Journal of Transportation Management

Volume 12 | Issue 2 Article 5

9-1-2000

The impact of state taxes on the development and growth of the trucking industry

Thomas Lambert
Spalding University

Hokey Min
University of Louisville

The impact of state taxes on the development and growth of the trucking industry

Cover Page Footnote
The authors would like to thank Mr. Harold Bernard of the Kentucky Motor Transport Association (KMTA) and Mr. Jerry Sample of Tyme-lt Transportation for their financial support for this research. Special thanks go to all the KMTA and National Motor Carrier Directory members who willingly responded to the mail questionnaire and provided valuable insights into this study.

THE IMPACT OF STATE TAXES ON THE DEVELOPMENT AND GROWTH OF THE TRUCKING INDUSTRY

Thomas Lambert
Spalding University

Hokey Min
University of Louisville

ABSTRACT

The presence of certain state taxes is believed to have a negative impact on truck registration and the location decisions of trucking firms. For example, in a metropolitan area that covers two or more states, a trucking firm might not choose to locate in the county that is in close proximity to the metropolitan area's business districts, population centers, and largest concentration of customers, if that county is in a state that imposes the taxes. Instead, it might choose to locate in a county that belongs to another state that does not impose such taxes as long as that county is adjacent to the metropolitan area's most industrialized districts. This paper examines the impact that state taxes have on the very competitive trucking industry. Through a case study of Kentucky, we illustrate how state taxes such as the motor vehicle usage tax and the weight distance tax can adversely affect the trucking firm's decisions in registering and plating trucks, and in locating its facilities.

BACKGROUND

On the average, a typical U.S. trucking firm earns only 3 to 4 cents on the dollar after taxes, compared to the 7 to 9% average profit margin of the heavy manufacturing industry (Dun and Bradstreet, 1999). As such, there is a growing concern regarding the profitability of the U.S. trucking industry, despite strong shipment growth and a moderate increase in freight rates over the last few years. Such anxiety partially originates from volatile fuel prices, and chronic truck driver shortage and retention problems. To make matters worse, some states such as Kentucky, still levy taxes on regionally based trucking firms and their assets. These taxes include the motor vehicle usage tax (MVUT) and the weight distance tax (WDT). These taxes can further reduce the trucking industry's thin profit margin and exacerbate its competitiveness.

For instance, in Kentucky where both MVUT and WDT are still intact, it has the second highest trucking business failure rate among eight neighboring states (see Appendix A). Such a high business failure rate is puzzling, given that the average revenue per trucking establishment in Kentucky during 1997 was above the national average and far greater than those of three neighboring states (Missouri, Virginia, and West Virginia) (See Appendix D). Many trucking firms believe that Kentucky's unique tax policy is the culprit.

Kentucky's MVUT is similar to taxes charged in many other states. It is basically a sales tax on all motor vehicles, including the rolling stock purchased by trucking firms. Some states, such as Kentucky, make all rolling stock fully taxable, whereas others cap the tax at a maximum fee or apportion it according to mileage driven in state. The last two methods are often less of a burden than those imposed by full coverage. Florida apportions sales taxes so that the more a truck is driven out of state, the less its owner pays. Some states, such as Indiana, exempt rolling stock from usage/sales taxation completely (*American Trucking Association*, 2000).

For example, a $100,000 purchase of rolling stock by a trucking firm that chooses to register and plate the truck in Kentucky, results in the owner having to pay an additional $6,000 in usage/sales taxes (6% sales tax ´ $100,000). In Indiana, where rolling stock is exempt from that state's sales taxes, an owner would not have to pay $6,000. A trucking firm owner in Kentucky would do better to license his/her truck in Indiana and buy parts or rolling stock from an Indiana supplier than to conduct such transactions in Kentucky. In states where there is a cap, like North Carolina or Vermont, the owner pays a pro-rated amount of what the tax bill would ordinarily be. Since equipment costs account for 34.3% of a truckload carrier's costs, MVUT can raise an owner's cost of capital substantially and thus can be perceived as an economic burden by the carrier (Boyer, 1998).

Kentucky's weight distance tax (WDT) is unique in that Kentucky is one of only four states (Kentucky, New York, New Mexico, and Idaho) that levy such a tax. Weight distance taxes also have been called ton-mile taxes or ton-axle taxes in other states because the intent of such taxes is to penalize the heaviest users of roadways and those who cause the greatest amount of depreciation in highway pavement and infrastructure. Thus, the owners of large, heavy commercial trucks pay a greater amount in taxes to a state's road fund than would the owners of much smaller vehicles. These trucks usually have five or more axles for both tractor and trailer and usually weigh around 60,000 pounds or more. From a public finance standpoint, such a tax makes sense if the heaviest user of a public good can be identified.

The dilemma is whether the user can pay the tax, and if so, can the tax be collected in a fair and efficient manner using self-reports. If not, some trucking firms will take the opportunity to "cheat" on taxes. Their marginal costs of creating road depreciation and restoration are borne by someone else (Boyer, 1998). In this situation, collecting the tax in a fair and efficient manner becomes problematic, since typical trucking firms cross many jurisdictional lines and self-report the taxes. To make matters complicated, there is no reciprocity among the states to collect these types of taxes that are different from fuel taxes and registration fees. In the past, both Ohio and Wyoming eliminated WDT because of the paperwork burden, the cost associated with the maintenance and expansion of ports of entry, and high rates of tax evasion by firms that were headquartered out of state (Smith and Associates, 1981; Curran and Stewart, 1982).

The main purpose of this study is to examine whether MVUT and WDT were detrimental to the state's trucking industry development and growth. In so doing, we analyzed available secondary data summarized in Appendices A though D and then conducted an empirical survey of trucking executives.

RESEARCH METHODOLOGY

By examining secondary data sources such as the Census Bureau's *Censuses of Transportation* (1982, 1987, 1992, and 1997); *County Business Patterns* (1967 to 1996); *Vehicle Inventory and Use Surveys* (1982,1987, 1992, and 1997); and *Censuses of Manufactures* (1982, 1987, 1992, and 1997) along with business failure rate records from *Dun and Bradstreet* (1999), we found Kentucky's trucking industry to be less profitable than most of the neighboring states. Kentucky and its major urban areas were behind other localities regarding the average size and number of trucking establishments, the number of trucks registered in each state, and the percentage of the area's workforce devoted to trucking. Although Kentucky had made strong gains in manufacturing over the years, and its labor force was roughly the same size as Tennessee's and Virginia's, the trucking industry did not do well when compared to surrounding states' trucking industries (See Appendices A through D).

Sample

In an effort to assess how the managers or owners of a firm felt about the state's MVUT and WDT, a special mail questionnaire was developed for trucking executives whose firms are based in Kentucky and Indiana. The questionnaire contained various questions related to the size of the fleet owned by the responding firms, their annual gross revenue, the primary location of truck registration and plating, the perceived effects of MVUT and WDT on the responding firm's trucking establishments and operations, and business climate with regard to the trucking industry. A sample of 500 respondents was randomly selected from both the *Kentucky Motor Transport Association (KMTA)* members and the *National Motor Carrier Directory* (1999) members based primarily in the states of Kentucky and Indiana. A survey was sent out in the fourth quarter of 1999 and some responses were received into early 2000. From this sample, a total of 112 trucking companies responded to the questionnaire. This produced a usable response rate of 22.4% that is higher than the 20% cut-off rate that is considered desirable for a valid survey (Yu and Cooper, 1983).

For-hire carriers made up 79.3% of the respondents. About half (54.4%) of the respondents had medium to large size trucking fleets (i.e., 11 trucks or more). More than half (60%) of the respondents turned out to be large carriers that reported annual revenues of $1 million or more. Before it was dismantled in 1995, the Interstate Commerce Commission (ICC) classified large carriers as those that engaged in interstate transportation and had revenues of $1 million or more (Silverman et al., 1997). A majority (70.1%) of the respondents said their trucks are primarily licensed or plated in Kentucky. Some of the responding firms' trucks are licensed or plated in Indiana (10.3%), Tennessee (6.2%), Illinois (4.1%), Ohio (4.1%), and other states (5.2%). More than half (57%) of the trucking firms that plate the majority of their trucks in Kentucky are small carriers who own less than 10 trucks. None of the large carriers (i.e., those fleets totaling 50 or more trucks) had vehicles plated in Kentucky. With these numbers, one can see how a great number of all firms' trucks could be plated out of state although 70% of the firms indicated that their trucks are primarily licensed or plated in Kentucky.

"Plating" a truck is the payment of a license fee to a state. Plating a truck in a particular state should indicate where the truck's main terminal is located, but this is not always the case. Registration fees vary from state to state, and how much a company has to pay in registration fees to a state depends upon how many miles the company's trucks drive in that state for a given year. If a truck owner plates a truck in a particular state, he/she ends up paying first year registration fees to that state for distribution to all states in which the truck plans to operate, based upon projected use of the truck. If a new truck is plated or licensed or registered in Kentucky, then it pays its fees to the Commonwealth of Kentucky. If a Kentucky licensed truck drives any distance in Indiana, Illinois, Tennessee, and/or any other state, then

it must pay its part of its Kentucky fees to these states based upon the number of miles driven within each state. For example, an 80,000 pound Kentucky licensed truck that is driven 30% of the time in Kentucky, 40% of the time in Indiana, and 30% in Tennessee will pay 30% of its roughly $1,260 registration fee to Kentucky, 40% to Indiana, and 30% to Tennessee.

Considering that some trucking firms tend to register and plate their trucks out of state to minimize tax payments, we asked respondents about their "plating" decisions and why they decided to register and plate a truck as they did. MVUT appeared to heavily influence plating decisions, since 60% of the respondents agreed that Kentucky's MVUT makes it too expensive to buy trucks and parts in the state (see Table 1). Almost half (49%) of the respondents agreed that Kentucky's WDT makes it costlier to plate their trucks in the state. On the other hand, a majority of the respondents seemed to agree that the amount of required paperwork, and the demand for a local firm's services did not matter when it came to plating decisions (see Table 1).

Because of the WDT and MVUT, there is an incentive to plate and register trucks in a state other than Kentucky. To minimize the WDT payment, owners in Kentucky have an incentive to report more miles driven in other states. Fuel taxes are reported separately from WDT records. To avoid Kentucky audits for the WDT, a truck owner might report that its truck drove 30% of its miles in Kentucky, and 70% in Indiana for the WDT payment (although the breakdown might actually be 50/50 for fuel taxes). Furthermore, it would probably be in the owner's best interests,

TABLE 1
DETERMINANTS AFFECTING THE TRUCKING FIRM'S PLATING DECISIONS

Determinants	The Degree of Agreement*				
	SA	A	A/D	D	SD
Kentucky's motor vehicle tax makes it too expensive to buy trucks and parts in the state.	48.0%	12.0%	2.0%	10.0%	28.0%
If the motor vehicle tax were repealed, our firm would plate all of its trucks in Kentucky.	36.0%	18.0%	12.0%	6.0%	28.0%
Our suppliers and customers are located over a vast area.	21.7%	28.3%	20.0%	19.6%	10.4%
Kentucky's weight distance tax makes it costly to plate our trucks in the state.	39.2%	9.8%	15.7%	15.7%	19.6%
Kentucky has a bad labor climate compared to other states.	18.0%	18.0%	40.0%	14.0%	10.0%
Kentucky's labor force is not adequate so we must locate trucks elsewhere.	10.9%	26.1%	32.6%	17.4%	13.0%
Kentucky's safety regulations make it costlier to plate trucks in the State.	22.0%	10.0%	34.0%	16.0%	18.0%
Kentucky requires too much paperwork in order to plate a truck within the state.	12.0%	16.0%	42.0%	18.0%	12.0%
There is insufficient demand in Kentucky for our firm's services	12.0%	16.0%	26.0%	18.0%	28.0%

*SA = Strongly Agree A = Agree A/D = Neither Agree Nor Disagree D = Disagree SD = Strongly Disagree

as long as the firm remains close to its customers, to physically relocate to another state where he/she will report more miles driven within that state and/or other states. Doing this will help the owner to minimize WDT payments and the possibility of an audit.

There is no reciprocity among states to collect the WDT as there exists with the collection of fuel taxes. It also entices the owner to plate his/her trucks in the state that does not have a WDT. This can also be done to avoid Kentucky's MVUT. Most records on how much and where the truck travels will come from a firm's fuel tax reports that are mandated by all 50 states under the Interstate Fuel Tax Agreement (IFTA). These reports help reallocate and readjust gas tax receipts from state to state. If gas taxes are paid by a truck driver who fills up his tank in Louisville, and yet the fuel is used in Indiana, then all taxes collected in Louisville should go to Indiana.

Considering the additional tax burden, some firms (41.5%) indicated that they had thought about moving their business from the state. More than one third of the respondents (40.2%) doubted that all firms accurately report their mileage driven in the state of Kentucky. Also, due to perceived adverse effects of MVUT and WDT, some firms (44.4%) would prefer to pay more in registration fees and diesel fuel taxes than to pay the MVUT and WDT (see Table 2).

Since Tables 1 and 2 show a large number (a total of 16) of constructs, the authors needed to identify a smaller set of common factors that account for most of the observed variation in responses. An exploratory factor analysis of the responses served this purpose. The factor analysis was used to determine the minimum number of common factors needed to explain correlation among the factors using the eigenvalue greater-than-one rule. To obtain a more meaningful representation of the factor structure, we used the *Varimax* rotation with *Kaiser Normalization*. As summarized in Table 3, we extracted four common factors: (1) tax burdens; (2) business climate; (3) business hassles; and (4) interstate operations. These factors may have affected a trucking firm's decisions to plate a truck out of state.

Hypothesis Development and Testing

Based upon the sample described earlier, we developed the following key hypotheses to validate the economic implications of MVUT and WDT for Kentucky's trucking industry.

H_1: A trucking firm's perception that Kentucky's MVUT makes it too expensive to buy trucks and parts in the state significantly influences its decision to register and plate trucks out of state.

Considering the added capital cost resulting from MVUT, we attempted to examine whether the presence of MVUT has affected the trucking firm's decision to register, plate, and locate out of state. For example, we discovered that some trucking firms had left the city of Louisville and Jefferson County in Kentucky and had relocated to an adjoining county across the Ohio River in southern Indiana where neither MVUT nor WDT was imposed. Among the respondents whose firms are headquartered in and/or have substantial operations in Kentucky, a majority indicated that their trucks are primarily registered or plated out of state, such as in Indiana, Illinois, and Tennessee.

The premise is that the MVUT discourages the trucking firm to register, plate, or establish in Kentucky. To test such a premise, we paired the dummy dependent variable (1 = a decision to register or plate trucks out of state, 0 = a decision to stay in Kentucky) with the independent variable "the degree of agreement with the statement that Kentucky's MVUT makes it too expensive to buy trucks and parts" (1 = strongly disagree, 5 = strongly agree). The result of the regression supports H_1 at $\alpha = .05$ (*p-value* = .0265).

H_2: A trucking firm's perceived burden of Kentucky's WDT significantly influences its decision to register and plate trucks out of state.

TABLE 2
PERCEIVED TAX BURDENS AND THEIR EFFECTS ON TRUCKING ESTABLISHMENTS AND GROWTH

Perceived Tax Burdens	The Degree of Agreement*				
	SA	A	A/D	D	SD
All trucking firms, whether based in Kentucky or out of state, do their best to accurately report the number of miles they drive within Kentucky.	22.5%	25.2%	12.1%	24.3%	15.9%
Aside from some problems, our firm is very competitive with out-of-state-based competition.	13.1%	31.8%	23.4%	26.2%	5.5%
It would be better for our firm to pay more in registration fees and diesel fuel taxes than to continue to report and pay the weight distance tax and/or motor vehicle usage tax.	25.5%	18.9%	26.4%	14.2%	15.0%
Our firm has thought about leaving the State of Kentucky.	28.3%	13.2%	24.5%	13.2%	20.8%
Kentucky's motor vehicle usage and weight distance taxes make it difficult to expand our business.	22.5%	16.8%	22.4%	19.6%	18.7%
Aside from some problems, Kentucky has a very good business climate for the motor freight industry.	6.5%	28.0%	26.3%	28.0%	11.2%
Exemption from the motor vehicle usage tax was a factor in our firm's decision to locate in an enterprise zone or to stay in an area that was later declared an enterprise zone or part of an enterprise zone.	23.1%	11.5%	38.5%	11.5%	15.4%

*SA = Strongly Agree A = Agree A/D = Neither Agree Nor Disagree D = Disagree SD = Strongly Disagree

Similar to hypothesis H_1, trucking firms are expected to move away from a state (Kentucky) where the WDT is imposed. Also, WDT is difficult for the trucking firm to monitor. Thus, we posit that the trucking firm tends to register or plate trucks out of state to avoid the WDT. We paired the dummy dependent variable (1 = a decision to register or plate out of state, 0 = a decision to stay in Kentucky) with the independent variable "the degree of agreement on the perceived impact of the WDT on the expense of plating" (1 = strongly disagree, 5 = strongly agree). Contrary to expectations, the regression results indicate that there is no statistically significant relationship between these variables at $\alpha = .05$ (*p-value* = .6053).

H_3: A trucking firm's concern over the inadequate labor force in Kentucky significantly effects its decision to register and plate trucks out of state.

Considering a record low unemployment rate and the subsequent labor shortage (especially among truck drivers) in Kentucky, it was assumed that the labor shortage contributed to the departure of some trucking establishments. To test this hypothesis, we measured the independent variable, "the degree of agreement on the perceived labor shortage in Kentucky" on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). This variable was paired with the same dummy dependent variable that we used in the

TABLE 3
FACTOR ANALYSIS RESULTS

Factors and Items	Loadings
Factor 1: Tax Burdens of MVUT and WDT (Eigenvalue: 7.378)	
1. The MVUT and WDT make it difficult to expand business.	.968
2. If the MVUT were repealed, firm would plate all trucks in Kentucky.	.914
3. Willingness to pay more in registration fees and diesel fuel taxes than to continue to report and pay MVUT and WDT.	.912
4. Firm has thought about leaving the state.	.877
5. MVUT makes it difficult and too expensive to buy trucks and parts.	.871
6. If WDT were repealed, firm would plate all trucks in Kentucky.	.850
7. Exemption from MVUT was a factor in locating in an enterprise zone.	.757
8. WDT makes it too costly to plate in Kentucky.	.704
Factor 2: Business Climate (Eigenvalue: 5.318)	
1. Kentucky has a very good business climate.	-.916
2. Kentucky has a bad labor climate.	.863
3. Kentucky's labor force is not adequate.	.813
4. Kentucky's safety regulations make it costlier to plate trucks in the State.	.753
Factor 3: Business Hassles (Eigenvalue: 1.879)	
1. Too much paperwork to plate a truck.	.971
2. Insufficient demand for services.	.793
3. Suppliers and customers are located over a vast area.	.615
Factor 4: Interstate Trucking Operations (Eigenvalue: 1.292)	
1. Accurate report of the number of miles driven within Kentucky.	.917
2. Competitiveness in out-of-state trucking.	.901

Reliability Coefficient = .9018

previous two hypotheses. The regression analysis indicates that the decision to register or plate out of state is significantly related to the inadequate labor force in Kentucky at $\alpha = .05$ (*p-value* = .0172). Somewhat congruent with this result, more than one-third (36%) of the respondents agreed that Kentucky has a bad labor climate compared to other states (see Table 1).

H_4: A trucking firm's resistance to costly safety regulations in Kentucky significantly effects its decision to register and plate trucks out of state.

Safety regulations could have caused trucking companies to relocate due to increased safety standards on trucks and subsequent cost increases that accompany compliance. Thus, we hypothesized that Kentucky's safety regulations had driven some firms out of the state. Results of the regression, however, forced the rejection of this hypothesis. In other words, no significant relationship between the trucking firm's registration/plating decision and the degree of agreement on the negative consequence of safety regulations at $\alpha = .05$ (*p-value* = .0908) was found.

H_5: A trucking firm's resistance to excessive paperwork requirements in Kentucky significantly effects its decision to register and plate trucks out of state.

In the case of both Wyoming and Ohio, the burden of the paperwork necessary for compliance with the WDT was one of the main reasons why WDT was made a candidate for repeal in those states. Therefore, we made a premise that the excessive paperwork requirement is yet another reason for plating a truck out of state. Contrary to our expectation, this hypothesis was rejected at $\alpha = .05$ (*p-value* = .6826).

H_6: The trucking establishment in a state (as measured by the number of general freight, long-distance, 5-axle trucks registered in the state for a given year) is inversely related to the presence of WDT, MVUT, diesel taxes, and/or registration fees.

Kentucky's situation raises questions as to whether trucking firms throughout the nation engage in the same tax avoidance behavior. To see if Kentucky's situation can be generalized to other states, we attempted to examine whether various taxes have negative consequences on trucking establishments in any given state. In particular, we used the number of general freight, long distance trucks as a surrogate measure for the number of trucking establishments in a given state. The rationale is that less-than-truckload (LTL) and/or short-haul carriers do not usually have very large trucks that would be covered by the WDT and usually do not travel outside of a limited geographic area. These carriers have to stay very close to customers, due to the perishable nature of their freight such as milk, frozen foods, and agricultural products. These regional LTL carriers are often exempted from state taxes. In Kentucky, for example, many LTL carriers that exclusively ship agricultural goods are exempt from various taxes that other trucking firms must pay.

Considering the possibility that some trucking firms would locate their trucks out of state to avoid taxes, we postulated that the number of registered trucks (large, general freight, commercial 5-axle trucks weighing at least 60,000 pounds) is likely to be smaller in states which have one or more taxes such as MVUT, WDT, and diesel fuel taxes than in those states which do not impose such taxes. Similarly, registration fees may have effected trucking establishments in a given state adversely.

Prior to testing the above hypothesis, we developed a fifty state database using the quinquennial publications of the *Census of Transportation, Census of Manufactures,* and *Vehicle Inventory and Use Survey* for the years 1987, 1992, and 1997. In addition, tax data was gathered from the American Trucking Association (ATA). As a preliminary testing procedure of hypothesis H_6, we measured to what degree a relationship exists between dependent and independent variables through correlation matrices summarized in Table 4. Since significant correlations were identified among the independent variables at $\alpha = .05$, we conducted additional statistical tests by using step-wise regression to eliminate redundant independent variables such as WDT and diesel fuel taxes.

Test results shown in Table 5 indicate that the trucking establishment, in terms of number of registered trucks in each state, is inversely related to the presence of MVUT, whereas the number of trucking establishments is positively related to the presence of registration fees at $\alpha = .01$. On the other hand, both WDT and diesel fuel taxes per gallon are not significantly correlated with the number of trucking establishments. Therefore, H_6 is not fully supported by our test results.

TABLE 4
CORRELATION MIX

	Number of Trucks	MVUT	WDT	Diesel Fuel Tax	Registration Fees
Number of Trucks	1.0				
MVUT	-.213**	1.0			
WDT	-.122	.051	1.0		
Diesel Fuel Tax	.201**	.043	-.237**	1.0	
Registration Fees	.273**	.015	-.323**	.418**	1.0

**p < .01

TABLE 5
STEPWISE REGRESSION RESULTS

Dependent Variable: Number of general freight, long-distance, 5-axle trucks registered in each state at a given time

Independent Variables	Unstandardized Slope Coefficient	Standard Error	Standardized Coefficient (Beta)	Significance Level
Constant	6951.004	3573.593		.000
MVUT	-4705.410	1675.423	-.217	.006**
Registration Fees	10.296	2.877	.277	.000**
WDT	Excluded	Excluded	Excluded	.768
Diesel Fuel Tax	Excluded	Excluded	Excluded	.177

F-ratio = 10.204, significant at p < .01 **p < .01

One thing to note is that there is a significantly positive relationship between the number of trucking establishments and the presence of registration fees. This is contrary to expectations, but could explain why most of the respondents prefer to pay registration fees over the MVUT. Perhaps reporting and paying registration fees are much easier to administer and require less paperwork than paying the MVUT. Higher registration fees have been used in the past in many states to replace the revenue lost from the repeal of the WDT. Another rationale may be that higher registration fees are not an administrative burden.

Also, states that have the strongest demand for trucking services and travel might be able to charge higher fees to all trucks coming into their state because truck registration fees are based upon the number of miles that a truck drives in each state. Those states in which a lot of miles are driven can charge higher fees, because carriers have inelastic demand for those states' roadways. Finally, if business is good enough,

and shipments to or from a particular state are very high, higher fees are not problematic for trucking firms.

H_7: The trucking establishment in a state (as measured by the number of general freight, long-distance, 5-axle trucks registered in the state for a given year) is positively correlated with the value of manufactured goods shipped from each state.

Costelleo and Saltes (2000) recently observed that growth patterns in revenues for the trucking industry are strongly linked to increases in consumer spending and manufacturing activity. In other words, trucking firms tend to adjust their shipping volume and the subsequent trucking establishment as demand increases. Since trucks shipped 75% of all manufactured goods in 1993 and 78% in 1997, we feel that the value of the manufactured goods shipped is a good proxy value for the demand of trucking services. Therefore, we posit that the value of goods shipped should be a good indicator of the number of trucks (or trucking establishments) in a given state.

To test the above hypothesis, we paired the independent variable "value of goods shipped" with the dependent variable "trucking establishment." Both correlation and simple regression analyses indicate that the value of goods shipped has a strong positive relationship with the number of trucking establishments (in terms of number of trucks) at $\alpha = .01$ ($r = .768$ and *p-value* = .000).

MAJOR FINDINGS AND IMPLICATIONS

This section summarizes key findings of the study and the practical implications for trucking firms who must cope with stringent state tax and regulatory policies.

First, the MVUT is perceived to be a heavy burden for most of the responding firms and consequently has become a major motivating factor behind some firm's attempts to move away from Kentucky. It would be better for a Louisville trucking firm to locate in southern Indiana, register its trucks there, and buy rolling stock in southern Indiana in order to avoid paying $.06 for every dollar of capital equipment bought because Indiana does not levy such a tax. An office headquartered in southern Indiana could be a simple one-room operation while the company's main operations remain in Kentucky, or the whole company and its facilities could move to southern Indiana.

Considering that the MVUT can substantially increase the owner of a trucking firm's cost of capital, it is not surprising to find that Kentucky has relatively few trucking establishments with 100 or more employees (see Appendix B). However, defying our common sense, neither the WDT nor diesel fuel tax appeared to be an important deterrent to the number of trucking establishments in a given state. As evidenced by our 50 state data analyses, such a pattern can be generalized to other states. Similarly, strict safety regulations and excessive paperwork requirements have no significant influence on the trucking firm's plating and registration decisions.

Second, we discovered that registration fees were *positively, not negatively* correlated with trucking establishments. The positive sign for registration fees can be explained by the mutually exclusive tax policy of many states. By examining the data for the 50 states, those states that have higher than average registration fees usually do not have the MVUT. These states, on average, also have a higher number of registered large trucks and trucking establishments in their jurisdictions. Perhaps this is one of the reasons why the registration fee increase is the most commonly chosen alternative, whenever the MVUT, the WDT, or another form of taxes on trucks is repealed and/or replaced by increases in other taxes.

Finally, despite a dramatic increase (by 102%) from 1987 to 1992 in the amount of manufactured goods shipped in Kentucky and its positive impact on the trucking industry, the number of heavy trucks registered in Kentucky has shown anemic growth. As a matter of fact, Kentucky

ranked first among eight neighboring states we examined with respect to value of goods shipped, but ranked last with respect to growth in trucking firms (or the number of trucks). In particular, we find that the number of trucks used by for-hire and owner-operated carriers located in Kentucky declined between 1987 and 1997. This disparity may have stemmed from the fact that out of state firms, who are free from additional tax burdens, and consequently become more price competitive than Kentucky-based firms, take some trucking business away from Kentucky. The verification of such a fact requires further research.

ACKNOWLEDGEMENTS

The authors would like to thank Mr. Harold Bernard of the *Kentucky Motor Transport Association (KMTA)* and Mr. Jerry Sample of *Tyme-It Transportation* for their financial support for this research. Special thanks go to all the *KMTA* and *National Motor Carrier Directory* members who willingly responded to the mail questionnaire and provided valuable insights into this study.

REFERENCES

Boyer, Kenneth D. (1998), *Principles of Transportation Economics,* Reading, MA: Addison-Wesley.

Costello, Bob and Saltes, Diego (2000), "Demand for Trucking Services is Up Overall," *Trucking Economic Review*, First Quarter, 2000, Alexandria, VA: The American Trucking Association.

Curran, Donald and Stewart, Douglas (1982), *An Analysis of Highway Finance in Ohio: Current Practice and Alternative Approaches.* Prepared for the Ohio Department of Taxation by The Urban Center, College of Urban Affairs, Cleveland State University, Cleveland, OH.

Dun and Bradstreet Information Services (1999), *Industry Norms and Key Business Ratios, 1998-99,* Murray Hill, NJ: Dun and Bradstreet, Inc.

National Motor Carrier Directory (1999), New York: Transportation Technical Services, Inc.

Stalknecht, Paul (2000), "The Future of Transportation," remarks by Paul Stalknecht, Senior Vice-President of the ATA, before *the Military Traffic Management Command Training Symposium*, April 4, 2000, Atlanta, GA. Published in the April 12, 2000 edition of the ATA's *Truckline.*

Wilbur Smith and Associates (1981), *Highway User Fee Study*. Prepared for the Wyoming Joint Transportation and Highways Interim Committee, Wyoming State Legislature by Wilbur Smith and Associates, Inc., Columbia, South Carolina.

US Census Bureau. (1992), *Census of Manufactures,* Washington, DC: US Department of Commerce.

US Census Bureau. (1987), *Census of Manufactures,* Washington, DC: US Department of Commerce.

US Census Bureau. (1982), *Census of Manufactures,* Washington, DC: US Department of Commerce.

US Census Bureau. (1992), *Census of Transportation,* Washington, DC: US Department of Commerce.

US Census Bureau. (1987), *Census of Transportation,* Washington, DC: US Department of Commerce.

US Census Bureau. (1982), *Census of Transportation,* Washington, DC: US Department of Commerce.

US Census Bureau *(1982), Truck Inventory and Use Survey* and *1987, 1992, and 1997 Vehicle and Inventory Use Surveys,* Washington, DC: US Department of Commerce.

Yu, J. and Cooper, H. (1983), "A Qualitative Review of Research Design Effects on Response Rates to Questionnaires," *Journal of Marketing Research*, 36: 36-44.

APPENDIX A
AVERAGE TRUCKING BUSINESS FAILURE RATES
1984 - 1995

State	Failure Rate per 10,000 Firms
Tennessee	456
Kentucky	***434***
Indiana	423
West Virginia	401
Illinois	352
Ohio	345
Missouri	343
Virginia	340

Source: Dun & Bradstreet, Inc.

APPENDIX B
SIZE CONSIDERATIONS: TOTAL EMPLOYMENT, AVERAGE NUMBER OF EMPLOYEES PER ESTABLISHMENT, AND ESTABLISHMENTS WITH MORE THAN 100 EMPLOYEES
1996

State	Total Number of Employees	Average Number of Employees	Establishments with 100 or More Employees
Illinois	94,733	16	120
Ohio	81,169	16	115
Indiana	55,181	16	77
Tennessee	52,636	19	68
Missouri	48,186	13	56
Virginia	36,901	12	49
Kentucky	***22,976***	***10***	***29***
West Virginia	9,963	8	8

Source: US Census Bureau's *1996 County Business Patterns*

APPENDIX C
AVERAGE SIZE OF TYPICAL TRUCKING ESTABLISHMENT
1996

Primary Metro County	Average Number of Employees	Average Estimated Annual Pay
Nashville–Davidson County	55	$31,289
Indianapolis–Marian County	44	$30,748
Shelby County (Memphis)	39	$31,284
Hamilton County (Cincinnati)	38	$31,558
St. Louis County	27	$29,520
Jefferson County (Louisville)	***25***	***$28,591***
Lexington-Fayette County	***24***	***$26,952***
United States	**15**	**$29,999**

Source: US Census Bureau's *County Business Patters*

APPENDIX D
AVERAGE REVENUE PER ESTABLISHMENT IN A GIVEN STATE

Data from 1992 *Census of Transportation*

General Freight Trucking—Long Distance

State	Estab.	Total Revenue ($1,000)	Annual Payroll ($1,000)	Paid Emp.	Avg. Emp.	Avg. Pay	Avg. Rev. per Estab.
Ohio	1,346	$ 2,961,495	$ 887,534	28,492	21	$31,150	$2,200,219
Illinois	1,179	2,998,419	934,268	29,079	24	32,129	2,543,188
Indiana	1,020	2,162,543	644,813	23,432	23	27,518	2,120,140
Missouri	980	1,840,875	563,042	21,416	22	26,291	1,878,444
Tennessee	842	2,310,043	711,258	24,184	29	29,410	2,743,519
Virginia	569	914,598	269,331	10,047	18	26,807	1,607,378
Kentucky	***388***	***695,481***	***169,608***	***6,636***	***17***	***25,559***	***1,792,477***
West Virginia	158	197,030	53,575	2,264	14	23,664	1,247,025
United States	**25,014**	**55,257,352**	**15,879,651**	**553,202**	**22**	**28,705**	**2,209,057**

Data from 1997 *Census of Transportation*

General Freight Trucking—Long Distance

State	Estab.	Total Revenue ($1,000)	Annual Payroll ($1,000)	Paid Emp.	Avg. Emp.	Avg. Pay	Avg. Rev. per Estab.
Ohio	1,343	$ 3,754,484	$ 1,144,951	32,113	24	$35,654	$2,795,595
Illinois	1,339	4,040,036	1,274,731	35,497	27	35,911	3,017,204
Indiana	1,174	3,151,455	867,479	27,799	24	31,205	2,684,374
Missouri	1,227	2,249,398	683,650	22,093	19	30,944	1,833,250
Tennessee	1,070	3,372,817	1,149,924	34,911	33	32,939	3,152,165
Virginia	701	1,251,999	385,642	12,657	18	30,469	1,786,017
Kentucky	***491***	***1,285,855***	***292,380***	***9,428***	***19***	***31,119***	***2,618,849***
West Virginia	175	214,519	63,985	2,211	13	28,939	1,225,823
United States	**29,321**	**76,152,239**	**22,200,009**	**684,730**	**23**	**32,422**	**2,597,191**

AUTHOR BIOGRAPHY

Thomas Lambert is a professor of economics at Spalding University. He holds a Ph.D. from the University of Louisville, an M.S. in economics from the University of Kentucky, and an M.B.A. from the University of Louisville. Dr. Lambert's areas of interest and research are urban and regional economics and development. His research has been published in *Economic Development Quarterly*, *The Journal of Economic Issues*, *Social Science Quarterly*, and *Population Research and Policy Review*.

AUTHOR BIOGRAPHY

Hokey Min is a professor of supply chain management and executive director of the Logistics and Distribution Institute at the University of Louisville. As an executive director, he oversees activities of four research centers including the UPS Center for World-wide Supply Chain Management. Dr. Min earned his Ph.D. in management sciences and logistics from the Ohio State University. His research interests include global logistics strategy, e-synchronized supply chain, benchmarking, and supply chain modeling. Dr. Min has published more than 65 articles in various refereed journals.