The Decision to be Regulated in Motor Carrier Markets

by

Erik J. Bjorvik

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University of Oregon
Department of Economics

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1. INTRODUCTION

The Motor Carrier Act of 1980 dramatically reduced regulatory impedments to entry. Since then the number of applications for operating authority has been rapidly growing. Yet, despite the apparent ease of entry, there are still large numbers of motor carriers that operate without authority. In this paper I develop and empirically test a model explaining firm decisions to be regulated.

In the model, following Stigler (1971), I explain firm decisions to obtain operating authority in terms of profit; firms will obtain authority if it is profitable to do so. Firms produce in two markets. The first market is not regulated and firms freely access the market. However, to produce in the second market firms must have regulatory authority to operate. Some firms have authority and some firms do not. Thus, my purpose is to explain the firm's decision to acquire operating authority under conditions of joint production. This market operates under conditions of joint production because of regulations imposed by the Interstate Commerce Commission (ICC).

The trucking industry has been regulated by the Interstate Commerce Commission since 1935. Under the provisions of the Motor Carrier Act of 1935 (MCA35) a motor carrier had to show that a proposed service was necessary, profitable, and was not going to take business away from an established carrier in order to be granted operating authority. These cases were almost always

litigated with the possibility of legal fees totalling more than $250,000 in current dollars (Robyn, 1987).

In 1980 the industry was substantially deregulated with passage of the Motor Carrier Act of 1980 (MCA80); much of the deregulation centered around easing of entry and exit requirements. However, even with eased entry only about 40% of my sample, drawn in 1987, of North Dakota firms have chosen to be regulated. Currently, the requirements for obtaing operating authority are not stringent. In discussions with the ICC, I found that a potential regulated trucker need only file an application, submit a minimal filing fee, and meet all state safety regulations in order to be regulated. Another indicator of the reduced difficulty of obtaining authority is the fact that the value, as seen in the amount firms are willing to pay to lease authority, has fallen significantly since deregulation of the industry took place in 1980 (Breen, 1977; Dooley, et al. 1989). The paradox in this paper is that under conditions of joint production and the ease of obtaining authority, it is seemingly difficult to explain why more firms have not chosen to obtain authority.

2. BACKGROUND

In this section I provide a brief overview of past regulation as well as current regulatory conditions in the trucking industry. This is important to understand as I look at the decision of the firm to obtain authority. Also, I examine the specific characteristics of the market in which the firms of my study operate. First, I start with the origins of regulation.

In the 1920's, the powerful railroads campaigned to enact state regulatory controls over the trucking industry. The reason the railroads wanted to regulate the trucks was because of the competitive advantage of the trucking industry (Robyn, 1987). The culmination of this regulatory push was the enactment of the Motor Carrier Act of 1935 (MCA35) which created the Interstate Commerce Commission (ICC). The ICC granted authority to firms to carry commodities across state borders. Rates as well as cargo are regulated by the ICC. However, certain commodities such as unprocessed agricultural products are not subject to regulation by the ICC. Carriers which did not wish to be regulated, for reasons such as high legal fees or a desire to stay free of government regulation, were lured to this subsector of the transportation market (Beilock and Freeman,1991).

This authority to carry regulated commodities became very valuable in the ensuing years after the ICC's creation in 1935. The regulated carriers would use their authority as collateral for banks since it represented so much value to the firm. A new firm that wished to obtain authority would almost always be litigated by established carriers. The entire process could take 2-3 years and require expensive legal fees.

The Motor Carrier Act of 1980 (MCA80) significantly deregulated the industry, making it easier for carriers to obtain operating authority. If safety requirements are met, the ICC will commonly grant authority to the firm (Dooley et al. 1989). Denials

of applications are rare and often more freedom is granted than is requested (Beilock and Freeman, 1991).

Possession of authority still can enable a firm to capture more profits than it could without authority. Carriers with authority would be expected to have lower costs in searching for a load on the the return leg of a roundtrip. This return leg is commonly called a "backhaul". The reduced costs are a consequence of the carrier not having a need to lease authority or look for unregulated products. The ability of a carrier to find a return movement is higher with the possession of operating authority. Dooley, Bertrum, and Wilson (1989) found that firms with operating authority obtain a return movement 84% of the time compared to 48% for firms without authority. This discrepency in the percentage of backhauls suggests that the deregulation of the industry was not complete enough to cease contributing to uneccessary empty movements by the firms in the market (Beilock and Kilmer, 1986).

These benefits must be weighed against the costs of getting authority. Disscussions with the ICC staff suggest that in order to obtain authority a trucker must fill out the ICC's OP-1 form, and along with $200 send it to the ICC. Typically this form can be filled out without legal costs. Once this form is received authority is obtained, however, there are further neccessary actions. Large carriers must file annual reports with the ICC, and all carriers must file rate changes. All other neccessary actions are required by the state as well as the ICC in order to operate.

The costs of authority encompass both direct costs and compliance costs. The direct costs include the application fee of $200. The compliance costs include the cost of filing rates with the ICC. Also, if you are a large firm, the costs of compiling and sending annual reports to the ICC are compliance costs.

Authority can cost between $600-$1000 as of April 1989. Authority can also be leased or traded. One broker pays $100 a month to lease it (Dooley, et. al 1989). Usually larger firms will lease their authority to smaller firms.

However, given the favorable benefits and costs above, only 39% of the firms have operating authority. Discussion with these carriers gives the general consensus that the government is out to get the truckers; the firms generally believe that obtaining operating authority is more trouble than it is worth; and that the fines for illegal hauling are less than the cost and hassle of operating authority. Next, I describe the market in which the firms operate.

The firms operate in two disticnt markets. The outbound or fronthaul market is the market which takes the truckers, loaded with grain, out to locations such as Minneapolis, Duluth, and the Pacific Northwest. On the return leg of the round trip the non-regulated firms either compete for commodities not subject to ICC jurisdiction, lease authority, or travel empty. The regulated firms have the option to obtain a regulated commodity for the return leg of the round trip. Therefore, the firms operate in two seperate markets, one that is non-regulated, and one that is either regulated

or non-regulated. In this way the firms operate under conditions of joint production.

In the next section, I present a model based on profit that explains decisions of firms to obtain and not obtain operating authority.

3. Theory

The firm travels in round trips from a location. These round trips may involve several legs. A regulated firm may serve all legs of the round trip, while a non-regulated firm is pre-cluded from serving the regulated markets. In the theory below a round trip between locations A and B is used to illustrate the model.

On one leg (A to B) firms haul non-regulated commodities and receive P_{ab} in revenue. On the other leg (B to A) of the round trip, firms that have regulatory authority receive P_{ba} in revenue, firms that do not have authority haul non-regulated commodities, or travel empty.

If the non-regulated firm chooses to access the BA market it will be more costly. These higher costs occur because non-regulated carriers must incur higher search costs or pay to lease authority.

Let the cost of suppying capacity C(T) be the round trip cost between markets without being loaded on either leg, while the access costs are the incremental costs of finding and delivering a load on either leg. The regulated firm has lower access costs per trip, however, it must incur the costs of obtaing and having authority. In short, regulated firms have lower costs in accessing

markets than do non-regulated firms. However, these lower costs are offset by additional fixed costs.

(1) $\prod^r = (P_{ab}+P_{ba})T^r - C(T^r) - (a^r_{ab}+a^r_{ba})T^r - F$

(2) $\prod^n = (P_{ab}+P_{ba})T^n - C(T^n) - (a^n_{ab}+a^n_{ba})T^n$

In choosing the $\prod$ maximizing alternative, to be a regulated or a non-regulated trucker, depends on the number of trips taken by the firm,which is also chosen by the firm. This decision in turn depends on access costs and prices that vary across regulated and non-regulated firms. Yet, the $\prod$ maximizing choice of being a regulated or a non-regulated trucker depends on the maximum profit available under each alternative. Thus profit under regulated and non-regulated cases must be evaluated at the profit maximizing level of trips.

To illustrate, let MC be linear and given by $MC=\beta T$.

The FOC condition for $\prod$ maximum given regulatory status:

$\partial\pi^r/\partial\pi^r = P_{ab}+P_{ba}-\beta T^r - a^r_{ab} - a^r_{ba} = 0$

$T^*_r = (P_{ab}+P_{ba}-a^r_{ab}-a^r_{ba})/\beta$, where T^*_r is the profit maximizing number of trips for a regulated firm.

And, $T^*_n = (P_{ab}+P_{ba}-a^n_{ab}-a^n_{ba})/\beta$, where T^*_n is the profit maximizing number of trips for a non-regulated firm.

Substitution of the results, T^*_r and T^*_n, into equations (1) and (2) the maximum profit given regulatory status ($\prod^*_r$ and $\prod^*_n$) for a regulated and non-regulated firm, respectively is:

(1) $\prod^r = (P_{ab}+P_{ba})(P_{ab}+P_{ba}-a^r_{ab}-a^r_{ba})/\beta -$

$C((P_{ab}+P_{ba}-a^r_{ab}-a^r_{ba})/\beta) - (a^r_{ab}+a^r_{ba})(P_{ab}+P_{ba}-a^r_{ab}-a^r_{ba})/\beta - F$

(2) $\prod^n = (P_{ab}+P_{ba})(P_{ab}+P_{ba}-a^n_{ab}-a^n_{ba})/ß-$
$C((P_{ab}+P_{ba}-a^n_{ab}-a^n_{ba})/ß)-(a^n_{ab}+a^n_{ba})(P_{ab}+P_{ba}-a^n_{ab}-a^n_{ba})/ß$

There are several clear results that arise. First, as access costs ($a_{ab}+a_{ba}$) increase, the profit maximizing amount of trips and total maximum profit ($\prod^*$) decrease. Second, as the cost of authority (F) increases, the regulated firm's profit maximizing amount of trips will remain unchanged, while its maximum profit ($\prod^*_r$) will decrease. MCA80 decreased the cost of authority (F). Therefore, obtaining operating authority becomes more attractive as these fixed costs decrease. Third, as prices ($P_{ab}+P_{ba}$) increase, the firm's profit maximizing amount of trips and total maximum profit ($\prod^*$) increase. Finally, as ß increases, both the firm's maximizing amount of trips and total maximum profit ($\prod^*$) decrease.

4. Empirical Model and Procedures

The purpose of this section is to describe the empirical model and procedures. I do not observe both $\prod^r$ and $\prod^n$ in the data. Rather, observed in the data is whether the firm has chosen to be regulated or not. Following the theory of the last section, this discrete variable is the result of a comparison of $\prod^r$ and $\prod^n$.

Let dependent variable ∂ be a binary variable taking a value of 1 if the firm has chosen to obtain operating authority and a value of 0 otherwise. Following the theoretical model, this decision is the result of a trucker comparing profit if it is regulated, and profit if it is not regulated. I assume these profits are a function of firm attributes and are given by:

$$\prod^r_i = a_o + \sum a_k X_{ik} + \mu^r_i$$

$$\prod^n_i = ß_o + \sum ß_k X_{ik} + \mu^n_i$$

Where: a_k and $ß_k$ are parameters to be estimated and X_{ik} is the k^{th} attribute of firm.

In this framework, ∂_i takes a value of 1 if $\prod^r_i + \mu^r_i \geq \prod^n_i + \mu^n_i$ and a value zero otherwise

The expected value of ∂_i then is:

$$\begin{aligned} E(\partial_i) &= Prb(\partial_i=1) \\ &= Prb(\prod^r_i \geq \prod^n_i) \\ &= Prb(a_o + \sum a_k X_{ik} + \mu^r_i \geq ß_o + \sum ß_k X_{ik} + \mu^n_i) \\ &= Prb(\mu^r_i - \mu^n_i) \geq (ß_o - a_o) + (ß_k - a_k)X_{ik} \end{aligned}$$

I use a linear probability model to estimate the probability that a firm obtains operating authority. As is well known, there are several problems with the linear probability model. These include heteroscedasticity, and the fact that the dependant variable estimate may lay outside the (0,1) range. I use weighted ordinary least squares in order to correct the heteroscedasticity.

The firm attributes include: size of firm, experience, average length of haul, size/experience, and location varables which are utilized in the form of dummy variables. These are based on the research of Beilock and Kilmer (1986), and Wilson and Dooley (1992). All of the above variables are included in Models 1 and 2 with the exception of location variables. Models 3 and 4 include location variables.

I expect size to have a significant effect on the obtainment of ICC authority. Following Beilock and Kilmer (1986), large firms are expected to utilize their equipment more which means obtaining operating authority in order to access the regulated market. I assert that with experience comes an increase in human capital relating to obtaining backhauls. The inclusion of a higher percentage of backhauls will increase a firm's profit. Therefore, more experienced firms realize that ICC authority will help them acquire backhauls and they obtain authority in order to maximize profits.

There are other firm characteristics which explain a firm's decision to obtain regulation. Average length of haul describes the distance the firm's trucks are traveling. Since grain is a non-regulated commodity, there is no need to obtain authority for the trip out of North Dakota. However, once a trucker empties his load he is either going to come back full or empty. As Wilson and Dooley (1992), and Beilock and Kilmer (1986) have shown, having ICC authority will increase the probability of coming back full. As average length of haul increases the search for a backhaul becomes more imperative because of the costs associated with hauling empty. Therefore, as average length of haul goes up I expect the probability of obtaining ICC authority to go up also.

Size divided by experience is a measure of a firm's talent, or in other words, a firm's ability to grow. The more profitable firms should have a high size/experience ratio compared to less profitable firms. I assume that obtaining operating authority

increases a firm's profits. Therefore, firms with a high size/experience ratio will be more likely to possess operating authority.

Finally, in Models 3 and 4 I have included location dummy variables which take on a value of one if the trucker is located in that region, and zero otherwise, and are defined for nine regions in North Dakota. Following Wilson (1992), these variables should serve as control for local supply and demand conditions in the market.

5. Data

The data are from a survey of motor carrier firms that haul grain from North Dakota. The survey was sponsored by the Upper Great Plains Transportation Institute in conjunction with North Dakota State University. There were 449 possible respondants from which there were 112 usable surveys resulting in a response rate of about 25%. The surveys asked about a wide range of topics including costs, location, and firm characteristics. There were 44 respondants which held ICC operating authority, and 68 which did not.

Insert Table 1

Table 1 indicates that regulated firms are larger, more experienced, travel farther on each trip, obtain a higher percentage of backhauls, and have a higher talent ratio than non-regulated firms. The empirical results focus on these specific firm attributes which affect the firm's decision to obtain operating authority.

6. Empirical Results

Several models were estimated, and all results are in Table 3. All models are reported to indicate the robustness of the results across specifications. Model 1 consists of four independent variables: a constant, size, experience, and average length of haul. Model 2 consists of a constant, size, experience, average length of haul, and size/experience. Models 3 and 4 consist of the same variables as models 1 and 2, respectively, except that they include regional dummy variables which identify where the trucker is located.

Insert Table 2

The predictive quality of the models is shown by the percentage correctly predicted. The percentage correctly predicted when the firm is regulated ranges from 39% to 46%. The percentage correctly predicted when the firms are not regulated is quite high ranging from 87% to 90%.

All of the coefficients show the sign that was expected except for experience in Model 1. However, the negative sign is reversed when size/experience is added, and later when regional dummy variables are added.

Insert Table 3

The remainder of this section will focus on Model 4. This is because the model has the highest predictive quality of the four. First, I examine the magnitude of each variable included, and following that discussion I describe the point at which $\prod^r = \prod^n$ for each variable while holding all other variables constant. It is at

this point where it becomes profitable for the firm to obtain operating authority.

The estimated coefficients, size, experience, ALH, and size/experience, are all of the expected sign, however their magnitudes vary. An addition of two tractors (size) to the firm will raise it's probability of being regulated by .032. Eight additional years of experience will increase it's probability by .03. An increased average length of haul of 200 miles will increase the firm's probability of being regulated by .03. Finally, if a firm's size/experience ratio increases by .13, it's probability will increase by .031.

As each variable increases, there is a point at which $\prod^r$ becomes larger than $\prod^n$. Below are these "crossover points" for Model 4.

The points are: six tractors, 21 years, 268 miles, and .3312. These points correspond to the variables: size, experience, ALH, and size/experience, respectively. It is at these points, or in other words, stages of growth, when the profit-maximizing firm should obtain operating authority.

7. Summary

Truckers travel in round trips, thus producing capacity in two markets. They haul grain, a non-regulated commodity, on the outbound leg. On the second leg of the round trip they haul a variety of products. In order to haul regulated commodities, the trucker must have ICC operating authority. It has been shown, by Wilson and Dooley, and Beilock and Kilmer that possesion of operating authority contributes to a higher percentage of backhauls

and thus the firm receives revenues to combat the fixed costs of the return leg.

Currently, obtaining operating authority is simple and relatively inexpensive for a firm no matter what it's characteristics are. Theory states that a firm will obtain operating authority if it is profitable to do so. With the costs of operating authority low and the benefits of authority evident, it is seemingly difficult to explain why only 39% of the firms own operating authority.

The empirical results indicate that large firms with a high talent ratio traveling long distances are the most likely to possess operating authority. Small firms with a low talent ratio that travel short distances are least likely to have operating authority.

This paper examined the characteristics of firms with and without operating authority. I described the theory (profit-based) of a firm's decision to obtain operating authority or not. There may be other variables which would strengthen the model. One such variable could be tastes. Firms which are regulation adverse could be influencing the model. This issue will need to be examined in the future.

Table 1. Firm Summary Statistics

Firm Attribute	Regulated	Nonregulated	All
Percent with Authority	61%	39%	100%
Size(number of tractors)	1.6	4.3	2.7*
Years in Business	13.1	16.3	14.3
Average Length of Haul	343	559	427*
Percent Loaded Backhaul Trips	45%	72%	56%*
Size/Experience	.2086	.3536	.2656*

- a * in the final column indicates significant differences between regulated and non-regulated carriers.

Table 2. Model Specifications and Variable Definitions

Model	Specification
1	X=CON, SIZE, YEARS, ALH
2	X=CON, SIZE, YEARS, ALH, SIZE/YEARS
3	X=MODEL 1,CRD1, CRD2, CRD3, CRD4, CRD5, CRD6, CRD7, CRD8
4	X=MODEL 2, CRD1, CRD2, CRD3, CRD4, CRD5, CRD6, CRD7, CRD8

Variable	Definition
CON=	Constant
SIZE=	The number of tractors owned by the firm
YEARS=	The number of years in business
ALH=	The average length of haul
CRD_i=	1 if the firm's location is in the ith crop reporting district, (i=1,2,3,4,5,6,7,8,9,). CRD9 is the base district.

Table 3. Coefficient Estimates, for Models 1, 2, 3, and 4.

Variable	1	2	3	4
CON	.3239	.2389	.1461	.2339
	(.1648)	(.1469)	(.1706)	(.2796)
SIZE	.0226*	.01445*	.0227*	.01579
	(.0057)	(.00469)	(.0069)	(.0080)
YEARS	-.0014	.00343	.0025	.0038
	(.0037)	(.00341)	(.0037)	(.0049)
ALH	.00048*	.00033*	.00045*	.0003*
	(.00007)	(.00012)	(.00012)	(.00015)
SIZE/YEARS		.2085*		.2428
		(.1012)		(.1539)
CRD1			.3059	.2986
			(.1982)	(.2404)
CRD2			.2789*	.2671*
			(.1358)	(.1255)
CRD3			-.0112	-.0464
			.1717	.1492
CRD4			.2234	.1396
			(.3368)	(.3964)
CRD5			-.1358	-.0606
			(.2013)	(.1591)
CRD6			-.0534	-.0554
			(.1963)	(.1543)
CRD7			.0166	.0293
			(.2013)	(.1845)
CRD8			-.1044	-.0995
			(.2472)	(.2326)
Percentage Correctly Predicted.				
Prb(Reg)	.44	.39	.46	.46
Prb(Non-reg)	.90	.90	.87	.89
All	.72	.70	.71	.72

- Standard Errors are in parentheses. A * indicates significance at the 5 percent level.

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