Using behavioral economic field experiments at a firm: the context and design of the truckers and turnover project," in Stefan Bender, Julia Lane, Kathryn L. Shaw, Fredrik Andersson, and Till von Wachter, eds., *The analysis of firms and employees: quantitative and qualitative approaches* (Chicago and London: The National Bureau of Economic Research and University of Chicago Press, 2008), pp. 45–106.

34 Costello, *Truck driver shortage analysis 2017*, p. 7.

35 Deborah Lockridge, "In search of drivers," *Truckinginfo.com*, https://www.truckinginfo.com/155901/in-search-of-drivers.

36 The lower figure is implied in estimates of the number of long-haul drivers by Gittleman and Monaco ("Truck driving jobs"). The higher figure is arrived at by taking two-thirds of the total employment recorded in the 2012 Economic Census for NAICS codes 484121 (general freight trucking, long-distance, truckload) and 484230 (specialized freight [except used goods] trucking, long-distance) and dividing that figure by the total number of heavy and tractor-trailer drivers in that year.

37 Steve Viscelli, *The big rig: trucking and the decline of the American dream* (Berkeley, CA: University of California Press, 2016).

38 "Driver turnover historic database TL" (Alexandria, VA: American Trucking Associations, 2017) and "Driver turnover historic database LTL" (Alexandria, VA: American Trucking Associations, 2017).

39 Jonathan S. Reiskin, "Driver shortage hits critical level as executives fear loss of business," *Transport Topics*, October 13, 2014, https://www.ttnews.com/articles/driver-shortage-hits-critical-level-executives-fear-loss-business; and Richard Clough, "As economy heats up, truck driver shortage burns more companies," *Transport Topics*, June 8, 2018, https://www.ttnews.com/articles/economy-heats-truck-driver-shortage-burns-more-companies.

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