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Geographic location, ownership and profitability of Washington log trucking companies

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Abstract. Deregulation of hauling rates can create more intense competition among log trucking companies within the industry, making it more difficult for firms to operate profitably. This paper investigates the role of ownership and geographic location in the profitability of commercial log trucking companies in Washington State, using data from an extensive 2007 log trucking survey. Overall, we found that profitability of the log trucking firm is significantly influenced by ownership and geographic location. Density positively affects firm profitability, indicating that benefits from clustering outweigh the decrease in hauling rates due to competition of spatially close trucking firms.

JEL classification: L25, R12, R30

Key words: Geographic location, ownership, firm performance, Washington log trucking

1 Introduction

Log trucking in Washington is characterized as an independent and small-operator-dominated industry. For many years, the Washington log trucking industry operated under state regulations, which controlled entry, set haulage rates, and established safety standards. As a result, the relationships between cost of operation and revenue per unit of output were effectively stabilized. However, due to the passage of the federal deregulation of the trucking industry in 1995, the intrastate commercial carrier industry in Washington, including log hauling, has been deregulated and thus the rate for commercial log hauling is determined by market demand and supply for the service. The deregulation of hauling rates creates more competition among log trucking companies within the industry, making it more difficult for firms to operate profitably. Consequently, there has been a significant decline in the number of Washington log truck companies. Previous investigation (Mason et al. 2008), has shown that many companies were operating below cost of operations due to highly variable current haul rate arrangements. A market-specific analysis by Woudsma and Kanaroglou (1996) on the impacts of trucking deregulation in the Ontario for-hire trucking industry also concluded that overall, there has been a decline in shipment rates in the truckload segment of the industry.

This paper investigates the role of firm ownership and geographic location (proximity to other firms), in the profitability of commercial log trucking companies in Washington State after the deregulation, using data from a 2007 log trucking survey. The majority of log trucking companies surveyed are located in Western Washington and appear to exhibit different operating characteristics based upon ownership form and the degree of geographic competition. We empirically estimate the relationship between firm characteristics (i.e., geographic location, ownership, and size), and firm profitability. Our findings indicate that ownership type and proximity have significant impacts on the profitability of the log trucking firms. In particular, *ceteris paribus*, a sole proprietorship log trucking firm tends to make less profit than a corporation log trucking company. The profitability and thus competitive success of a log trucking firm is significantly influenced by location. Log trucking firms tend to be more profitable when they cluster around the mills or forest sites where the demand for hauling service is concentrated. This indicates that the increase in the hauling demand and lowering in travel costs overweigh the decrease in hauling rate due to intense competition when firms locate near each other.

The remainder of the paper is organized as follows. Section 2 provides a brief description of the Washington log hauling industry regarding types of ownerships and hauling rates. Related existing literature on the relationship between firm characteristics and firm profitability is summarized in Section 3. Empirical model specifications and data are presented in Section 4. Section 5 discusses empirical results and Section 6 presents the conclusions of the study.

2 Washington log hauling industry

Washington State is ranked as the second largest state in lumber production in the United States, about 6 billion board feet per year, and fourth in production of both plywood and pulp and paper products (Mason et al. 2008). This industry relies mostly on truck transportation to move raw logs from the forest sites to mills or processing and export facilities. Washington lumber is often shipped locally or regionally and less so internationally (Perez-Garcia 2007). Log hauling firms are categorized as either private or for-hire. Private firms carry the goods owned by the firm while for-hire firms are hired by timber companies to haul logs from the forest sites to the destinations. This paper analyses only for-hire log hauling companies.

Major problems facing the Washington log hauling industry include increasing operating costs and low haul rates since the deregulation in the mid-1990s. Most timber companies have not changed their rates since deregulation. A study conducted by Washington State University and University of Washington reported that many independent log truckers find it increasingly difficult to sustain their business. According to this study, approximately 28 percent of log trucking companies reported that they lost money, about 50 percent broke even and only 21 percent made a profit in 2006 (Mason et al. 2008). Hauling rates are set by timber companies and then each independent log trucker can choose either to haul or not.

Of 129 surveyed log trucking companies, 67 percent of them were single-operators. Two types of ownership exist in the Washington for hire log trucking industry: sole ownership and corporation or limited liability company. Sole proprietorship is the most common and simplest form of business organization, in which a business entity is owned and managed by one person. The inseparability between ownership and management also means that taxes on a sole proprietorship are determined at the personal income tax rate of the owner. A corporation, owned by shareholders, is an independent legal and tax entity. The major difference between a corporation and a sole proprietorship is the separation between the owners and managers, with limited personal liability of the owners for business debts and claims (URL: http://www.themoneyalert.com/businesstypesofownership.html).

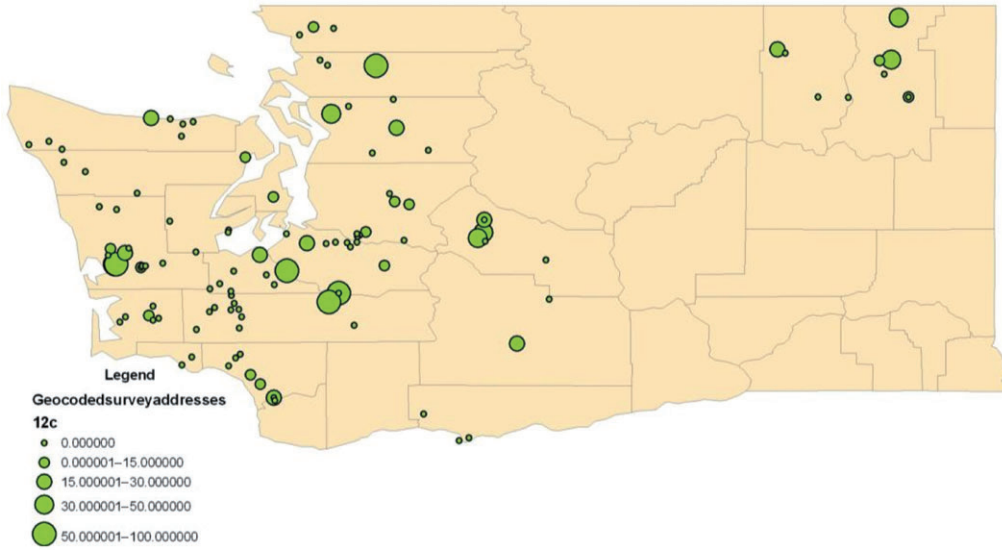

Fig. 1. Geographic location of sample log trucking firms
Note: The size and number of the green circle represents the annual net income from trucking.

The geographic locations of the surveyed log trucking firms are illustrated in Figure 1. Most of the log trucking companies are located in Western Washington. Figure 2 (from Perez-Garcia 2007) presents the number of annual log truck loads (in thousands) taking logs from the harvest sites and transporting them to mill clusters in Washington state for 2004. For example, an estimate of 132.7 thousand log truck loads (5 mbf/load) serviced the mill cluster in Grays Harbor county while only 1.1 thousand log truck loads were shipped to the mill in Yakima county. These figures show that there is a concentration of log trucking firms in the Grays Harbor, Thurston, Lewis and Cowlitz counties, where the forest product mill clusters are located or harvest occurs.

3 Related studies

The nature of the relationship between ownership, location, size and firm profitability is an important issue that may shed light on the factors affecting profits. In this section, some of the key findings in the literature on the impacts of those factors on firm profitability are presented and analysed.

3.1 Ownership and firm profitability

Empirical investigations of the relationship between ownership structure and firm performance have provided mixed results. Some studies found no effect of ownership on profits (Demsetz and Lehn 1985), while others found a positive significant effect (McConnell and Servaes 1990; Zeitun and Tian 2007), or a negative significant impact of ownership on the firms value and profitability (Leech and Leahy 1991).

Glancey (1998) argued that the motivations of professional managers with no ownership stake in the firm may be different from those of the owner-managers in smaller firms. In the

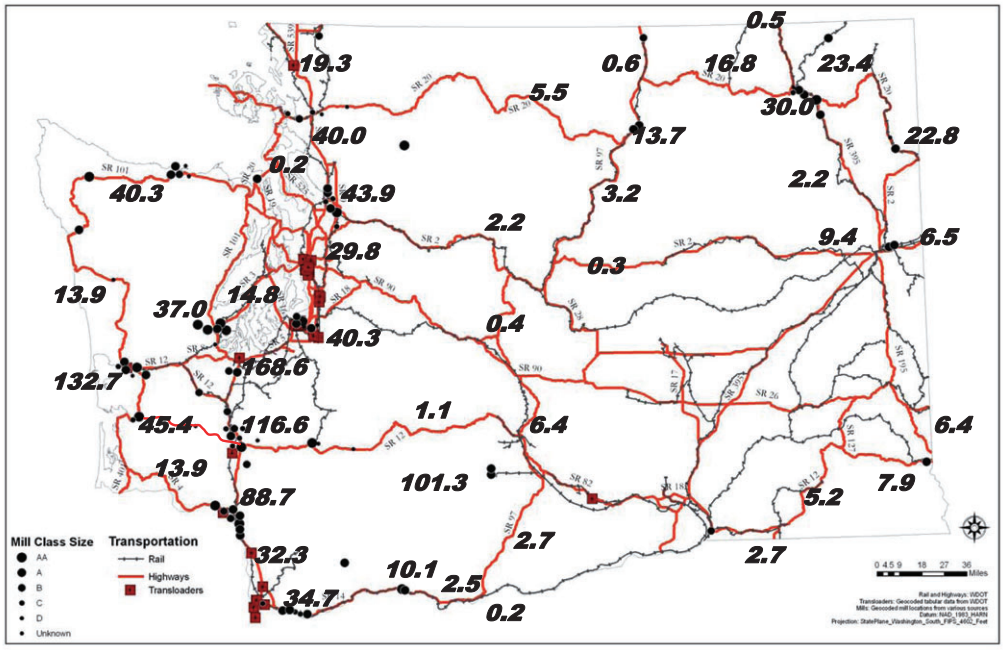

Fig. 2. Location and size of servicing mills (in terms of log truck loads) in Washington State
Source: Perez-Garcia (2007).

owner-manager firms, ownership and management are inseparable, making the manager more committed in pursuing his objectives. This contrasts fundamentally with the large corporate firm in which there is a separation between ownership and management. Ang et al. (2000) showed that companies with an owner-manager have lower agency costs and that agency costs decrease with the managerial ownership share but increase with the number of outside shareholders. However, McCann and Vroom (2009) found that professionally managed firms are more likely to engage in behaviours consistent with profit-maximization goals than owner-managers, and that the economic decisions of owner-managed firms are all relatively less responsive to the markets in which they operate.

A study by Stephan and Tsapin (2008) on the persistence of profit and its determinants in emerging markets of approximately 3,000 Ukrainian companies suggests that ownership structure and regional location of the firm have a significant impact. However, their empirical results provide no support for the hypothesis that there is a lower persistence of profits due to more intense competition.

3.2 Location, spatial competition and firm profitability

Location decisions significantly affect the profit margins and eventual success of a firm due to many variables, such as availability and proximity of raw materials and labour, proximity to customers and competitors, infrastructure and transportation costs, etc. (Schmenner 1994; Stevenson 2007; Schiele 2008). When prices and profit margins are fixed, firms choose their locations so as to maximize their profits by maximizing their demand (Hotelling 1929). As the number of firms in a market increases, each firm will be spatially closer to one of its rivals and

chooses a best price, given the perception that all other firms hold their prices constant (Salop 1979). As a result, the equilibrium price is a symmetric zero profit Nash equilibrium.

Three main benefits that firms obtain when locating near each other are labour market pooling, input sharing and knowledge spillovers (Marshall 1920). However, the benefits that firms could gain from locating near one another also depend on geographical distances and the similarity in business activities performed by firms. Firms anchored in clusters to form focal points can achieve, on average, higher productivity than isolated companies and consequently they can be more profitable. On the other hand, such agglomeration economies may also lead to intense competition, congestion, pollution and other negative externalities caused by the clustering of firms (Dudey 1990; Rocha 2008).

Numerous empirical studies on spatial competition among firms within various industries concluded that greater spatial concentration of sellers increases price competition, thereby lowering selling prices (Bresnahan and Reiss 1991; Nagel et al. 2000; Stewart and Davis, 2005; Turnbull and Dombrow, 2006). Syverson (2006) studied the spatial competition across markets and equilibrium prices for the ready-mixed concrete industry and found that average prices are lower in denser markets because the competition-driven selection effect drives out high-cost producers.

Similar to other industries, log products are manufactured at one location and then distributed to various markets. Distance imposes costs on the economic agents due to transportation costs and general frictions of distance. These spatial elements are considered to be significant for pricing practices and hence for competition among firms in the industry. Henrickson and Wilson (2005) constructed a model of transportation demand and the interrelated supply decisions of agricultural shippers over a geographic space. Their results provide strong evidence that transportation demands are elastic and that spatial market areas vary substantially with transportation rates.

3.3 Firm size and profitability

The current empirical research on the relationship of firm size and profitability also provides somewhat inconsistent results. Some of the studies report a positive relationship (Shepherd 1972; Demsetz 1973; Lee 2009), while others observe an inverse relationship between firm size and profitability (Haines 1970; Amato and Wilder 1985).

Demsetz (1973) stated that in highly concentrated markets large firms earn higher profits than smaller firms. He argued that the greater profits of large firms have a weak or even no connection with scale economies; rather it is the superior efficiency in management of large firms that rewards them in both growth and high profit. On the other hand, Scherer (1973) suggested that scale economies may be related to profit because of their advantages to serve as entry barriers and impose cost disadvantages on smaller firms. Recently, Lee (2009) examined the role of firm size in profitability for over 7,000 US firms during the period 1987–2006 and concluded that profit rates are positively correlated with firm size in a non-linear manner when holding other characteristics constant.

In summary, the literature suggests that the effects of ownership and firm size on firm profitability can range from positive to negative or no identifiable impact at all. It may be inferred from the current literature that the relationship between firm size and profitability may be positive within some range of firm sizes and become neutral or negative beyond that range. The argument is that increases in firm size may further separate ownership from management and thus, the relationship between firm size and profit can become negative beyond some threshold (Amato and Wilder 1985; Ammar et al. 2003). The relative influence of geographic location on firm profitability appears to be more consistent in the literature. Depending on

geographical distances and the similarity in business activities, firms can benefit from clustering near each other in terms of input factors availability, higher concentrated demand, transportation costs, and knowledge spillovers that make them more profitable. On the other hand, high concentration of firms can also lead to intense competition, thus lower prices that can cause firms to go out of business.

4 Model specification and data

Profitability is one important indicator of firm performance. The profit of a log trucking company is the difference between revenue from transporting logs and the total cost of moving logs to the required destinations. For a log trucking firm, hauling distance and weight act as proxies for shipment costs, such as fuel, labour, and maintenance. These elements make up over 80 percent of shipment costs (Bonsor 1984). Since the hauling rate is set by the timber company, the log trucking firm makes the decision whether to take the job based on the hauling rate it receives and its operating cost to do the job. When there is no negotiation for the hauling rate, for a given load, the only way for the log trucking firm to maximize profits is to improve productivity in order to reduce operating costs. However, a log trucking firm only can surivive in the long run if the hauling rate covers its total cost.

In a cross sectional analysis of the variation in profits within an industry the most common modelling procedure in the literature is the linear regression (Ruiz 2003), of the form: $\pi_i = X_i\beta + \varepsilon_i$ where π_i is the profit level of firm i and X is a vector of firm and market specific explanatory variables, such as firms productivity, ownership type, market density or concentration, etc. Based on previous related analyses and our available dataset, we therefore propose the empirical model of the following form to examine how geographic location and ownership affect the profitability P of log trucking companies:

$$P = \beta_0 + \beta_1 index + \beta_2 type + \beta_3 density + \gamma X + \varepsilon$$

The *index* variable is used to determine the effects of nearby competitors in terms of their sizes and distances on the profitability of the firm. This variable is constructed as follows.

$$Index = \sum_{j=1}^{5} \frac{distance_j}{size_j}$$

By the construction of this variable, a competitor having a larger value of this index would have smaller impact on the profitability of the firm. In other words, when a competitor is located farther away or has a small size or both, we would expect less influence from this competitor on the profitability of the firm of interest and thus the profit of the firm may increase. Inclusion of constructed variable *index* in the model will help to examine the impact of competitors locations and sizes on the profitability of the firm. Our pre-investigation result shows that this impact becomes more significant when including five closest competitor firms, thus we chose five closest competitors in the construction of variable index.

The variable *type* is a binary variable indicating whether the firm is a sole-ownership or a corporation company. If the value of this variable equals 1, then the firm has sole ownership and equals 0 if the firm has corporation ownership type. Inclusion of this variable in the model will help us to examine the impact of ownership structure on performance of the log trucking firm. When other things are equal, the estimate of coefficient on this variable indicates the difference in profitability between the two types of ownership. If this coefficient is estimated to be negative,

then a firm of sole-ownership is less profitable than a corporation. Conversely, if this coefficient is found to be positive, then corporation type is more profitable than sole-ownership type.

The variable *density* represents the number of log trucking competitors within a radius of 10 miles of the firm. Inclusion of the constructed variable *density* in the model will help to determine the effect of firm clusters, or concentration of nearby competitors, on the profitability of the firm. It might initially appear that variable *index* may also pick up some clustering effect and thus be highly correlated with *density*. However, our data inspection on the correlation coefficient between these two variables shows that this is not the case because the variable *index* takes into account the locations and sizes of competitors, which may locate far beyond 10 miles.

X is a vector of firm and market specific variables that might influence the profitability of the firm through other channels, other than the impact of the geographic location and ownership type. These include proxies for firm's efficiency and variables representing the local market demand for log hauling, such as firm size, maintenance time, operation time, hauling distance, and diesel price. Inclusion of these proxy variables in the model is to control for the cost-effects and the demand-effects on firm profitability. ε is the disturbance term. The coefficients on three variables *index, type, and density* are the estimates of our main interests.

We use two model specifications to estimate the empirical profit models for log trucking companies. In the first specification, besides the three main interest independent variables, we include three other explanatory variables: *size* to capture the size effects, *cost per mile* to directly control for the cost-effects, and *rate per mile* to control for the demand-effects, on the profitability of the firm. The number of operating trucks is used as the measure of firm size. The majority of the surveyed respondents reported that they are price takers, that is, the timber companies set the hauling rates and log truckers decide whether or not to take the job. Thus, we consider *rate per mile* to be exogenous. On the other hand, the variable *cost per mile* is potentially endogenous since operating costs of the firm are generally affected by firm's location, size, and ownership type. In this model specification, the dependent variable profit is the firm's profit gained in 2006 and measured in US dollars. We estimate the first specification of the profit model for the log trucking companies by using two-stage least squares (2SLS) estimation method. In the presence of endogeneity, the conventional ordinary least squares (OLS) estimation will lead to inconsistency of parameter estimates; therefore, 2SLS is used to correct for possibility of endogeneity in the variable *cost per mile*. The instrumental variables consist of the following: *hauling distance*, *maintenance*, *operation time*, and *diesel price*. Description of these instruments is provided in the next section. The condition that endogenous variable *cost per mile* is correlated with the instrumental variables is tested. The null hypothesis of no correlation is rejected at the 0.01 significance level.

In the second specification, in addition to the three main interest independent variables, *X* includes hauling distance, maintenance, operation time, and diesel price. Hauling distance. Hauling distance is the average one way of hauling distances. Operation time is the number of weeks that a log trucking firm operated in 2006. Maintenance is the number of hours per week that are normally required for maintenance on a log truck of a firm. Diesel price is the average diesel price per gallon in US dollars that the firm had to pay in 2006. In this model specification, the dependent variable is profitability, which is measured by net profit per each dollar of expenditure. Since this measure takes into account the firm size of business operation, the second model specification does not explicitly include explanatory variable Size as in the first specification when profit level is the dependent variable.

The second specification of the profit model for the log trucking companies is treated as a generalized linear model and estimated by maximum likelihood (Newton-Raphson optimization method). Generalized linear model (GLiM) is an extension of the linear modelling process that allows the response variable to follow any probability distribution belonging to the exponential family. Generalized linear models also relax the requirement of homoscedasticity of variances

Table 1. Summary statistics

Variable	Unit	Obs.	Mean	Std.Dev.	Min	Max
Profit	USD	78	43,167	19,897	2,073	96,214
Profitability	USD	78	0.522	0.35	0.014	1.764
Index	*	116	55.57	41.34	8.7	226.4
Type	*	116	0.57	0.5	0	1
Density	Firm	116	2.47	1.82	0	5
Size	Truck	116	2.64	4.02	1	28
Distance	Mile	113	68.09	31.36	17	200
Operation time	Week	102	43.37	6.99	11	52
Maintenance	Hrs/w	113	6.96	3.54	1.5	24
Cost per mile	USD	68	1.47	0.4	0.66	2.5
Rate per mile	USD	66	2.14	0.39	1.28	2.94
Diesel Price	USD	89	2.87	0.4	1.4	4

and normality of the error terms that is required for hypothesis tests in traditional linear models. Although it is more complicated to interpret the estimation results from the GLiM, the signs of the estimated coefficients can provide us with the direction of the relationship between the response and the covariates. In the presence of heteroscedasticity, OLS coefficient estimates are inefficient relative to GLiM estimates. Violation of the normality assumption may lead to unreliable test results. Our data inspection results for the distribution of the response variable suggests an estimation of the generalized linear model with Gamma distribution family and natural log link function to be most appropriate.

Both profit model specifications are estimated using the data collected from the 2007 log truck survey. Table 1 presents the descriptive statistics of all the variables of the model. The total number of firms responded to the survey is 129, but some firms did not provide complete information to permit their inclusion in the analysis. This explains why the number of observations in the models is reduced and not the same for all model estimation methods. On average, a log trucking firm in the sample earned approximately US$43,000 profit in 2006. More than half of these firms are sole-ownership. The average of one way hauling distance is 68 miles and the number of operating weeks is 43 for the firms in the sample.

5 Empirical results

Table 2 presents the estimation results of the main variables of interst in the first specification obtained by 2SLS estimation (column 2) and in the second specification by ML estimation (column 3). A complete estimation results for all variables are presented in Table 3. Because of the missing data in the sample, the number of observations available for 2SLS method is 44 and for the ML method is 62. The R-squared for the first model specification obtained by the 2SLS method is 0.739. Analogous to the residual sum of squares in linear regression, the deviance statistic is a measure for goodness-of-fit in a generalized linear model. The Akaike information criterion (AIC) statistic is also used to compare the goodness-of-fit of alternative non-nested profit models. Our chosen GLiM has the smallest AIC of 0.64 and deviance statistic of 19 among the alternative models. We also obtain the predicted mean of the response and calculate the correlation coefficient between the observed response variable and its predicted mean. The correlation coefficient is 0.511, which is similar to an R-squared from the OLS. However, the GLiM is more robust to the deviation of the homoscedasticity and normality assumptions in the classical linear model. Our data inspection suggests that there is some departure from these assumptions in the data but not to a severe extent.

Table 2. Estimation results for variables of interest

P	Specification 1	Specification 2
Index	134**	0.005**
	(–56)	(–0.003)
Type	–15636***	–0.313*
	(–4072)	(–0.177)
Density	2442	0.233***
	(–1641)	(–0.066)
N	44	62
R^2	0.739	0.511

Values in parenthesis are standard errors.
Estimated coefficients of *X*'s are omitted. See Table 3.
*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$.

Table 3. Estimation results of both specifications

Specification 1	2SLS	Std. error	Specification 2	GLiM	Std. error
Index	134**	(–56)	Index	0.005**	(–0.003)
Type	–15636***	(–4072)	Type	–0.313*	(–0.177)
Density	2442	(–1641)	Density	0.233***	(–0.066)
Size	–1144	(–802)	Distance	–0.005**	(–0.002)
Cost per mile	–38973***	(–13094)	Maintenance	–0.041*	(–0.023)
Rate per mile	41491***	(–8554)	Operation time	0.012	(–0.013)
			Diesel Price	0.161	(–0.216)
Intercept	12404	(–13745)	Intercept	–1.786	(–1.100)
N	44		N	62	
R^2	0.739		R^2	0.511	
$Adj.R^2$	0.697		Deviance	19.109	

Overall, the coefficient estimates on the variables of interest are statistically significant and their signs are consistent in both estimation methods. The positive coefficient estimate on *index* indicates that decreases in this variable are associated with declines in profitability of the firm. That is, when a competitor is located close to the firm or has a large size or both, it would have more competitive influence on the profitability of the firm and thus the profit of the firm may be driven down. The parameter estimate of this variable is statistically significant at the 0.05 level in both methods. This result emphasizes that the locations and size of the nearby competitors have an important impact on the profitability of the firm. If all five closest competitors are located far away from the firm or have small sizes or both, then the profitability of the firm is less affected compared to those competitors who are located close to the firm or have large sizes or both.

The ownership type appears to be a significant factor affecting firm profitability. The negative sign on the coefficient estimate of variable type implies that overall, in Washington State, a sole proprietorship log trucking firm is less profitable than a corporation log trucking company, *ceteris paribus*. In particular, when other things are held constant, on average, a firm of sole proprietorship would make a profit level of about US$15,600 less than that of a corporation company based on the results of the 2SLS estimation. Compared to the first model specification, the statistical significance level of this variable becomes weaker in the second model specification.

The coefficient estimate of the variable density, which represents the number of log trucking competitors within a radius of 10 miles of the firm, is positive in both specifications. High

density of competitors means more intense competition and so it is expected to have negative impacts on firm profitability. Moreover, the coefficient estimate of variable density becomes strongly significant with a positive sign in the second specification. This result seems rather contradicting; however, one possible explanation is that log trucking firms choose to locate where the demand is to maximize their demand and lower travel costs. That is, they tend to locate near the mills or near sources of raw materials, which are forest or logging sites. As observed, most of the log trucking firms are price takers because they cannot negotiate the hauling rate with the mills and their service products are relatively homogenous. Under these circumstances, Hotelling (1929) enunciated the principle of minimal differentiation, that is, firms choose their locations so as to maximize demand. Thus log trucking firms tend to cluster around the regional focal points, which are near the sources of demand, even if this means more intense competition. By doing that the firms clustering around the centre are able to lower their transportation costs and increase the demand for their hauling services more than the isolated firms. If the increase in the demand is not offset by a considerable decrease in hauling rates due to intense competition from a high density of competitors, then such location strategy may help firms make profits. Therefore, the positive effect of the density of competitors on firm profitability in the Washington log trucking industry provides evidence to support that the profitability and thus competitive success of a firm is significantly influenced by its geographic location.

6 Conclusions

Deregulation of hauling rates creates more competition among log trucking companies within the industry, making it more difficult for firms to operate profitably. This paper investigates the role of ownership and geographic location in profitability of the firm among commercial log trucking companies in Washington State, using data from the 2007 log trucking survey. We developed two empirical models and employed two estimation methods, 2SLS and ML, to examine the relationship between profitability of the firm with their ownership and geographic location. Overall, we found that ownership and geographic location have significant impacts on the profitability and therefore competitive success of the Washington log trucking firms.

In Washington State, a sole-proprietor log trucking firm tends to make less profit than a corporation log trucking company, *ceteris paribus*. Profitability of a firm having close competitors of large sizes is conversely affected. Our empirical results provide evidence that geographic proximity fundamentally affects firm profitability through the significant effects of the distances, sizes, and density of the nearby competitors. High density of competitors means more intense competition and thus is often expected to have a negative impact on firm profitability. However, we found a positive significant effect of density on the profitability of the log trucking firms in the second model specification. This result indicates that the increase in the demand for hauling services and lowering in travel costs are not offset by a decrease in hauling rates due to competition of clustering log trucking firms. This arises because the only raw materials of the log trucking industry are logs; thus, log trucking firms choose to locate near the sources of demand, for example, near the mills or logging sites, to minimize the costs and increase demand in order to maximize their profits.

References

Amato L, Wilder P (1985) The effects of firm size on profit rates in US manufacturing. *Southern Economic Journal* 52: 181–190

Ammar A, Hanna A, Nordheim V, Russell S (2003) Indicator variables model of firms size-profitability relationship of electrical contractors using financial and economic data. *Journal of Construction Engineering and Management* 129: 192–197

Ang J, Cole R, Lin W (2000) Agency costs and ownership structure. *Journal of Finance* 55: 81–106

Bonsor C (1984) *Transportation economics: Theory and Canadian policy*. Butterworth, Toronto

Bresnahan F, Reiss C (1991) Entry and competition in concentrated markets. *The Journal of Political Economy* 99: 977–1009

Demsetz H (1973) Industry structure, market rivalry, and public policy. *Journal of Law and Economics* 16: 1–9

Demsetz H, Lehn K (1985) The structure of corporate ownership: Causes and consequences. *Journal of Political Economy* 93: 1155–1177

Dudey M (1990) Competition by choice: The effect of consumer search on firm location Decisions. *The American Economic Review* 80: 1092–1104

Glancey K (1998) Determinants of growth and profitability in small entrepreneurial firms. *International Journal of Entrepreneurial Behavior & Research* 4: 18–27

Haines W (1970) The profitability of large-size firms. *Rivista Internationale de Science Economiche e Commerciale* 17: 321–351

Henrickson E, Wilson W (2005) A model of spatial market areas and transportation demand. *The Transportation Research Record* 1909: 31–38

Hotelling H (1929) Stability in competition. *Economic Journal* 39: 41–57

Lee J (2009) Does size matter in firm performance? Evidence from US Public Firms. *International Journal of the Economics of Business* 16: 189–203

Leech D, Leahy J (1991) Ownership structure, control type classifications and the performance of large British companies. *The Economic Journal* 101: 1418–1437

McCann B, Vroom G (2009) Ownership structure, profit maximization and competitive behavior. Working paper No.800, IESE Business School, University of Navarra

McConnell J, Servaes H (1990) Additional evidence on equity ownership and corporate value. *Journal of Financial Economics* 27: 595–612

Marshall A (1920) *Principles of economics*. McMillan, New York

Mason L, Casavant K, Lippke B, Nguyen D, Jessup E (2008) The Washington log trucking industry: Costs and safety analysis. Research report, Washington State University and University of Washington

Nagel K, Shubik M, Paczuski M, Bak P (2000) Spatial competition and price formation. *Physica A* 287: 546–562

Perez-Garcia J (2007) Forest products use of roadways and transload facilities in Washington. Report prepared for Research Office, Washington State Department of Transportation, Olympia, Washington 98504-7372

Rocha N (2008) Firm location determinants: Empirical evidence for France, HEID Working Paper No. 08

Ruiz I (2003) About the theory and empirical analysis of the persistence of profit and its applicability to Colombia. *Ecos de Economa* 16: 65–76

Salop S (1979) Monopolistic competition with outside goods. *Bell Journal of Economics* 10: 141–156

Scherer M (1973) The determinants of industrial plant size in six nations. *The Review of Economics and Statistics* 55: 135–145

Schiele H (2008) Location, location: The geography of industry clusters. *Journal of Business Strategy* 29: 29–36

Schmenner W (1994) Service firm location decisions: Some midwestern evidence. *International Journal of Service Industry Management* 5: 35–56

Shepherd G (1972) The elements of market structure. *Review of Economics and Statistics* 54: 25–35

Stephan A, Tsapin A (2008) Persistence and determinants of firm Profit in Emerging Markets. *Applied Economics Quarterly* 54: 231–253

Stevenson J (2007) *Operations Management* (9th edn). McGraw-Hill, Boston, MA

Stewart H, Davis D (2005) Price dispersion and accessibility: A case study of fast food. MPRA Working Paper No. 7617

Syverson C (2006) Prices, spatial competition, and heterogeneous producers: An empirical test. NBER Working Paper No. 12231

Turnbull K, Dombrow J (2006) Spatial competition and shopping externalities: Evidence from the housing market. *The Journal of Real Estate Finance and Economics* 32: 391–408

Woudsma G, Kanaroglou S (1996) The impact of trucking Deregulation in Ontario: A Market-specific analysis. *Canadian Public Policy* 22: 356–377

Zeitun R, Tian G (2007) Does ownership affect a firms performance and default risk in Jordan? *Corporate Governance* 7: 66–82

doi:10.1111/j.1757-7802.2011.01033.x

Resumen. La desregulación de los precios del transporte por carretera puede aumentar la intensidad de la competencia entre transportistas del sector de trozas de madera, dificultando que operen de forma rentable. Este artículo investiga el papel que juegan la propiedad y la localización geográfica en la rentabilidad de las empresas de transporte de trozas de madera en el estado de Washington, utilizando para ello datos de una amplia encuesta sobre el transporte de trozas en 2007. En general, observamos que la rentabilidad de cada transportista se ve influida significativamente por la propiedad de la empresa y la localización geográfica. La densidad afecta de manera positiva a la rentabilidad de la empresa, e indica que los beneficios de la aglomeración tienen mayor peso que la disminución en los precios de transporte debidos a la competencia de empresas de transporte espacialmente próximas.

要約　輸送費の規制緩和は木材運搬業界に競争激化をもたらし、業者が利益をあげることが困難になる可能性がある。本論文では、ワシントン州の民間木材運搬業者の収益力における経営形態と立地の役割を、2007 年に実施した木材運搬の実態調査のデータを基に分析する。概して、木材運搬業者の収益力は経営形態と地理的な立地に左右される。同業者密度の高い立地では、企業の収益力にプラス効果があり、競争激化による輸送費下落に勝るベネフィットが得られることを示す。