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DISCUSSION PAPER SERIES

IZA DP No. 11813

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ABSTRACT

Is the U.S. Labor Market for Truck Drivers Broken? An Empirical Analysis Using Nationally Representative Data

The US trucking industry trade press often portrays the US labor market for truck drivers as not working, citing persistent driver shortages and high levels of firm-level turnover, and predicting significant resulting constraints on the supply of motor freight services. We investigate the truck driver labor market using three techniques. First, using data from the Occupational Employment Statistics of the Bureau of Labor Statistics, we delineate the structure of the driver workforce. Second, from the same source we find that the trucking labor market has displayed some characteristics of a "tight" labor market since 2003: rising nominal wages, stable/growing employment, and lower rates of unemployment than other blue-collar jobs. Third, 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. The market as a whole appears to work as well as any other blue-collar labor market, and while the truck driver market tends to be "tight," there do not appear to be any special constraints preventing entry into (or exit from) the occupation. There is thus no reason to think that driver supply should fail to respond to price signals in the standard way, given sufficient time. The persistent issues localized in the TL segment are not visible in the aggregate data, and require a distinct analysis.

JEL Classification: J62, J49, R49, J24

Keywords: occupational mobility, industrial mobility, trucking, truckload, motor freight, turnover, truck driver, driver shortage, secondary labor market segment

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1. Introduction[1,2]

How does the labor market for truck drivers compare to the labor markets for other blue-collar occupations with similar human capital requirements?[3] The most prominent story about the market for drivers is that told by the American Trucking Associations (ATA),[4] which represent firms that are central industry participants. The ATA has been arguing systematically since an initial report in 2005 that firms hauling freight for-hire face a shortage of truck drivers (ATRI Staff 2005; Global Insight Inc. 2005; Costello 2017), and discussion within the industry of a shortage actually dates to the late 1980s (Casey 1987; Mele 1988; Cooke 1989). Stories about a persistent driver shortage, and the potential effects on the larger economy, have also appeared periodically in major media outlets, most recently in 2018 (Long 2018; Meyersohn 2018).

The consistent position from major industry stakeholders that there is a long-standing shortage of employees poses a puzzle for empirical labor economics. Economists think of a shortage as a type of disequilibrium situation that normal market forces will tend to moderate and eventually remove, other things equal. A sound theoretical foundation for labor *surpluses* (and potentially, for associated unemployment) has long been recognized in the concept of efficiency wages, in which it is profit-maximizing for the pay level to be held above the market–clearing level by employers, creating a surplus

[1] We note that an earlier version of the material herein was contained in a larger paper about the truck driver labor market, the long distance truckload segment of that market, and the prospects for autonomous trucks, which was presented at the 59th Annual Transportation Research Forum, April 2018, Minneapolis, MN. The present paper represents a revision and updating of the first half of the earlier and longer paper; the balance of the earlier paper is intended to be revised in a separate future work.

[2] We acknowledge helpful comments from Jesse Eklund, Denis Ostroushko, Jon Anderson, and Michael Cagle, and from Linda Cohen and other participants at the 59th Annual Transportation Research Forum, Minneapolis, MN April 11, 2018.

[3] We define "blue-collar" occupations as those falling in the following categories: i) construction, ii) production, iii) transportation and material moving, and iv) installation, maintenance, and repair.

[4] The American Trucking Associations is a federation of 50 state trucking associations, which also includes cross-cutting subgroups that cover specific industry segments (e.g. the Truckload Carriers Association and the Automobile Carriers Conference) and specific professional functions within the industry (e.g. the Technology and Maintenance Council).

of job seekers and queues for such "good jobs" (Cain 1976; Weiss 1990). Shortages, however, are somewhat 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 (which may or may not bring wages back near their original level, depending on the cost of the new supply). While it is not unusual for any specific market to be out of equilibrium at a point in time, for a market to be consistently out of equilibrium in the direction of a shortage over more than a decade (or longer if we consider the earlier industry discussion of a driver shortage), suggests either some unusual and persistent causal factor at work, such as a skills-mismatch or 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 Blank and Stigler (1957), who offer the following definition relevant to the current question: that "the quantity of labor services in question that is demanded is greater than the quantity supplied at the prevailing wage (1957; page 23)."[5] In her turn-of-the-century review of prior work, Veneri (1999) argues that no single criterion based in standard governmental data sources can be used to identify an occupational shortage, but 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 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.

[5] This is the second of three definitions they offer as being used in practical settings; the other two are less relevant.

In this paper, we use publicly available nationally representative data collected by agencies of the US government on employment, earnings, and occupational mobility to examine the state of the labor market for truck drivers. We first describe the structure of the occupation—there are three detailed occupational categories which fall within the broader truck driving occupation—and identify the numbers engaged in the different types of truck driving. Second, we compare the earnings of truck drivers and their unemployment rates to those of a broad group of related jobs ("blue-collar" occupations[6]) 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 economic theory would predict. We tabulate from which occupations and industries those entering truck driving originate, and to which occupations and industries those 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 the truck driving occupation, to see if these are consistent with economic theory.

We find that there are indeed some indicators that the market for truck drivers has tended towards tightness over the period from 2003 through 2017: wages have been strong relative to similar blue-collar occupations and employment numbers have been robust by the same standard. Additionally, over the last business cycle the unemployment rate for truck drivers was persistently lower than for other blue-collar workers. But we also find indicators of normal labor market behavior. Individuals who migrate into and out of this occupation come from occupations that either have on-the-job contact with truck drivers or have similar human capital requirements and job-specific skills, and entries and exits respond in the standard way to differences in earnings, controlling for hours.[7] Surprisingly, it also appears that truck driver occupational attachment is actually a bit higher than that of some other blue-

[6] Defined above, footnote 3, page 3.

[7] There is one modest exception-individuals who have self-selected into driving are estimated to be relatively undeterred by higher hours from switching occupations; see Section 5.1.

collar occupations. This 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.[8] 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 motor freight; a more specific analysis of this segment is indicated, but this is not addressable with the data utilized in the present paper.

The balance of the paper is organized as follows: section 2 provides background on the number and types of truckers, the regulations surrounding truck driving work, and the size of market for trucking services. Section 3 displays the employment and earnings patterns of truck drivers relative to those of other blue-collar workers. Section 4 first describes how Current Population Survey (CPS) data can be used to analyze truck drivers and then presents unemployment statistics for drivers and relevant comparison groups, followed by exhibiting the patterns of occupations and industries from which drivers come and to which they go. Section 5 presents econometric models of exits from and entries into the truck driving occupation, to evaluate the effects of earnings on these movements. In section 6 we return to the industry's perception of a truck driver shortage and place it into the context of our analysis, and Section 7 concludes.

2. **How Many Truck Drivers Are There, and How Important Is Trucking?**

Truck driving is a large, low-education, predominantly male occupation with distinctive rules governing the terms of employment for many in the occupation. According to data from the Occupational Employment Statistics (OES) survey, a nationally representative survey of non-farm

[8] Of course, "operating about as well as other blue-collar labor markets" may not be a very high standard; those concerned with the development of income inequality in the US have suggested that secular stagnation of the wages and earnings in blue-collar labor markets is an important social problem (Mishel, Bivens et al. 2012).

business establishments administered by the Bureau of Labor Statistics (BLS), there were approximately 1.75 million heavy-truck/tractor-trailer employee drivers in the U.S. in 2017, along with 877,670 light-truck/delivery employee drivers, and an additional 427,000 driver/sales workers (Bureau of Labor Statistics 2018b; Bureau of Labor Statistics 2018c).[9] The projected growth from 2016 to 2026 of these occupational segments is 108,400, 62,100, and a decline of 6,900, respectively (Bureau of Labor Statistics 2018d). These numbers omit owner operators, self-employed truck drivers, who comprise between 10% and 15% of the heavy truck driving labor force (Burks, Belzer et al. 2010), and do not include drivers employed at farm establishments.[10] Due to the continuing retirement of current employees, the annual demand for new drivers is expected to be significantly greater than the net changes in each occupation. BLS projects 213,500 new heavy and tractor-trailer drivers to be needed annually through 2016, along with 109,800 light and delivery truck drivers, and 48,500 driver/sales workers (Bureau of Labor Statistics 2018d). The occupation is characterized by modest levels of education; the mode is a high school degree (Belman, Monaco et al. 2005; O*NET Online 2016). There

[9] Heavy and Tractor-Trailer Truck Drivers are Standard Occupational Classification (SOC) code 53-3032, Light and Delivery Truck drivers are SOC code 53-3033, and Driver/Sales Workers are SOC code 53-3031 (Bureau of Labor Statistics 2018a). We note that according to the OES definition the only one of these categories requiring a commercial driver's license (CDL) is the first. The Federal Motor Carrier Safety Administration estimates that 3,100,000 drivers used CDLs in interstate transportation in 2017, and an additional 900,000 used them in intrastate work (Federal Motor Carrier Safety Administration 2017). These estimates are based on the number of CDLs extant, adjusted downward to account for individuals not actively using their CDLs on the job. The fact that this number is higher than BLS estimates for heavy and tractor-trailer truck drivers may partly reflect that some drivers of this type are based on farms, and so are not included in BLS surveys. But it may also reflect the fact that there are three types of CDLs, and not all are used for the operation of heavy and tractor-trailer trucks. Class A is required for tractor-trailers. Class B is for large single-unit trucks or buses with up to a small trailer. Class C is primarily for buses. So a significant number of CDLs recorded by FMCSA are used for buses. In addition, some states have more expansive requirements for CDLs; e.g., California requires one for every person whose primary occupation is driving, no matter the vehicle size.

[10] The BLS also issues the Employment Projections (EP) statistics, which include estimates of the self-employed in each occupation (Bureau of Labor Statistics 2018d). For 2016 the difference in the two estimates is 1,871,700 (EP) – 1,705,520 (OES) = 166,180. This implies a 2016 BLS estimate of the number of owner-operators in heavy and tractor-trailer truck driving of about 166,000.

are low returns to additional education and to firm tenure for heavy and tractor-trailer truck drivers (Belman, Monaco et al. 2005).

Drivers who are engaged in any aspect of interstate transportation (whether working in one locality or across state lines) are not subject to the overtime provisions of the Fair Labor Standards Act which govern the majority of other private and public sector occupations; their hours are governed by the Federal Hours of Service (HOS) regulations, which limit drivers to approximately 60 hours of work over a seven day period, and do not require time-and-a-half for weekly hours over 40.[11] Most tractor-trailer drivers work far in excess of 40 hours per week (Belman, Monaco et al. 2005; O*NET Online 2016).

Truck driving is important not only because it is a large occupation, but because the services provided by truck drivers are critically important to the U.S. economy. Trucks were estimated to have hauled 61% of the total freight transported in the U.S. by value in 2016 (Bureau of Transportation Statistics 2018, Tables 2-1, 2-2), and this activity contributed an estimated 3.5% of the Gross Domestic Product (GDP) of the US (Bureau of Transportation Statistics 2017, Figure 5-2). This estimate includes both 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).[12] Trucking is the primary mode of freight transportation within the U.S., and in addition to moving goods produced and consumed within the U.S., trucking is a crucial

[11] Formally, firms with weekend operations may assign drivers up to 70 hours work time over eight days, and 60 hours over seven days is generally used by those closed on weekend. 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 this (FMCSA 2012).

[12] Federal statistical agencies assign industry codes according to the primary line of business (United States Census Bureau 2017a); this affects how truckers and trucking are identified in government data (see details provided in the discussion in Section 4 and in Section 10: Appendix C). It is not easy to directly estimate the size of private carriage. In the past, truck users were surveyed directly as part of the Vehicle Inventory and Use Survey (VIUS), which collected data directly from private carriage truck users. While the VIUS was last conducted in 2002, an analysis of historical VIUS data suggests that the total production of trucking services in private carriage was similar in magnitude to that of for-hire carriage, though private carries tend to use more and smaller trucks, and operate them fewer miles, than for-hire carriers (Burks, Monaco et al. 2004a).

component of international trade. In 2016 65% of the value of goods transported between the U.S. and its border countries (Canada and Mexico) was carried by truck (Bureau of Transportation Statistics 2018, Table 3-3).

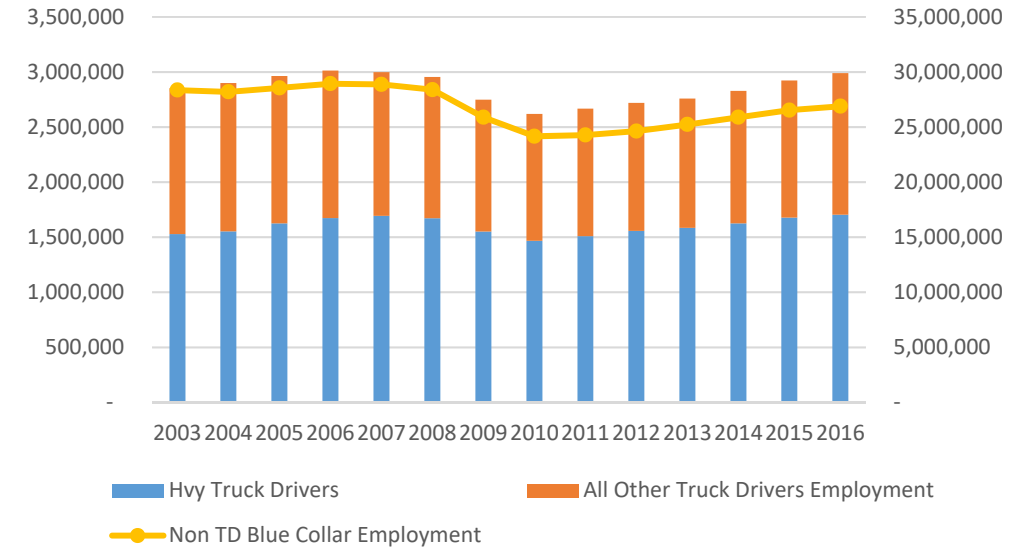
3. Employment and Earnings: Truck Drivers versus Other Blue-collar Workers

We use OES estimates (introduced above, Section 2) to examine the employment and earnings of truck drivers relative to other workers.[13] The OES uses the standard occupational classification (SOC) system to identify occupations, which allows us to analyze the three types of drivers identified above: heavy and tractor-trailer truck drivers (shortened to "heavy truck drivers" or "heavy drivers" in several places below), light truck drivers, and sales drivers.

Figure 1 presents employment of heavy truck drivers relative to light truck and sales/delivery drivers ("all other truck drivers employment"). Heavy truck drivers comprise roughly half of total truck driver employment. Though truck driver employment dipped during the recession, it is notable that by 2013 employment 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 (not including truck drivers) 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 demand for workers with low levels of education has declined substantially in other sectors.

[13] Though we present the estimates on charts with a time dimension, it is important to note that 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.

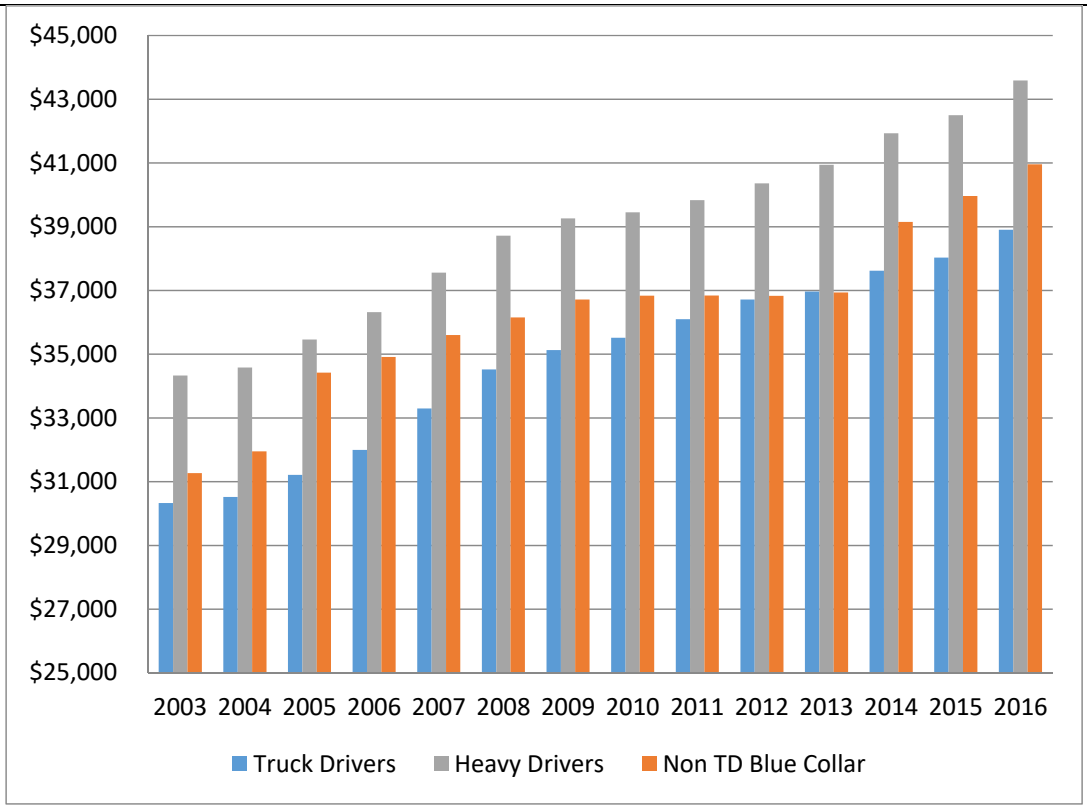
Figure 1: Truck Driver (left scale) and Blue-Collar Employment (right scale), 2003-2016



This picture of a relatively tight labor market is supported by the earnings estimates from the OES (Figure 2). The bars represent the level of nominal earnings.[14] While it appears that truck drivers are at an earnings disadvantage relative to non-driving blue-collar workers, this wage disadvantage is only evidence of an earnings gap between light and sales drivers and blue-collar workers – heavy truck drivers earn more than blue-collar workers throughout the period (ranging from 10% more in 2003 to 3% in 2005, to 6% in 2016). In summary, driver employment is stable or slightly increasing over time, and associated with this we observe earnings that are increasing in nominal terms and strong relative to other jobs with similar educational requirements. This is consistent with a labor market in which overall supply is responding over time in the expected manner to growing overall demand.

[14] It may be noted that real earnings have stagnated across this period. The nominal mean annual earnings of heavy truck drivers were $34,330 in 2003 and $43,590 in 2016. Using the CPI-U (standard Consumer Price Index for Urban workers (Bureau of Labor Statistics 2017c)) to translate 2003 mean earnings into 2016 dollars gives (240/184)x$34,330 =$44,778. If we use the Chained CPI-U (CPI adjusted annually for substitution effects (Bureau of Labor Statistics 2017d)) we get (137.3/107.8)x$34,330 = $43,754. Either way, heavy and tractor-trailer truck drivers did not gain in real earnings over this period. All non-truck driving blue collar workers had no gain according to the CPI-U and a gain of about 3% according to the C-CPI-U.

Figure 2: Truck Driver and Blue-collar Nominal Earnings



The main advantage of the OES is its large sample size – it is possible to get reliable estimates of employment and earnings at a detailed occupational level; however, it lacks other information about workers' characteristics. To examine further the dynamics of the truck driver labor market, we turn to data from the Current Population Survey (CPS).

4. Analyzing Truck Drivers Using Current Population Survey (CPS) Data

Before continuing our analysis, we need first to describe the data to be used for the next section of this paper in a bit more detail. We use data from the CPS public-use microdata files from 2003-2017. The CPS surveys a representative sample of the US workforce on a rolling basis; using the structure of the CPS we create "short panels" of individuals who are observed twice, exactly 12 months apart, when they are asked questions about their occupation and employment. Such panels are known as Outgoing

Rotation Groups (ORGs); we call the first observation "period 1" and the second observation "period 2". We restrict our sample to males aged 20-65. We use 20 years of age as the lower bound as 21 is the minimum age for an individual to qualify for a commercial driver's license in interstate transportation.[15] We use only males, as the truck driving occupation has a very small share of females (less than 5% over the time period in question). In the sample of males there are approximately 22,000 reporting the occupation of truck driver, or slightly over 4% of the total sample for which occupational codes are present.[16]

The advantage of using the CPS data is that we can capture individual characteristics and identify them exactly one year later. The disadvantage is that we cannot tell whether an individual is a heavy and tractor-trailer driver, light or delivery truck driver, or driver/sales worker, as these three SOCs are aggregated into a single Census Occupation Code "driver/sales worker and truck driver." To the extent possible, we attempt to remove drivers not operating heavy and tractor-trailer trucks (shortened to "heavy trucks" frequently, below) from the truck driver sample. Light or delivery truck drivers and driver/sales workers are different from heavy drivers (as is evident from their wages in the OES and the tasks associated with their jobs identified in O*NET (Bureau of Labor Statistics 2018b; Bureau of Labor Statistics 2018c)). We rely on two sources of auxiliary information, the 2002 Vehicle Inventory and Use Survey, and the Industry-occupation Matrix provided by BLS (Bureau of Labor Statistics 2017a; Bureau of Labor Statistics 2017b). Using these sources, we drop observations in industries that have few heavy truck drivers.[17] Wholesale and Retail Trade both have a minority of heavy truck drivers among all truck drivers employed, but that minority nonetheless adds up to approximately 15% of all heavy truck

[15] We want the data set to contain those who are eligible to become drivers in interstate transportation by their second observation, and in addition, some states allow those aged 18-20 to operate heavy and tractor-trailer trucks in intrastate-only transportation.
[16] For a more detailed description of the data, including the matching process, see Section 8: Appendix A.
[17] For a more detailed description of how observations are selected for dropping, see Section 9: Appendix B.

drivers. So our default analysis excludes them, and we look to see if results change when we add them back, as a robustness check.[18]

Finally, we reconsider how to categorize drivers in the CPS sample by industry. According to the formal definitions of these two types of trucking operations (described above in Section 2), "for-hire" carriers haul freight as their primary business, while "private carriers" provide trucking services within a firm that is engaged in another primary line of business (Burks, Belzer et al. 2010). In this paper, we do not distinguish between for-hire and private carriage in the data in the way that is typically done, based on whether a driver's Census industry code is "Truck Transportation" or not.[19] Instead, we use a more general distinction between for-hire drivers as those employed at establishments in transportation (2-digit categories 48-49 in the North American Industry Classification System (NAICS; United States Census Bureau 2017a), which includes all of "Transportation and Warehousing") on the one hand, and private carriage drivers as those employed at establishments in all other industries, on the other (United States Census Bureau 2017a).[20] (A discussion and a comparison of our approach with the conventional one is provided in see Section 10, Appendix C.)[21] After adjusting the identification of which drivers are for-hire and which are private carriage, we are left with the distribution of industries shown in Table 1. Throughout this paper, we will refer to the drivers employed in non-transportation industries that remain in the sample as "private carriage" drivers, and those categorized as "for-hire" in our revised scheme as "for-hire (broad version)".

[18] Further details are provided in Section 9, Appendix B.

[19] More formally, the trucking designation is NAICS 3-digit code 484 "Truck Transportation" (United States Census Bureau 2017c).

[20] Our results are generally not sensitive to this distinction – results using the more conventional separating of for-hire versus private carriage as drivers in trucking versus non-trucking industries are available from the authors upon request.

[21] The reason for making this change is that the categorization of the industry of a driver is based on the primary business at the establishment or location at which the driver is employed, and this can introduce two misclassifications from the standpoint of the definitions of for-hire and private carriage offered above. One is due to private carriage drivers at establishments engaged primarily in trucking, and a second due to drivers at large parcel carriers, whose establishments are classified as part of transportation and warehousing, but not within the trucking industry per se; these issues are explained in Section 10, Appendix C.

Table 1: Industry Distribution of Truck Drivers in the CPS	
Industry	Percent 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 (broad version)	53.4%
Administration, Support, Waste Management, Remediation	5.6%
Source: authors' calculations from CPS outgoing rotation group data, 2003-2017.	

4.1. Truck Driver Movements Into and Out of Unemployment

We first use CPS data, adjusted to drop drivers in industries using few heavy trucks, to evaluate the employment status – and the transitions between employment and unemployment – of truck drivers versus comparable workers. Tightness in the trucking labor market should result in relatively low occupational unemployment rates, as well as a higher probability of returning to the job among those who are initially unemployed. While we cannot examine these trends by type of truck driver, we can compare for-hire to private carriage drivers, bearing in mind that if the trucking industry's perception of a persistent shortage in for-hire trucking is based on conditions that are widespread in that segment, we should see stronger indications of tightness among for-hire drivers as compared to among private carriage drivers.

The top rows of Table 2 present basic measures of the unemployment rate for all males, all truck drivers, for-hire drivers, private carriage drivers, low education males, and blue-collar males. These rates are presented for the entire period under consideration, as well as for the period pre-, during, and post-recession. Ninety-five percent confidence intervals are provided below the point estimates.

The truck driver unemployment rate is lower than the overall male unemployment rate across the entire period and pre- and post-recession, but is not statistically different during the recession; however, it is substantially lower than either low education or blue-collar male unemployment across all

Table 2: Unemployment Rate by Group, ages 20-65						
	All Males	All Truck Drivers	For-Hire (broad version)	Private Carriage	Low Education Males	Blue-collar Males
Entire period: 2003-2017	**0.066**	**0.055**	**0.053**	**0.057**	**0.091**	**0.081**
	0.065, 0.066	0.051, 0.059	0.047, 0.059	0.051, 0.062	0.089, 0.093	0.079, 0.082
2003-2007	**0.049**	**0.034**	**0.030**	**0.038**	**0.066**	**0.058**
	0.048, 0.050	0.029, 0.039	0.023, 0.037	0.030, 0.045	0.064, 0.069	0.056, 0.060
2008-9	**0.081**	**0.082**	**0.078**	**0.087**	**0.115**	**0.109**
	0.079, 0.084	0.070, 0.095	0.060, 0.097	0.070, 0.10	0.110, 0.119	0.104, 0.113
2010-2017	**0.072**	**0.062**	**0.062**	**0.062**	**0.102**	**0.089**
	0.071, 0.073	0.056, 0.068	0.053, 0.071	0.053, 0.070	0.100, 0.105	0.086, 0.091
Unemployed in period 2, given unemployed in period 1	**0.378**	**0.353**	**0.313**	**0.388**	**0.400**	**0.390**
	0.371, 0.386	0.313, 0.393	0.254, 0.372	0.334, 0.442	0.391, 0.411	0.378, 0.401
Paired numbers below rates are 95% confidence intervals. Source: Authors' calculations from CPS outgoing rotation group data, 2003-17.						

periods. The truck driver unemployment rate is roughly 2 percentage points lower than the blue-collar male rate across all time periods and 3 percentage points lower than that of blue-collar males post-recession. The magnitude of these differences is meaningful, and this provides additional evidence that the driver labor market is tighter than the labor market for comparable workers.

It is notable, however, that there is no difference between truck drivers in the for-hire (broad version) category and those employed as private carriage drivers in other industries. The point estimates of unemployment rates appear slightly lower for for-hire drivers before and during the recession, but the difference is not statistically significant. Thus, the tightness of the labor market as evidenced by a basic metric, the unemployment rate, does not systematically vary by driver labor market segment, contrary to the prediction, implied by trucking industry worries about the situation facing for-hire firms, that the for-hire part of the labor market should be tighter than the private carriage segment.

The bottom row of Table 2 examines the transition back into employment from unemployment. Given that a person is unemployed in period 1, what is the likelihood that they are still unemployed in period 2? Point estimates would suggest that drivers regain employment faster than low education or blue-collar males, but the differences are not statistically significant.

Combining these findings with the earlier descriptive statistics on drivers from the OES, we find some evidence that the market for drivers is characterized by tightness, which could be perceived as a shortage by employers: solid earnings versus blue-collar workers, employment rebounding to pre-recession levels, and lower unemployment rates. However, none of these stylized facts suggest that the either the labor market as a whole, or specific segments identifiable in the OES or CPS, is failing to function. In the next section we use the CPS ORG microdata to examine occupational mobility among truck drivers.

4.2. Patterns of Occupational and Industrial Mobility for Truck Drivers

There is a great deal of literature that addresses the question of why workers switch jobs. While the types of switching and models vary between papers, job switching is generally linked to individual preferences, individual abilities, and available opportunities (Bartel and Borjas 1981; Mincer and Jovanovic 1981; Light and McGarry 1998; Neal 1999; Munasinghe and Sigman 2004; James 2011).[22] However, there is limited work in the literature specifically on truck drivers. Two prior non-academic studies for the ATA on labor supply of truck drivers (Christenson, Aames et al. 1997; Global Insight Inc. 2005) focused on the role of alternative job opportunities, such as in unskilled construction work, but this has not been well-examined within the academic literature. Beilock (2005) provided a study of a relatively small number of long-haul drivers of refrigerated trucks, and suggested that the tenure of

[22] 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 is low ability) or the result of disruptions in tenure 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 (Kambourov and Manovskii, 2009; Neal 1999).

truck drivers, while relatively short, is not unlike that of individuals in jobs with similar qualifications. This has some support in more general models of occupational switching. James (2011) models multiple scenarios using data from the NLSY97, including occupational clustering and occupational cycling, and finds that there is correlation between laborer and driver jobs within transportation.

We first examine the patterns of industry and occupational mobility visible in CPS ORG data on 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 analysis will consider for-hire (broad version) and private carriage drivers separately, since there are systematic differences between the two groups; drivers in for-hire trucking are more likely to be engaged in long-haul trucking and those in other sectors are more likely to be engaged in short-haul trucking (Burks, Monaco et al. 2004a). As can be seen in Table 3, the hours and wages of these drivers are substantially different (comparing drivers who are employed full- time).

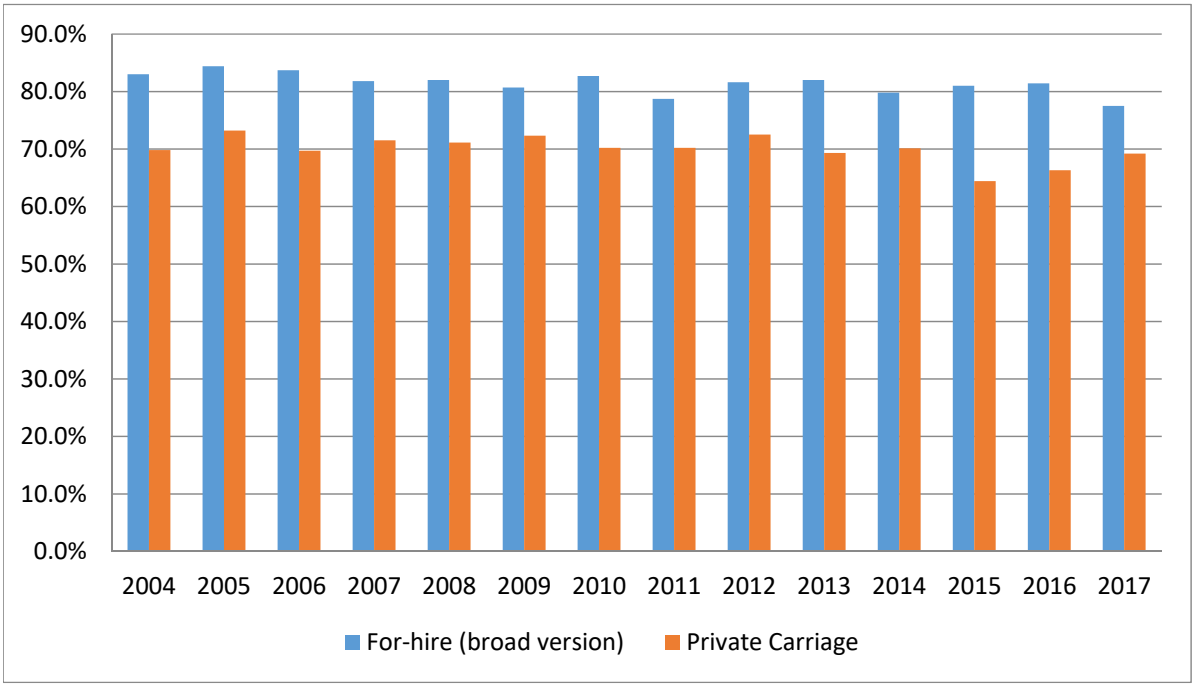
Table 3: Characteristics of Those Who Initially Report Employment as a Truck Driver

	For-hire (broad version)	Private Carriage
Real hourly wage (standard deviation)	$20.5 (9.5)	$18.7 (8.2)
Usual hours (standard deviation)	48.8 (11.2)	45.5 (8.8)
Union	18.8%	16.9%
White, non-Hispanic	64.3%	65.6%
Black, non-Hispanic	14.8%	11.5%
Other Race, non-Hispanic	3.1%	2.7%
Hispanic	17.8%	20.2%
Less than High School Diploma	12.7%	15.4%
High School Diploma	56.4%	56.9%
Some College, Associate or Vocational Degree	25.8%	23.2%
College Degree or Higher	5.1%	4.4%

Source: authors' calculations from CPS outgoing rotation group data, 2003-17
Standard deviations presented in parentheses for continuous variables

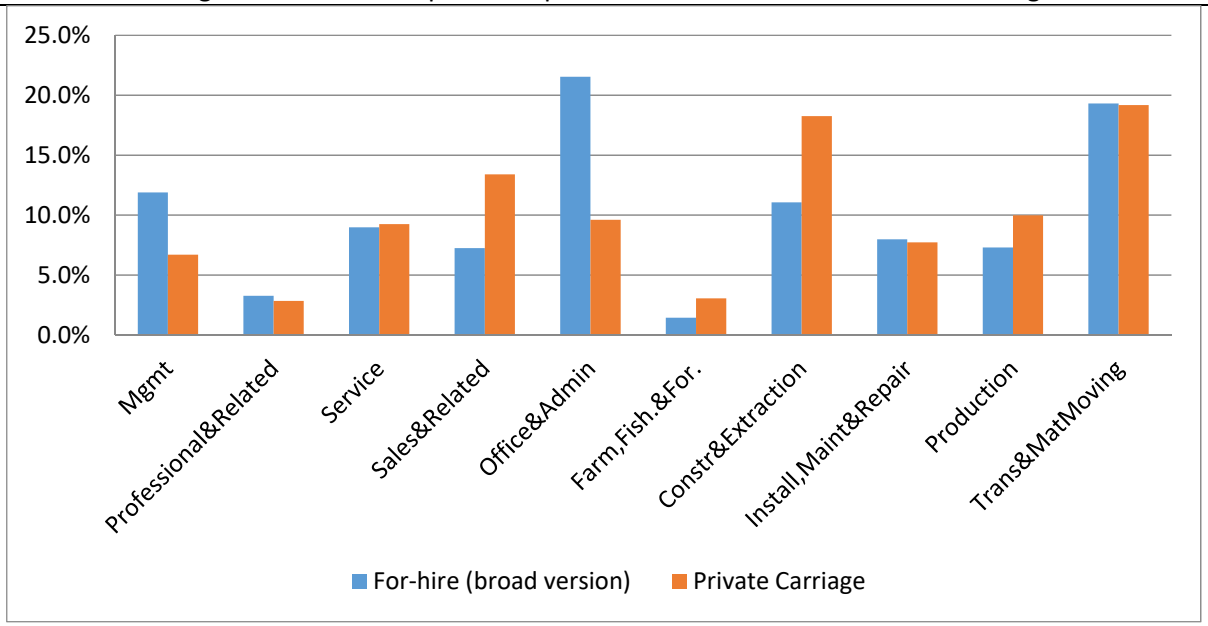
Recalling that CPS ORG data allows us to observe the occupation and employment status of the same individuals twice, one year apart ("period 1" and "period 2"), we see in Figure 3 that there are substantially different patterns of occupational retention in the two segments. Truck drivers who are

Figure 3: Percentage of Truck Drivers Who Retain their Occupation in Period 2



employed in private carriage in period 1 are substantially less likely to remain truck drivers in period 2 than are for-hire drivers. Over the entire timespan, we see that roughly 82% of those who were for-hire truck drivers in period 1 remained for-hire truck drivers in period 2. The corresponding figure for private carriage drivers is 71%. Across all drivers in the sample the one-year occupational migration rate is 22%. This is in line with Kambourov and Manovskii (2008) who find occupational mobility of 18% at the relatively detailed "three-digit" level, using Panel Study of Income Dynamics (PSID) data across all workers for an earlier period (1969-1997). Further restricting their findings to workers with demographics similar to truck drivers – high school education or lower and aged 35-40 – the three-digit occupational migration is still 18%, indicating that what we see across all drivers is roughly similar to workers economy-wide, as well as those with similar levels of education.

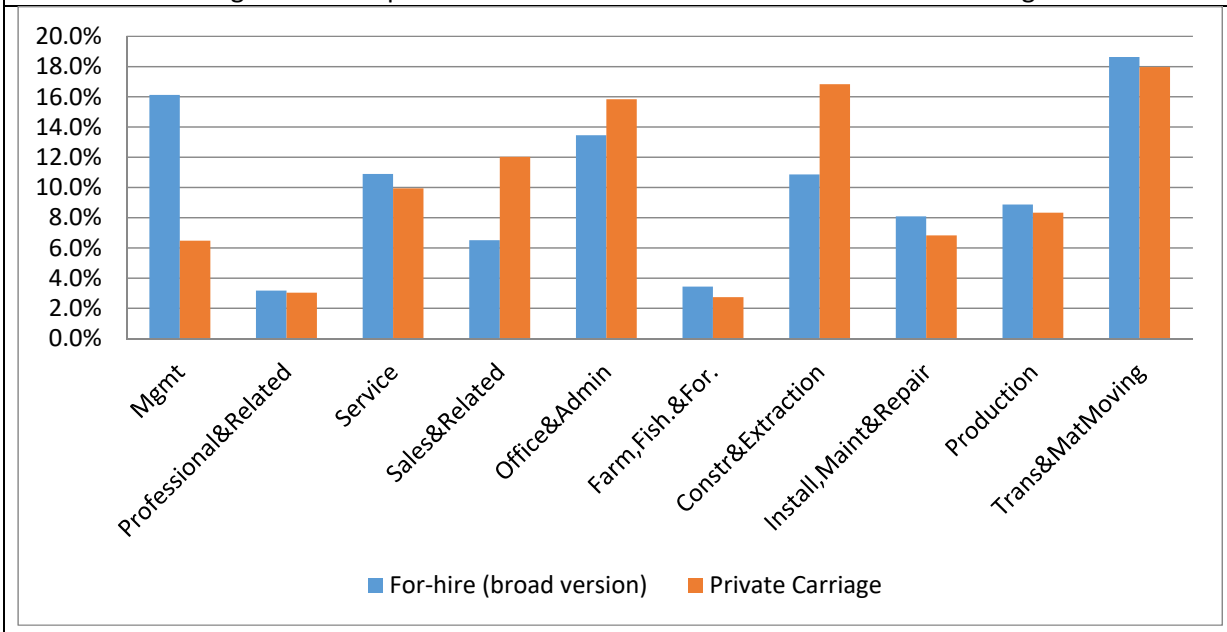
Figure 4: Initial Occupation Departed for Those Who Enter Truck Driving



Trucking operations in for-hire trucking (broad version) appear to draw truck drivers from similar occupations as do trucking operations in private carriage (all other industries), with a few differences (Figure 4). Both segments draw from construction and extraction occupations, but the proportion drawn by private carriage is approximately 50% higher. Another key occupation is non-trucking transportation and material movers (roughly 19% 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 who are originally managers/executives (especially among for-hire (broad version) drivers). 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 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 5: Occupational Destination of those Who Leave Truck Driving



The occupations to which truck drivers exit are similar in profile to those from which they are drawn (Figure 5). The fact that the alternate occupations among those who leave and enter are similar leads us to believe that these jobs (particularly those in production, construction, office and administration, and transportation and material moving occupations) represent a reasonable set of occupations from which potential drivers could be recruited. These findings are broadly in accord with an analysis of data from the Occupational Requirement Survey (Bureau of Labor Statistics 2018), which shows a pattern of job skills required by heavy truck drivers that suggests those skills are likely to be found in the occupations from which drivers come, and to which drivers exit (Gittleman and Monaco 2017). These occupations may serve as a benchmark for the level of pay and hours that might attract workers into truck driving, and suggest that differences in earnings and hours may be among the things

that predict switches between these occupations and truck driving, if the labor market is operating normally.

Figure 6: Initial Industry for Those Who Enter Truck Driving in Period 2

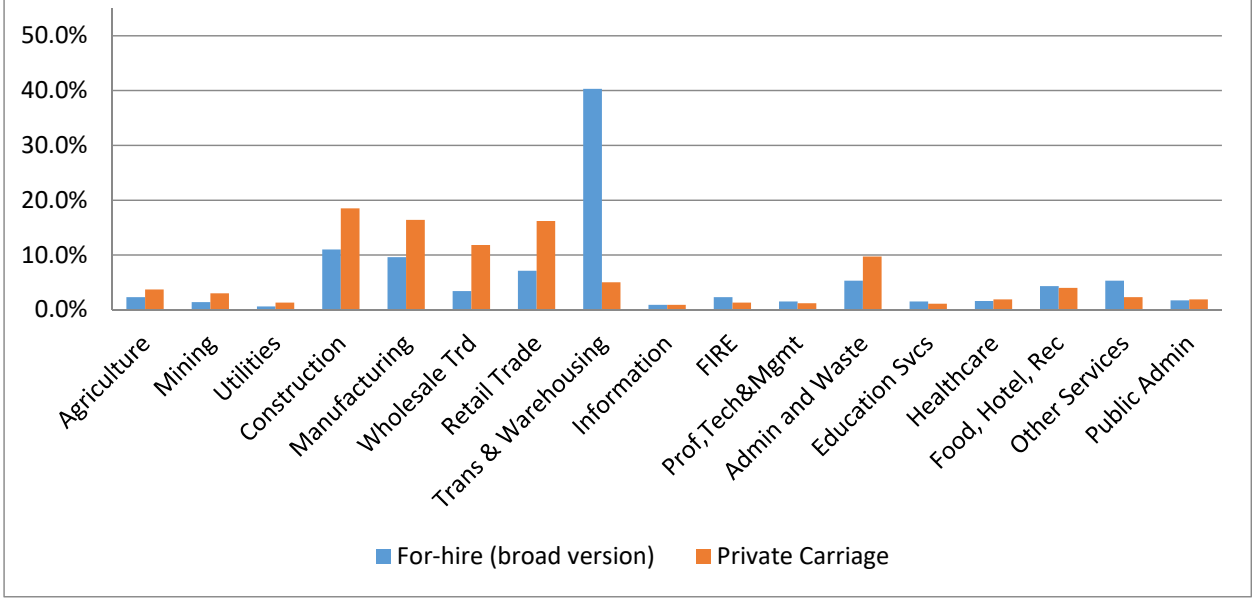
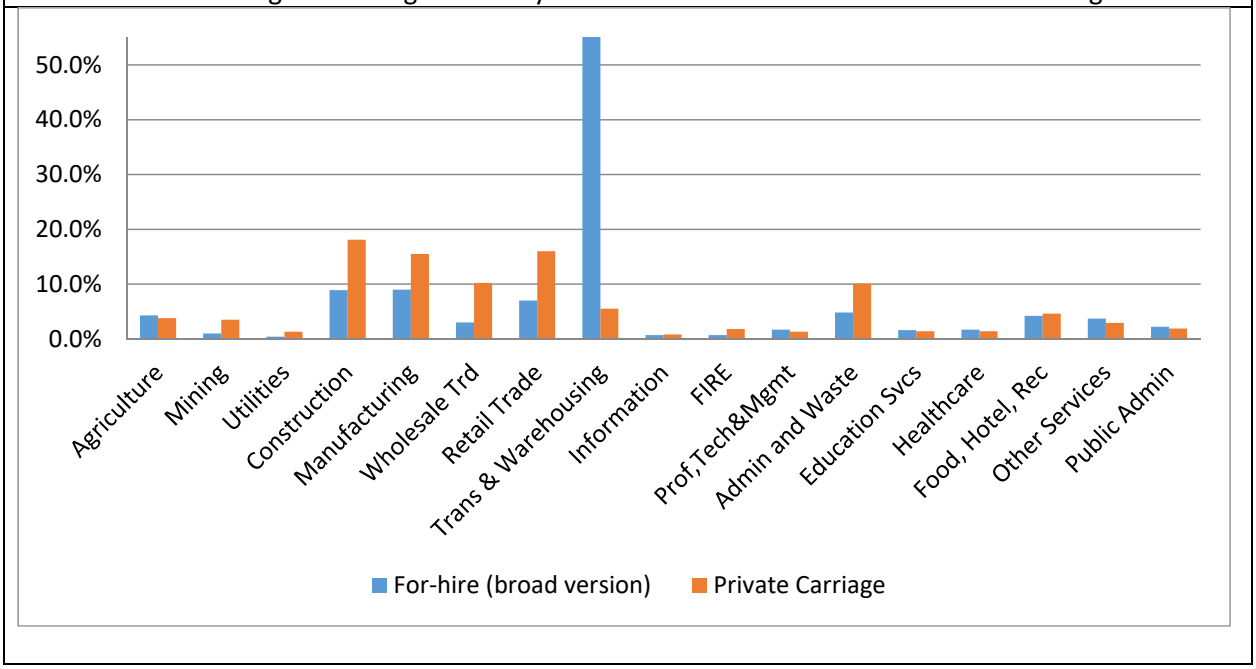


Figure 7: Target Industry in Period 2 for Those Who Leave Truck Driving



We next examine the industries from which drivers enter (Figure 6) and to which they exit (Figure 7). Not surprisingly, two fifths of the entry into truck driving in the for-hire segment (broad version that encompasses all of transportation and warehousing) comes from individuals who originally worked in another occupation within transportation and warehousing. Looking at the occupations from which these individuals enter, we find laborers and freight, stock, and material movers; transportation managers/supervisors; dispatchers; and truck and bus mechanics (these total approximately 55% of the three-digit occupational codes). Over half of those leaving for-hire truck driving (broad version) leave for another occupation in transportation and warehousing, and the distribution of occupations to which the worker moves is remarkably similar. It appears that firms in the for-hire segment might most productively recruit from other areas within their firm or those of their competitors (i.e. workers handling freight at terminals or docks in the transportation and warehousing industries).

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

The construction and manufacturing industries combined 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 to and from which individuals move into and out of truck driving 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.

		PERIOD 2	
		FOR-HIRE (broad version)	PRIVATE CARRIAGE
PERIOD 1	FOR-HIRE (broad version)	52%	5%
	PRIVATE CARRIAGE	5%	38%

Table 4: Distribution of Individuals Who Stay in the Truck Driver Occupation in Both Periods by Major Labor Market Segment and Period of Observation

Finally, 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 of them change industry segments (Table 4)? The answer is that there is relatively little inter-industry migration of truck drivers. Ninety-one percent of individuals who remain truck drivers in both periods but 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 eighty-eight percent.[23]

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

[23] Replicating the figures and tables in Section 4 using the for-hire/private carriage distinction used in prior literature does not change the results substantially. In table 4, for example, the off-diagonal elements (capturing drivers shifting sectors) are 6%, suggesting that sectoral shifts are not substantively changed by our broader specification of the for-hire driver category.

5. CPS Econometric Models of Truck Driver Occupational In- and Out-Migration

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

5.1. Exit from Truck Driving

We first examine truck driver occupational out-migration, by modeling the probability that an individual employed as a truck driver in the first period is no longer working as a driver in the second period. We only consider those who are employed in both periods and who are in the truck driver occupation in the first period of observation. The dependent variable is binary and takes a value of 1 if the individual has left the truck driving occupation and 0 otherwise. Explanatory variables include standardized age and its square, marital status, race and ethnicity, union status (whether 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 2-digit NAICS industry controls and the percent of heavy trucks used in the industry (calculated from the 2002 VIUS data). This last variable is 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 service driver, or as a driver-sales worker, recalling that we can't distinguish these within the CPS truck driver category, though we have dropped the observations we can identify as most likely to be of these types (Section 4, above).

We are interested in the role of earnings and hours in the probability of 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 higher earnings in period 1 should reduce the probability of leaving, all else constant.

In the second specification we want to factor in an individual's expectation regarding their pay and hours in the second period. For earnings, we want to capture a "reasonable" expectation regarding 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.[24] For the case of individuals who remain as 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, weighted by the proportion of movers who chose each one, to generate the expected earnings the stayer 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 one if the expected period 2 earnings are at least 15% higher than the period 1 earnings (zero otherwise). The second, "expected wage decrease" takes a value of one if the expected period 2 earnings are at least 15% lower than the period 1 earnings (zero otherwise). The reference (omitted) group is no expected earnings change ($\pm$ 15%).[25]

For hours, in the second specification we follow an analogous procedure to that for wages. For movers the expected hours are those in period 1 for the occupation to which they switch. For stayers the expected hours are computed as a weighted 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 current period hours). A one-unit

[24] Period 1 earnings since these are a proxy for what would be observable at the time of a decision on period 2 occupation.

[25] The results are not particularly sensitive to the threshold used. Results assuming 5, 10 and 20% changes are available from the authors.

increase in this variable means that the expected hours difference is larger, i.e. that expected period 2 hours have become an hour greater in comparison to current hours.

Both specifications seem relevant: a truck driver may leave the occupation due to earnings dissatisfaction and get a job in a different occupation, only to find that the job does not pay more. Thus, controlling for the initial conditions is important (specification 1). Under the assumption that workers switching occupations have sufficient information, the difference in earnings and hours will more completely identify workers who are leaving to achieve better economic outcomes (specification 2).

Table 5: Probability of Exiting Truck Driving Occupation between Period 1 and Period 2.
Results are presented as odds ratios from logit models.
(OR<1.00 reduces chance of exit, OR=1.00 indicates no effect, OR>1.00 increases chance of exit)

	for-hire (broad version)		private carriage	
standardized usual hours (P1)	0.779***		0.908**	
	(-5.52)		(-2.14)	
standardized weekly earnings (P1)	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		1.03***		1.009*
(expected – current)		(5.84)		(1.93)
standardized percent heavy trucks			0.267***	0.267***
			(-18.09)	(-18.32)
Observations	5,465	5,465	6,202	6,202
Robust z-statistics in parentheses	(N's reflect the number of truck drivers in the P1 sample)			
*** p<0.01, ** p<0.05, * p<0.1; "P1" and "P2" abbreviate Period 1 and Period 2, respectively.				

The estimated odds ratios for the earnings and hours measures are presented in Table 5.[26] In the first specification, those with higher initial weekly earnings are less likely to leave driving in the second period. A one standard deviation increase in weekly earnings decreases the likelihood of leaving for-hire

[26] Full regression results are available from the authors. We also explored models that use hourly wage rather than weekly earnings, finding little difference.

truck driving by 16%, and private carriage by 25%. 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% less likely to leave for-hire carriage truck driving and 9% less likely to leave private carriage. Additionally, for private carriage truck drivers there is a lower likelihood of leaving if the driver is in an industry with a higher percentage of heavy trucks. Those working in an industry with a percentage of heavy trucks one standard deviation higher are only 25% 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 and delivery service drivers or driver sales workers, some of whom still remain in the data despite adjustments that were made to limit their number, as explained in the introduction to Section 4 and Section 9-Appendix B..

Considering the second specification, an expectation of an earnings increase is positively associated with the odds of leaving. The relationship is weak in for-hire carriage, with a point estimate that suggests a 17% increase in the chance of leaving for an earnings increase, but which is not statistically significant. It is quite strong in private carriage, with an expected earnings increase predicting a 41% 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 (columns 2 and 4, respectively). The for-hire carriage point estimate is a 3% increase in the chance of leaving for a one hour increase in the gap. The private carriage estimated is smaller, indicating almost a 1% increase in the chance of leaving for a one hour increase in the gap. These effects are not large, as the mean value for drivers who leave is 0, but the standard deviation is 8.7, so this bears examination. It is conventional in labor economics to consider leisure as a good and an additional hour of work as a reduction in the quantity of this good. However, not all tastes are identical, and those observed to be truck drivers in Period 1 are self-selected into the occupation, with its already-high hours (Belman, Monaco et al. 2005). Recalling that the nominal earnings of heavy

truck drivers are higher than those of other blue-collar workers (Figure 2), a natural interpretation of the results on the variables related to hours in the two specifications (initial hours and expected change in hours) is that heavy truck driving attracts individuals who are not put off by an additional hour (holding the higher earnings constant), and this holds in alternative jobs as well as in trucking.

5.2. Entry into Truck Driving

We next turn to estimating the probability of entering truck driving. The sub-sample used for 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 those workers who changed occupations between periods ("movers"). To find these workers in the CPS, we compare 3-digit occupations between the two periods and designate those who change 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, we consider "large" occupations (those with at least 1000 observations in the data set). Our assumption is that more common jobs are less likely to be miscoded in the CPS.

Using this sub-sample, we first want to get a sense of whether truck drivers are more or less likely to switch occupations between periods as compared to individuals in other occupations. We estimate a logit model of changing occupations across all occupations (due to the size of the output, results are not presented in this paper and are available from the authors upon request). We include the same controls as in the exit model, along with a series of 3-digit occupational dummies, with truck driver as the reference (i.e. omitted) group. Somewhat surprisingly, we find that the odds ratios estimated for most occupations are greater than one, which indicates that males working in all other occupations in the first period are more likely to leave their occupation in period 2 than those in truck driving. As a robustness check, we then restrict the sample to those with a high school education or less (as these workers may be less likely to migrate between jobs due to reduced opportunities). Again, we find that individuals in other occupations besides truck driving are more likely than truckers to leave for

a different occupation. This provides additional evidence that the mobility patterns of truck drivers are not out of step with other blue-collar jobs – while some parts of the occupation may have high turnover at the level of firms (i.e. quitting from a specific motor carrier to switch to another, while staying a driver), as a group, truck drivers appear to have higher levels of occupational attachment than other occupations requiring similar human capital.

Next, we turn to the main point of this section: estimating the probability of individuals entering truck driving, conditioned on the fact that they changed jobs between the two periods (that is, 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 entering the truck driving occupation. Earnings variables compare current income to the average income in trucking, based on the same argument

Table 6: Probability of Entering Truck Driving in Period 2 among Occupation Switchers.
Results are presented as odds ratios from logit models.
(OR<1.00 reduces chance of entry, OR=1.00 indicates no effect, OR>1.00 increases chance of entry)

	for-hire (broad version)		private carriage	
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 (P2-P1)		0.991		0.992*
		(-1.55)		(-1.69)
Observations	85,977	85,977	86,298	86,298
z-statistics in parentheses	(Ns reflect the total number of occupation changers)			
*** p<0.01, ** p<0.05, * p<0.1				

about a “reasonable expectation” as for the exit model.

Higher initial pay reduces the odds of entry to truck driving jobs in period 2, while higher initial hours increases the odds of entry, for both the for-hire and private carriage specifications. This suggests that those entering truck driving see it as an avenue to increased 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, slightly smaller in magnitude (.9%) but opposite in effect to that for the exit model. (So making the hours gap larger reduces the likelihood of entry, which aligns with the usual labor economics interpretation that an hour of extra work is a reduction of an hour in leisure, which is a good; compare to the exit model interpretation). However, the estimate is not statistically significant in the for-hire segment, and is only weakly significant for private carriage, so this does not appear meaningful for either sector.

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

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

6. **Why Do Motor Carriers Perceive a Truck Driver Shortage?**

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 truck driving occupation is actually a composite of driving labor market segments, and that one segment in particular, long distance TL, is a "secondary market" (Cain 1976; Dickens and Lang 1993). Arguably, long distance TL is characterized by high levels of competition, average costs which are similar across all scales of production, and very limited ability to differentiate prices in the product market, resulting 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 (Burks, Carpenter et al. 2008).

The ATA distinguishes between high turnover rates and a labor market shortage in its most recent driver shortage report (Costello 2017a), but also argues the long distance TL segment is the focus of the shortage: "The vast majority of the shortage is within the over-the-road, or non-local, for-hire truckload sector" (Costello 2017a, p. 7), and the shortage of drivers and high turnover are empirically linked in the analysis offered. 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 (Lockridge 2015).

The persistently high turnover faces managers in the TL segment, who employ between one sixth and one fourth of all heavy and tractor-trailer truck drivers,[27] with a real business problem: managing recruitment and retention when many individuals entering the occupation in this specific part of the

[27] The lower figure is implied in estimates of the number long haul drivers by Gittleman and Monaco (2017); the higher figure is arrived at by taking 2/3 of the total employment recorded in the 2012 Economic Census for NAICS classifications 484121 "General freight trucking, long-distance, truckload" and 484230 "Specialized freight (except used goods) trucking, long-distance" and dividing by the total number of heavy and tractor-trailer drivers that year.

trucking industry discover the working conditions and earnings to be unattractive (Viscelli 2016). One empirical indicator of the magnitude and persistence of this issue is that the American Trucking Associations survey of carriers shows that between 1995 and 2017, the annual turnover rate at large TL carriers averaged 94.0% and that at small TL carriers 79.2%, while that at firms in a different segment, less-than-truckload (LTL) carriers, who were surveyed 2000-2017, averaged only 11.7%. During the depths of the recession of 2008, in the first quarter of 2010, the large TL carrier annual turnover rate bottomed out at 39%, and the small TL carrier one hit 35% (ATA Economics Department 2017a; ATA Economics Department 2017b), both of which are still very substantial by the standards of blue-collar occupations. 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 has happened twice post-recession, in 2014 (Reiskin 2014) and again in 2018 (Clough 2018).

However, economists would not regard high turnover rates and the associated problems of recruiting and retaining drivers in this part of trucking as either a long term shortage (since wages rise, with a lag, when product market and then the derived demand for labor increases). Nor would it be called a "broken market," except to the extent that one might use that term for a secondary labor market segment due to the associated high turnover as an indicator that jobs in this segment are relatively unattractive to many potential employees.

The high turnover in this segment does not show up in the analysis of the present paper 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 (we estimated between one sixth and one fourth above). Second, CPS data only gives us an indirect look at firm-specific turnover, as there is no job tenure variable in the data, and the only firm exits seen in the ORG data are those that are also either occupation or industry exits.

7. **Conclusion**

The truck driving occupation is often portrayed by the industry and in the popular press as beset by high levels of turnover and persistent "labor shortages" (Casey 1987; Mele 1988; Cooke 1989; ATRI Staff 2005; Costello 2017; Long 2018; Meyersohn 2018). Our analysis of the Occupational and Employment Survey 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 has been resilient, unemployment relatively low, 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 truck driver labor market (for long distance truckload motor carriers) that has experienced high turnover rates that have persisted for decades (ATA Economics Department 2017a), the overall picture is consistent with a market in which labor supply responds to labor market demand as it increases over time, and a deeper look does not find evidence of a secular shortage.

Using data from the Current Population Survey, we modeled exit from and entry to the occupation and find that occupational migration among drivers is similar in magnitude to that in other blue-collar occupations (Kambourov and Manovskii 2008). From the short panels available in the CPS Outgoing Rotation Groups data we cannot see cycling in and out of occupations for an individual over his career, nor can we see firm-level turnover that does not involve a change of either occupation or industry. However, the occupations from which drivers enter and to which they leave are similar – construction, production, and non-trucking transportation jobs – providing evidence that drivers consider the earnings and hours of these jobs as alternatives to trucking.

Econometric models of in and out-migration of drivers support this. 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 labor markets for other blue-collar occupations.

We may note that employees in trucking and warehousing experienced more than a 25% fall in real earnings historically, from 1978 (just before the deregulation of 1980) to the turn of the century, a drop that was driven by larger declines in the real earnings of truck drivers (Engel 1998; Belzer 2000). And heavy and tractor-trailer truck drivers experienced unchanged real wages over the period 2003-2016, which is similar to the situation for all non-trucking blue collar workers[28], a period when overall labor productivity increased by 20%. So whether one thinks that working as well as other blue-collar labor markets is a satisfactory outcome depends on one's view of the evolution of wages and conditions in other blue-collar labor markets in the US over the relevant time period, a topic the further pursuit of which is beyond the scope of the present paper (Mishel, Bivens et al. 2012).

It is true that the BLS estimates the need for new heavy and tractor-trailer truck drivers to be approximately 213,000 per year through 2026 as a consequence of modest projected industry growth and significant retirements (Bureau of Labor Statistics 2018d). And of course, short term increases in the demand for freight movements can produce the same short term labor supply issues for truck drivers as may arise in any occupation. This is especially true if coupled with simultaneous higher demand for labor in the occupations identified in this paper as the primary alternatives for truck driving, as can happen when there is a sufficiently robust macroeconomic expansion. But nothing in the available evidence suggests there will be an actual shortage of drivers which will bring about "severe supply chain disruptions resulting in significant shipping delays, higher inventory carrying costs, and perhaps shortages at stores" (Costello 2017a), as a long run result.

[28] See calculations in Footnote 14, page 10.

8. Appendix A: Construction of Matched Outgoing Rotation Group CPS Files

We use data from the CPS Outgoing Rotation Groups (ORG) files from 2003-2017 from the Center for Economic and Policy Research (Dew 2018). Individuals in the CPS are surveyed for four consecutive months and asked the key labor questions (such as industry and occupation) in the fourth month. They leave the survey for eight months at which point they are picked up for another four months, and again asked key labor questions in the fourth month. Thus, though the CPS is technically a cross-sectional data set, short panels that contain information on earnings, hours, occupation and industry can be constructed by matching individuals in their fourth month of their first and second spells (exactly one year apart).

There are technical issues that arise when matching CPS data files. Though the CPS data files can be used to exploit the longitudinal information, the survey is not intended to be a panel, and relatively little effort is made to deal with non-response in the second period. Thus, there is a significant amount of attrition in the data after the first observation of each individual in the ORG, resulting from non-response, death, and relocation (Madrian and Lefgren 1999). Because individuals are not uniquely identified in the data, one needs to be cautious when matching. Following prior studies, we use HHID, HHNUM, LINENO, STATE and MONTH variables to identify potential matches and then check for inconsistencies in sex, race, and age across the two periods to identify and eliminate false matches. Doing this we are able to match roughly 70% of period 1 respondents in the data, in line with Neumark and Kawaguchi (2004).

Neumark and Kawaguchi (2004) compare attrition in the CPS to the Survey of Income and Program Participation (SIPP; US Census Bureau 2018) and generally find relatively small amounts of attrition bias. Given that we are focused on working age males, we think that the amount of potential attrition bias is relatively low. There should be relatively low mortality among 21-65 year-olds (Madrian

and Lefgren (1999) find the highest rates of mortality attrition at substantially higher ages). Adverse economic experiences (such as layoff/firing) might lead to attrition, but, since our analysis focuses on those employed in both periods, this should have minimal effect on our empirical models.

9. Appendix B: Identifying Heavy and Tractor-trailer Truck Drivers in the CPS

To limit the number of light truck drivers and driver/sales workers in our CPS Outgoing Rotation Group sample by selecting observations to drop, we rely on two auxiliary sources of data. One is the VIUS (mentioned above, in Section 2).[29] The VIUS is a sample of survey responses from a nationally representative sample of owners of all vehicles in use at the time of the survey, of which commercial vehicles are a subset. The data set has information on the industry of use for commercial trucks, which we use to identify industries, other than trucking, that utilize a substantial number of heavy trucks. We find almost no such trucks in the following industries: public administration; information; finance, insurance and real estate; health care; educational services; professional; management; and other services (US Census Bureau 2004).

The second data source used is the industry-occupation matrix provided by the Bureau of Labor Statistics, Employment Projections (Bureau of Labor Statistics 2017a; Bureau of Labor Statistics 2017b). From this matrix, we can identify the percent of truck drivers in different industries. Because the matrix is based on the SOC, we can directly identify the industries which are most likely to contain driver/sales workers, light truck drivers, and heavy truck drivers. Much like the VIUS, we find few heavy truck drivers in public administration; information; finance, insurance and real estate; health care; educational services; professional, technical and managerial; other services; and arts, entertainment, and recreation. In two of the remaining industries, wholesale trade and retail trade, heavy truck drivers are present in significant numbers, but comprise a minority (less than 50%) of truck driving jobs. In retail trade, light truck drivers dominate with 62% of jobs versus 21% sales drivers and 17% heavy truck drivers. In

[29] As noted in Section 2, a limitation of this approach is that the VIUS, which was part of the Quinquennial Economic Census, was last administered in 2002, and was permanently cancelled in 2007. However, this is the best truck use data available, and there is little reason to think that heavy and tractor-trailer trucks have become more prevalent in industries that did not have them in 2002.

wholesale trade, the largest share is heavy truck drivers, 42%, followed by light truck drivers, 31%, and sales drivers, 27%.[30]

Based on this, we are fairly confident in dropping drivers from the CPS driver sample who are in the industries that the VIUS and the occupational-industry matrix identify as containing few heavy truck drivers. We are less clear about how to approach wholesale and retail trade. While heavy drivers do not comprise the majority of either industry, these industries combined employ roughly 700,000 drivers, which means the heavy truck drivers in them are potentially significant parts of the overall occupation. We choose to keep them in the sample and run all regressions with and without drivers in the wholesale and retail trade industries as a sensitivity test (we report on the comparison infrequently in the main text, but the alternative regression results are available from the authors upon request).

[30] A copy of the matrix is available from the authors upon request.

10. Appendix C: A Modification of the Usual Approach to For-Hire versus Private Carriage

As mentioned in the first part of Section 4, we reconsider how to categorize drivers in the CPS sample by industry. According to the standard definitions of these two types of trucking operations (described in Section 2), "for-hire" carriers haul freight as their primary business (NAICS code 484 "Truck Transportation" (United States Census Bureau 2017c)), while "private carriers" provide trucking services within a firm that is engaged in another primary line of business (Burks, Belzer et al. 2010).[31] Existing work has tended to identify those individuals identified by the CPS as employed in the trucking industry *per se* as for-hire, and those employed in all other industries as private carriage, but we suggest that this distinction does not work as is conventionally expected in either household (CPS) or establishment (OES) survey data.

The problem is that the industry in which a driver is employed is generally assigned based on the primary business at the *work location* (an "establishment") being surveyed. This raises two issues. One is that this may not be the same as the primary business for the firm as a whole. Large private carriers operated by firms whose primary business is something other than trucking may be assigned to the trucking industry, because trucking is the primary business at the relevant work location of the private carrier. This tends to put private carriage drivers into the for-hire category. A second issue is that from the perspective of the for-hire trucking industry, parcel carriers who operate lots of heavy trucks at distances beyond a single metropolitan area, such as UPS and FedEx, are part of for-hire trucking, since they haul freight for customers, not freight owned by UPS or Fed Ex, as do private carriers. However, according to federal statistical taxonomy, the formal industry classification of these firms is "NAICS 49211: Couriers and Express Delivery Services" (United States Census Bureau 2017b), so a substantial

[31] Industries are classified in the CPS according to the North American Industry Classification System (NAICS; United States Census Bureau 2017a). The taxonomy is designed to make the most useful classifications overall given the many and diverse uses of the data, while maintaining consistency across Mexico, the US, and Canada; these may not be the classifications that analysts of a particular industry, such as trucking, would prefer.

proportion of their establishments will fall outside of the for-hire trucking industry. This tends to put drivers more naturally designated as for-hire into the private carriage category. While we cannot be certain of the balance of these two misclassifications, and neither matches the categorization researchers focusing on trucking would prefer, we think it is likely that the over-identification of courier and express services drivers as private carriage is larger.

Thus, instead of identifying for-hire and private carriage drives in the data in the manner of past research, based on whether a driver's Census industry code is "Truck Transportation" or not, we use a more general distinction between for-hire drivers as those employed at establishments in any part of the transportation business (NAICS 48-49, which includes all of "Transportation and Warehousing" (United States Census Bureau 2017a)) on the one hand, and private carriage drivers as those employed at establishments in all other industries, on the other.[32] This fixes one of the two problems identified above: courier and express service heavy truck drivers will now be counted in the for-hire category, because Courier and Express Delivery Services, which are expected to be the primary activities at establishments operated by such firms, fall within the broader category of Transportation and Warehousing. It does not address the other problem, that some private carriage drivers are reported as for-hire because they work at large establishments at which the primary business is operating trucks, though this is not the primary business of the overall firm; these drivers will still be classified as for-hire. In addition, it classifies as for-hire drivers who work for private carriers operated by firms who are not trucking companies but whose overall primary business still falls within Transportation and Warehousing.

Thus, the usual classification scheme using the trucking industry as the identifier of for-hire drivers most likely leads to over-identification of drivers as private carriage, while the present approach

[32] Our results are generally not sensitive to this distinction – results using the more conventional separating of for-hire versus private carriage as drivers in trucking versus non-trucking industries are available from the authors upon request.

may lead to the opposite, over-identification of drivers as for-hire. We accept this misclassification on the grounds that those who are incorrectly classified as for-hire using our approach tend to be more similar to drivers who work for for-hire carriers (especially in terms of the nature of work and type of equipment operated), than they are to private carriage drivers working for firms outside of Transportation and Warehousing.

For comparison to Table 1 in Section 4, we also provide here Table 7, which shows the distributions using the more usual identification of for-hire drivers. The primary difference is that 8.7% of drivers are removed from the 53.4% contained in the broad version of the trucking industry, and then are placed in a separate category of "Transportation and Warehousing, other than Trucking."

Table 7: Industry Distribution of Truck Drivers in the CPS ORG Sample	
Industry	Percent 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%
Administration, Support, Waste Management, Remediation	5.6%
Trucking Industry (conventional specification of "for-hire")	44.7%
Transportation and Warehousing, other than Trucking	8.7%
Source: authors' calculations from CPS outgoing rotation group date, 2003-2017	

11. References

ATA Economics Department (2017a). Driver Turnover Historic Database TL. American Trucking Associations. Alexandria, VA.

ATA Economics Department (2017b). Driver Turnover Historic Database LTL. American Trucking Associations. Alexandria, VA.

ATRI Staff (2005). Top Industry Issues 2005. ATRI Research Reports. Arlington, VA, American Transportation Research Institute: 7.

Bartel, A. P. and G. J. Borjas (1981). Wage Growth and Job Turnover: An Empirical Analysis. Studies in Labor Markets. S. Rosen, University of Chicago Press: 65-90.

Belman, D. L., K. Monaco, et al. (2005). Sailors of the Concrete Sea: A Portrait of Truck Drivers' Work and Lives. Lansing, MI, Michigan State University Press.

Belzer, M. (2000). Sweatshops on Wheels: Winners and Losers in Trucking Deregulation. New York, New York, Oxford University Press.

Blank, D. M. and G. J. Stigler (1957). The Demand and Supply of Scientific Personnel. New York, National Bureau of Economic Research.

Bureau of Labor Statistics. (2017a, October 24, 2017). "Table 1.8 2016–26 Industry-occupation matrix data, by occupation." Occupational Employment Projections Retrieved July 21, 2018, from https://www.bls.gov/emp/tables/industry-occupation-matrix-occupation.htm.

Bureau of Labor Statistics. (2017b, March 8, 2018). "Table 1.9 2016–26 Industry-occupation matrix data, by industry." Occupational Employment Projections Retrieved July 21, 2018, from https://www.bls.gov/emp/tables/industry-occupation-matrix-industry.htm.

Bureau of Labor Statistics (2017c). Table 24: Historical Consumer Price Index for All Urban Consumers (CPI-U):. Archived Consumer Price Index Supplemental Files. Washington, DC, US Department of Labor.

Bureau of Labor Statistics (2017d). Chained CPI Table 24C. Chained Consumer Price Index For All Urban Consumers (C-CPI-U). Washington, DC, US Department of Labor.

Bureau of Labor Statistics. (2018). "Occupational Requirements Survey." Retrieved August 9, 2018, from https://www.bls.gov/opub/hom/ors/home.htm.

Bureau of Labor Statistics. (2018a). " Standard Occupational Classification." Retrieved July 14, 2018, from https://www.bls.gov/soc/finding_soc_code.htm.

Bureau of Labor Statistics. (2018b, April 13, 2018). "Heavy and Tractor-Trailer Truck Drivers (SOC code 53-3032)." Occupational Outlook Handbook Retrieved July 14, 2018, from http://www.bls.gov/oes/current/oes533032.htm.

Bureau of Labor Statistics. (2018c, April 13, 2018). "Delivery Truck Drivers and Driver/Sales Workers (SOC codes 53-3033 and 53-3031." Occupational Outlook Handbook Retrieved July 14, 2018, from http://www.bls.gov/oes/current/oes533033.htm and http://www.bls.gov/oes/current/oes533031.htm

Bureau of Labor Statistics. (2018d, March 8, 2018). "Table 1.2 Employment by detailed occupation, 2016 and projected 2026." Occupational Employment Projections Retrieved July 21, 2018, from https://www.bls.gov/emp/tables/emp-by-detailed-occupation.htm.

Bureau of Transportation Statistics (2017). Freight Facts and Figures 2017. Washington, DC, US Department of Transportation: 111.

Bureau of Transportation Statistics (2018). Pocket Guide to Transportation 2018. Washington, DC, U.S. Department of Transportation: 1-69.

Burks, S. V., M. Belzer, et al. (2010). Trucking 101: An Industry Primer. Transportation Research Board, Transportation Research Circular Number E-C146. Washington, DC, Transportation Research Board.

Burks, S. V., J. Carpenter, et al. (2008). Using Behavioral Economic Field Experiments at a Firm: The Context and Design of the Truckers and Turnover Project. The Analysis of Firms and Employees: Quantitative and Qualitative Approaches. S. Bender, J. Lane, K. Shaw, F. Andersson and T. von Wachter. Chicago and London, NBER and University of Chicago Press: 45-106.

Burks, S. V., K. Monaco, et al. (2004a). "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 43(2): 159-171.

Cain, G. G. (1976). "The Challenge of Segmented Labor Market Theories to Orthodox Theory: A Survey." Journal of Economic Literature 11(4): 1215-1257.

Casey, J. F. (1987). "An Assessment of the Truck Driver Shortage." Transportation Executive Update 1(1): 20-23.

Casey, J. F. (1987). An Assessment of the Truck Driver Shortage. American Trucking Associations Research Reports, American Trucking Associations: 12.

Christenson, D., R. Aames, et al. (1997). Empty Seats and Musical Chairs: Critical Success Factors in Truck Driver Retention. Washington, DC, Gallup Organization for the ATA Foundation.

Clough, R. (2018). "As Economy Heats Up, Truck Driver Shortage Burns More Companies-Bloomberg News." Transport Topics Retrieved September 3, 2018, from https://www.ttnews.com/articles/economy-heats-truck-driver-shortage-burns-more-companies.

Cooke, J. A. (1989). Women, Minorities Seen Ending Driver Shortage. Traffic Management: 17.

Costello, B. (2017). Truck Driver Shortage Analysis 2017. Alexandria, VA, American Trucking Associations: 13.

Costello, B. (2017a). Truck Driver Shortage Analysis 2017. Arlington, VA, American Trucking Associations: 1-13.

Dew, B. (2018, April 12). "2017 CEPR CPS ORG extract data updated." Retrieved June 15, 2918, from http://ceprdata.org/2017-cepr-cps-org-extract-data-updated/.

Dickens, W. T. and K. Lang (1993). Labor Market Segmentation Theory: Reconsidering the Evidence. Labor Economics: Problems in Analyzing Labor Markets. J. Kevin. W. Darity. Norwell, MA, Kluwer Academic: 141-180.

Engel, C. (1998). "Competition drives the trucking industry." Monthly Labor Review 121(4): 34-41.

Federal Motor Carrier Safety Administration (2017). 2017 Pocket Guide to Large Truck and Bus Statistics. Washington, DC.

FMCSA. (2012, September 6, 2018). "Hours of Service of Drivers." 49CFR395 Retrieved September 9, 2018, from https://www.ecfr.gov/cgi-bin/text-idx?SID=0aa46d72d1c5fda86d0446a79e23d77c&mc=true&node=pt49.5.395&rgn=div5.

Gittleman, M. and K. Monaco (2017). Truck Driving Jobs: Are They Headed for Rapid Elimination? 2017 Conference, Industry Studies Association. Working Paper.

Global Insight Inc. (2005). The U.S. Truck Driver Shortage: Analysis and Forecasts.

James, J. (2011). Ability matching and occupational choice, Federal Reserve Bank of Cleveland, Working Paper: 1125: 66 p.

Kambourov, G. and I. Manovskii (2008). "Rising Occupational and Industry Mobility in the United States: 1968-97." International Economic Review 49(1): 41-79.

Light, A. and K. McGarry (1998). "Job Change Patterns and the Wages of Young Men." Review of Economics and Statistics 80(2): 276-286.

Lockridge, D. (2015). "Driver Dilemma: In Search of Drivers; Digging into the causes of what could be the worst driver shortage ever." Heavy Duty Trucking: Truckinginfo.com Retrieved May 15, 2015, from https://www.truckinginfo.com/155901/in-search-of-drivers.

Long, H. (2018) "WonkBlog Analysis: America has a massive truck driver shortage. Here's why few want an $80,000 job." The Washington Post.

Madrian, B. C. and L. J. Lefgren (1999). A Note on Longitudinally Matching Current Population Survey (CPS) Respondents. NBER Technical Working Papers #247. Cambridge, MA, National Bureau of Economic Research.

Mele, J. (1988). Driver Shortage: Crisis or Challenge? Fleet Owner**:** 73-84.

Meyersohn, N. (2018) "Truck driver shortage sends shipping costs sky-high." CNNMoney.

Mincer, J. and B. Jovanovic (1981). Labor Mobility and Wages. Studies in Labor Markets. S. Rosen. Chicago, IL, University of Chicago Press**:** 21-64.

Mishel, L., J. Bivens, et al. (2012). The State of Working America. Ithaca, Cornell University Press.

Munasinghe, L. and K. Sigman (2004). "A Hobo Syndrome? Mobility, Wages, and Job Turnover." Labour Economics 11(2): 191-218.

Neal, D. (1999). "The Complexity of Job Mobility among Young Men." Journal of Labor Economics 17(2): 237-261.

Neumark, D. and D. Kawaguchi (2004). "Attrition Bias in Labor Economics Research Using Matched CPS Files." Journal of Economic and Social Measurement 29(4): 445-472.

O*NET Online (2016). Online Database of Occupational Information. Occupational Information Network, US Department of Labor/Employment and Training Administration.

Reiskin, J. S. (2014). "Driver Shortage Hits Critical Level as Executives Fear Loss of Business." Transport Topics(October 13): 1& 69.

United States Census Bureau. (2017a). "Introduction to NAICS." North American Industry Classification System Retrieved July 14, 2018, from https://www.census.gov/eos/www/naics/.

United States Census Bureau. (2017b). "2017 NAICS Definition: 492110 Couriers and Express Delivery Services." North American Industry Classification System Retrieved July 14, 2018, from https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=492110&search=2017%20NAICS%20Search.

United States Census Bureau. (2017c). "2017 NAICS Definition: 484 Truck Transportation." North American Industry Classification System Retrieved August 7, 2018, from https://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=484&search=2017%20NAICS%20Search.

US Census Bureau (2004). Vehicle Inventory and Use Survey Microdata CD-ROM: 2002. Economic Census. Washington, DC.

US Census Bureau. (2018). "Survey of Income and Program Participation." Retrieved August 17, 2018, from https://www.census.gov/sipp/.

Veneri, C. M. (1999). "Can occupational labor shortages be identified using available data?" Monthly Labor Review 122(3): 15.

Viscelli, S. (2016). The Big Rig: Trucking and the Decline of the American Dream Berkeley, CA, University of California Press.

Weiss, A. (1990). Efficiency Wages: Models of Unemployment, Layoffs, and Wage Dispersion. Princeton, New Jersey, Princeton University Press.