Differences in Truck Driver Labor Supply Between Owner-Operators and Employees

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Abstract

This study seeks to examine the work hours of truck drivers and the factors influencing drivers' supply of labor to the freight transportation market. Recently, truck driver hours have been the object of regulatory scrutiny and regulation by the U.S. Department of Transportation, ostensibly for safety reasons. The new Hours of Service regulations are being blamed by some in the trucking industry for decreasing the amount of labor supplied by drivers by drivers entering other fields of employment. While drivers operate under this regulatory environment, the current study examines the other determinants of labor hours for truck drivers. These determinants are particularly relevant in light of projections of a shortage in the supply of truck drivers within the United States in the near future, and the associated costs and rates of driver turnover within the trucking industry. The nature of driver employment, either as an employee of a firm, or as an owner-operator, is also examined within the context of modern industrial organization theories of transaction costs and agency.

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Introduction

A truism of the current market economy is the fact that practically all goods consumed or produced in the United States moved at some point by truck, either from its place of production to a center of manufacturing, or from a center of manufacturing to a final point of consumption. Integral to this process are the truck drivers who physically move these goods from place to place. In light of recent surveys (American Transportation Research Institute, 2005) indicating the importance of driver retention and driver shortages, examinations of the motivating factors in the labor supply are timely.

This study seeks to examine the work hours of truck drivers and the factors influencing drivers' supply of labor to the transportation market. Recently, truck driver hours have been the object of regulatory scrutiny and regulation by the U.S. Department of Transportation, ostensibly for safety reasons.[i] The new federal Hours of Service regulations are effectively decreasing the amount of labor supplied by drivers and exacerbating an already existing truck driver shortage (Guido, 2005). While drivers operate under this regulatory environment, the current study examines other possible determinants of labor hours for truck drivers. These determinants are particularly relevant in light of projections of truck driver shortages within the United States in the near future,[ii] and the associated costs and rates of driver turnover within the trucking industry.[iii] The nature of driver employment, either as an employee of a firm, or as an owner-operator, is also examined within the context of modern industrial organization theories of transaction costs and agency.

Previous studies have documented declining wages for truck drivers over the last 25 to 30 years (Hirsch and MacPherson 1997) and those factors of deregulation and human capital contributing to this decline (Belman and Monaco 2001). The American Trucking Association [iv] in 1997, identified driver retention and driver shortages as significant issues facing the trucking industry since the period of deregulation circa 1980. This study also found that several factors are crucial in retaining drivers such as "higher pay, more regular and predictable hours, greater benefits, or better equipment and working conditions."[v] Given these recent trends of declining wages and truck-driver shortages, this paper seeks to address several questions. First, what is the real wage rate of truck drivers in comparison to the actual number of hours worked? Do various performance incentive schemes affect a driver's willingness to work? Do compensation and benefit programs provide incentives to drivers to provide more labor? What demographic, or specific individual characteristics affect the labor supply decisions of truck drivers? To what extent do these conditions affect a driver's employment relation decisions? In order to answer these questions a unique data set based upon an extensive driver survey conducted by the University of Michigan, is used to construct a model of driver wages and labor supply.

One factor that may influence labor supply decisions from the truck drivers' perspective is the nature of the employment type that the drivers operate under. As noted by Nickerson and Silverman (2003), modern industrial organization theories of transaction costs and agency posit that the owner-operator form of employment should dominate truck driving. Reasons for this are the nature of trucks as non-specific capital assets that are easily redeployed (Williamson, 1985; Klein, Crawford and Alchian, 1978). This general lack of asset specificity in trucking argues against vertical integration by trucking firms (Tirole, 1988). Also, agency theory posits that

delivery performance is usually easily measured, but that vehicle condition and depreciation are less easily monitored by trucking firms and these costs should be internalized by the drivers (Milgrom and Roberts, 1992; Tirole, 1988; Williamson, et al, 1975; Alchian and Demsetz, 1972) through driver ownership of the trucks. Yet, in a 1991 study by the American Trucking Association, almost 70 percent of truck drivers were employees of firms that own the tractor rigs, assign the shipments to various drivers and manage the logistical functions associated with transporting goods from origin to destination.[vi] One explanation for this divergence between theory and reality is in the organizational market niche the trucking firm seeks to exploit (Scheraga, 2005). Using the University of Michigan Trucking Industry Program (UMTIP) survey data, a final question is asked. Given the labor supply variables noted above, the non-specific nature of truck assets, and that the apparently "structureless" nature of the truck driver labor market (Williamson, et al, 1975), what is the probability that a driver will choose to be the employee of a trucking firm, or choose an owner-operator form of employment relation[vii]?

Data and Models

Standard models of labors supply (Borjas 1999) identify many of the variables associated with the hours-of-work decisions made by participants in the labor force. In addition to the hourly wage, demographic variables such as educational attainment, race, marital status and gender have all been shown to have an effect on labor supply. Other factors that may influence labor supply decisions are nonlabor income and other forms of labor-related income such as health insurance, pensions and deferred income from savings plans, and the award of bonuses or imposition of penalties.

This study uses information drawn from a truck driver survey conducted by the University of Michigan Trucking Industry Program (UMTIP) in 1997. The survey is an extensive questionnaire of 573 individuals regarding many aspects of truck driver's working conditions and work lives (Belman, et al 1998). From this survey, 481 observations have been extracted in order to examine the hours-of-work decisions made by truck drivers in relation to factors such as hourly wage, payment schemes[viii], the provision of benefits such as health insurance, pensions or deferred compensation programs, and the presence of bonuses or penalties related to service.[ix] Monaco and Willmert (2003) have also examined wages and hours using UMTIP data in comparison to Current Population Survey data from the U.S. Census Bureau. The current study also uses the UMTIP data to examine the factors influencing the employment relation decisions made by truck drivers.

The survey also has the benefit of detailed demographic and employment characteristic information regarding the drivers. Information obtained from the UMTIP survey includes data on the drivers experience *as a truck driver*, union status, the type of employer[x], and whether the driver classifies their job as "over-the-road," i.e., long-haul trucking, or local pick-up and delivery. Demographic information includes race, gender, marital status, spousal employment, the number of children, total family income in 1996, and the educational attainment of the driver. Educational attainment is classified as less than high school, some high school, high school, vocational or technical school, some college, associate's degree and bachelor's or higher college degree.

One important characteristic obtained from the survey is the type of employment relation of the

driver. Drivers identified themselves during the survey as either employees or as owner-operators.[xi] This distinction is maintained throughout the study in order to identify any characteristics that can be associated with driving trucks as an employee, or as an owner-operator. In the survey data utilized for this study, 28.5 percent of the respondents identified themselves as owner-operators. This percentage conforms closely to a previous study examining truck drivers (Corsi and Grimm 1989) and to results from the 1991 annual reports of the American Trucking Association noted above. Also, the original UMTIP survey[xii] found that 25.5% of the respondents identified themselves as an owner-operator.

In the survey results, one caveat must be noted. The survey respondents were overwhelmingly male (97.5 percent). The extraordinarily large gender bias of the drivers is evidence that truck driving is still a "man's" occupation. It was also noted by Belman and Monaco (2001) that the female drivers that were interviewed were almost always older, married and had children who were grown.

Descriptive statistics for the variables of interest in this study are shown in Table 1. Some interesting comparisons between employees and owner-operators are evident in these results. In general, owner-operators have 2 more years of experience as a truck driver than employee drivers. Employee drivers are heavily concentrated in local pick-up and delivery (85 percent), while only 6 percent of owner-operators work locally. This indicates that owner-operators, who attempt to achieve some economies of scale and distance for their owned equipment, concentrate on long-haul carriage over short-distance hauls.[xiii] In addition, the type of trucking firm the drivers are employed by differs between the two classes; employees are more likely to work for

private fleets (companies that maintain their own internal fleet and do not generally engage outside trucking firms), with over 21 percent of employees reporting such a firm arrangement. Only 11 percent of the owner-operators reported contracting exclusively with a firm that is not engaged primarily in the trucking industry. The biggest disparities are in hourly wage rate and non-driver-earned family income. Owner-operators have the highest mean hourly wage and family incomes, and also the highest variability. Other differences are in the forms of alternate compensation the drivers receive; employees are more likely to have some form of deferred compensation and health insurance than reported by owner-operators. However, more owners report having some form of pension savings plan than do employees. These differences may reflect variation in tax treatments for owner-operators and for firms hiring employee drivers, as well as differences in short-term costs of health and deferred compensation versus the long-term benefits of pension contributions for each driver category.

Labor Supply Model and Results

For the purposes of this analysis, an ordinary least squares (OLS) regression for the log of the reported hours worked against the independent variables listed in Table 1 was conducted. The hourly wage rate for employee drivers variable was computed by taking the last paycheck amount reported in the UMTIP survey, the pay period for the check, i.e. weekly, bi-weekly or monthly, and the total hours worked as reported in the survey. From these variables, a weekly hours and the hourly rate could then be constructed. For owner-operators the survey was more direct; the questions asked for revenue earned last week and the total hours worked last week.[xiv] Drivers may be paid hourly, by salary, or by the load, while total labor hours include driving time and additional time spent waiting to load and unload. If the actual hours associated with a

particular load are unusually long, or short, such disparities in wages become evident. Seven driver's reported compensation and hours that resulted in a calculated hourly wage rate below the national minimum wage rate of $5.15 per hour, while an additional twelve drivers reported a combination of compensation and labor hours resulting in hourly wages rates of $100 per hour or more. An additional eight drivers reported weekly hours in excess of 122 hours per week, or more than 16 hours per day over 7 days. These extreme value observations were excluded from the estimated model. The wage rate for the "censored" sample of drivers ranges from a low of $5.34 to a high of $98.33 per hour, while the sampled hours per week range between 9 and 110.

As noted by Borjas (2000), "The typical framework that economists use to analyze labor supply behavior is commonly called the 'neoclassical model of labor-leisure choice.' The objective of this model is to isolate the factors that determine whether a particular person works and, if so, how many hours she chooses to work." The basic structure of the model used in this study regresses the log of the weekly hours worked against a variety of independent variables and has the form

$$h_i = \beta w_i + \gamma V_i + \eta X_i$$

where h_i are the labor hours supplied, w_i is the wage rate, V_i is non-labor income, and X_i is a vector of other characteristics. Standard variables estimated in the model are the hourly wage rate, characteristic variables such as gender, race, age, number of children, marital status, whether the spouse works, family income and union membership. The family income variable is the reported total family income less the drivers reported income. This represents the additional non-labor source of income for the driver. Characteristic variables were also included for

educational attainment using drivers with a high school education as the reference base in the regression.[xv]

In general, changes in the wage rate may produce "ambiguity" in the relation between the wage and the hours of labor supplied. For example, assuming that truck drivers are utility maximizers, an increase in the wage rate will increase the demand for leisure by the drivers. However, an increase in the wage rate also makes leisure more expensive (an hour's time is now worth more due to the increased wage) for high-wage workers while remaining relatively less expensive for low-wage workers. As a result, we would expect that truck drivers who have lower hourly wage rates will decrease their labor supply, while drivers with higher hourly wage rates will increase their supply of labor.[xvi] This effect is captured by the β coefficient, where a negative sign implies a dominant income effect, while a positive sign implies the substitution effect dominates (Borjas, 2000).

Variables that are unique to the survey attempt to measure some of the special wage factors of truck driving and their effects on hours worked. These variables include dummies identifying the driver as local or over-the-road, whether the driver works for a private trucking firm, or for a company with a truck fleet, whether the driver is subject to bonuses or penalties to their wage, whether they are paid for their time while waiting to load, unload, drop off or pick up a load, and whether they have deferred compensation plan such as a 401K, a conventional pension plan or IRA, or if they have health insurance.

Standard OLS regression results for all drivers, employees and owner-operators are presented in Table 2. For the all drivers category, the constant was 3.866. This translates into a mean hours worked per week of 47.8 ($e^{3.866}$=47.8). Interestingly, the mean hours worked that was estimated for both employees and owner –operators were significantly larger: 56.4 hours per week for employees and 82.9 hours for owner-operators. The other variables then represent factors inducing drivers to work longer or to cut back on their labor supply. These numbers bear out the contention by Belman and Monaco that truck drivers earn a middle-class income by working the equivalent of 1.5 full-time jobs.[xvii] For owner-operators, the results indicate that they work the equivalent of over 2 full-time jobs.

This study also confirms another result from Belman and Monaco (2001) regarding experience and tenure. Belman and Monaco find almost no significant relationship between tenure (experience) and annual income.[xviii] The results presented here also show that experience is an insignificant factor in the determination of the hours-of-work decisions of truck drivers.

The results also point out a salient fact regarding truck driver labor supply: for the most part, there is no discernible return to education for truck drivers. As can be expected, educational attainment does not have a bearing on the amount of labor necessary for truck drivers to do their jobs. This is borne out by Monaco (2005) who also finds that driver productivity is not related to a driver's education level, and thus to earnings power.[xix] Several educational variables were found to be significant in the labor supplied by employee drivers, while no educational variables were of significance for owner-operators. Employee drivers with vocational school, an associate's degree, or a college degree worked almost 8 additional hours per week than drivers

who have a high school education. Educational attainment does not appear to be a significant factor in the determination of the hours of labor supplied by owner-operators, although the variable for college education was marginally significant at a 0.11 level. Characteristic variables such as race, union membership, children, spousal employment, age and marital status were found to be insignificant for both driver types. Gender was found to be somewhat significant for owner-operators, with men supplying more labor hours than women, *ceteris paribus*. The general results provide some confirmatory evidence for the results of Beilock (1995), which found no differences in demographic components for either employees or owner-operators. [xx]

The one primary variable of significance is consistent with a priori labor theory: the hourly wage rate. This variable was highly significant for all three categories, and the coefficient was negatively signed for all three estimation groups. According to the neo-classical model of labor supply as noted above, the negative sign of the wage rate coefficient indicates that the income effect dominates over the substitution effect and drivers will reduce their hours of labor supplied with an increase in the hourly wage rate. This also indicates that most truck drivers perceive of themselves as "low-wage" workers and will respond to higher wages by reducing their labor supply. In regard to the new USDOT Hours of Service regulations, this would further indicate that compliance to the new rules will increase (due to drivers increased willingness to work less) as driver pay and compensation is increased. An additional factor arising from this response is the incentive for drivers to frequently switch employers or contracts in search of higher wages.

The family income variable was significant for both driver types and, in contrast to theory (Borjas, 2000), the sign of the variable was positive. However, the impact of this variable was

extremely negligible, having almost no effect on the hours of labor supplied by the drivers. Most of the other variables included in the regression analysis were found to be statistically insignificant, which indicates that there is great uniformity in the hours-of-work for truck drivers. Employee drivers were found to increase their hours of labor if they are compensated for waiting either to pick up or drop off a load, or if they have a pension plan. The significance of compensation for waiting time would be evidence that many employee drivers are paid on an hourly or scheduled rate in which time spent waiting is equivalent to time spent driving. In the final analysis, the substantial factor influencing hours worked is the nature of the job itself: truck driving requires a considerable time commitment from those individuals who enter the profession.

Owner-operators had the fewest significant variables affecting their hours-of-work decisions. Other than the hourly wage rate mentioned above, the only other variables having statistically significant influences on labor supply are the dummies for type, gender and family income. Owner-operators who are male increase their hours of labor supplied, while decreasing their labor if they are contracted to a private (non-trucking industry) fleet.

Employee drivers respond to different incentives in determining their hours of work. Being paid for waiting decreased the number of hours worked, likely due to a fixed hourly wage structure for many employee drivers. Spousal employment has a negative effect on the hours-of-work decisions of employee drivers, with drivers working an average of 7 hours less per week if they have a working spouse ($4.033-0.130 = e^{3.903}=49.6$). The family income also affects driver's labor supply, indicating increasing hours worked as family income increases, but by an amount

virtually equal to 0. The availability of a pension plan as part of the driver compensation package does have a positive effect on labor hours supplied, likely due to pension savings being conditioned on the wage level, and then, by extension, on the hours of labor.

The OLS regression results do point to the existence of some differences in the labor supply decisions made by drivers depending upon their type of employment. Only the hourly wage rate and family income were jointly significant for each group. While the standard industrial organization literature on contracts cited above holds that owner-operators should be the dominant form of employment organization, Nickerson and Silverman (2003) find that externalities such as coordination risk for LTL freight, reputation effects, and the need for non-standard rig configurations combine to limit the numbers of truck drivers who become owner-operators.[xxi] Scheraga (2005) further notes that trucking firms adopt different operating strategies in order to create competitive advantage. These strategic market positions are either through cost competition, service differentiation, or high service-price premium carriage, or through niche-seeking and specialization. Firms that pursue differentiated or niche market strategies are more likely to directly employ drivers as noted by Nickerson and Silverman (2003), while firms engaged in cost leadership will conform more closely to the theoretical models of employment described by standard industrial organization theory. Nickerson and Silverman emphasize the importance of reputation effects and measures used by firms to provide inducements and oversight of their contracted owner-operators in order to mitigate coordination and driver-associated risk. Among the measures that are cited are late penalties, on-time bonuses and financial support for tractor rig maintenance. Notably, the presence of incentives and penalties did not significantly alter the labor supply decisions of the owner-operators in the survey. Also,

the UMTIP survey found that only 9 percent of owner-operators received *any* form of financial support for maintenance costs. These results would appear to indicate an incentive disconnection between firms and owner-operators in mitigating any reputation effects associated with driver behavior.

Employment Relation Model and Results

Another means of examining the differences between owner-operators and employee drivers is by implementing a binary response model. In this instance, the binary response is whether the driver is an employee or an owner-operator. If the driver is an employee the response is coded as a 0, while if the response is for an owner-operator it is coded as a 1. The model then estimates the probability of a driver choosing a particular type of employment arrangement, contingent upon a set of explanatory variables. Formally, the model is

$$P_t = \Pr\left(y_t = 1 \middle| \Omega_t\right) = E\left(y_t \middle| \Omega_t\right)$$

where P_t is the probability that $y_t = 1$, i.e., that a driver will be an owner-operator, and Ω_t is the set of conditioning explanatory variables and $0 \le E\left(y_t \middle| \Omega_t\right) \ge 1$, so the range of values of the expectation is between 0 and 1.[xxii] Thus, the binary response model transforms the relationship between the binary response variable and the explanatory variables into a percentage probability.

Since the OLS model used to examine the labor supply decisions of the drivers indicated the presence of normality, the probit form of the binary response model was used to model the expected probabilities of drivers choosing to become owner-operators. Those variables found to be significant in the labor supply decisions were used in the estimation of the probit model on the

rationale that the motivating factors that a driver chooses in supplying labor also inform the employment relation decision. The marital status of the driver was also included as it was found to be significant in determining the probability of a driver violating USDOT hours of service regulations.[xxiii] The probit estimation results are provided in Table 3.

The probit estimation confirmed the importance of several of the significant OLS regression variables in determining the probability of driver employment type, although the predicted probability was significantly lower than the observed probability (26.87 percent observed against 8.54 percent predicted). The only variables that were not found to be significant were marital status, family income, age, and college education. While the gender variable was significant, the overwhelming numbers of male survey respondents would argue against emphasizing the results for this variable. The results then indicate that a driver's choice to become an owner-operator is due to a combination of type (long-haul v. local delivery), the firm type and with wage rate expectations, and is not dependent on additional family income or demographic considerations such as age or the level of education. On a final note, the R^2 level for the probit was 0.7805; the remaining variation in explaining the employment type probability may then be due to an immeasurable "entrepreneurial" component that then determines a driver's willingness to engage in an owner-operator employment relation.

Conclusion

This study has examined those factors influencing the hours-of-work decisions made by truck drivers. The findings indicate that the labor supplied by truck drivers is determined largely by the inherent occupational characteristics of the job of driving trucks. Moreover, the results of the

regression analysis find that there is considerable uniformity in the determination of labor supply, with some variation between drivers who are employees and drivers who are owner-operators. Little or no evidence was found for any returns to education, race, gender, age or other demographic characteristics, although there was some indication of educational effects for employee drivers. Owner-operators exhibited modifications to their labor supply based upon gender and the fleet/firm type that they contract with. These results are borne out by the probit estimation of the driver employment relation, but there is significant variation between the predicted and observed probabilities of a driver engaging in an owner-operator form of employment relation. As suggested by Williamson, et al (1975) and Scheraga (2005), additional research on the relationship between the strategic positioning of trucking firms and the types of drivers these firms employ, as well as turnover and wage rates, is merited.

The primary conclusions of this study are that truck driving is a time-intensive endeavor, in which the labor supplied is largely determined by the nature of the occupation and that drivers are highly responsive to changes in the wage rate and have a large incentive to leave their current employer/contract for promises of higher income. These results underscore the challenge to the trucking industry identified in the ATA study of 1997[xxiv]: how to best structure the combination of wage rates, working hours and labor conditions in order to avoid shortages in the supply of driver labor and associated high levels of driver turnover.

Table 1: Descriptive Statistics for all drivers, employees and owner-operators

	All Drivers				Employees				Owner-Operators			
Variable	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Max**
log hours	3.97	0.45	2.20	4.70	3.98	0.45	2.25	4.70	3.97	0.45	2.20	4.70
local	0.64	0.48	0	1	0.85	0.36	0	1	0.06	0.23	0	1
experience	14.35	9.97	1	51	13.78	9.69	1	41	15.88	10.58	1	51
experience sqd.	304.98	369.59	1	2601	283.60	334.64	1	1681	363.16	447.63	1	2601
type	0.19	0.39	0	1	0.21	0.41	0	1	0.11	0.32	0	1
owner-employee	0.27	0.44	0	1	0.00	0.00	0	0	1.00	0.00	1	1
bonus	0.53	0.50	0	1	0.59	0.49	0	1	0.36	0.48	0	1
penalty	0.53	0.50	0	1	0.48	0.50	0	1	0.67	0.47	0	1
paid for waiting	0.43	0.50	0	1	0.48	0.50	0	1	0.29	0.45	0	1
paid for loading	0.52	0.50	0	1	0.58	0.50	0	1	0.35	0.48	0	1
hourly rate	21.18	15.48	5.34	98.33	14.35	6.49	5.34	48.48	39.76	17.49	11.49	98.33
deferred	0.46	0.50	0	1	0.58	0.49	0	1	0.12	0.33	0	1
pension	0.35	0.48	0	1	0.30	0.46	0	1	0.49	0.50	0	1
health	0.83	0.37	0	1	0.90	0.30	0	1	0.66	0.47	0	1
gender	0.97	0.16	0	1	0.98	0.13	0	1	0.95	0.22	0	1
age	41.91	10.11	19	75	41.66	10.07	19	75	42.60	10.22	22	67
married	0.65	0.48	0	1	0.64	0.48	0	1	0.71	0.45	0	1
spouse works	0.42	0.49	0	1	0.41	0.49	0	1	0.43	0.50	0	1
children	1.25	1.99	0	31	1.26	2.15	0	31	1.22	1.47	0	9
family income	12,838.16	46,347.42	0	940,000	47,220.12	20,515.29	4,000	125,000	68,233.05	94,860.75	0	1,000,000
race	0.85	0.36	0	1	0.86	0.35	0	1	0.84	0.37	0	1
union	0.11	0.31	0	1	0.14	0.35	0	1	0.02	0.13	0	1
less than highschool	0.02	0.15	0	1	0.02	0.14	0	1	0.02	0.16	0	1
some highschool	0.17	0.38	0	1	0.16	0.37	0	1	0.20	0.41	0	1
highschool	0.46	0.50	0	1	0.46	0.50	0	1	0.45	0.50	0	1
vocational school	0.05	0.21	0	1	0.05	0.23	0	1	0.03	0.18	0	1
some college	0.21	0.41	0	1	0.21	0.41	0	1	0.20	0.41	0	1
associates	0.04	0.20	0	1	0.04	0.19	0	1	0.04	0.20	0	1
college	0.05	0.21	0	1	0.05	0.22	0	1	0.04	0.20	0	1
	total obs=454				total obs=332				total obs=122			

Table 3: OLS results for log hours

	All Drivers			Employees			Owner-Operators		
Variable: log hours	**Coefficient**	**Std. Error**		**Coefficient**	**Std. Error**		**Coefficient**	**Std. Error**	
local	0.103	0.062	*	0.112	0.067	*	0.059	0.174	
experience	0.002	0.006		-0.006	0.008		0.003	0.012	
experience sqr.	0.000	0.000		0.000	0.000		0.000	0.000	
type	-0.072	0.053		-0.097	0.059		-0.190	0.112	*
owner-employee	0.055	0.087	***	----	----	----	----	----	----
bonus	0.001	0.041		-0.039	0.047		0.102	0.080	
penalty	0.034	0.038		0.028	0.044		0.002	0.073	
paid for waiting	-0.072	0.045		-0.035	0.048		-0.185	0.121	
paid for loading	0.083	0.046	*	0.120	0.050	**	-0.072	0.097	
hourly rate	-0.017	0.002	***	-0.035	0.004	***	-0.012	0.002	***
deferred	0.045	0.045		0.040	0.051		0.133	0.096	
pension	0.060	0.043		0.087	0.051	*	0.064	0.072	
health	0.080	0.064		0.045	0.072		0.076	0.090	
gender	0.111	0.118		0.049	0.199		0.279	0.156	*
age	-0.002	0.003		-0.000	0.003		-0.009	0.006	
married	0.081	0.050		0.090	0.055		0.009	0.108	
spouse works	-0.069	0.048		-0.130	0.060	**	0.067	0.087	
children	-0.007	0.009		-0.004	0.008		-0.011	0.028	
family income	6.15E-07	2.27E-07	***	3.79E-06	1.31E-06	***	5.56E-07	2.57E-07	**
race	0.051	0.058		0.017	0.065		-0.013	0.099	
union	0.097	0.062		0.097	0.065		0.013	0.251	
less than highschool	-0.183	0.156		-0.186	0.178		-0.321	0.340	
some highschool	-0.029	0.056		-0.046	0.068		-0.013	0.093	
vocational school	0.150	0.062	**	0.152	0.064	**	0.138	0.153	
some college	-0.033	0.054		-0.044	0.060		-0.001	0.112	
associates	0.152	0.078		0.103	0.057	*	-0.237	0.157	
college	0.243	0.065	***	0.233	0.072	***	0.258	0.157	
constant	3.866	0.167	***	4.033	0.249	***	4.418	0.259	***
number of obs.	454			332			122		
R-squared	0.2606			0.3474			0.3934		

*significant at .10 ** significant at .05 *** significant at .01

Note: standard errors are White's robust estimates

Table 3: Probit Estimates of Employment Relation Choice

Dependent Variable: Owner-employee

Variables	**Coefficient**	**Std. Error**	**Significance**
local	-0.577	0.050	***
type	-0.086	0.042	***
hourly rate	0.018	0.005	***
gender	-0.209	0.092	**
married	0.002	0.045	
family income	1.59E-07	3.28E-07	
age	-0.002	0.002	
college	0.153	0.121	
number of obs.	454		
pseudo R-squared	0.7805	obs. probability	0.2687225
pseudo log likelihood	-58.003206	pred. Probability	0.0853716

***significant at .01 ** significant at .05 *significant at .10

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Endnotes

[i] See "The U.S. Truck Driver Shortage: Analysis and Forecasts," paper prepared for the American Trucking Association by Global Insight, Inc.

[ii] ibid.

[iii] Rodriguez, et al. (2000), find that "the average cost of [driver] turnover … was $8,234 and ranged from $2,243 to $20,729," and that annual turnover rates in excess of 100% are common for firms in the industry. This suggests that firms are ignorant of the true costs of turnover on their operating margins. Standard industrial organization and bargaining theory implies that firms should be willing to pay up to the amount of turnover costs to the drivers in order to retain the services of the driver, thereby avoiding the costs of turnover. Rodriguez, et al. also find that most driver turnover is due to drivers changing jobs within the industry, rather than leaving the field. That firms continue to experience turnover rates of 100% or greater per annum suggests that drivers do respond to income or time incentives and will change jobs accordingly, but that firms do not adjust their payment or labor policies.

[iv] "Empty Seats and Musical Chairs: Critical Success Factors in Truck Driver Retention." Study prepared by the Gallup Organization for the American Trucking Association Foundation, October 1997.

[v] ibid.

[vi] See "Financial and Operating Statistics: Motor Carrier Annual Report," American Trucking Association (1991).

[vii] Conversely, this may also be viewed as a strategic organization decision made by trucking firms.

[viii] Payment schemes cover some measures of how drivers are paid. Specifically, whether drivers are paid for work related to the actual loading and unloading of the trailer, travel to pick up a trailer, and time spent waiting to load, unload, pick up or drop off a trailer.

[ix] Bonuses included on-time incentives, safety record bonuses and "other." Penalties included less desirable loads, missed/skipped assignments, monetary fines or other discipline.

[x] The type of employer was identified as "for hire" referring to firms whose primary business is trucking, or "private carriage," meaning firms that were in another line of business, but maintained a truck fleet.

[xi] The owner-operator classification includes drivers who are 100% contractually bound with a specific firm or carrier who might otherwise be identified as employees. However, these drivers are fully responsible for all costs associated with the operation and maintenance of their vehicles and, in some cases, their trailers. A relevant example is the contrast between UPS and Federal Express: UPS drivers are all employees and many are union members, while almost all FedEx drivers are independent contractors (owner-operators) who receive a company-designated territory and company-supplied "loads."

[xii] Belman, Monaco and Brooks (1998).

[xiii]For example, over 20% of Schneider National's drivers are owner-operators (approximately 3,000 out of driver force of 14,000). Source: http://www.schneider.com/ .

[xiv] Last week was defined as the previous 7 days in the survey. Owner-operators reported gross revenue, not strictly wages. This reflects the fact that as owners they are responsible for costs incurred, so their hourly "wage" may be less than what is reported.

[xv] This addresses the problem of multicollinearity in the estimation arising from the education variables. The variable for drivers with a high school education was dropped from the regression parameters. As a result, the value

for the constant term (β_0) represents the labor hours supplied by high school educated drivers. The other variables are then estimates of how differences in educational attainment affect labor hours supplied for other drivers against drivers with a high school diploma.

[xvi] See Borjas (2000), Chapter 2 , "Labor Supply."

[xvii] See Belman and Monaco (2001) and Belman, Monaco and Brooks (1998).

[xviii] See Belman and Monaco (2001) and Monaco (2005).

[xix] See Monaco (2005).

[xx] See Beilock (1995). It is interesting to note that Beilock's data was for truck drivers in Florida. The similarity in results with the UMTIP data, which is concentrated in the Great Lakes and Ohio River Valley region of the United States, points to the general applicability of the results nationally.

[xxi] Nickerson and Silverman provide a fairly comprehensive overview of most the standard industrial organization arguments in favor of owner-operators being the dominant form of employment organization in trucking.

[xxii] See Greene (1997).

[xxiii] See Monaco and Willmert (2003).

[xxiv] "Empty Seats and Musical Chairs: Critical Success Factors in Truck Driver Retention." Study prepared by the Gallup Organization for the American Trucking Association Foundation, October 1997.