

Earnings and Employment in Trucking: Deregulating a Naturally Competitive Industry

by

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Abstract

The effect of motor carrier deregulation on the employment and earnings of truck drivers is examined, using data for the period 1973-95. The use of a quasi-experimental design is made possible through the comparison of wages before and after deregulation among drivers in the previously regulated for-hire sector, drivers in unregulated private carriage, and an economy-wide group of male non-driver non-professionals. Deregulation is associated with approximately a 15 percent relative wage decline among drivers employed in the for-hire sector, resulting primarily from decreases in union wages and a shift from high-wage union to low-wage nonunion employment. In contrast to wage losses among for-hire union drivers, losses among nonunion drivers relative to workers economy-wide are small. The decline in wages among both union and nonunion drivers in the unregulated private carriage sector largely mirrors wage changes among the male non-driver control group. Our results indicate that there was little rent sharing during the regulatory period among drivers in unregulated private carriage or among nonunion drivers in the regulated sector. Sizable wage advantages among for-hire drivers and among union drivers in both the for-hire and private sectors have been maintained throughout the deregulation period.

Panel analysis and use of supplemental data on skills and working conditions indicate that unmeasured worker skills and work shift can account for all of the wage advantage among drivers in the for-hire sector, while worker skills (associated in part with occupational tenure) may account for about two-thirds of the union wage advantage. Deregulation has also affected employment, as evinced by a sharp decline in union density, slow employment growth in private carriage as compared to growth in the for-hire sector and among owner-operators, and through an increase in minority employment in the previously regulated for-hire sector. The "textbook" response of drivers' wages and employment quickly following deregulation may be unique to the motor carrier industry, but the trucking experience is likely to be representative of the long-run labor market effects of deregulation in the other previously regulated industries.

I. Introduction

The motor carrier industry provides what in many ways is an ideal setting to evaluate the effects of regulation and subsequent deregulation on labor employment and earnings in what is a naturally competitive industry. The trucking industry includes a large number of companies, important segments of the industry are characterized by low capital and entry costs to firms, and, because worker skills are acquired quickly, labor supply is highly elastic. Entry and rate regulation by the Interstate Commerce Commission (ICC), coupled with the emergence of a powerful trade union (the International Brotherhood of Teamsters), resulted in the capture and maintenance of labor rents by drivers. At the same time that the motor carrier industry was subject to strict entry and rate regulation, however, many shippers had the ability to escape direct ICC regulation through the use of unregulated private carriage (i.e., own-company employment of drivers).

The standard economic model provides reasonably clear-cut predictions regarding the effects of deregulation on employment and wages in a previously regulated industry. If rents were being realized under regulation, wages in previously regulated sectors should decline relative to those in unregulated sectors and relative to wages received by similar workers doing comparable levels of work elsewhere in the labor market. If union power were the principal vehicle for the capture of regulatory rents, then deregulation should result in a decline in union wage premiums, unless there existed substantial nonunion rent sharing, in which case both union and nonunion wages would decline following deregulation. Union density should decline, as long as unions continue to acquire rents for their members. Sectoral or union wage differentials that survive in the long run are likely to reflect some combination of rents and compensating differentials associated with worker skills and working conditions.

The expected effects of deregulation on employment are less clear. On the one hand, if deregulation leads to lower labor and shipping costs, there will be an unambiguous increase in traffic, leading to increased employment for a given production technology. If deregulation also eliminates route inefficiencies associated with regulation, shipments should expand even more. On the other hand, if regulation locked-in labor-intensive production technologies or facilitated union-management bargaining (explicit or implicit) over employment as well as wages, then the initial effects of deregulation might be a

decline in employment, even in the face of increased traffic. Deregulation should also be associated with a shift of traffic and employment away from private carriage and toward previously regulated for-hire or common carriers and owner-operators. Finally, if preference-based discrimination were important during the regulatory period, deregulation should lead to increased employment of minority drivers, with the largest change being among previously regulated common carriers.

Section II provides a brief historical background on regulation and subsequent deregulation in the motor carrier industry. In Section III, we outline theory and previous evidence on the effects of deregulation on unionization and labor earnings. Methodology and specification issues are discussed in Section IV, with attention given to the quasi-experimental design of the analysis. Section V describes the data used in the paper, while descriptive evidence on employment is provided in Section VI. We then present evidence on the relative wages of truck drivers over the 1973-95 period, with Section VII focusing on differences in the for-hire and private carriage sectors and Section VIII on union-nonunion wage differences within each of these sectors. Longitudinal analysis is provided in Section IX in order to determine the extent to which wage advantages realized by drivers in the for-hire sector and by union drivers in both sectors are the result of compensating differentials for unmeasured driver skills. Section X explores further the sources of compensation differentials among drivers, with attention given to the receipt of health insurance and pension coverage, the role of shift work, employer size differentials, and the importance of occupational tenure.

II. Historical Background: Regulation and Deregulation of the Motor Carrier Industry¹

Regulatory authority over motor freight carriage by the Interstate Commerce Commission (ICC) was provided in the Motor Carrier Act of 1935. The regulation had the support of the previously regulated railroad industry and the newly created American Trucking Association, both groups being concerned about the ease of entry into the rapidly expanding trucking industry. ICC regulation severely restrained entry and price competition in the industry. Covered by federal regulation were for-hire common carriers engaged in intercity and interstate cartage. Largely exempt from ICC regulation were private (i.e., own-company) carriage and local carriers, as well as carriers of exempt commodities (e.g., unprocessed agricultural

¹ Part of the discussion in this section is based on Hirsch (1988). For further background and citations, see Belzer (1994, 1995). For general discussions of regulation and labor earnings see Hendricks (1977, 1986, 1994), Ehrenberg

products). The regulated sector involved a distinct minority of carriers and truck drivers, but their total operating revenues and ton-miles exceeded those in the noncovered sector.

Regulated common carriers operated under ICC authority that designated points of origin and destination, the routes over which freight was to be carried (in the case of regular route carriers of general freight), and types of freight (in the case of irregular route carriers of special commodities). Regular route carriers often operated through terminals where less-than-truckload (LTL) cargoes were sorted into full-load lots for movements to customers or other terminals. The LTL sector of the trucking industry was heavily unionized under regulation, and remains the most unionized sector today (Belzer, 1994). Point-to-point(s) truckload (TL) shipments were provided both by regulated for-hire common carriers and the largely unregulated private carriage sector in which shippers owned and managed their own trucking operations. The regulated TL sector includes many owner-operators, who are not covered by the National Labor Relations Act (NLRA). Both the TL portion of the regulated for-hire sector and the unregulated private carriage sector have been less unionized than the LTL portion of the industry.

Although the ICC "grandfathered" many carriers operating prior to 1935, they severely constrained issuance of new route certificates. The ICC issued certificates of public convenience and necessity only where routes were not previously being served and if entry would not economically damage existing carriers. The primary mechanism through which companies expanded or entered into new lines of service was through purchase of route certificates in the secondary market. The aggregate market value of these route certificates was considerable prior to deregulation, roughly 6 billion in 1996 dollars, but fell virtually to zero following deregulation.² The aggregate value of the certificates provides a rough estimate of the monopoly returns to original certificate and capital owners from regulation, net of the higher labor and service costs under regulation. Rose (1987) has estimated that labor captured a substantial portion of the rents resulting from regulation. Trucking firms, however, suffered significant losses in market value as a result of deregulation (Rose, 1985). In order to avoid the complex task of setting of detailed freight rates, the ICC encouraged regulated carriers to establish rate bureaus through which they could engage in joint

(1979), and Winston (1993).

² The former figure is converted from Moore (1978), who reports a value of 1.5 to 2 billion in 1972 dollars, while the

ratemaking. Individual firm ratemaking in the regulated sector was severely constrained. Rate bureaus were exempted from the antitrust laws by the Reed-Bullwinkle Act of 1948 and, by 1980, approximately ten major and fifty-five smaller rate bureaus were in operation.

It is not straightforward to date the *effective* deregulation of the trucking industry. We follow Rose (1987), Hirsch (1988), and others and let 1979 be considered the first year of the deregulation period. Although prior to the adoption of the Motor Carrier Act of 1980 (passed in June), there had been a large degree of administrative deregulation prior to that time, while some forms of (largely ineffectual) regulation remained after 1980. There had been increasing competition in the industry throughout the 1970s, arising in large part as a natural economic response to inefficiencies and cost differentials engendered by past regulation and union wage premiums. There were increased legal restrictions on Teamster activities. For example, in the mid-1960s the Teamsters were increasingly constrained in their use of secondary boycotts and in their ability to restrict nonunion traffic. By 1980, nonunion trucking operations had already increased their share of the market, as evidenced by the rapid growth of private carriers and of nonunion owner-operators in shipment of TL cargoes.

The most important factor in dating deregulation is the *administrative* deregulation within the ICC that began prior to passage of the 1980 MCA. ICC administrative actions that began in 1977 expanded the areas under which trucking operations were exempt from federal control and eased entry restrictions, although initially most awards of certificates were for extensions in service by existing carriers, rather than entry by new carriers. In a series of important decisions beginning in late 1978, the ICC allowed companies hauling their own goods to apply for authority to haul for others, abolished regulations that had limited contract carriers to servicing no more than eight shippers, expanded airport zones which were exempt from regulation, and announced they would consider rates a factor in granting operating rights (Moore 1983).

ICC administrative actions had largely deregulated the truckload market prior to 1980. Although much of what the Motor Carrier Act of 1980 did was to codify prior ICC administrative actions, its passage accelerated and made complete the effective deregulation of trucking transport. The MCA eliminated barriers to entry through a weakening of the public need test, removed most restrictions on operations (e.g.,

latter is from Moore (1983).

route and commodity designations), and allowed individual variation in rates until January 1, 1984, at which time collective rate bureaus were no longer exempt from antitrust action.

The direct effects of the MCA of 1980 on trucking product markets are not easy to quantify, since legislative deregulation primarily accelerated changes in the industry that were already underway, and because deregulation coincided with a recession that brought about a significant decline in traffic. There is little question, however, that deregulation facilitated exactly the qualitative responses that theory would predict (Perry 1986; Belzer 1994). There was a collapse in prices for operating licenses, increased entry of low-cost and nonunion firms, a high rate of business failure in trucking markets most affected by entry, rates that more closely reflected marginal costs and a lessening of cross-subsidization between lines of service, increased alternatives and price discounting available to shippers, improved efficiency and greater innovations in operations, and greater coordination with alternative freight systems. Traffic shifted from private carriage to previously regulated for-hire motor carriers. Boyer (1987) provides evidence for the 1977-83 period showing that shares of tonnage carried increased sharply among for-hire motor carriers, decreased moderately among private motor carriers, and fell sharply among railroads. The number of employers, particularly union employers, fell during the 1980s, while at the same time the growth of large firms (e.g., UPS) resulted in a more concentrated general freight industry (Belzer, 1994). The market share of union trucking and Teamster employment continued to decline (Belzer, 1994), while fierce rate competition among carriers exerted a continuing pressure on labor costs.

III. The Effects of Deregulation on Unionization and Labor Earnings:

Theory and Previous Evidence

ICC restrictions on entry and rate competition in the trucking industry created the potential for labor to realize rents, while collective bargaining provided the institutional mechanism that facilitated their capture. The goal of the International Brotherhood of Teamsters (IBT) had long been the signing of a national wage agreement that would largely remove labor costs from competition. Attainment of this goal was facilitated by ICC ratesetting that based rates on operating ratios measuring the ratio of operating costs to revenues. Increases in labor costs, which accounted for roughly two-thirds of total freight costs, could

largely be passed through in rates. While individual trucking firms still had incentive to lower costs, Teamster control of major terminals and their effective use of secondary boycotts until the 1960s allowed the IBT to organize major segments of the industry. The Teamsters' major strength was (and remains) among regular route carriers of general freight in the less-than-truckload (LTL) market. Less highly organized were irregular route and special commodity carriers and private carriers operating in the truckload (TL) market.

National bargaining by the Teamsters was achieved in 1964 in the first National Master Freight Agreement (NMFA), which shifted bargaining power from the regional to national level. NMFA contracts have followed every three years since 1964 (the most recent agreement as this is written was in 1994). While the NMFA was a major victory for Jimmy Hoffa in his move to centralize bargaining, there continued to exist regional bargaining and diversity in contracts.³

The predicted labor market effects of deregulation depend on changes produced in product markets, the effects of union bargaining power on union and nonunion employment and wages prior to deregulation, and on the speed of adjustment in various sectors toward competitive outcomes following deregulation. Suppose, for example, that the regulatory period was characterized by union power in the regulated for-hire sector of the industry, but that there was neither nonunion rent sharing in the trucking industry nor a wage spillover to the unregulated private carriage sector. If this were a correct characterization of the labor market during the regulatory period, then deregulation should lead to little change in union or nonunion wages in the previously unregulated private sector or among nonunion drivers in the for-hire sector. One should observe, however, a decline in relative union wages in the previously regulated for-hire sector and a decrease in union density -- a decrease more rapid the more slowly union wages fall toward those of similarly skilled nonunion drivers. And as wages and shipping rates fall in the previously regulated for-hire sector, employment should shift from the private to the for-hire sectors.

Initial evidence of the effects of trucking regulation and deregulation is provided in studies by Rose (1987) and Hirsch (1988), who utilize the May Current Population Survey (CPS) public use files for 1973-

³ For more detailed descriptions of collective bargaining in the motor carrier industry, see Levinson (1982), Perry (1986), and Belzer (1994, 1995).

85. Although hampered by particularly small sample sizes during the years immediately following deregulation, Rose and Hirsch draw inferences that are highly supportive of the competitive scenario described above. Among truck drivers in the previously regulated for-hire sector, they conclude that both union density and the union-nonunion wage premium decreased in the transition from a regulated to a largely deregulated environment. Moreover, they conclude that there was relatively little evidence of nonunion rent sharing during the regulatory period. They draw this conclusion based on evidence that wage changes among nonunion drivers in the covered sector, as well as both union and nonunion drivers in the unregulated private carrier sector, tended to mirror control group wage changes following deregulation of the industry. Because evidence on wage changes by union status and industry sector following deregulation relied on very small sample sizes and year-to-year variation in wages was considerable, the conclusions in Rose and Hirsch must be regarded as tentative. What was most clear-cut in their analyses was that the market share of union trucking and the level of union employment declined markedly following deregulation.

More recent evidence has been assembled by Belzer (1994, 1995), based chiefly on firm-level data from the trucking industry. Belzer documents the continuing loss of union jobs and Teamster membership, the decreased coverage of the NMFA, and the spread of decentralized agreements and concession bargaining. He emphasizes the importance of structural changes in the industry. Whereas most firms carried both truckload (TL) and less- than-truckload (LTL) shipments prior to deregulation, the market became more specialized following deregulation, with most carriers operating exclusively either in the TL or LTL market. There existed relatively easy entry into the TL market, with little need for a costly hub-and-spoke structure. The TL market has become dominated by nonunion carriers, many of these new entrants since deregulation. By contrast, LTL carriage requires a relatively costly hub-and-spoke infrastructure and displays substantial economies of scale. Union coverage has remained high among carriers in the LTL sector.

An additional effect of deregulation in the motor carrier industry may have been a decline in labor market discrimination. Based on a proposition proffered by Alchian and Kessel (1962), who extend

Becker's (1957) theory of discrimination, Heywood and Peoples (1994) propose that employment of minority truck drivers should increase following deregulation, since increased competition should raise the costs of discrimination. They summarize literature on the history of discrimination in the trucking industry and provide evidence supportive of their position. Based on similar reasoning, Peoples and Saunders (1993) provide evidence suggesting that trucking deregulation led to a narrowing of the black/white wage gap in trucking.⁴ If the effect of regulation on discrimination is important, we should expect to see a relatively large increase in minority employment in the previously regulated for-hire sector, but not in what was a largely competitive private sector even during the regulatory period. The effects on minority employment among owner-operators is less clear. On the one hand, employment discrimination in the for-hire sector during the regulatory period might have increased minority self-employment. On the other hand, limitations on price and entry competition in much of the contract carrier sector served by owner-operators may have permitted shipper discrimination and limited minority density among owner-operators.

Given what appears to be a highly competitive product market structure, a relatively elastic short- and long- run supply of labor, and a substantially weakened union presence and bargaining power, one might expect a high degree of wage uniformity. That is, the competitive model suggests that substantial wage differences between similarly skilled drivers in jobs with similar working conditions should not exist. Yet, as shown below and in previous work (Hirsch, 1987; 1993), there continues to exist a substantial wage advantage among drivers in the for-hire common carrier sector as compared to drivers with similar measured characteristics in private carriage, and a substantial union wage advantage among drivers in both the for-hire and private sectors. Absent significant union bargaining power, it is likely that much of the observed wage differential represents unmeasured differences in driver skills or in working conditions. Based on longitudinal evidence on wage changes among drivers changing union status, Hirsch (1993) has suggested that a substantial portion of the observed union wage premium following deregulation represents a compensating differential for unmeasured driver experience and skills.⁵ He does not provide a similar

⁴ Assuming that labor supply is highly elastic, changes in discrimination should show up primarily in changes in employment by race, rather than as changes in relative wage (Heywood and Peoples, 1994).

⁵ The standard argument is that union employers forced to pay wages above competitive levels offset part of the cost increase by hiring higher-skill workers. As shown by Wessels (1994), such a result need not follow since hiring

investigation of the for-hire/private carrier wage differential. In what follows (Section IX), we utilize longitudinal analysis measuring wage changes among drivers switching union status and sector of employment in order to explore the source of what appear to be large long-run wage differentials.

IV. Methodology and Specification: Inference from a Quasi-Experimental Design

In order to determine the effects of motor carrier regulation and subsequent deregulation on labor earnings, we follow the approach previously employed by Rose (1987) and Hirsch (1988). Although they do not describe their methodology as such, it is similar to what Meyer (1994) has described as a "quasi-experimental" approach. Using language from the experimental literature, deregulation can be regarded as an exogenous "treatment" affecting the earnings of drivers in the regulated for-hire common carrier sector.⁶ The treatment effect can be measured in alternative ways. The simplest approach is a "difference" method measuring the change in wages of affected drivers between the non-treatment (regulatory) and treatment (deregulatory) periods, with controls for driver characteristics. Because real wages for drivers would have changed over time absent deregulation, the difference approach is not likely to provide a reliable estimate of the treatment effect. We then employ a "difference-in-differences" approach. Here we measure the treatment (i.e., deregulation) effect by the difference in wages changes between the treatment group (drivers in the regulated sector) and wage changes among a control group of otherwise similar workers not affected by deregulation.

A critical issue in this approach is the choice of control group and interpretation of results. If we are confident that regulation and subsequent deregulation did not affect the wages of truck drivers in the private carriage sector, then those drivers constitute a natural control group, since they are a similar group of workers in an identical occupational category, thus providing control for driver-specific effects on the labor market other than deregulation. If the earnings of drivers in private carriage are likely to have been affected by regulation and subsequent deregulation then a preferable comparison group is otherwise similar workers who are not truck drivers, similarity being achieved through the selection of an appropriate sample and

higher-skill workers increases union wage demands in subsequent bargaining periods. Knowing this, the firm may not upgrade skill levels. The implication is that there can be no general presumption for skill upgrading in union firms, nor should there be a full productivity offset in the presence of union bargaining power.

⁶ The exogeneity assumption is a reasonable one. Deregulation was imposed rather than selected by trucking firms and

measurable controls. The non-driver comparison group has the advantage of being unaffected by the treatment (deregulation), but the disadvantage of not controlling for non-treatment wage changes specific to truck drivers.

In the analysis that follows, we provide results on wage changes among all three groups -- non-drivers, drivers in the previously regulated sector, and drivers in the unregulated sector. We attempt to assess the appropriateness of the alternative control groups. If wage changes among private carriage drivers mirror those of the non-driver control group, we can conclude that there was little regulatory rent-sharing across sectors and the choice of comparison group will not affect inferences. If wage changes among private sector drivers differ from the non-driver group and move in a fashion similar to those among previously regulated for-hire drivers, then we can conclude that there existed regulatory rent sharing and that the non-driver sample is the preferred comparison group. Finally, if wage changes among private sector drivers differ from those among both the non-driver group and the treatment group (for-hire drivers), and these wage changes are not consistent with theoretical expectations from deregulation, then private sector drivers are being affected by driver-specific shocks and may form the preferred comparison group.

The fact that labor supply of truck drivers is relatively elastic, owing to the relatively low cost of acquiring entry-level skills, implies that driver-specific wage determinants unrelated to the regulatory environment should be short-lived. This suggests that the non-driver sample is the appropriate control group if private carriage rent sharing is likely, while either the non-driver or private carriage samples are appropriate if rent sharing were absent. Prior evidence (Rose, 1987; Hirsch, 1988) suggests that rent sharing was not important outside the regulated sector, based on a finding of similar wage changes following deregulation among private carriage drivers and alternative control groups of non-drivers. In this case, the choice of the comparison group is unimportant or, stated alternatively, the analysis has the virtue of arriving at largely similar conclusions using multiple non-treatment groups (Meyer, 1994).⁷

affected virtually all for-hire carriers, independent of labor earnings.

⁷ In the empirical work that follows, we also examine results based on the union status of drivers. In this analysis, wage changes among union for-hire drivers are compared those among nonunion for-hire drivers, union private drivers, nonunion private drivers, and non-drivers economy-wide. Even if there were no changes in relative union-nonunion wages, deregulation could lead to a decrease in average industry wages as traffic and employment shift from union to nonunion companies.

To put the above discussion in focus, in what follows principal attention is given to the change in real wages over the 1973-95 period among drivers in the previously regulated for-hire trucking industry. In order to measure changes over time in real wages, we adjust for price level changes and control for measurable changes in worker characteristics. We initially examine changes by year in for-hire wages, and then compare these wage changes to changes among truck drivers in the previously unregulated private carrier sector and among a control group of "similar" non-driver male workers employed economy-wide. We then use regression analysis to estimate relative wage differentials by year across groups of workers, with for-hire drivers being compared to drivers in the private carriage sector and to a broad group of non-driver male wage and salary workers in selected broad occupational categories. We control for a variety of worker characteristics, since workers in the control group may differ substantially from truck drivers. A similar method of analysis is then used to examine wage changes among union and nonunion truck drivers.

Evidence on changes over time in real wages is provided by an "adjusted wage index" measure. The adjusted wage index is constructed separately for truck drivers in the for-hire and private sectors, union and nonunion drivers by sector, and the non-driver comparison group. Each wage index is constructed from a log wage regression, pooled over the 1973-95 period, of the following form:

$$(1) \quad \ln W_{ijt} = \sum \beta_{jk} X_{ijtk} + \sum \varphi_{jy} YEAR_{ijty} + \epsilon_{ijt}$$

where $\ln W_{ijt}$ is the log of hourly earnings for individual i in sector j (e.g., for-hire or private, union or nonunion, non-driver occupations) in year t , X_{ijtk} includes variables (indexed by k) measuring worker and market characteristics and β_{jk} are the corresponding coefficients (X_0 equals unity and β_0 is the intercept), $YEAR$ is a set of dummy variables (indexed by y) for 1973-74 through 1995, and ϵ is an error term assumed for now to have zero mean and constant variance. The omitted reference year is 1977-78, the period just prior to administrative deregulation and the period in which driver wages peaked. Values of φ_{jy} measure the logarithmic earnings differentials relative to the base period; these are converted to a percentage index by $100[\exp(\varphi)-1]+100$, with 1978-79=100. Pooling across years assumes a stable wage structure over time, an assumption relaxed below.

We next estimate annual measures of "relative wage differentials" for the years 1973-95. In its most

general form, the wage regression provides estimates of the log wage differential for each group of truck drivers -- union for-hire, nonunion for-hire, union private, and nonunion private -- relative to the control group of union and nonunion non-driver employees (and to each other), following control for worker characteristics. The differentials are calculated from annual log wage regressions, which allow the economy-wide wage structure to vary by year. The annual wage regressions take the following form:

$$(2) \quad \ln W_{it} = \sum \beta_k X_{kit} + \theta_t UN-CON_{it} + \sum \Gamma_{jt} TRUCK_{jit} + \epsilon_{it},$$

where i designates individual, t is year, k indexes the worker and labor market control variables in X with β_k the corresponding coefficients. Five dummy variables ($UN-CON$ plus $TRUCK_j$) delineate the six groups of workers -- union and nonunion workers who are in the non-driver economy-wide control group, drivers in the private sector, and drivers in the for-hire sector.⁸ The wage differential for each of the four truck driver groups by year is calculated by the difference between its coefficient Γ_{jt} and the sample-weighted average of union and nonunion non-driver control group wages. That is, the log wage differential d for truck driver group j in year t is calculated by:

$$(3) \quad d_{jt} = \Gamma_{jt} - p_t \theta_t$$

where Γ_{jt} is the coefficient on the j group of truck drivers in year t , p_t represents the control group union density in year t , and $p_t \theta_t$ represents the weighted average of union and nonunion control group wages (nonunion non- drivers are the reference group normalized at zero).⁹ Equation (2) also allows us to calculate the differential between union and nonunion drivers in the for-hire and private carriage sectors by simply calculating the difference in union and nonunion Γ_{jt} by sector and year.

V. Data

The principal data source for this paper is the Current Population Survey (CPS). Files used in the paper include the 204 monthly CPS Outgoing Rotation Group (CPS ORG) earnings files for January 1979 through December 1995, the May CPS earnings files for 1973-81, and additional CPS supplements noted below. The ORG files include the quarter sample from each monthly CPS that are asked questions on

⁸ Nonunion non-drivers are the omitted reference group. We also estimate a simpler specification providing differentials for the for-hire and private sectors, but with no union status designation. This specification permits use of a larger CPS data set for the years 1979-82.

⁹ As expected, highly similar wage differential estimates are obtained when $UN-CON$ is omitted from the wage

current earnings, hours worked, and union status. Between 1973 and 1978, earnings supplement questions were administered only in the May surveys, but to all rotation groups. Questions on union status were asked during the May 1973-78 surveys, and monthly beginning in January 1983. Union status information is not available in the CPS ORG files for 1979-82, but is available for the full May samples in 1979 and 1980, and a quarter of the May sample in 1981.¹⁰ There were no union questions in the CPS during 1982. Subsequent longitudinal analysis will rely on two-year panels constructed by us from matched CPS ORG files for 1983/84 through 1994/95. Construction of the panel data is described in a later section and in a Data Appendix.

The CPS data set used in our wage analyses includes employed male wage and salary workers ages 16 and over. Excluded are women, workers whose principal activity is schooling (except for 1994-95, where this exclusion is not possible), whose implicit real hourly earnings (weekly earnings divided by hours worked per week) are less than one dollar or greater than \$99.99, and whose industry or occupation of employment has been allocated by the Census. *Employment* figures also are calculated without such exclusions (e.g., female drivers are included) for wage and salary drivers and self-employed owners-operators (incorporated and nonincorporated); earnings and union status information is not provided for self-employed workers in the ORG files. The wage sample includes all wage and salary workers who identify their occupation as truck driver and all control group workers meeting the selection criteria stated above. Truck drivers are identified as either in the for-hire or private sectors, and as either union or nonunion (based on membership status) within each of those sectors. For-hire drivers are defined as those employed in the trucking services industry, while private carriage drivers are defined as those employed outside the trucking industry.¹¹ The non-driver control group includes the following broad occupational categories:

regression, making the omitted reference group the pooled sample of union and nonunion non-drivers.

¹⁰ Only half the May 1979 and one-quarter of the May 1980 and 1981 samples were asked the earnings questions *during May*. We obtain nearly full samples for May 1979 and 1980 by matching individuals from the May surveys to their earnings records from the CPS ORG files in their outgoing month in May-August.

¹¹ In the 1983-91 CPS (using 1980 Census of Population occupational codes), there were two truck driver codes -- heavy truck driver and light truck driver. Light truck drivers are primarily nonunion and in private carriage, with few in the for-hire sector or unionized private sector. Prior to 1983 (i.e., 1970 Census codes) and after 1991 (1990 Census codes), there is a single occupation called truck driver. Both light truck and heavy truck drivers are included in the Census truck driver category beginning in 1992. Prior to 1983, however, light drivers were included in the category "deliverymen and routemen." Because this category also includes workers who were not light truck drivers, it is not

administrative support; services; production, craft, and repair; operators, assemblers, and inspectors; transportation and material moving; and handlers, equipment cleaners, and laborers. Excluded occupational categories are: executive, administrative, and managerial; professional and specialty; technician and support; sales; and farming, forestry, and fishing.

The wage rate for both salaried and hourly workers is measured by usual weekly earnings on the primary job, inclusive of tips, commissions, and overtime, divided by usual hours worked per week.¹²

Workers with top-coded earnings are assigned the estimated mean earnings above the earnings cap based on the assumption that the upper tail of the earnings distribution follows a Pareto distribution.¹³

VI. Employment

Total employment among truck drivers (i.e., wage and salary for-hire and private drivers, plus owner operators), shown in Table 1, has increased from 1.62 million drivers in 1973-74 to more than 2.84 million in 1995. Employment has roughly doubled among owner-operators and drivers in the for-hire sector, but increased by only half among drivers in private carriage. These differences in employment growth are consistent with the thesis that trucking entry and price regulation constrained traffic and employment in the regulated for-hire and owner-operator sectors, while shifting traffic to private carriage.

possible to construct a perfectly consistent sample of drivers over the entire 1973-95 period. The series is consistent, however, for 1973-82 and 1983-95, but not consistent for 1982-83 (i.e., earlier years do not include light drivers while latter years do). A consistent sample for 1982-83 was constructed by creating a sample that omitted light truck drivers for 1983-91. We used this sample to estimate "correct" changes in indices for 1982-83. Estimates presented in the paper, thus, utilize the sample including light drivers beginning in 1983, but make a small adjustment to the private sector and nonunion private sector wage indices and wage differentials to correctly measure the 1982-83 change. No adjustment is made in the for-hire sector estimates or (in results by union status) the union private sector estimates, since few light drivers are in these sectors. Mean wage rates by sector and union status, presented in Table 3, do not include an adjustment.

¹² In order to reduce measurement error in the calculated wage, hours worked per week are capped at 70 hours per week. Department of Transportation regulations place limits on allowable hours by drivers. The gist of the regulations is to restrict hours to no more than 10 hours without an 8 hour break, and 60 hours over 7 consecutive days. A relatively small percent of the sample reports over 70 usual hours worked per week. Weekly earnings increase as expected with respect to reported hours worked up to about 60 hours, but show only small increases beyond 60 hours. All wage equations include a series of reported hours dummies, thus allowing the measured log wage to vary with reported hours. Our results are little affected by the hours cap. For the years 1994-95, respondents in the CPS are allowed to report variable hours worked. For workers reporting variable hours, we measure the wage using the following sequential process: 1) use the reported wage for workers separately reporting a wage and not receiving tips, commissions, or overtime; 2) measure the wage by usual weekly earnings divided by hours worked *last week*; 3) use the reported wage for workers reporting receipt of tips, commissions, or overtime but with variable usual hours and no reported hours worked last week; or 4) delete from the sample if the wage cannot be constructed in any of the above ways (few workers are deleted).

¹³ Hirsch and Macpherson (1996, p. 6) provide gender-specific estimates of mean weekly earnings above the cap for

Following deregulation and the twin recessions of 1979-80 and 1982, driver employment fell in both the for-hire and private sectors. Likewise, employment grew rapidly in the for-hire, private, and owner-operator sectors immediately following the 1982 recession. Since the mid-1980s, nearly all employment growth among truck drivers has been within the trucking services industry and among owner-operators, with little growth in private carriage employment.¹⁴

Perhaps the most striking employment change has been the shift away from union toward nonunion drivers. While total employment has doubled for truck drivers in the for-hire sector during the 1973-95 period, union employment has fallen, from a high of about 350 thousand union drivers in 1979 to about 250 thousand in 1995. Union density in the for-hire sector has declined from 60 percent in 1973-74 to only 25 percent in 1995. Although unionization has always been lower in the private carriage sector, a similar trend is evident. Union employment has fallen from over 400 thousand at the time of deregulation to about 260 thousand today. Union density has fallen from 40 percent in 1973-74 to only 17 percent in 1995. In short, increased competition and greater management resistance to unionization during the 1980s and 1990s, in part but not fully due to trucking deregulation, has resulted in a dramatic decline in the importance of unions in trucking transport, both within and outside the motor carrier industry. Although union density remains high in the LTL segment of the industry (Belzer, 1994), union drivers in 1995 constitute a small proportion of total drivers -- 20.3 percent of all wage and salary drivers and 18.1 percent of total employment (wage and salary plus owner-operators).

The employment figures in Table 1 include workers for whom driving a truck is designated as their primary job. Using the 1994 and 1995 CPS files, which include limited information regarding workers' secondary jobs, we calculated the number of workers who moonlight as truck drivers. Averaged over 1994-95, we estimate that there are 120.6 thousand workers annually moonlighting as drivers. Of this number, 87 percent are wage and salary workers and 13 percent owner-operators. Among the wage and salary secondary drivers, 75 percent are in private carriage, a higher proportion than among primary drivers. How

1973-95. Few truck drivers have earnings above the cap.

¹⁴ Figures reported in Peoples and Peteraf (1995) suggest a far more rapid increase in the proportion of owner-operators. Their figures are misleading, resulting from sampling changes in the CPS that they failed to take into account.

important a contribution do secondary drivers make to total labor supply? The 120.6 thousand drivers increase total driver employment by just over 4 percent, from an average 2.84 million in 1994-95 (as calculated from Table 1) to a total 2.96 million (the percentage increase in hours is of course less). In short, moonlighting modestly increases the total supply of truck drivers, but does not constitute an important source of driver supply, particularly among trucking firms.¹⁵

Finally we briefly examine the employment of minority drivers. As discussed previously, Heywood and Peoples (1994) propose that employment of minority truck drivers in the previously regulated for-hire sector increased following deregulation in response to increased competition and the higher costs of discrimination. The predicted effects on minority employment among owner-operators is less clear (see Heywood and Peoples, 1994). Table 1 reports the percentage of minority employment among truck drivers in the for-hire sector, private sector, and self-employment (owner-operators) for the years 1973-95, as well as similar figures for the control group of non-professional males. Minority employment is defined as workers who are either Hispanic, Black, or other race (primarily Asians); that is, all workers other than non-Hispanic whites.¹⁶ There is support for the Heywood- Peoples proposition. In the previously regulated for-hire sector, minority employment increased from about 12- 13 percent during the 1970s to more than 20 percent during the 1990s. In results not shown, there are increases over time in Hispanic, Black, and "other race" driver employment (sample sizes by race by sector by year are small). In contrast, one sees little change in the other two sectors. Minority employment has been roughly 25 percent in the private sector throughout the period, with little trend. Minority employment is even smaller in the owner-operator sector, with a roughly 15-17 percent minority share throughout the period. In both the private sector and owner-operator sector there appears to be a small decrease in employment shares among Black drivers, and increases among Hispanics and other races (these results not shown).

Before concluding that deregulation led to a decline in employment discrimination, it is important to

¹⁵ We also calculated the number of primary truck drivers who are employed as non-drivers in secondary jobs. Averaged over 1994-95, 3.9 percent of for-hire drivers and 4.8 percent of private carriage drivers moonlight. This compares to economy-wide moonlighting rates of 6.4 percent for men and 5.9 percent for women, calculated from the May 1991 CPS dual job supplement (Paxson and Sicherman, 1996: 360).

¹⁶ A very small number of workers in the CPS have Hispanic status designated as "don't know." We assign to these workers Hispanic status equal to .5.

compare racial and ethnic employment changes in trucking to those occurring outside of trucking during the same period. Focusing on our control group of males, we find that the economy-wide employment share of minorities increased as well over the period, from about 20 percent during the regulatory period to 29 percent by 1995. Increases in economy-wide minority employment can account for some of the growth in the for-hire trucking sector. It cannot account for the faster growth of minority employment in the for-hire than in the private and owner-operator sectors of trucking. Indeed, the slow growth in minority employment in the private and owner-operator sectors is rather puzzling. Despite this ambiguity, the weight of the evidence supports the Heywood- Peoples proposition.¹⁷

VII. Real and Relative Wages Among Truck Drivers in the For-Hire and Private Carriage Sectors

In this section, we provide evidence tracking wage levels of truck drivers over the 1973-95 period, by sector and relative to alternative wages for a control group of workers with similar measured characteristics. Table 2 provides descriptive evidence on real hourly earnings (in 1995 dollars, using the monthly CPI-UX) for all truck drivers, for-hire drivers, private carriage drivers, and for the non-driver control group.¹⁸ Table 3 reports similar evidence separately for union and nonunion drivers. Real hourly earnings have decreased substantially since 1973. For example, wage rates for drivers in the for-hire sector have fallen from \$16.78 in 1977-78 just prior to administrative deregulation, to only \$12.70 in 1995. Wages among private carriage drivers fell from \$12.47 to \$10.38 over the same period. Note that the decline in mean wages, particularly in the for-hire sector, is a result of declining union and nonunion wages *and* a shift of employment from relatively high-wage union to low-wage nonunion jobs. The within-sector decline in wages by union status was most notable for union for-hire drivers, from \$19.15 in 1977-78 to \$15.62 in 1995 (see Table 3). Declining real wage rates, of course, have not been limited to truck drivers, our control group of non-professional males showing a wage decline, from \$13.77 to \$11.61, similar to the decline for private carrier drivers. Although union for-hire drivers exhibit the steepest wage decline, their mean wage of \$15.62 in 1995 continues to represent a sizable advantage over wages for nonunion for-hire (\$11.71), union private

¹⁷ For a detailed discussion, see Heywood and Peoples (1994) and Heywood (this volume).

¹⁸ The CPI-U changed its method for measuring housing costs in the early 1980s. The CPI-UX incorporates these revisions and backdates them into the 1970s and early 1980s to create a time-consistent price series. The CPI-U and CPI-UX are equivalent beginning in 1983. Measured inflation (and real wage decline) is lower using the CPI-UX than

(\$13.59), and nonunion private (\$9.70) drivers.

Our principal method for examining wage trends is the use of an "adjusted wage index" for 1973-95, as seen in Table 2. Index values are derived from a log wage regression (equation 1) for each group, pooled over the 1973-95 period, with controls included for years of schooling completed, potential experience (age-schooling-6) and its square, race (2 dummy variables), marital status (2), region (8), large metropolitan area, and year (1977-78 is the omitted base year). The year dummy coefficients ϕ_y provide information necessary to construct the earnings index, with 1977-78=100. We combine years into two-year periods during 1973-78, since annual sample sizes prior to 1979 are relatively small. Included in Table 2 are the wage index values for the for-hire, private carriage, and control group samples.

Real wages for truck drivers in both sectors have fallen substantially relative to their 1977-78 peak. The drop is most substantial in the previously regulated for-hire sector, where wages in 1995 are 28 percent below their peak. But the drop is also large in the private carriage sector, with wages roughly 17 percent lower than in 1977-78. In the for-hire sector, wages fell rapidly just following deregulation, while the deterioration in drivers' wages outside the industry occurred more steadily. Real wages for drivers in both sectors continued to fall until the recent 1994-95 rise. Opportunity cost wages, however, also fell during the same period, as seen by the 17.5 percent real decline in the non-professional male control group wages. Indeed, the decline in wages in the private carriage sector over this more than twenty year period is virtually equivalent to the economy-wide decline. This is consistent with the proposition wages in the private sector mirrored those economy-wide, and that the private carriage labor market was highly competitive during the regulatory period, with relatively modest rent sharing. By contrast, wages in the previously regulated for-hire sector declined substantially more than did opportunity cost wages.

Also evident from the wage indices is the sensitivity of driver hourly earnings to macroeconomic conditions, in particular rapid (and largely unanticipated) inflation. Declines in driver wages are particularly evident during the 1975-76 and 1979-80 periods (economy-wide wages moved in a similar but less extreme manner). Of course, macro-related changes during 1979-80 cannot be easily distinguished from the effects of deregulation.

the CPI-U. For a comparison of real wage trends using alternative price indices, see Bosworth and Perry (1994).

We next estimate "relative wage differentials" d_{jt} , representing the wage differentials by year t between groups j (for-hire and private carriage drivers) and our control group of male non-professionals, following control for measurable characteristics. Included in the log wage equation are variables measured at the individual level: years of schooling completed and potential experience and its square; and dummies for marital status, region, and large metropolitan area.¹⁹

Table 2 presents the wage differentials by year. Readily evident from these results is the decline in relative wage rates among truck drivers in the for-hire sector following deregulation. Drivers in the previously regulated for-hire sector realized wage premiums of about 20 percent during the 1973-78 period, relative to the economy-wide control group. Log wage differentials then fell steadily, from roughly 14 percent during 1979-81, to 8 percent during 1982-84, to 4 percent during 1985-87, and to close to zero since the late 1980s. In short, relative wages for drivers in the for-hire sector have fallen by more than 15 percent (roughly -.17 log points) since the regulatory period.

Relative wages also have fallen among private carriage drivers, whose wage levels are considerably lower than those among for-hire drivers. In contrast to the for-hire sector, however, the decline since the 1970s has been far lower, only about 2 percentage points if one focuses on 1994-95 wage levels (or roughly 6 percentage points if one compares the 1983-93 period to the 1970s). Whereas relative wages in the for-hire sector began falling at the time of deregulation, the pattern is less clear within the private carriage sector, where relative wages fell moderately in 1980 and between 1982 and 1984.

Based on the relative wage differentials presented in Table 2, what can be concluded about the overall effect of deregulation on driver earnings? The difference-in-differences method compares wage changes among for-hire drivers either to those in the economy-wide control group, or to drivers in the previously unregulated private sector. Assuming the economy-wide group forms the appropriate control group, deregulation decreased log wages by roughly .17 in the for-hire sector through 1994-95 and by roughly .02 in the private carriage sector. If we assume that the private carriage sector did not share in regulatory rents and that it forms the appropriate comparison group, the difference-in-differences estimator

¹⁹ The male comparison group sample is restricted on the basis of occupational category, but we have not included occupation or industry dummies in the wage regression, which would act to further narrow the effective comparison

of the log wage effect from deregulation is roughly .15, the difference in the relative wage decline between the for-hire sector and the private carriage sector. A reasonable estimate is that motor carrier deregulation led to a roughly 15 percent decline in driver wages in the previously regulated for-hire sector, while having at most small effects on wages in the private carriage sector.²⁰

Left unexplained by the analysis is why relative wages are roughly 7-10 percentage points higher among for-hire drivers than among drivers in private carriage. Given that such a sizable differential has been maintained many years since deregulation, it is fair to assume that it represents a long-run differential. Such a differential may result from unmeasured differences in drivers skills and job characteristics between the two sectors, or may represent, at least in part, the presence of union rents and higher union density in the for-hire sector. We turn to each of these issues in Section IX. Below, we examine difference in union and nonunion wages in the for-hire and private carriage sectors.

VIII. Relative Wages Among Union and Nonunion Truck Drivers

In this section, we examine separately wage changes among union and nonunion truck drivers, with an emphasis on drivers in the previously regulated for-hire sector. Adjusted wage indices for union and nonunion driver in each sector are estimated over the samples containing union status information; that is, we substitute the May 1979-81 CPS files for the 1979-82 annual ORG files. Although we present the results separately by year for 1979-81, note that sample sizes in 1979 and 1980 are less than one-third and in 1981 one-twelfth the size of samples for years beginning with 1983. Because the data are further cut by sector and union status, figures for individual years, particularly 1981, should be treated with caution.²¹

Table 3 presents the union and nonunion wage indices, with 1977-78=100. We observe the largest wage decline among unionized drivers in the previously regulated for-hire sector. Drivers employed by unionized common carriers suffered wage declines immediately following administrative and subsequent legislative motor carrier deregulation, with real wages having fallen by 16 percent by 1984. Wages then

group.

²⁰ As previously noted, the decline in for-hire wages is in part the result of a shift from union to nonunion employment, as well as from declines in union and nonunion wages.

²¹ Owing to differences in the samples and because the latter estimates are based on separate analysis by union status, the sectoral results presented previously in Table 2 are not identical to a weighted average of union and nonunion results provided in Table 3.

stabilized for union drivers in the mid-1980s, but resumed their decline after 1988. By 1995, real wages these drivers had fallen by 23 percent. In contrast, wages among nonunion drivers in the trucking industry do not appear to have fallen immediately following deregulation, although small sample sizes in 1979-81 make us reluctant to attach much weight to this conclusion. By the early 1980s (when sample sizes are far larger), real wages had fallen by roughly 10 percent.

In the private carriage sector, real wages also declined, but by less than in the for-hire sector. Among union private sector drivers, the 1994 and 1995 figures appear to be outliers (the former year unusually high and latter year low), not surprising given that only 17-18 percent of the sample is union. Averaging these years, private sector union wages appear to have declined at a rate not unlike that for nonunion drivers.

Included in Table 3 are wage differentials for union and nonunion workers, relative to the economy-wide control group, as well as union-nonunion differentials within each of the sectors. Union drivers in the for-hire sector saw their wage premiums relative to the economy-wide control group fall sharply following deregulation, from roughly .30 to .20 log points. This union advantage relative to non-drivers has been remarkably stable at about .20 since 1979. The wage advantage of union drivers in the private sector, as compared to similar non- drivers, has remained about the same for more than twenty years (there is, of course, year-to-year variation). Among nonunion for-hire drivers, wages relative to those economy-wide fell moderately about 1983, but have moved in a similar fashion since that time. Relative wages for nonunion private sector drivers showed little change before and after deregulation, although their relative wages appear to have increased by roughly 5 percentage points during 1994-95.

Finally we examine (in the last column of Table 3) union-nonunion differentials in the for-hire and private carriage sectors. Consistent with the above evidence, the union wage advantage fell in the for-hire sector immediately following deregulation (but recall that May 1979-81 CPS sample sizes are particularly small); by the late 1980s it had returned close to the level during regulation. Little pattern is evident in the private sector industry, apart from an apparent decline in 1995. Overall, the evidence is consistent with the conclusion that the effects of deregulation were most concentrated among union drivers in the previously

regulated common carrier sector, and to a lesser degree, among nonunion drivers in that sector. Moreover, regulation brought about an employment shift from high-wage union to lower-wage nonunion jobs within the for-hire sector. There is little evidence of rent sharing associated with regulation for either union or nonunion drivers in the previously unregulated private carriage sector.

Notable in the results presented in this section is the large and persistent wage advantage realized by union relative to nonunion drivers in both the for-hire and private carriage sectors, both during and after motor carrier regulation. Likewise, there is a persistent wage advantage among drivers in the for-hire relative to private sector, independent of union status. In the following section, we explore the extent to which the sizable and persistent union and for-hire sector wage advantages represent rents, versus compensating differentials associated with greater driver skill.

IX. Rents or Compensating Differentials? Panel Analysis of Union and Sectoral Wage Differentials

The evidence shows clearly that large wage differences have been maintained between the for-hire and private carriage sectors, and between union and nonunion drivers within each of these sectors. These differentials have survived for many years following deregulation, despite the presence of relatively easy firm entry, sharply diminished union power and membership, and what should be rapid adjustments to long-run equilibria owing to highly elastic labor supply. The existence of such differentials suggests that they reflect compensating premiums or sustained bargaining power. Wage differences between for-hire and private carriage drivers are likely to result from unmeasured differences in skills and working conditions. The premium for union drivers in each sector is likely to represent a combination of a rent, owing to union bargaining power, and a compensating differential owing to higher skills (Hirsch, 1993).

In this section we estimate differentials based on wage gains and losses of drivers moving between the for-hire and private carriage sectors and into and out of union jobs. By examining wage changes among given workers, one controls for worker-specific differences in unmeasured skills and preferences whose effects are fixed over time (one year with our data) and transferable across jobs. In the next section, we utilize supplementary data to further probe the sources of the sectoral and union wage gaps. Panel analysis is limited by the quantity and quality of data. It requires that there be an adequate number of "joiners" and

"leavers" and that job changes be measured accurately, since wage change estimates are sensitive to measurement error on the right-hand-side. An additional concern is that we cannot rule out the possibility that switching is endogenous and potentially correlated with wage change, independent of the sectoral change being studied. We return to these issues when we interpret results.²²

Panel estimates are obtained using matched panels from the CPS ORG files for 1983/4 through 1994/5. The sampling structure of the CPS permits construction of a panel of workers in the same month in consecutive years (see the Data Appendix). An advantage of the CPS ORG matched panel is that earnings and other variables are measured in exactly the same way one year apart. The CPS ORG panel has disadvantages. Because it relies on matched interviews one-year apart, with different Census survey takers and coders, and possibly a different household member providing answers, there is measurement error in the change variables. Of concern for us is whether there is substantial measurement error on the union status, occupation, and industry variables. Polivka and Rothgeb (1993) show that prior to the 1994 changes in the CPS, occupational changes were seriously overstated, while industry changes were moderately overstated. Because we are examining only workers who are recorded as truck drivers in consecutive years, measurement error on the occupational variable is of little concern in our panel. We suspect that mismeasurement of sectoral status (i.e., whether a driver is employed by a company in the trucking service industry or not) is small. Measurement error on the *change* in union status variable may be substantial, however, particularly since the analysis is restricted to workers not changing occupation. Moreover, workers who change households or whose household moves during a year drop out of the CPS. As shown by Peracchi and Welch (1995), this causes young workers to be somewhat underrepresented.

Table 4 provides means and regression estimates of wage changes among sectoral and union switchers. All estimates are provided for the sample pooled across years. Pooling increases statistical efficiency by maximizing the number of switchers; moreover, there was only modest change after 1983 in the magnitude of sectoral and union (cross-sectional) wage differentials. Mean wage change and regression wage change estimates are similar, given that most right-hand-side variables do not change in the panel. In

²² Longitudinal models examining union wage effects include Freeman (1984) and Jakubson (1991). Bound, et al. (1994) carefully examine measurement error in survey data, and provide references to earlier literature.

addition to changes in sector and union status, the regression estimates include year dummies and variables measuring changes in experience squared and in eight hours worked dummies.

The panel data set includes 9,193 truck drivers observed in consecutive years between 1983/84 and 1994/95. Among this sample, 454 (4.9 percent) truck drivers are recorded as switching from private carriage to for-hire employment; an identical number (coincidentally) have switched from for-hire to private carriage. Similarly, 386 (4.2 percent) are recorded as switching from nonunion to union status, while 400 change from union to nonunion (4.4 percent).²³

Mean wage changes reflect the effects of changing sectoral and/or union status, wage gains associated with an additional year of experience, plus any other determinants of wage change. Truck drivers changing from private carriage to the for-hire sector realized a .027 log wage gain, as opposed to the .008 log wage gain among drivers staying in private carriage. Drivers leaving the for-hire sector suffered a .010 log wage loss, as compared to the .015 wage gain realized by drivers staying in the for-hire sector. In short, mean wage gain and losses associated with joining or leaving the for-hire sector, *relative to staying in their initial sector*, is only about 2 to 2½ percent, far less than the approximate 7-10 percent wage advantage observed among for-hire drivers in the cross-sectional regression analysis. Our wage change regression analysis, which controls for year and changes in union status, experience squared (changes in potential experience are equal to one for everyone and reflected in the intercept), and hours worked, produces similar results. The coefficient on the change in for-hire status is .025, indicating an approximate 2½ percent wage gain (loss) associated with joining (leaving) for-hire employment.

A concern in longitudinal analysis is that many job changes are endogenous. If sectoral (or union status) change is in part determined by expected wage change, then coefficient estimates may be biased. Gibbons and Katz (1992), among others, have examined wage changes among workers displaced by plant closings as a method of restricting the analysis to truly exogenous switchers. Although we cannot rule out bias from endogenous switching, we would be surprised were this factor affecting our results to any

²³ A small number of workers in the CPS have their union status allocated by the Census. Unfortunately, a union allocation flag is not included in the CPS files prior to 1989. For the years after 1989, following the exclusion of those with allocated union status in either panel year, 3.0 percent of the sample joined and 3.8 percent left a union. Workers for whom either industry or occupation is allocated have not been included in either the wage level or wage change

substantial degree. Endogenous (e.g., voluntary) job switching should lead to an overstatement of the typical wage gain from switching into for-hire (or union) employment, while understating the typical wage loss from a switch out of for-hire (or into nonunion) employment. The relative symmetry of observed wage changes (in absolute value) for drivers switching into and out of the for-hire sector (and, as seen below, union employment) increases our confidence that endogeneity bias is relatively unimportant.

Based on the panel analysis, we conclude that most of the substantial wage advantage observed among for-hire relative to private carriage sector drivers reflects worker-specific quality -- skills not measured by worker characteristics variables but observed and rewarded by employers. The remaining 2½ percent wage differential not only is small, but could easily be the result of unmeasured differences in working conditions between for-hire and private carriage employment. Indeed, it would be surprising if the wage differential between sectors were not accounted for fully by compensating differences for worker skills and working conditions, given that the relatively stable observed wage advantage has been maintained over time and there is no obvious alternative explanation for a large systematic wage advantage.²⁴

The evidence on wage changes associated with the change in union status indicates that the sizable union wage advantage, roughly .25 to .30 log points in each sector, represents both a rent to union workers associated with union bargaining power and a compensating differential associated with greater unmeasured skills among union drivers. First, examining mean wage changes, we find that union joiners realize a .084 log wage gain, as compared to a .007 wage gain for union stayers (i.e., a .077 net gain). Union leavers suffer a .042 wage loss, compared to a gain of .011 among nonunion stayers (a net loss of .053). The regression estimate of the wage change associated with union status change is .057. If this estimate is reasonably accurate, it indicates that about four-fifths of the wage advantage realized by union relative to nonunion truck drivers reflects greater driver-specific skills among union drivers, while the remainder reflects a true rent. If there exists substantial (random) measurement error in the union change variable, its coefficient is biased toward zero and we have understated the rent component and overstated the skills

analysis.

²⁴ Differences in union coverage between sectors could account for a systematic differential, but changes in union status are controlled for in the regression. We cannot rule out efficiency wage and monitoring cost explanations for sectoral wage differences. But if these factors affect sectoral differences, our evidence indicates that their importance

component. Our priors are that measurement error is important. If the true union effect is, say, .10 rather than .06, then approximately a third (i.e., $.10/.275=.36$) of the union wage advantage reflects a rent and the other two-thirds driver skills. This figure suggests a somewhat greater skill component than the "guesstimate" of one-half provided by Hirsch (1993).²⁵

X. Further Evidence on Union and Sectoral Differentials: Fringes, Shift Work, Employer Size, and Occupational Tenure

In this section, we examine further the wage advantage realized by drivers in the for-hire relative to the private carriage sector, and by union relative to nonunion drivers in both sectors. Two general types of evidence are provided. First, we examine the receipt of two important fringe benefits -- health insurance and pension coverage -- among drivers based on sectoral and union status, in order to see if wage differentials understate or overstate total compensation differentials. Second, we examine whether observed wage differentials by sector and union status are associated with differences in occupational tenure, employer size, and shift work.

The CPS wage measure used throughout this paper does not include compensation for health insurance, pensions, or other fringes. To examine such evidence, we use CPS Benefit Supplements for May 1983, May 1988, and April 1993. Each survey is roughly one-sixth the size of the annual ORG files, including both current outgoing rotation groups and those outgoing in the subsequent month. Table 5, columns 1 and 2, provides health and pension recipiency rates for truck drivers based on sectoral and union status, as well as rates among the control group of non-professional male workers (using the same selection criteria used earlier). Health insurance coverage is provided (with full or partial employer financing) to 67.5 percent of truck drivers -- 69.3 percent of drivers in the for-hire sector and 66.5 percent in the private carriage sector. In each sector, union drivers have substantially higher health insurance coverage than nonunion drivers -- 90.9 versus 58.0 percent among for-hire drivers and 91.6 versus 59.0 percent among

is quite limited.

²⁵ When we restrict our analysis to the post-1989 sample, the deletion of workers for whom union status has been allocated causes estimates of wage change associated with the change in union status to moderately *decrease*, counter to our expectations based on random measurement error. This evidence suggests that downward bias from measurement error may not be so large as we expect. If the union switching results presented in Table 4 are not greatly affected by measurement error, it gives credence to the lower bound estimates of union rents and upper bound

private carriage drivers. For purposes of an economy-wide comparison, 69.3 percent of the male non-driver control group had health insurance coverage over these years.

Similar figures are provided for pension reciprocity, with coverage defined as a worker both being offered and enrolled in a pension plan (including 401(k)s and union plans). Pension funding is provided to 46.2 percent of all truck drivers -- 46.8 and 45.8 percent among for-hire and private carriage drivers, respectively. Pension coverage among union drivers in each sector is far higher than among nonunion drivers -- 88.7 versus 24.9 percent in the for-hire sector and 85.1 versus 33.7 in private carriage. Economy-wide, 53.2 percent of the male non-driver control group has an employer-funded pension.

The data on fringe benefits shows rather clearly that the observed wage advantage among for-hire relative to private carriage drivers, and union relative to nonunion drivers, is not the result of a *lower* fringe mix in the compensation bundle. There is no evidence of a meaningful difference in health or pension coverage between the for-hire and private sectors. What is readily evident is a substantially higher level of health and pension coverage among union than among nonunion drivers, independent of sector of employment. The union wage advantage identified previously understates the total compensation premium realized by union drivers. As compared to the economy-wide control group, there is little difference in fringe reciprocity between truck drivers and non-drivers, suggesting that our estimates of overall driver/non-driver wage differentials provide a good proxy for the total compensation differentials. Nonunion drivers, however, receive substantially fewer fringes, and union drivers substantially more, than the economy-wide male non-driver control group.

Longitudinal wage change analysis presented in the previous section showed that most of the for-hire wage advantage, and much of the union wage advantage, could be accounted for by relatively high unmeasured skills among union and for-hire drivers. Evidence on occupational tenure provides some insight into the *source* of the unmeasured quality differential. CPS supplements conducted in January 1987 and 1991 provide information on years in an occupation.²⁶ If the quality advantage among for-hire and union

estimates of worker skill effects.

²⁶ The CPS Benefit Supplements provide evidence on *company* tenure. For several reasons, occupational rather than company tenure is a preferable skill proxy for driver skill. First, driver skills are largely occupation specific rather than firm specific, allowing drivers to move between employers. Second, the growth of the for-hire relative to private

drivers takes the form of longer experience as a driver, it should be evident in these data. Column 3 of Table 5 provides mean years in one's current occupation. It is readily evident from these figures that part of the observed wage and skill advantage among for-hire and union drivers is associated with driver experience. Occupational tenure among for-hire drivers is 11.8 years, as compared to 8.7 years among private carriage drivers. For purposes of comparison, the economy-wide control group has an average 9.0 years of occupational tenure. Union drivers have substantially more driving experience than nonunion drivers -- 14.0 versus 10.9 years in the for-hire sector and 14.4 versus 7.5 years in the private carriage sector. The "unmeasured" quality advantage of for-hire and union drivers identified in our longitudinal analysis appears to represent, to no small degree, substantially more experience as drivers.

We next examine differences in employer size by sector of employment and union status. Company and establishment size are positively (and independently) associated with higher wages, although the sources of the differential are not well understood (Brown and Medoff, 1989). Economy-wide, about half of the employer size wage advantage is associated with *measured* skills (of the type controlled for in our wage differential estimates), while a rather modest amount appears to be associated with unmeasured skills accounted for in longitudinal analysis (Brown and Medoff, 1989). Using the 1983, 1988, and 1993 CPS Benefit Supplements described previously, we calculate mean company and establishment size by union status and sector of employment.²⁷

The evidence on employer size, reported in Table 5, columns 4 (company size) and 5 (establishment size), suggests that little of the for-hire wage advantage but some portion of the union advantage is associated with employer size. Economy-wide, male non-professional workers are employed in companies with about 2,000 employees and in establishments with about 300 workers. Truck drivers tend to work in relatively small establishments, regardless of sector. Trucking companies tend to be of roughly average size,

carriage sector following deregulation tends to decrease mean company tenure in the for-hire sector (in contrast to occupational tenure, company tenure is similar across sectors). Finally, company tenure and the wage are determined simultaneously; in particular, high firm tenure (or low quit rates) among union drivers is in part a result of high wages rather than a reflection of high skills.

²⁷ Company and establishment sizes are provided as grouped data with different breakpoints across CPS surveys. In order to construct single time-consistent measures, information from *County Business Patterns* and *State of Small Business* is used to calculate industry-specific mean employer sizes by CPS size category. For a description of the size variables, see Even and Macpherson (1996: p. 726).

whereas the employers of private carriage drivers are somewhat smaller than average. Specifically, for-hire drivers work for employers in companies with about 2,000 employees and in establishments with about 120 workers. Corresponding figures for private sector drivers are about 1,350 and 140 workers, respectively. Based on this evidence, it appears that a small amount of the for-hire wage advantage is related to company but not establishment size.

More substantial employer size differences are found based on the union status of drivers. In the for-hire trucking industry, union drivers work for companies averaging 3,900 employees and establishments with about 180 workers, as compared to only 1,000 and 100 workers, respectively, among nonunion workers. Outside the trucking industry, unionized private carriage drivers work for companies averaging 2,700 employees and establishments with 320 workers, while comparable numbers among nonunion drivers are only 1,000 and 90 workers, respectively. Very roughly, among all drivers company size is about three times larger for union than nonunion drivers, while establishment size is about 2½ times larger for union than nonunion drivers.

The descriptive evidence above indicates that some portion of the union wage advantage among truck drivers is associated with employer size. We examine this thesis directly by estimating union-nonunion truck driver differentials from wage equations with and without employer size variables. Using the pooled 1983, 1988, and 1993 CPS Benefit Supplements, a specification largely identical to that used previously to estimate annual union premiums produces a union wage premium of .324 log points, moderately higher than the sector-specific union premiums shown for those years in Table 3. Following inclusion of company and establishment size variables, the union-nonunion differential declines to .276, suggesting that roughly 15 percent of the union wage advantage is associated with employer size.²⁸

Interpretation of the union-size results hinges largely on the routes through which size increases the wage. To the extent that employer size is a proxy for unmeasured skills, then it suggests, as argued previously, that some portion of the union premium for drivers estimated with wage level analysis is skill

²⁸ The regression results summarized here are not included in a table. Because union premiums are similar in the for-hire and private sectors and sample sizes of drivers are not large, a pooled equation is used. When we estimate wage equations over a sample of drivers only, we find that employer size is a somewhat more important wage determinant among drivers than economy-wide. The union premium estimated over a driver-only sample falls 24 percent, from

related. Longitudinal evidence in Brown and Medoff (1989), however, points clearly to the conclusion that size is associated with worker rents, and our wage change analysis (controlling for unmeasured skills) continues to find a union premium. In the end, we conclude that union workers realize significant rents, even following an accounting for measured and unmeasured skills. A portion of these rents are realized through unions being organized in relatively high paying large companies and establishments.

Our next probe into the source of truck driver wage differentials involves the measurement of shift work differences among drivers by sector and union status. The CPS Dual Job Supplements for May 1985 and May 1991 provide information on when work hours are typically performed, with designated categories being day shift, evening shift, night shift, split/rotating shift, or irregular/other shift. In columns 6 and 7 of Table 5 we report information on the percentages of workers who do and do not regularly work day shift hours (i.e., "non- day" shift is the sum of the latter four categories). Among the non-driver male control group, 28.5 percent of workers perform their jobs other than during a standard day shift. Among private carriage truck drivers, non-day schedules are less frequent, accounting for only 21.7 percent of work shifts. By contrast, among for-hire drivers non-day shifts, in particular irregular and split/rotating shifts are far more prevalent, with 41.5 percent of drivers working other than a standard daytime shift. These results indicate that at least some of the for-hire wage advantage represents a compensating differential for less desirable work hours. By contrast, none of the union wage advantage can be accounted for by differences in schedule. In the for-hire sector, 36.3 percent of union drivers work non-day schedules, whereas 43.5 percent of nonunion drivers perform their work during less desirable shifts.²⁹ Among private carriage drivers there is little difference in shift by union status, with 22.8 percent of union and 21.4 percent of nonunion drivers working non-standard shifts.

How important are shift differences in explaining the wage advantage among for-hire drivers? An obvious approach to addressing this question would be to estimate a wage regression with shift dummies, using their coefficients to represent the marginal compensating premium associated with non-day work

.340 to .259, following inclusion of employer size variables.

²⁹ Explicit union contract provisions are likely to result in union drivers being awarded larger premiums than are nonunion drivers for shift work (for economy-wide evidence of larger union shift premiums, see Kostiuk, 1990). This in turn raises the cost to unionized trucking companies of scheduling drivers during non-day hours.

hours. When one does this with an economy-wide sample, however, coefficients are very small, suggesting only a 1 to 2 percent compensating differential for evening and night hours. These estimates seriously understate the true compensating differential. As emphasized by Kostiuk (1990) and Hamermesh (1995), employees working night shift tend to be workers with either low measured and unmeasured skills (in particular, experience), or night work is transitional, with the expectation that a switch to day shift will be obtained following the accumulation of seniority. In either case, the observed wage differential associated with shift will understate the true differential needed to compensate for night work. Kostiuk (1990) examines data for manufacturing and uses a selection model to account for the non-random assignment of workers to shift. He concludes that the true night premium is on the order of 10 percent, a figure cited in turn by Hamermesh (1995). If we assume a 10 percent compensating wage differential for drivers during non-day shifts, this would account for 2 percentage points of the wage differential between for-hire and private carriage drivers.³⁰ Two percent is roughly the magnitude of the sectoral wage differential found in our longitudinal analysis, which controls for unmeasured worker-specific quality differences. In short, the already small quality-adjusted wage difference between for-hire and private carriage drivers is fully accounted for once we consider difference in shift work. By contrast, there continues to exist what appears to be a significant, albeit modest, union wage premium.³¹

XI. Conclusions and Interpretation

The magnitude of labor market rents and the relationship between rents and product market structure, the regulatory environment, and unions are topics at the core of labor economics. The evolution of the labor market among drivers in the motor carrier industry following deregulation tells us much about

³⁰ The 2 percent figure is obtained by multiplying 10 percent by the difference in non-day hours between for-hire and private carriage drivers -- $.10(.415-.217)=.020$.

³¹ We looked briefly at difference in occupational skills and working conditions between truck driving and non-driving occupations, based on data from the *Dictionary of Occupational Titles (DOT)*. In comparison to the sample-weighted occupations of our control group, truck driving tended to rate somewhat lower in terms of skill and training requirements, while rating similarly in terms of working conditions. We did not pursue this approach because the *DOT* data file makes no distinction among drivers for trucking firms or in private carriage, or between union and nonunion drivers, thus providing no insight into the source of driver differentials by sector or union status. *DOT* values were adopted from England and Kilbourne (1988), who provide means of *DOT* variables for approximately 500 1980 Census occupational categories, calculated as weighted averages across roughly 12,000 *DOT* occupations (special Census projects mapped CPS workers to *DOT* occupations and 1980 Census of Population respondents to both 1970 and 1980 Census occupational codes). For a description and analysis of the *DOT*, see Miller, et al. (1980).

how labor markets work, and allows us to observe the creation and dissolution of economic rents. The approach used in this study can be characterized as quasi-experimental. In order to evaluate the "treatment" effect of deregulation on the labor market, we: 1) examine differences in labor market outcomes before and after deregulation in the treated (i.e., for-hire) sector of the motor carrier industry, 2) measure the difference-in-differences between the regulated (for-hire) and unregulated (private carriage) markets in which drivers are employed, and 3) measure the difference-in-differences in labor market outcomes for "treated" drivers, non-treated drivers, and an economy-wide group of male non-driver non-professional workers, with controls for measurable characteristics.

The evidence presented here and in previous work provides what we believe is a relatively clear story. The evolution of the powerful Teamsters union during the period of ICC regulation facilitated the capture of sizable wage gains for its members. Regression analysis of truck driver and non-driver wages for 1973-1995 suggests that relative wages for drivers in the previously regulated for-hire sector fell about 15 percent as a result of deregulation. Mean driver wages in the trucking industry fell primarily because of real wage declines among union drivers, and the shift of traffic and employment from high wage union to low wage nonunion companies. While we find significant wage decreases following deregulation among union for-hire drivers, smaller wage declines are found for nonunion for-hire drivers and for union and nonunion private carriage drivers. Indeed, changes in the real wages of nonunion for-hire drivers and union and nonunion private drivers largely mirrored economy-wide wage changes among a non-driver male control group. Within the for-hire sector, union premiums fell immediately following deregulation, while union premiums within the private carriage sector were little affected by deregulation. Union density fell in both sectors, with a particularly steep decline in the previously regulated for-hire sector.

The evidence supports the view that driver *wages* in private carriage were little affected on net by regulation or deregulation, and that there existed a competitive nonunion sector within the for-hire sector of the trucking industry prior to deregulation. While regulation had significant effects on employment patterns, entry, shipping rates, traffic, firm operating ratios, and the like, the wages of nonunion drivers reflected its opportunity cost, as measured by wage rates outside of trucking. Deregulation sharply limited the ability of

firms to continue maintenance of costly unionized trucking operations, particularly in the truckload segment of the industry.

Evidence on employment complements the wage evidence. Following deregulation, traffic and employment shifted from private carriage to the previously regulated for-hire sector and, to a lesser extent, to owner-operators. Much of the initial entry in the for-hire sector consisted of nonunion operations specializing in truckload freight. Over time, union density has fallen sharply in both the for-hire and private sectors. Less-than-truckload freight in the for-hire sector is the one remaining sector of union strength (Belzer, 1994, 1995).³²

Price and entry regulation of the trucking industry acted to lower the cost of discrimination in employment by trucking firms and in contracting by shippers with owner-operators. Deregulation appears to have reduced what was long-entrenched discrimination in the industry, leading to an increase in the number of minority drivers in the for-hire sector. There appears to have been little direct effect on minority employment among owner-operators and in private carriage, where regulatory-related discrimination had played at most a minor role (see Heywood and Peoples, 1994, and Heywood, this volume, for an analysis).

Two stylized facts in the truck driver labor market are the wage advantage for drivers in the for-hire relative to the private carriage sector, and a sizable wage premium for union relative to nonunion drivers in each sector. Using longitudinal analysis, we observe that truck drivers switching between sectors display little change in wages, while drivers switching into or out of union employment realize modest wage changes. We conclude that virtually all of the observed wage differential between the for-hire and private sectors reflects a compensating differential for otherwise unmeasured driver skills, representing in part modestly longer occupational tenure. Remaining wage advantages can be accounted for by differences in shift work. The union wage advantage, on the other hand, reflects both a substantial compensating differential for skill advantages among union drivers (occupational experience being an important source of the greater skill), along with what is a modest rent stemming from union bargaining strength.

³² The analysis in our paper has largely ignored the issue of selectivity in union status determination. Dodge, Stone, and Wilson (1994) use data among companies in the Class I general freight sector of the motor-carrier industry. They find that variation in wage premiums and organizational costs, which in turn arise from firm attributes and heterogeneity in market segments, influence the likelihood of union organization.

It is important to contrast the labor market effects of trucking deregulation with labor market changes occurring in other previously regulated industries in the transportation, communication, and financial sectors, most importantly airlines and telecommunications. The trucking industry certainly stands out, being the one major industry that moved *quickly* toward largely competitive labor market outcomes following deregulation. Not surprisingly, researchers reviewing labor market outcomes and previous research on deregulation (Hendricks, 1994; Winston, 1993) have concluded that the trucking industry is the exception rather than the rule. Indeed, the rather remarkable heterogeneity of outcomes in previously regulated industries has cast considerable doubt on the usefulness of the standard competitive model to predict and explain the labor market effects of product market regulation and deregulation.

We believe such a conclusion is premature. There are several reasons why substantial wage declines may not be observed in an industry immediately following product market deregulation. First, high wage levels in a previously regulated industry need not reflect worker rents but, rather, may represent, at least in part, compensating differentials associated with high skills or difficult working conditions. Second, product market deregulation easing price and entry restrictions and production inefficiencies leads to an increase in output. If the output effect is large and labor supply is not highly elastic (owing, say, to specialized skills and certification requirements), there will exist considerable upward pressure on wages following deregulation. Third, substantial economies of scale or scope, reputational effects, or other barriers to entry may allow product market power to be maintained for some time. Fourth, growth in traffic and the maintenance of product market power make it more likely that union organizing strength and bargaining power can be maintained following deregulation, thus preserving labor rents. Finally, if regulation facilitated nonunion rent sharing and produced a low dispersion in industry wages across firms, then deregulation may result initially in a decline in nonunion wages. Deregulation in highly unionized industries may initially be characterized simultaneously by a small competitive fringe, the entry of nonunion operations, a rising union wage premium (due to low-wage nonunion entrants), and increasing wage dispersion.

The circumstances above correspond closely to what Hirsch and Macpherson (1995) have found for

the airline industry.³³ Like other researchers (Card, 1986, 1989; Hendricks, 1994), they find that airline industry wages, relative to alternative wages economy-wide, initially rose following deregulation in 1978, and by the mid- 1980s showed little change from wage levels during the regulatory period. Hirsch and Macpherson find, however, that wages among airline craft groups and in the industry as a whole have fallen considerably since the late 1980s. They conclude that part of the explanation for high wage levels in the industry are occupational skill requirements and adverse working conditions, but that airline industry workers still received sizable rents throughout the 1980s. Union bargaining strength and the threat of union organizing provided the principal source for these rents. Immediately following deregulation, it was *nonunion* wages that fell, as union workers maintained bargaining power and nonunion workers no longer were able to share in regulation-related rents. Although the union premium initially rose following deregulation, it has steadily narrowed over time. Although relative wages in the airline industry did not decline immediately following deregulation, union and nonunion wages have fallen considerably during the late 1980s and the 1990s, both in absolute terms and relative to alternative control groups of workers in occupations with similar skill requirements and working conditions.

The recent experience in the airline industry suggests that the standard competitive model is a useful starting point for analyzing the effects of regulation and deregulation on labor earnings. But it also suggests, in contrast to the experience of the trucking industry, that competitive labor market outcomes may take a long time to occur.³⁴ And the specific routes through which an industry moves toward a competitive outcome depends on such factors as product market structure, labor organizing and bargaining strength (e.g. strike threat power), skill requirements and labor supply elasticities, and the nature of the labor market prior to deregulation. Ultimately, competitive cost pressures in a deregulated industry are likely to squeeze out most labor rents. But this need not occur quickly or in a uniform fashion among what are likely to be very

³³ See their paper for references to previous studies. In recent work, Crémieux (1996) uses carrier level data from the U.S. Department of Transportation and also finds evidence of significant wage declines. Card (this volume) reports, among other things, a relative wage decline in the airline industry of roughly 10 percent between 1979 and 1989 (using large samples from the Census), a finding he characterizes as evidence of a modest regulatory rent, comparable to wage premiums earned in other sectors of the labor market.

³⁴ MacDonald and Cavalluzzo (1996) arrive at a similar conclusion regarding the railroad industry. Although wages initially rose following the Staggers Rail Act of 1980, long-run changes facilitated by deregulation led to decreased demand for labor and, eventually, to a decline in wages.

different industries.

Economists attempting to understand the effects of regulation on labor earnings need not and should not throw out the standard economic model. The competitive labor market model, the law of one price, and the theory of equilibrium wage differentials (arising from worker skills and job attributes) provides what is a powerful framework for analyzing the long-run effects of deregulation. Understanding the processes and routes through which regulation and deregulation facilitate the creation and dissolution of rents, however, requires detailed knowledge of the specifics of an industry. It is this lengthy and frequently painful movement toward a competitive outcome that is often of interest to researchers and policy-makers (and, of course, participants). The movement from regulation toward competitive product and labor market outcomes affects the survival and market shares of individual firms, the returns to shareholders, entry of new firms, the size and strength of organized labor, and the employment and well-being of incumbent workers and entrants. Although these outcomes are important, it is long-run aggregate employment and wage effects that warrant a heavy weight in making policy and in the evaluation of regulated and deregulated markets. Despite what appears to be the unique experience of the trucking industry immediately following deregulation, the wage and employment effects observed in trucking are likely to be representative of the *long-run* labor market effects of deregulation in the airline and other previously regulated industries.

Data Appendix: Construction of the Longitudinal Sample from the CPS ORG Files

The longitudinal ORG file was created from the CPS Outgoing Rotation Group (ORG) Earnings Files for 1989-95 in the following manner. Households are included in the CPS for 8 months -- 4 consecutive months in the survey, followed by 8 months out, followed by 4 months in. Outgoing rotation groups 4 and 8 are asked earnings supplement questions (weekly earnings, hours, union status, etc.). The CPS contains household identification numbers (ID) and record line numbers, but not individual identifiers. Individuals potentially can be identified for the same month in consecutive years; that is, individuals in rotation 4 in year 1 can be matched to individuals in rotation 8 in year 2.

Separate data files were created for males and females, and for pairs of years. Within each file, individuals were sorted as appropriate on the basis of ascending and descending household ID, year, and age. To be considered an acceptable matched pair, a rotation 8 individual had to be matched with a rotation 4 individual with identical household ID, identical survey month, and an age difference between 0 and 2. Several passes were necessary because a single household may contain more than one male or female pair. Checks were provided to insure that only unique matches were selected. For each rotation 8 individual, the search was made through all rotation 4 individuals with the same ID to make sure there was only 1 possible match; the file was resorted in reverse order and each selected rotation 4 individual was checked to insure a unique rotation 8 match. Incorrect changes in the variables marital status, veteran status, race, and education (e.g., a change in schooling other than 0 or 1, a change from married to never married, etc.) were used to delete "bad" observations in households where there were multiple observations and ages too close to separate matched pairs. Several passes at the data were made. In households where two pairs of individuals could be separated based on a 1 year but not the 0 to 2 year age change, a 1 year criterion was used. If a unique pair could not be identified based on these criteria, they were not included in the data set.

The principal reasons that matches cannot be made or for exclusion from our earnings sample are if a household moves, if an individual moves out of a household, if a worker becomes self employed, if the Census is unable to reinterview a household and/or receive information on the individual, or if an individual drops out of the labor market or fails to meet other sample selection criteria stated in the text. Peracchi and

Welch (1995) analyze attrition rates among matched March CPS files and conclude that age is the most important determinant of a successful match. Other factors that lessen match probabilities are poor health, low schooling, and not a household head, while sex and race are unimportant predictors following control for other factors. Longitudinal estimates in the paper are based on the sample of workers who are truck drivers in consecutive years.

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Table 1: Truck Driver Employment and Shares of Union, Minority, and Female Employment, by Sector, 1973-1995

Year	For-Hire Sector				Private Carriage				Owner-Operators			Comparison	
	Employ	%Un	%Min	%Fem	Employ	%Un	%Min	%Fem	Employ	%Self	%Min	%Fem	%Min
1973-1974	509.4	60.3	13.7	0.8	970.8	40.0	21.4	0.9	137.1	8.5	17.1	0.5	18.7
1975-1976	513.4	54.6	10.8	0.8	1,002.9	36.6	22.2	0.7	152.2	9.1	14.0	1.6	19.4
1977-1978	595.3	55.8	15.4	1.2	1,218.6	34.2	26.5	2.0	164.7	8.3	18.2	0.9	20.4
1979	626.6	56.8	15.5	1.8	1,141.1	34.8	23.5	1.9	206.3	10.5	14.7	2.1	21.7
1980	577.6	53.2	14.4	1.4	1,097.0	38.9	24.1	2.4	206.2	11.0	17.2	3.1	22.3
1981	556.3	51.1	17.3	2.0	1,094.7	30.4	25.6	2.5	207.2	11.2	16.1	3.3	22.7
1982	530.7	--	17.7	1.5	1,075.5	--	24.9	2.1	220.1	12.1	12.2	3.5	22.7
1983	595.8	45.2	16.4	1.8	1,333.3	26.8	23.4	3.2	269.7	12.3	13.2	2.5	23.1
1984	711.0	38.3	18.2	2.9	1,417.6	23.2	25.0	4.6	243.2	10.3	16.0	4.1	23.1
1985	723.0	37.6	19.1	2.7	1,436.6	22.6	25.1	4.6	241.4	10.1	12.1	5.5	24.8
1986	735.0	32.5	22.9	2.7	1,475.8	20.6	25.2	4.3	229.7	9.4	14.0	4.7	25.7
1987	773.6	29.8	19.5	3.4	1,519.9	22.4	27.1	4.2	260.6	10.2	18.9	4.9	26.3
1988	828.8	30.2	20.5	3.6	1,487.2	20.1	23.7	4.5	266.1	10.3	17.2	4.2	27.3
1989	836.7	29.1	22.8	2.6	1,580.7	19.7	24.6	4.9	229.7	8.7	12.7	4.6	27.6
1990	886.0	27.7	22.1	3.4	1,516.1	20.0	26.4	3.9	207.4	7.9	15.3	3.9	27.6
1991	884.1	28.7	22.0	4.1	1,521.7	18.5	28.2	3.6	227.9	8.7	14.4	6.3	27.9
1992	895.3	27.0	21.9	3.7	1,525.5	18.5	28.0	4.6	255.6	9.5	16.1	6.7	28.0
1993	954.4	25.1	24.5	3.2	1,566.7	18.4	25.2	5.0	257.4	9.3	15.9	4.4	28.3
1994	1,002.9	24.7	22.3	3.7	1,552.2	17.6	28.2	4.2	278.1	9.8	18.2	5.1	28.8
1995	1,008.2	24.9	24.3	3.0	1,521.5	17.2	25.4	4.7	311.2	11.0	17.2	7.9	29.1

Employ is employment (in thousands); %Un is the percent of wage and salary drivers in a sector who are union members; %Min is the percent of drivers (male and female) in a sector who are Hispanic, Black, or race other than white; %Fem is the percent of drivers in a sector who are female; and %Self is the percentage of total driver employment made up of self-employed owner-operators. Control group is male, non-driver, non-managerial and professional wage and salary workers, as described in the text. All employment figures are calculated from the 1973-78 May CPS and the 1979-95 CPS ORG files. Union density for 1979-81 is calculated from the 1979-81 May CPS.

Table 2: Mean Wages, Adjusted Wage Indices, and Log Wage Differentials for For-Hire, Private Carriage, and Economy-Wide Control Group, 1973-1995

Year	For-Hire		Private		Comparison		Adjusted Wage Indices			Wage Differentials	
	N	Wage	N	Wage	N	Wage	For-Hire	Private	Comparison	For-Hire	Private
1973-1974	498	17.01	1,001	12.78	26,547	13.96	97.15	99.64	100.60	.1808	-.0573
1975-1976	478	16.16	968	12.00	24,577	13.65	91.80	95.25	98.35	.1505	-.0926
1977-1978	613	16.78	1,300	12.47	28,475	13.77	100.00	100.00	100.00	.1987	-.0643
1979	1,178	16.05	2,228	12.74	54,360	13.55	95.39	100.86	99.54	.1449	-.0622
1980	1,265	15.00	2,498	12.16	61,391	13.17	89.22	95.95	96.54	.1070	-.0851
1981	1,140	14.90	2,262	12.01	56,633	13.01	89.27	95.01	94.99	.1231	-.0820
1982	1,071	14.27	2,144	12.01	51,262	12.95	83.77	94.15	93.66	.0671	-.0810
1983	1,162	14.68	2,514	11.33	50,593	12.95	84.72	92.16	92.53	.0874	-.0967
1984	1,310	14.20	2,540	11.00	50,638	12.85	81.97	90.32	91.55	.0549	-.1090
1985	1,349	13.93	2,474	10.96	50,983	12.90	81.76	89.76	91.47	.0380	-.1126
1986	1,293	13.66	2,461	10.83	49,843	12.89	81.21	90.01	91.89	.0356	-.1196
1987	1,379	13.45	2,448	11.19	49,967	12.76	79.53	90.90	90.56	.0401	-.0962
1988	1,373	13.33	2,321	10.91	47,367	12.68	78.09	88.33	89.71	.0272	-.1197
1989	1,403	13.05	2,446	10.77	47,966	12.48	76.55	87.61	88.64	.0070	-.1202
1990	1,519	13.13	2,474	10.45	49,985	12.26	76.67	85.44	86.63	.0345	-.1173
1991	1,463	12.70	2,386	10.14	47,913	12.08	74.53	83.88	85.32	.0155	-.1259
1992	1,448	12.40	2,320	10.18	46,594	11.99	72.57	83.57	83.86	.0021	-.1179
1993	1,512	12.23	2,391	10.32	45,820	11.89	70.85	82.89	82.87	-.0238	-.1190
1994	1,452	12.86	2,207	10.44	45,717	11.75	72.04	85.74	82.68	.0152	-.0733
1995	1,388	12.70	2,123	10.38	45,127	11.61	72.28	83.13	82.52	.0142	-.0902

All figures are calculated from the 1973-78 May CPS and the 1979-95 CPS ORG files. The sample is employed wage and salary truck drivers, plus a control group of male non-professional employees. N is the CPS sample size; Wage is hourly earnings in 1995 dollars (adjusted by the CPI-UX); Adjusted Wage Indices are based on within-group regressions pooled over all years, with 1977-78=100; and Wage Differentials are log differentials between the truck driver group and the economy-wide control group, based on annual wage regressions as described in the text. Further details are included in the text.

Table 3: Union and Nonunion Mean Wages, Adjusted Wage Indices, and Log Wage Differentials for the For-Hire and Private Carriage Sectors, 1973-1995

Year	Union and Nonunion Mean Wages		Adjusted Wage Indices		Wage Differentials		Union-Nonunion
	Wage	Wage	Union	Nonunion	Union	Nonunion	Differential
For-Hire Sector:							
1973-1974	19.29	13.17	96.71	95.08	.2847	-.0129	.2976
1975-1976	18.30	13.24	92.55	94.70	.2520	-.0014	.2534
1977-1978	19.15	13.19	100.00	100.00	.3299	-.0048	.3347
1979	17.30	13.72	91.20	104.28	.1951	.0211	.1740
1980	16.02	12.36	87.78	98.70	.2097	.0085	.2013
1981	16.36	14.37	85.32	101.89	.2008	.0736	.1271
1982	--	--	--	--	--	--	--
1983	17.19	12.55	87.80	90.61	.2419	-.0387	.2806
1984	16.27	12.87	83.63	91.32	.1919	-.0308	.2226
1985	16.17	12.56	83.17	91.78	.1834	-.0424	.2259
1986	16.61	12.22	86.22	90.30	.2130	-.0521	.2651
1987	16.58	12.08	86.10	88.54	.2321	-.0487	.2808
1988	16.67	11.87	85.86	86.77	.2241	-.0633	.2874
1989	16.38	11.68	83.81	85.41	.2076	-.0810	.2886
1990	15.93	12.06	83.50	87.13	.2217	-.0375	.2592
1991	16.10	11.31	82.09	84.10	.2099	-.0632	.2731
1992	15.86	11.08	81.22	82.32	.2062	-.0745	.2807
1993	15.94	10.99	80.48	80.29	.2068	-.1026	.3093
1994	15.99	11.80	80.59	81.82	.2306	-.0576	.2882
1995	15.62	11.71	76.89	84.15	.1940	-.0427	.2367
Private Carriage Sector:							
1973-1974	15.55	11.03	98.29	98.84	.1147	-.1597	.2744
1975-1976	15.27	10.20	95.71	94.30	.1093	-.2026	.3119

Table 3 (continued): Union and Nonunion Mean Wages, Adjusted Wage Indices, and Log Wage Differentials for the For-Hire and Private Carriage Sectors, 1973-1995

Year	Union	Nonunion	Adjusted Wage Indices		Wage Differentials		Union-Nonunion
	Wage	Wage	Union	Nonunion	Union	Nonunion	Differential
1977-1978	15.71	10.79	100.00	100.00	.1316	-.1667	.2982
1979	15.31	11.08	96.04	101.40	.0651	-.1827	.2478
1980	15.29	9.86	94.34	98.20	.0876	-.1720	.2596
1981	16.03	11.37	93.66	99.51	.0949	-.1557	.2505
1982	--	--	--	--	--	--	--
1983	14.85	9.96	94.20	92.72	.1255	-.1861	.3116
1984	14.83	9.74	92.93	91.43	.1102	-.1857	.2959
1985	15.05	9.68	94.87	89.75	.1337	-.1979	.3316
1986	15.39	9.56	95.88	90.68	.1282	-.1970	.3252
1987	15.21	9.95	94.52	91.91	.1266	-.1683	.2949
1988	14.91	9.81	92.68	89.83	.1118	-.1864	.2982
1989	15.02	9.62	92.73	89.35	.1182	-.1865	.3047
1990	14.20	9.46	88.90	87.45	.1046	-.1801	.2847
1991	13.77	9.29	86.28	86.54	.0873	-.1823	.2696
1992	14.02	9.23	86.48	86.04	.0954	-.1747	.2702
1993	13.94	9.43	86.09	85.56	.1051	-.1750	.2801
1994	14.29	9.59	89.03	88.78	.1547	-.1243	.2790
1995	13.59	9.70	81.43	87.12	.0781	-.1288	.2069

All figures are from the 1973-81 May CPS and the 1983-95 CPS ORG files. The sample is employed wage and salary truck drivers, plus a control group of male non-professional employees. Wage is hourly earnings in 1995 dollars (adjusted by the CPI-UX); Adjusted Wage Indices are based on within-group regressions pooled over all years, with 1977-78=100; Wage Differentials are log differentials between the truck driver group and the economy-wide control group, based on annual wage regressions as described in the text, and Union-Nonunion Differential is difference between union and nonunion wage differentials. Further details are included in the text.

**Table 4: Mean Wage Changes and Regression Results, Panel
Estimates of Sectoral and Union Wage Differentials**

	N	%Sample	Log Wage Change
Sectoral Status:			
For-Hire Stayer	3,382	36.8	.0146
Private Stayer	4,903	53.3	.0083
For-Hire Joiner	454	4.9	.0272
For-Hire Leaver	454	4.9	-.0097
Union Status:			
Union Stayer	2,509	27.3	.0069
Nonunion Stayer	5,898	64.2	.0110
Union Joiner	386	4.2	.0838
Union Leaver	400	4.4	-.0415
Wage Change Regression Results:			
	coefficient		Standard error
Δ For-Hire	0.0246		.0122
Δ Union	0.0568		.0131
Δ Exp-Sq/100	-0.0637		.0158
Δ Hours		included	
Year dummies		included	
R-Squared			.027
N			9,193

Data source is matched CPS ORG panels for 1983/85-1994/95. Sample includes matched wage and salary workers who are truck drivers in consecutive years (see the Data Appendix). The dependent variable in the regression is the change in the wage.

Table 5: Fringes, Occupational Tenure, Employer Size, and Work Shift, by Sector and Union Status

	%Health Insurance	%Pension Coverage	Years Occ. Tenure	Employer Size		%Day Shift	%Non-day Shift
				Company	Establishment		
Comparison Group	69.3	53.2	9.0	1,989	295	71.5	28.5
Truck Drivers	67.5	46.2	9.9	1,583	135	71.1	28.9
For-Hire	69.3	46.8	11.8	1,997	122	58.5	41.5
Private Carrier	66.5	45.8	8.7	1,361	142	78.3	21.7
Union	91.3	86.7	14.2	3,207	257	71.5	28.5
Nonunion	58.7	30.9	8.7	998	91	71.0	29.0
Union For-Hire	90.9	88.7	14.0	3,889	177	63.7	36.3
Nonunion For-Hire	58.0	24.9	10.9	1,037	95	56.5	43.5
Union Private	91.6	85.1	14.4	2,664	321	77.2	22.8
Nonunion Private	59.0	33.7	7.5	980	90	78.6	21.4
N-Comparison Group	14,187	14,254	7,795		15,254		20,573
N-Truck Drivers	1,188	1,148	574		1,234		1,648

Truck driver sample includes employed male wage and salary drivers. The control group includes non-professional males meeting selection criteria outlined in the text. All samples exclude CPS rotation groups for which union status is not provided. Data sources are as follows: health and pension coverage -- May 1983, May 1988, April 1993 CPS Pension Supplements; occupational tenure -- January 1987, January 1991 CPS Supplements; employer size -- May 1983, May 1988, April 1993 CPS Pension Supplements; and work shift -- May 1985, May 1991 CPS Dual Job Supplements.