

Deregulation and the Competitive Fringe: Owner-Operators in the Trucking Industry¹

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Abstract

This paper assesses the direct and indirect effects of regulatory reform in the trucking industry on the employment of owner-operators. We utilize a probit estimation form derived from driver utility functions to estimate the change in the probability that a truck driver is an owner-operator following deregulation.

We find that a representative driver with mean characteristics is 155.6 percent more likely to choose employment as an owner-operator in the deregulated environment. Thirty-six percentage points of this increase is due to the indirect effects of deregulation, which operate primarily through changes in wage differentials and unionization. The direct effect of deregulation accounts for a 120% increase in the probability of a driver choosing employment as an owner-operator.

1. Introduction

Owner-operators, sometimes known as independents, are small-scale truckers who own and operate their own rigs.² Although overshadowed by the highly organized segment of the motor carrier industry, they constituted a non-trivial portion of the drivers before trucking

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 - 2 This definition comes from the Hearing Before the Subcommittee on Antitrust, Impact of Deregulation, and Privatization of the Committee of Small Business, House of Representatives, October 6, 1987. Others distinguish between owner-drivers, "true independents" (exempt owner-operators), and multi-unit owner-operators. (See Maister 1980.)

deregulation. Indeed, Wyckoff and Maister (1975) reported that these drivers numbered approximately 100,000 during the mid 1970s.

Despite their strong presence, the operations of owner-operators were severely restricted prior to deregulation of the industry. In general, they were prohibited from obtaining the necessary operating authority that would permit them to function as regulated, forhire motor carriers. Thus, trucking regulation severely limited the competitive domain of this important sector of the motor carrier industry.

This paper presents an empirical inquiry of the direct and indirect effects of motor carrier deregulation on the relative size of the owner-operator segment of the industry. The direct effects of regulatory reform have to do with the reduction in restrictions placed on owner-operators and with changes in the nature of the operating environment. As a more atomistic segment of the market, the owner-operator could be viewed as a competitive fringe. The elimination of prohibitions inherent in regulation could be expected to increase the fringe and so the degree of competition in the market. The indirect effects of deregulation operate primarily through the influence of wage differentials and union strength on choice of employment. Deregulation has decreased the ability of the Teamster's Union to dictate wages and working conditions. This, in turn, has diminished the ability of the union to recruit and retain members. By lowering entry barriers and increasing competition in the trucking industry, deregulation has affected the relative rewards of working as an owner-operator or company-driver as well. This study examines changes in truck driver employment over the period 1973 to 1988 by conducting a probit analysis based on a model of the relative utilities of working as an owner-operator or a company-driver. We utilize individual worker information from Current Population Survey (CPS) files and control for differing personal characteristics, regional effects, and changing trends in the economy. By including the wage differential and the extent of unionization as well as a deregulation dummy variable, we are able to decompose the total effect of deregulation into the direct effect and the indirect effects.

Our results suggest that regulatory reform operated primarily in a direct fashion rather than through unionization and relative wages. We find that the direct effect of deregulation was to increase the likelihood that a randomly selected driver would be an owner-operator by 120%. The indirect effects of deregulation accounted for only another 36 points in probability.

Other authors have noted an increase in the use of owner-operators by large (class I and II) motor carrier firms after deregulation.³ While our results are consistent with these findings, this study differs in a number of ways. We develop and test our hypotheses in the context of an economic model of the regulatory effects. We control for demographic, regional, and economic factors. We look at the changes within the entire forhire sector. This includes the whole range of motor carrier firms, including owner-drivers operating under their own authority. We utilize time series data covering a period of fifteen years from a data source that has not been used to study owner-operators, although it has been used to examine other effects of deregulation on the trucking industry.⁴ Finally, and most importantly, we decompose the effect of regulatory reform into its direct effect and the indirect effect through unionization and wage differentials.

3 See, in particular, Corsi and Grimm (1987) and Corsi and Stowers (1991), who use difference of means comparisons for two years, one before and one after deregulation.

4 See Rose (1987) and Hirsh (1988).

2. Owner Operators and Regulatory Reform

Assessing the effect of regulatory reform on the extent of owner-operator participation requires an understanding of owner-operators as competitors, of the sectors in which they compete, and of the changes in the regulatory environment.

Owner-operators are viewed commonly as providing low-cost transportation services.⁵ This is due in large part to the fact that owner-driver wages are low relative to company-driver wages (Wyckoff and Maister 1977). Part of this difference is the “price of independence” that owner-drivers are willing to pay (Wyckoff and Maister 1977). But other factors explain this differential as well. Their desire for independence makes owner-operators difficult to organize in unions. Efforts to organize owner-operators have also been hampered by the indeterminate legal status of owner-operators.⁶ In contrast, Rose (1987) offers evidence that, under regulation, monopoly rents were earned elsewhere in the trucking industry and shared with unionized company-drivers.⁷ She found no evidence of rent spillovers to non-union drivers. In addition, large, regulated motor carriers may have exercised monopsony power over the atomistic independents, depressing their wages even further during the regulated regime.⁸ As is well known, monopsonists maximize profits by hiring fewer workers and paying a less-than-competitive wage. Finally, wages were also relatively low for owner-drivers because they operated in sectors characterized by the highest levels of both intramodal and intermodal competition.

While owner-operators are found in every sector of the motor carrier industry, they have always operated principally in the truck-load (TL) sector. Even in the less-than-truckload (LTL) sector, they tend to be utilized in special-commodity, TL divisions. This is notable in that regulatory reform dramatically intensified competitive pressures in this sector, since there are virtually no sunk costs.

Prior to the reform era, the operations of owner-operators were severely restricted. In general, they were unable to obtain the necessary operating authority that would permit them to function as regulated, forhire motor carriers.⁹ In the forhire sector, this left them with three options. First, they could haul exempt commodities. In 1978, it was reported that approximately one third of owner-operators were primarily exempt haulers.¹⁰ Second, they could lease their services to regulated motor carriers, under “permanent” or “trip” lease contracts.¹¹ Third, they could, and sometimes did, operate illegally (Wyckoff and Maister 1975).

To increase competition in the motor carrier industry, as part of the more general trend toward deregulation, regulators and legislators acted to ease the regulatory burden on

5 See Corsi, Agar, and Roberts (1985), Rose (1985) and Keeler (1989).

6 The organization of “independent entrepreneurs” violates antitrust laws. The courts classify owner-operators as independent entrepreneurs or “employees” on a case by case basis (Levinson 1982).

7 See also Moore (1978).

8 The larger motor carrier firms tended to use owner-operators more extensively than smaller firms (U.S. Dept. of Justice 1978).

9 The ICC restricted entry into the industry. Their procedures made it difficult if not impossible for owner-operators without substantial financial resources to enter (Wyckoff and Maister 1975).

10 U.S. Department of Justice (1978).

11 Permanent leases are contracts for a period of no less than thirty days, but with no guarantee of any specific level of activity for the owner-operator. Trip leases are contracts for a one-way trip. All leasing activities are regulated by the ICC.

owner-operators. Indeed, four provisions of the Motor Carrier Act of 1980 (MCA) targeted them expressly. Specifically, the MCA expanded the list of exempt commodities and permitted owner-operators to obtain agricultural back-haul certificates based on a test of fitness only. Further, it outlawed the practice of forced hiring of loading/unloading help without compensation, and it increased the ability of agricultural cooperatives (which rely on owner-operators) to transport non-farm freight.¹² Of even greater importance, perhaps, were the more general provisions which relaxed entry requirements and permitted more competitive rate-making.¹³

The legislative changes prescribed by the MCA and other regulatory reforms initiated in 1978 by the ICC changed the competitive environment of owner-operators markedly. Most significantly, they enlarged the arena in which independents could compete by making it possible for them to acquire their own route authority and to compete for newly classified exempt traffic. By allowing owner-operators greater direct access to shippers and more business alternatives, regulatory reform provided them with the opportunity to compete in the more profitable sectors of the motor carrier industry. A secondary effect was that it enhanced the bargaining power of owner-operators vis-à-vis motor carrier firms by giving owner-operators more profitable alternatives.¹⁴

Deregulation also affected owner-operator employment through its effects on the forhire motor carrier industry. By lowering barriers to entry and expansion and by encouraging price competition, regulatory reform increased the output of trucking services. This increased employment opportunities, particularly for owner-operators who were viewed as a more flexible, lower cost alternative to company-drivers. As the motor carrier industry became more contestable, opportunities for owner-operators increased, since motor carrier firms could utilize them to employ "hit and run" entry tactics with little sunk cost investment.¹⁵ To the extent that reform had a greater impact on the TL sector, in which owner-operator use was concentrated, these effects were magnified.¹⁶

Deregulation also affected owner-operators indirectly, through its effect on relative wages and unionization. Prior to the reforms, rate regulation and the rate bureaus facilitated the practice of cost pass-throughs of wage increases. This permitted employers to hire unionized company-drivers at high wages while earning supra-normal profits. Both Rose (1985; 1987) and Moore (1978) provide evidence of monopoly rents shared between the regulated motor carriers and the union during this period. With increased entry and price competition, deregulation put pressure on firms to lower costs.¹⁷ This served to lower company-driver wages relative to owner-operator wages. By effectively reducing the union's power over wages and working conditions, deregulation also diminished its ability to attract and retain members. Since unions had long pressured shippers and motor carrier firms to avoid the use of owner-operators and other non-union carriers, the decline of union power resulted in an expanded and less hostile competitive environment for owner-operators.¹⁸

12 See Corsi, Tuck, and Gardner (1981) for an early assessment of the effect of these provisions.

13 The MCA loosened the power of rate bureaus substantially by permitting carriers to negotiate individual discount rates. Entry restrictions were all but eliminated in practice (McMullen and Stanley 1988).

14 See Corsi (1979; 1981).

15 See Wyckoff and Maister (1977) and Maister (1980).

16 The TL sector, absent regulation, is perhaps the most nearly "contestable," since sunk costs are close to zero. Moore (1986) reports greater entry and lower prices in the TL sector after deregulation.

17 Ying and Keeler (1991) provide evidence that rates fell substantially in response to competitive pressure and cost cutting efforts after deregulation.

In the next section, we present a structural model of how regulatory reform affected the utility functions of both owner-operators and company-drivers. From these equations, we derive the estimating equation used in our probit analysis.

3. Modeling the Employment Effects of Regulatory Reform

Because truck drivers may choose to operate as company-drivers or owner-operators, we consider the effects of deregulation on the utility of working in either type of employment. The utility of working as an owner-operator may be characterized as follows:

$$U_{00} = U_{00}(W_{00}, A_{00}^p, A_{00}^j),$$

where W_{00} is the earnings of owner-operators, A_{00}^p is a vector of personal attributes which may reflect preferences, and A_{00}^j is a vector of non-pecuniary attributes of the job.

The earnings of owner-operators are directly dependent on their revenue and operating cost. Their revenues are influenced by the level of economic activity, by union power, since unions acted to restrict employment opportunities for owner-operators, and by region, since union strength varied by region. Indeed, Levinson (1982) reports that Eastern locals impeded firms from expanding their special commodity divisions where owner-operators tend to be employed, while Central and Western locals have been more receptive to owner-operator utilization.¹⁹ Revenues are also affected by the regulatory environment (R). The competitive domain of owner-operators was severely restricted prior to the reform era. Afterwards, owner-operators had greater latitude to serve more profitable sectors and had greater bargaining power. Their revenues may have increased as well due to greater demand for their low-cost, flexible services in the more contestable post-reform environment.

Costs are affected by other factor prices (F^p), especially fuel price and availability. Costs may also be a function of the regulatory environment, since a restrictive environment may hamper efficiency.

Driver attributes are personal characteristics which reflect attitudes toward independence and risk-taking, as well as perceptions regarding the opportunity cost of other employment. Non-pecuniary job attributes include the freedom, independence, and sense of ownership that comes with being an owner-operator. These intangibles are affected by the regulatory environment (R). To the extent that regulatory reform cut red-tape, lifted burdensome restrictions, and expanded an owner-operator's opportunity set, it should enhance the job attributes of working for oneself.

In sum, we express the utility function of owner-operators as follows:

$$U_{00} = U_{00} [W_{00}(R), UNION(R), REGION, UNEMPL, F_p, A_{00}^p, R].$$

In similar fashion, we represent the utility of working as a company driver with the following equation:

$$U_{cd} = U_{cd}(W_{cd}, A_{cd}^p, A_{cd}^j).$$

18 See Perry (1986).

19 See also Wyckoff and Maister (1975).

Company driver wages are affected by motor carrier profitability, unionization, and regulation. In the regulated era, motor carriers shared monopoly rents with the Teamsters. In the reform era, competitive pressures unleashed by deregulation reduced both company profits and union power. Regulatory reform may also affect job attributes by affecting safety, benefits, and other working conditions.

We portray the utility function of company drivers, then, as follows:

$$U_{cd} = U_{cd}[W_{cd}(R), UNION(R), REGION, UNEMPL, F^p, A_{cd}^p, R].$$

We utilize a probit procedure to analyze the employment choice of truck drivers. A driver will choose employment as an owner-operator (OO) if his/her utility as an owner-operator exceeds his/her utility from being a company-driver (CD).

That is:

$$OO = 1 \text{ if } U_{OO} - U_{cd} > 0.$$

We write:

$$U_{OO} = X\beta_1 + \varepsilon_1 \text{ and } U_{cd} = X\beta_2 + \varepsilon_2.$$

Then, $OO = 1$ iff

$$X(\beta_1 - \beta_2) + \varepsilon_1 - \varepsilon_2 > 0.$$

This yields an estimating equation of the following general form:

$$P_r(\text{owner-operator} = 1) = \Phi [\beta_0 + \beta_1 ATTRIB + \beta_2 REGION + \beta_3 FUEL \\ + \beta_4 UNEMPL + \beta_5 EARN-DIFF + \beta_6 DEREG + \beta_7 UNION],$$

where Φ is a standard cumulative normal distribution function and 'owner-operator' is a binary variable with a value of one if the individual truck driver is an owner-operator and zero if the individual is a company-driver.

The set of worker attributes included in the vector *ATTRIB* are individuals' age, years of schooling, region of work place, and race. The age of a driver (*AGE*) is considered since older drivers are more likely than their younger counterparts to have acquired enough wealth to start their own operation. Schooling (*EDUC*) and race (*BLACK*, *WHITE*, *OTHR*) may reflect different preference orderings as well as perceived (and real) differences in employment opportunities. Employment opportunities may tend to equalize following deregulation, since stepped-up competition increases the cost of differential hiring practices.²⁰

REGION is a vector of regional location dummy variables (*SOUTH*, *WEST*, *N.CENTRAL*, and *N.EAST*). They account for differences in the extent of entry resistance from organized companies. The variable *SOUTH* has been excluded from the regression to avoid the dummy variable trap.

FUEL captures changes in real fuel prices. Periods of high fuel prices are likely to reduce the probability of being an owner-driver, since the cost of operating independently may prove to be prohibitive during such periods. Levinson (1980) reports that relatively small increases in operating costs greatly reduce profit margins in the trucking industry. This is particularly

20 Levinson (1982) reports that the trucking industry was known for excluding minorities from better paying jobs during the regulated era.

problematic for owner-operators, since their margins are generally quite slim (Wyckoff and Maister 1977).

UNEMPL reflects the level of economic activity. Periods of high unemployment may enhance the probability of choosing employment as an owner-operator, since self-employment is a common job choice during an economic downturn.

The earnings differential (*EARN-DIFF*) reflects the relative monetary rewards of working as an owner-operator versus working as a company driver. All other things equal, drivers should prefer working as a company-driver when the pecuniary rewards are relatively greater. *EARN-DIFF* is a ratio of the difference between mean company-driver earnings and mean owner-operator earnings over mean company-driver earnings for each year.

DEREG is a dummy variable, equalling zero for the sample period from 1973 to 1978 and one for the sample period from 1979 to 1988. This break in the data is chosen to reflect major regulatory reform in the motor carrier industry that was initiated prior to the MCA by the Interstate Commerce Commission. Such a choice is common for regulatory analysis in this industry (Rose 1987; Hirsch 1988; 1992).

The coefficient, β_6 , reflects the marginal effect of regulatory reform on the probability of a driver working as an independent rather than a company-driver in the forhire sector, all else equal. Because we control for changes in relative rewards and union strength, this measures the direct effect of deregulation.

Union density (*UNION*) measures the percentage of union members in the industry work force. Unions acted to restrict opportunities for owner-operators and often created hostile working conditions. To maintain their strong presence, the International Brotherhood of Teamsters (IBT) often negotiated contracts that restricted the use of owner-operators by motor-carrier firms, since these drivers were viewed as a non-unionized threat to high union wages.²¹ Their power was weakened with the relaxation of stringent entry restrictions, as indicated by the significant influx of nonunion companies since deregulation (Perry 1986; Rose 1987; Hirsch 1992).

In sum, we estimate the following equation:

$$\begin{aligned} Pr(00=1) = & \Phi(\beta_0 + \beta_1 AGE + \beta_2 EDUC + \beta_3 BLACK + \beta_4 WHITE \\ & + \beta_5 WEST + \beta_6 N.CENTRAL + \beta_7 N.EAST + \beta_8 FUEL + \beta_9 UNEMPL \\ & + \beta_{10} EARN-DIFF + \beta_{11} DEREG + \beta_{12} UNION). \end{aligned}$$

3.1. Data Sources

Data on individual workers was taken from March and May Current Population Survey (CPS) files for the years 1973 to 1988. The 1982 survey is excluded, as information on union status was not collected for that year. Such exclusion follows past studies that used data on individual drivers (Rose 1987; Hirsch 1988; 1992). These survey files provide information on individual workers' age, years of schooling, region of work place, occupation, industry of employment, race, annual earnings, and union status. A limitation of the data source is that earnings information on owner-operators was only reported on March files. These files,

21 Although a small minority of owner-operators were union members (a condition of employment by some motor carriers), their interests were never well represented. See Wyckoff and Maister (1975) and Maister (1980).

however, do not report individual information on region of work place before 1976. Thus, industry averages for annual earnings are calculated from March files, while all other individual information is taken from the more complete May files.

Another limitation encountered when using these files is that they do not report the union status of owner-operators. Thus union density measures only the proportion of company-drivers who belong to a union. Since owner-operators are significantly less likely to belong to a union, using CPS data may overstate the true level of union density.²² The CPS data are also known to include individuals with intermittent employment histories. Since we are interested in the effects of deregulation on the quantity differential between driver types, this latter problem may not be too serious unless it affects one set of drivers more than the other.

Lastly, there may be some problems of endogeneity among the variables which cannot be treated easily due to a dearth of CPS information from which to construct suitable instruments (Rose 1987). The two variables that are most problematic are the wage differential and union density. Since the wage differential is constructed from mean annual income figures and drivers are atomistic, we assume that drivers are price takers with respect to industry averages. The union density variable is less of a problem than it might be because it is constructed with respect to company-drivers only. Nevertheless, to mitigate this problem we present two sets of equations: one including the union density variable and one without.

Characteristics	Owner-operator		Company-Driver	
	Pre Deregulation	Post Deregulation	Pre Deregulation	Post Deregulation
Percentage of Forhire Sector's Driver Population	22.08	46.98	77.92	53.02
Age	42.10	42.20	38.90	38.43
Years of Schooling	10.35	11.19	11.01	11.47
Region of Employment (Percentages)				
West	16.39	21.09	18.37	21.57
North Central	36.09	31.32	32.51	28.06
North East	14.92	15.63	18.58	19.30
South	32.60	31.96	30.54	31.06
Race (Percentages)				
Black	9.76	6.98	7.25	9.37
White	90.05	92.11	92.22	88.66
Nonblack Minority	0.19	0.91	0.53	2.03
Annual Earning (1985 dollars)	23671.37	22615.01	27222.29	24834.22
Union Density in Forhire Sector			58.51	40.38
Number of Observations	543	1446	1916	1632

*Sources: 1973-1988 March and May Current Population Survey files.

22 In the late 1970s, only 10% of owner-operators belonged to the union (Perry 1986). After deregulation, they were even less likely to join (Maister 1980).

Table 1 reveals the nature of the CPS data by presenting the mean worker and industry characteristics before and after deregulation. As expected, the employment share of owner-operators in the forhire carrier sector shows a nontrivial increase in their participation in this industry following deregulation (a 113% increase). This increased share is accompanied by slight changes in the differences of years of schooling and region of work place between owner-operators and company-drivers. Much larger changes in differential racial composition are revealed for these two groups as the probability of whites driving their own truck increased following deregulation. A drop in the annual earnings differential and union density also occurred during deregulation.

Data on fuel prices and national unemployment rates are taken from the *Annual Economic Report to the President* (1991). This information shows that while the pre- and post-deregulation sample periods both include oil price shocks, the post-deregulation period includes a long period of declining prices from 1982 to 1988. Further, the pre-deregulation period covers a recession and a recovery, while the post-deregulation period covers a recession and two recovery periods, spanning seven years. This evidence may suggest that part of the increase in owner-operator participation may be influenced by national economic trends.

Descriptive statistics for the entire sample are presented in table 2.

5537 obs.		
Variable	Mean	Standard Deviation
ONE	1.000	0.000
AGE	39.957	11.539
EDUC	11.130	2.226
BLACK	0.081	0.272
WHITE	0.909	0.287
WEST	0.198	0.399
N.CENTRAL	0.312	0.464
N.EAST	0.177	0.381
FUEL	0.876	0.150
UNEMPL	6.730	1.264
EARN-DIFF	0.137	0.117
DEREG	0.556	0.497
UNION	0.458	0.155

4. Results

Table 3 presents the probit estimation results for two equations: one including the union density variable and one without it. Standard errors are in parentheses. The bracketed figures for continuous variables are elasticities, calculated from the average derivative of the probit function with respect to each variable. The average derivative of variable j is given by

$$\hat{\beta}_j \cdot \sum_{i=1}^N \varphi \frac{(X_i \hat{\beta})}{N},$$

(Probit Procedure, where Owner-operator = 1 and Company-driver = 0; 5537 obs.)		
Variable	(1)	(2)
CONSTANT	-0.884 (0.265)** —	-1.054 (0.262)** —
AGE	0.014 (0.002)** [0.482]	0.014 (0.002)** [0.513]
EDUC	-0.035 (0.009)** [-0.334]	-0.033 (0.009)** [-0.349]
BLACK	0.464 (0.203)* [0.035]	0.398 (0.201)* [0.032]
WHITE	0.472 (0.193)* [0.378]	0.420 (0.191)* [0.358]
WEST	0.001 (0.053) —	-0.003 (0.053) —
N.CENTRAL	0.062 (0.047) —	0.062 (0.046) —
N.EAST	-0.122 (0.055)* —	-0.131 (0.054)* —
FUEL	-1.282 (0.170)** [-0.988]	-1.722 (0.156)** [-1.415]
UNEMPL	0.134 (0.017)** [0.794]	0.155 (0.017)** [0.981]
EARN-DIFF	0.431 (0.186)* [0.052]	0.321 (0.185)+ [0.041]
DEREG	0.717 (0.052)** —	0.887 (0.045)** —
UNION	-0.931 (0.143)** [-0.375]	— — —
LOG-LIKELIHOOD RATIO	-3255	-3277
CHI-SQUARED	720.93	677.94

Note: ** indicates $p < 0.01$; * is $p < 0.05$; + is $p < 0.10$

where i is the sample observation.²³

The results for the vector of demographic variables are very plausible. They indicate that older and less educated drivers are more likely to choose employment as owner-operators. This is consistent with the premise that less educated drivers have fewer lucrative alternatives and that capital accumulation requires time and experience. They also show that both blacks and whites are more likely to choose to be owner-operators than other minorities. A t-test was used to test for the significance of the difference between the coefficients on *BLACK* and *WHITE*. The results enable us to reject the hypothesis that either variable is more significantly associated with owner-operator status.²⁴ That is to say, blacks are no more likely to select self-employment than whites.²⁵ Drivers living in the Northeast are less likely to choose employment as owner-operators than drivers living in any other region. This is consistent with reports that Eastern locals have impeded firms from expanding their special-commodity divisions, where owner-operators tend to be employed. Central and Western locals have been more receptive to owner-operators. Of this set of variables, only *WEST* and *N.CENTRAL* are insignificant. The results of a Chi-squared test indicate that the set of variables taken together is highly significant.²⁶

The estimated coefficients on *FUEL* and *UNEMPL* are also highly significant. A positive coefficient is found on real fuel prices, which is consistent with the notion that owner-operators are more directly affected by changes in other factor prices. The elasticity of *FUEL* indicates that every 10% increase in real fuel prices leads to a 9.9% decrease in the probability of a driver being employed as an owner-operator. This is a very dramatic effect, suggesting that the number of owner-operators employed may be quite volatile. It is less surprising when one considers that fuel costs account for a very high percentage of operating costs and that owner-operator margins are, in general, very low.²⁷ The ICC has, historically, been slow to initiate surcharge and fuel pass-through provisions, which provide some relief to owner-drivers operating under lease.²⁸ In addition, high fuel prices are sometimes associated with severe shortages, which are even more disruptive to independent operations. Working hours spent seeking out fuel and waiting in line make profitable operation nearly impossible (Wyckoff and Maister 1975).

The findings on the unemployment rate (*UNEMPL*) reveal an elasticity of .794. This indicates that for every 10% rise in the unemployment rate, there is a 7.94% rise in the probability of a truck driver working under self-employ. During recessionary periods, when there are few opportunities elsewhere, drivers may select self-employment as an option. It is important to keep in mind, however, that these data include drivers who may be only

23 See Ashenfelter et al. (1992).

24 The t-test used to test this significance is as follows:

$$t = (\beta_b - \beta_w) / [\text{var } \beta_b + \text{var } \beta_w + 2 \text{cov } \beta_b \beta_w]^{1/2},$$

where β_b is the coefficient for *BLACK* and β_w is the coefficient for *WHITE*. The t-score is -.3257.

25 This result is somewhat surprising. In the 1970s, the trucking industry was well known for its discriminatory practices against blacks and other minorities (Levinson 1982). Denied opportunity in better paying company jobs, one might expect them to choose self-employment unless access to capital is equally a problem.

26 The Chi-square distribution is most appropriate for testing probit results due to their asymptotic nature. The result of this test was a Chi-squared of 73.7 with 4 degrees of freedom.

27 Fuel represented about 54% of variable costs for a vehicle driven 100,000 miles a year in 1978, when real fuel prices were less than 48% of their peak over the sample years (Maister 1980).

28 It took shutdowns in both 1974 and 1979 to force the ICC to take action. See Wyckoff and Maister (1975) and Maister (1980).

intermittently employed. While drivers may select self-employment during contractionary periods, they may not achieve long-term success.

Our results regarding the effect of *EARN-DIFF* indicate that a 10% increase in the differential of company-driver earnings over owner-operator earnings results in a 0.5% increase in the probability of a driver finding employment as an owner-operator. This at first seems counterintuitive, since company-driver earnings exceed owner-operator earnings and an increase in the differential would appear to make employment as a company-driver more attractive, other things equal. Our intuitive explanation is that all other things are not equal. In particular, the post-regulatory environment is considerably more risky. This directly affects owner-operators who, as entrepreneurs, must bear this risk. Since the earnings reported are not risk adjusted, owner-operators' income in the pre- and post-reform periods are not strictly comparable. This effect could reverse an apparent decrease in the earnings differential, making the reported sign perfectly intuitive. Secondly, it can be observed from table 1 that the mean earnings of both company-drivers and owner-operators declined in the wake of deregulation. Although the percentage decline in owner-operator income was smaller, it may have had a greater impact on them since their profit margins were already so slim (Levinson 1980).

The direct effect of deregulation is captured by the *DEREG* variable, since we control for all other variables which may be affected by deregulation as well as for exogenous trends. Column 1 of table 3 shows that, all else equal, the estimated coefficient on the deregulation dummy is positive and highly significant, indicating that a randomly selected driver was far more likely to choose self-employment in the reform era. Indeed, when all other variables are held at their post-deregulation mean values, we find that the probability of reporting as an owner-operator increases from 21.21 prior to the reforms to 46.70 in the post-reform sample period. This represents a remarkable 120% increase in probability.

The reported elasticity for the *UNION* variable suggests that a 10 percent decline in union density corresponds to a 3.8 percent increase in the probability of a truck driver reporting as an owner-operator.²⁹ This supports our hypothesis that unions barred owner-operators from entry and created an inhospitable working climate for them.

Union strength was declining throughout the entire period of study (Percy 1986). But Teamster memberships dropped off dramatically after deregulation as a result of the reforms. Part of the observed effect of *UNION*, then, reflects an indirect effect of deregulation. This is true of the *EARN-DIFF* variable as well, which was impacted by both the competitive effects of deregulation and the decline in union strength. To gauge the size of these indirect effects, we first measure the total effect of deregulation. This is accomplished by utilizing both pre- and post-deregulation means for all regressors whose values changed following deregulation in the calculation of Z statistics.³⁰ We find that the total effect of deregulation was to increase the likelihood of a representative driver reporting as an owner-operator by 155.6% over the pre-reform probability. The difference between this value and the calculated direct effect of deregulation is the indirect effect of deregulation, through changes in relative earnings and unionization. We find that nearly thirty-six percentage points in probability can be attributed to these effects.³¹

29 Note, however, that the use of average explanatory variables such as *UNION* in non-linear models creates a problem on inconsistency.

30 We use post-deregulation means for all other variables.

We report the results of a regression that excludes the *UNION* variable in equation 2. This is because of some concern that there may be a problem of collinearity, particularly with regard to the *UNION* and *DEREG* variables. We find, however, that the exclusion of *UNION* does little to change the regression results. The coefficients of *UNION* and *DEREG* in both equations are very precisely estimated. Comparing the two equations, we do see that excluding *UNION* increases the effect of deregulation on the probability of being an owner-operator from 13% to 16%—a 19% increase. This supports our result that the total effect of deregulation goes beyond the direct effect.

We test for the possibility of fixed time effects by running the regression with 13 annual dummy variables, the constant term, and the deregulation dummy. We omit from the regression the four variables that capture the indirect effects and economic trends (*EARN-DIFF*, *UNION*, *UNEMPL*, and *FUEL*) since these variables, like the constant and dummy variables, are constant within each year.³² The log likelihood ratio is a statistically significant 302.9. While the value of the coefficient on *DEREG* is reduced, it remains statistically significant.

To explore further, we ran a regression with fourteen time dummies without *DEREG*. Then, we regressed the constant and the coefficients on the time dummies derived from this model on *UNION*, *EARN-DIFF*, *UNEMPL*, *FUEL*, and *DEREG*. We find that these variables explain more than 85% of the variation captured by the fixed effect model. The time trend dummies appear to explain very little over and above what is already explained by these five variables. This evidence suggests that the use of yearly economic variables provides a reasonable alternative for the fixed effect model in addressing the problem of coefficient heterogeneity over time.

5. Discussion

The results of this study correspond quite closely to the information revealed by comparing the pre- and post-deregulation means of the raw data. From table 1, we see that the percentage of owner-operators among drivers in the forhire sector increased by 113% over the pre-regulation mean value. What is notable about the probit analysis findings is that this result holds up even after controlling for other factors which were affected by deregulation. This implies that the effects of deregulation on owner-operator employment were primarily a direct effect. The effects of deregulation through earnings differential and unionization, while not insignificant, were substantially smaller.

To the extent that regulatory policy reforms were intended to increase the utility of owner-operators and to expand the range of their competitive opportunities, it is likely that they have succeeded. The increase in owner-operators over company-drivers in the forhire sector is suggestive of the increasing presence of owner-operators in market segments that had formerly been closed to them. If, as a result of the expansion in opportunities owner-operators are now serving a greater proportion of base-level demand, instead of providing mainly peak-sharing capacity as Wyckoff and Maister (1977) have suggested, then owner-

31 Since regional effects and racial composition may also be affected by deregulation, we also calculated the total effect of deregulation by including these variables among the indirect effects. In this case, the total effect is a 153% increase over the pre-deregulation probability. Thirty-three of these percentage points can be attributed to the (more inclusive) indirect effect.

32 The entire set is therefore perfectly collinear with the time dummies.

operators will have gained greater earnings and employment stability as well. This is not an unreasonable expectation, given the results of this study. Prior to the reform movement, owner-operators were constrained to operate within that segment of the transport market that contains two of the most volatile sources of demand: agricultural commodities and household goods, both of which are highly seasonal.³³ The lowering of entry barriers and the expansion of opportunities for owner-operators in other sectors must surely have lessened the seriousness of such fluctuations on owner-operator performance and survival.

Owner-operators were among the strongest supporters of deregulating the industry. If increased earnings stability and freedom in the market place were among their primary objectives, then they were rational in their demand for reforms.³⁴ Our results certainly suggest that regulatory reform increased their utility relative to that of company-drivers.

To the extent that reforms were intended to encourage the increased utilization of this low cost, highly productive segment of the labor force by more providers and users of transportation services, it also appears to have had the desired effect. The results of this study suggest that, on net, shippers as well as regulated motor-carriers shifted traffic to owner-operators.

There is some evidence, however, of a decline in owner-operators over the past few years. Corsi and Grimm (1989) report, on the basis of a survey of drivers, that by 1987, owner-operator use had fallen sharply.³⁵ This is in contrast to their earlier study, which showed owner-operator use increasing through 1986. Corsi and Stowers (1991) also report a decline, utilizing Annual Report data from the American Trucking Association (ATA). While the ATA data do indicate a significant decline after 1987, these data should be interpreted with some caution. First, the carriers of household goods were excluded from the carrier total, beginning in 1988. Since over 90% of household goods carriers are owner-operators, this could have a big impact on the results.³⁶ Second, the ATA data cover only the large, class I and II carriers. While there may be some decline in owner-operator use by these firms as some change to advanced truckload firm (ATLF) strategies, there may be a compensating increase in owner-operator use by upstart carriers (class III), by private carriers, and by shippers contracting with owner-operators directly.³⁷ Lastly, comparisons such as these do not control for other factors, such as the economic slump and its effect on this industry over the period of time.

It may be that the introduction of new production technologies such as those employed by ATLF's has shifted the utility comparison by enhancing the job attributes of company-drivers. Company-drivers who work for ATLF's are more likely to get home for the weekend, for example. If deregulation has spurred such technological and organizational innovations by unleashing competitive forces, then there may be other indirect effects that are not measured by this study. The size of our reported direct effect is so great, however, that it is unlikely that even the inclusion of these factors could change materially our conclusion that the principle effect of deregulation was direct.

33 See U.S. Dept. of Justice (1978).

34 See Stigler (1971) and Pelzman (1976) on the role of interest groups in demanding regulatory change.

35 This survey is from the National Motor Freight Transport Data Base.

36 See Maister (1980).

37 ATLF's tend to employ teams of company drivers and utilize sophisticated load matching capabilities to increase their load factors (Boyer 1993; Corsi and Grimm 1989).

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