AGRIBUSINESS SHIPPER'S RESPONSE TO REGULATORY CHANGE: A RE-EXAMINATION

by

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Abstract

The passage of the Ocean Shipping Reform Act of 1998 in the United States changed the way freight rates and other logistical costs were determined by shippers, and consequently affected the operational structure of the industry. Many shippers now utilize third-party agents to negotiate service contracts with carriers while others choose to negotiate directly with carriers. This paper re-examines the factors affecting the contractual decisions between shippers and carriers of containerized cargo, taking into account the shortcomings of previous study by Stewart and Inaba (2003). Consistent with their findings, our empirical results suggest that shippers' decision on contractual negotiation method is affected by the volume of cargo being shipped. However, our study found that shippers' decision on the type of third-party agent is not largely affected by factors related to product type and frequency of shipments as was concluded in the previous study.

1. Introduction

The Ocean Shipping Reform Act of 1998 (OSRA) was established to replace the Shipping Act of 1984 which enforced common carriage on shippers. Under the previous regulatory regime, shippers could either negotiate contracts directly with a carrier or use a published schedule of tariff rates. Regardless of which option was chosen, this information would be made available to the public by the Federal Maritime Commission (FMC). The FMC also required that the carrier grant the same terms of the service contract to any shipper with similar characteristics. Consequently, the market power was shifted to two large rate-setting cartels: the Transpacific Westbound Rate Agreement (TWRA), which oversaw exports and the Asia North American Eastbound Rate Agreement (AN-ERA), which oversaw imports. Within these cartels, carriers set freight rates, regulated the supplies of the industry, and consequently controlled the majority of the market and greatly decreased the options available to shippers (Lewis and Vellenga, 2000; Stewart and Inaba, 2003).

OSRA promotes a more market-driven environment for determining freight rates based on private contracting between carriers and shippers, thus creating a more competitive market for the international ocean liner shipping services. The increasing number of independent service contracts has revealed the important role of third-party agents in negotiating freight rates with carriers for small shippers under the new regulation and the reduction in the market power of the two largest shipping conferences, TWRA and AN-ERA, to fix freight rates and regulate supplies. It was estimated that contracting increased by 200 percent and more than 80 percent of all cargo now operates under private contracting after OSRA went into effect (FMC, 2001). This suggests that the new regulation has created, by promoting private contract negotiations, a more competitive market for shippers that depend on containerized ocean shipping.

Stewart and Inaba (2003) investigated how agribusiness shippers transact with carriers in the post-OSRA era, using a sample of 81 surveyed firms exporting food and forest products from the United States to East Asia via West Coast Ports. They concluded that the provisions of OSRA have weakened the rate-setting power of cartels and provided shippers with more options to

transact with carriers. The shipper's choice of negotiation with carriers depends upon shipper characteristics. They found that while shippers of larger volume lots are more likely to negotiate service contracts directly with carriers, smaller shippers are more likely to rely on third-party agents to negotiate with carriers on their behalf. However, their conclusion on shipper's negotiation decisions was based on their estimation of a statistical model with only one four-level categorical independent variable *Volume*. A model with only one single independent variable might suffer from misspecification issues, consequently leading to inconsistency of its parameter estimate. Another limitation of a model having only one categorical variable such as *Volume* is that it only can tell us whether volume affects shipper's decision but is unable to tell us the differences in the impacts of different ranges of volume. It would be more interesting to find out what threshold of firm size has a significant impact on the firm's decision on contractual negotiation.

Furthermore, Stewart and Inaba indicated that their estimated coefficients and standard errors for their bivariate probit model are unreliable and thus they also estimated a linear probability model as a robust check for their results. As commonly known, the linear probability model has a number of shortcomings. A minor complication arises because the error is heteroskedastic in a way that depends on the parameters of the model. A more serious flaw is that we cannot be assured that the predictions from this model will truly look like probabilities; that is, the predicted probabilities cannot be constrained to the 0-1 interval. Such a model can produce both nonsense probabilities and negative variances. For these reasons, the linear model is becoming less frequently used (Green, 2003). In addition, the nested logit model is a common approach for modeling sequential decision (but was not utilized in the previous study by Stewart and Inaba). It is possible that there might be some similarities between decisions at each stage that can be captured by nesting the decisions together.

For the aforementioned reasons, this paper re-examines the impact of OSRA on service contracting within the containerized cargo shipping industry and describes the operational strategies that shippers and carriers have undertaken since OSRA first went into effect. We analyze the same dataset of 81 agribusiness shippers used by Stewart and Inaba but use different statistical modeling methods. In particular, we first estimate our models with the same set of

explanatory variables that was used by Stewart and Inaba study. Second, we introduce dummy variables representing firm sizes into the model in the first stage. Similar to the argument by Stewart and Inaba, we expect that large shippers will be more likely to negotiate directly with the carrier to obtain lower freight rates because of their bargaining power advantages as larger firms. Smaller firms, on the other hand, are expected more likely to utilize a third-party agent to negotiate their shipping contracts in order to increase their bargaining power and therefore receive the lower freight rates enjoyed by the larger firms. To distinguish the effects of different ranges of shipping volume on the shipper's contractual decision, we include three dummy variables into our model, representing the small and large size, while omitting the medium category to avoid perfect collinearity in estimation. Consistent with the earlier findings of Stewart and Inaba, our empirical results suggest that shippers' decision on contractual negotiation method is affected by the volume of cargo being shipped. However, our study found that shippers' decision on the type of third-party agent is not largely affected by factors related to product type and frequency of shipments as was concluded in the previous study.

2. Related Studies

The primary goal of the deregulation in the ocean shipping service is to improve the competitiveness of the industry. Under a deregulated market, firms is expected to behave in a more competitive manner allowing for more efficient operation of an industry. However, deregulation can also cause prices to be less stable and higher due to unfettered monopoly power, or cause firms to increase predatory behavior, change their operational structure, and eliminate barriers to entry.

Goetz (2002) studies the effect of deregulation on competition and antitrust implications in the US airline industry. Following deregulation large carriers have experienced economies of scale and scope, which help them crowd out smaller airlines by concentrating a larger proportion of their operations at the larger hubs. Thus, the deregulation gives larger airlines some level of monopolistic power and acts as an entry barrier for new and/or smaller airlines to operate through these hubs. This in turn, raises the price of air fare for passengers traveling through the larger hubs because of the dominance of the larger airlines. Goetz claims that there are few

smaller airlines operating at the larger hubs and this is evidence to suggest larger airlines do enjoy monopoly power and engage in predatory behavior.

Bowen (2002) also examines deregulation and its effect on the global airline industry. His analysis consists of evaluating whether the relative accessibility of cities in poor countries has improved or worsened following deregulation. He found that deregulated airline capacity increased their services and restructured their operations so they could take advantage of new markets. McMullen and Stanley (1988) study changes in the production structure of the motor carrier industry follow deregulation. They found that deregulation eliminated entry restrictions and encouraged the large scale entry of owner-operated carriers. A higher percentage of firms had lower per unit costs, indicating efficiency gains in production from a less regulated environment.

Deregulation of the ocean liner shipping industry in the United States following OSRA lead others to reevaluate ocean liner shipping in other parts of the world. For example, the EU has taken such action and repealed their Regulation 4056/86. Although OSRA was only applied to west coast ports, thus only on trans-pacific shipping lanes, it is found to have an indirect impact on the trans-Atlantic shipping lanes. Wang (2006) assessed the impact that OSRA have on the market structure on the containerized cargo industry on trans-Atlantic routes. He used the changing tariff structure of the trans-Atlantic lane in 1999 to provide evidence of the impact of OSRA on the maritime industry and evaluated traffic volume and freight rates of inbound and outbound trades. He concluded that OSRA has had a substantial influence on the market structure of the trans-Atlantic lanes, forcing trans-Atlantic carriers to operate in a more competitive manner.

Inaba and Mendez (2001) examined how the size of a shipper influences its support for OSRA and found that larger shippers would be more supportive of OSRA when negotiating freight rates than smaller shippers. This is because OSRA promotes private negotiations between shippers and carriers to gain favorable service contracts while carriers strive to optimize their vessel capacity by pursuing large volume and recurrent service in order to maximize their profits. Thus, large shippers will be more likely to be successful in negotiating favorable freight rates than

smaller shippers. Blatner, Inaba, and Stewart (2003) also found an increase in reliance on private contracting and a large decline in collusion agreements under ORSA. The profitability of carriers depends on their ability to obtain long-term contracts with shippers of large volume and recurrent shipments, suggesting that a smaller volume shipper will find greater benefits from using a third-party agent.

Stewart and Inaba modeled the contractual decision structure between shippers and carriers. The shipper first decides whether to negotiate directly or use a third party agent to conduct service contract negotiations. If a shipper chose a third party agent then in the second step the shipper has to decide on which type of third-party agent to hire. Using the data from their own survey, Stewart and Inaba utilized both a bivariate probit and a linear probability model to estimate their model. They found that shippers of larger volume were less likely to use a third party agent and a shipper's decision on which type of third-party agent was based upon their type of products being shipped. However, their conclusion on shipper's negotiation decisions was based on their estimation of a statistical model with only one single independent variable *Volume,* which is a categorical variable with four different levels, corresponding to four different sizes of shippers. Besides the misspecification concerns raised for the model in the first stage, their results could not provide information regarding what threshold of firm size has a significant impact on the firm decision on contractual negotiation. Moreover, as indicated earlier, the linear probability model used in the study by Stewart and Inaba has a number of shortcomings, such as nonsense predicted probabilities and negative variances, while the nested logit model is a natural alternative for modeling sequential decision, but was not utilized in their study.

3. The Model

This paper re-examines the impact of OSRA on service contracting within the containerized cargo shipping industry and describes the operational strategies that shippers and carriers have undertaken since OSRA first went into effect. We analyze the same dataset of 81 agribusiness shippers used by Stewart and Inaba, taking into account the shortcomings of the previous study. In contrast to their model which has only one categorical variable Volume in the first stage model, we include three dummy variables, representing the small, medium, and large size into

our nested logit model. By doing this, we are able to distinguish the effects of different ranges of shipping volume on the shipper's contractual decision. The limit of a model having only one categorical variable Volume is that it only can tell us whether volume affects shipper's decision but is unable to tell us the differences in impacts of different ranges of volume.

In the first stage (shipper decides whether to negotiate directly or use a third party agent to conduct service contract negotiations):

$$\text{Prob}(TPA = 1|x) = F(x, \beta)$$
$$\text{Prob}(TPA = 0|x) = 1 - F(x, \beta)$$

In the second stage (shipper decides on which type of third-party agent to hire):

$$\text{Prob}(SA = 1|z) = F(z, \theta)$$
$$\text{Prob}(SA = 0|z) = 1 - F(z, \theta)$$

3.1 Bivariate Probit Model

If $F(\cdot) = \Phi(\cdot)$, a normal cumulative distribution function, then the system of equations become the bivariate probit model. The general specification for a bivariate probit model is:

$$\text{Prob}(TPA = 1|x) = \text{Prob}(x'\beta + \varepsilon > 0)$$
$$\text{Prob}(SA = 1|z) = \text{Prob}(z'\theta + \omega > 0)$$
$$E(\varepsilon|\, x, z) = E(\omega|\, x, z) = 0$$
$$\text{Var}(\varepsilon|\, x, z) = \text{Var}(\omega|\, x, z) = 1$$
$$\text{Cov}(\varepsilon, \omega|\, x, z) = \rho$$

There are some distinctions between the multivariate probit model and the logit models for multiple choices. In the multivariate probit model, there are several decisions, each between two alternatives. In the logit models for multiple choices, there is a single decision among two or more alternatives.

3.2 Heckman Two-Step Selection Model

Sample selection is a problem when it causes the error to be correlated with an explanatory variable. The Heckman two-stage procedure is often used to deal with this problem. However, relative to subsample OLS, Heckman procedure does not perform well when the errors are not

normally distributed, the sample size is small, the amount of censoring is small, the correlation between the errors of the regression and selection equations is small, and the degree of collinearity between the explanatory variables in the regression and selection equations is high (Kennedy, 2003).

Following Green (2003), let TPA=1 if shipper chooses to use third party agent and 0 otherwise. Also, let SA=1 if shipper chooses shipping association and 0 otherwise. For a given shipper, SA is not observed unless TPA equals 1. Thus, there are three types of observations in the sample, with unconditional probabilities:

Selection mechanism:

TPA=1: $\text{Prob}(TPA = 1|x) = \Phi(x'\beta)$

TPA=0: $\text{Prob}(TPA = 0|x, z) = 1 - \Phi(x'\beta)$

Censored sample:

SA=0, TPA=1: $\text{Prob}(SA = 0, TPA = 1|x, z) = 1 - \Phi(-x'\beta, z'\theta, -\rho)$

SA=1, TPA=1: $\text{Prob}(SA = 1, TPA = 1|x, z) = \Phi(x'\beta, z'\theta, \rho)$

Regression model:

$$E(SA|TPA = 1, z, x) = z'\theta + \rho\sigma_\varepsilon\lambda(x'\beta) = z'\theta + \rho\sigma_\varepsilon\phi(x'\beta)/\Phi(x'\beta)$$

4. The data

This study analyzes the same dataset provided by Stewart and Inaba. The dataset consists of 81 responding firms. These firms exported from the West Coast of the U.S. to East Asia through West Coast ports, with a variety of products including: lumber, fresh produce, beef, poultry, ingredients for food, juice purees and concentrates, canned food, dried food, nuts, and other foods. The data includes the type of commodity shipped, annual volume, regularity of shipment, and whether the shipper relied on a third-party agent and the type of third-party agent.

Similar to Stewart and Inaba, we use dummy variables to represent different types of goods being transported.

- P1 = 1 if transports only lumber and/or engineered wood products;
- P2 = 1 if transports only meat and/or poultry;
- P3 = 1 if transports only fresh produce;

- P4 = 1 if transports processed food products or multiple types of goods.
- SPOT = 1 for shippers who are both small and irregular; SPOT equals zero for all other shippers.

Annual volume is categorized into four levels: small (1-100 TEU), medium (101-1000 TEU), large (1001-5000 TEU), and very large (over 5000 TEU[1]). Of 81 surveyed firms, small shippers account for 35 percent of the sample, medium shippers make up 38 percent of the sample, large shippers account for 21 percent, and 6 percent of the sample is very large shippers. Small shippers who make irregular shipments may not have the ability to make binding export commitments over a given year. Therefore, small shippers are divided into two groups, regular and irregular, based upon the regularity of their shipments. Consequently, the potential inability to make binding commitments may prevent these exporters from joining a shipping association or in negotiating their service contracts on their own. The shippers that are small and have irregular shipments are known as SPOT shippers (Stewart and Inaba).

The data shows that shippers of small volume lots are less likely to negotiate directly with carriers while shippers of large volume lots are much more likely to negotiate directly with carriers. Specifically, about 21 percent of small shippers and 48 percent of medium shippers chose to negotiate directly, but over 70 percent of large shippers and 100 percent of very large shippers negotiate directly with carriers.

Two types of third party agents are freight forwarders and shipper's associations. There are 43 shippers in the sample relying on a third party agent, of which 22 shippers chose a shippers' association and 21 chose a freight forwarder. The fraction of shippers choosing a shipping association over a freight forwarder varies, depending on the size of shipper and types of commodities being shipped. Shippers of small size tend to choose freight forwarders while shippers of medium and large size have a tendency to choose shipping associations. Shippers of

[1] TEU is an inexact unit of measure of cargo capacity and stands for twenty-foot equivalent unit. It is based on a twenty-foot long cargo container with various degrees of height which can range from approx. 4 – 10 ft.

fresh produce, vegetables, meat, poultry, lumber, and wood products are more likely to choose shipping associations than shippers of processed foods.

5. Results

The model specification and estimation method in Stewart and Inaba have shortcomings and consequently their results and conclusions were suspect. For example, the standard error of the intercept for their bivariate probit is $8.5x10^5$ and the standard error of the correlation coefficient is $1.36x10^{18}$. Thus, we re-estimate their model and our estimation results are presented in Table 1. Compared with Stewart and Inaba, the parameter estimates and their standard errors for our bivariate probit model appear to be plausible. In the first stage model, they found that the estimated coefficient on Volume is negative and statistically significant while we found this variable is statistically insignificant even though it has the negative sign. In the second stage model, all three dummy variables representing types of commodity being shipped were found statistically significant in Stewart and Inaba but we found only shippers of fresh produce are significantly more likely to join a shipping association. The estimate of the correlation coefficient is close to 1 as in Stewart and Inaba's results but the standard error of the correlation coefficient in our model is 0.0007 whereas theirs is $1.36x10^{18}$ (indicating a problem with their model results).

The estimation results of the two Heckman two-step models are similar in both stages. The first Heckman sample selection model is presented in the third column of Table 1. The first-stage model is estimated by probit and the adjusted second-stage model is estimated with the inverse Mills ratio included as a regressor and maximum likelihood estimation of the correlation coefficient ρ, where the selection is on shippers using third-party agents. Compared with the bivariate probit model, the estimated correlation coefficient in the Heckman selection model becomes statistically insignificant.

The estimation results of the second Heckman two-step model are presented in the fourth column of Table 1. In the first stage, we estimated a probit model of shipper's decision on negotiation choice with a single regressor Volume as in Stewart and Inaba. We obtained the same results in terms of parameter estimate, standard error, and the statistical significance of variable Volume,

but not the intercept. In the second stage, we also estimated a probit model of shipper's choices on third-party agents, with the inverse Mills ratio (IMR) included as a regressor for shippers using third-party agents. We found that only shippers of fresh produce are more likely to use shipper association, but at a marginal level of significance while Stewart and Inaba found that both shippers of lumber and/or engineered wood products and shippers of fresh produce are more likely to use shipper association.

Table 1: Estimation results for the Bivariate Probit Model and Heckman Two Step Model

Variable	Bivariate Probit	Sample selection	Heckman 1
Stage1: TPA or OWN			**Probit**
Intercept	0.4339	0.5315***	0.5277***
	(0.3666)	(0.1881)	(0.1868)
Volume	-0.0003	-0.0004***	-0.0004***
	(0.0003)	(0.0001)	(0.0001)
Stage2: SA or FF			**Probit**
Intercept	-0.8932***	-0.7972***	-1.6551
	(0.3096)	(0.3154)	(1.1278)
P1 (lumber or wood products)	0.4048	0.6966	0.8840
	(0.5057)	(0.4875)	(0.6500)
P2 (meat or poultry)	0.4039	0.5634	0.8435
	(0.5002)	(0.5085)	(0.7532)
P3 (fresh produce)	0.6781*	0.7022*	0.9999*
	(0.3755)	(0.3708)	(0.5256)
SPOT (small/irreg shipments)	-0.4313	-0.6164	-0.7940
	(0.4398)	(0.4023)	(0.5347)
Selectivity Correction			
Rho	0.9999***	0.9999	
	(0.0007)	(0.0000)	
IMR			2.2060
			(1.8587)

Standard errors are in parenthesis. *** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.1$

Stewart and Inaba concluded that shippers of larger volume lots are more likely to negotiate service contracts directly with carriers, smaller shippers are more likely to rely on third-party agents to negotiate with carriers on their behalf. However, their conclusion on shipper's negotiation decisions was based on their estimation of a statistical model with only one categorical independent variable *Volume*. This variable equals the midrange of shipper volumes in each category: 50.5 for small shippers, 550.5 for medium-sized shippers, 3000.5 for large shippers, and 7500.5 for very large shippers. It is possible that *Volume* is the only significant variable found in the first-stage model because the model has only one independent variable. A model with only one single independent variable might suffer from misspecification issues and consequently leading to inconsistency of its parameter estimate.

Furthermore, Stewart and Inaba indicated that their estimated coefficients and standard errors for their bivariate probit model are unreliable and thus they also estimated a linear probability model as a robust check for their results. As commonly known, the linear probability model has a number of shortcomings. A minor complication arises because the error is heteroskedastic in a way that depends on the parameters of the model. A more serious flaw is that we cannot be assured that the predictions from this model will truly look like probabilities; that is, the predicted probabilities cannot be constrained to the 0-1 interval. Such a model produces both nonsense probabilities and negative variances. For these reasons, the linear model is becoming less frequently used (Green, 2003).

Moreover, a model having only one categorical variable *Volume* only can tell us whether volume affects shipper's decision but unable to tell us the differences in the impacts of different ranges of volume. To distinguish the effects of different ranges of shipping volume on the shipper's contractual decision, we include two dummy variables, representing the small and large size, into the model in the first stage. The medium category is omitted to avoid perfect collinearity. Similar to the argument by Stewart and Inaba, we expect that large shippers will be more likely to negotiate directly with the carrier to obtain lower freight rates because of their bargaining power advantages as larger firms. Smaller firms, on the other hand, are expected to be more likely to utilize a third-party agent to negotiate their shipping contracts in order to increase their bargaining power and therefore can receive lower freight rates. We argue that the shipper's

choice of negotiation with carriers might not only depend on the volume of goods being shipped, but also on the frequency of shipments. Thus, our model in the first stage includes two dummy variables for firm sizes and one dummy variable for regularity of shipments. Bivariate probit model and various Heckman two-step models were estimated. The estimation results of our model are presented in Table 2.

Table 2: Estimation results

Variable	Bivariate Probit	Sample Selection	Heckman-Probit	Heckman-Logit
Stage 1: TPA or OWN				
Intercept	0.0464	0.0217	-0.1465	-0.2608
	(0.5848)	(0.5702)	(0.5971)	(1.0330)
SML	0.6617	0.6902	0.8680*	1.4395*
	(0.4788)	(0.4647)	(0.4946)	(0.8604)
Large	-0.5339**	-0.8584**	-0.7883**	-1.2883**
	(0.2771)	(0.3643)	(0.3721)	(0.6229)
Reg	-0.0033	0.0889	0.1869	0.3254
	(0.5599)	(0.5467)	(0.5531)	(0.9685)
Stage 2: SA or FF				
Intercept	-0.9081***	-0.8425***	-0.7947	-1.2766
	(0.3070)	(0.3124)	(0.6295)	(1.0681)
P1 (lumber or wood products)	0.4208	0.8172	0.9588	1.5283
	(0.3616)	(0.5303)	(0.6440)	(1.0835)
P2 (meat or poultry)	0.4175	0.4784	0.9247	1.5078
	(0.3616)	(0.4830)	(0.7444)	(1.2580)
P3 (fresh produce)	0.5946*	0.6362*	1.0628**	1.7404**
	(0.3554)	(0.3557)	(0.5266)	(0.8855)
SPOT(small/irreg shipments)	-0.3154	-0.5201	-0.8775	-1.3970
	(0.4062)	(0.4401)	(0.5620)	(0.9577)
Selectivity Correction				
Rho	0.9999	0.9999		
	(0.0000)	(0.0000)		
IMR			0.7069	1.1141

	(0.8479)	(1.4604)

Standard errors are in parenthesis. *** $p \leq 0.01$ ** $p \leq 0.05$ * $p \leq 0.1$

The bivariate probit and the Heckman model, which controls for the correlation coefficient ρ, provide similar results. These results of these models suggest that large shippers are significantly more likely to negotiate directly with carriers, but provide no statistically significant evidence that small shippers are more likely to use third-party agents. In the second stage, only shippers of fresh produce are more likely to select shipping association, but at a marginal significance level.

The estimation results are similar for Heckman models with probit and logit when IMR is included in the model as a regressor. The estimated coefficients for small shippers are now positive and statistically significant at the 0.1 level in both models. The parameter estimates for large shippers are negative and statistically significant at the 0.05 level, confirming that large shippers are significantly less likely to use third-party agents. The magnitude and significance of the coefficient estimate for shippers of fresh produce in the second stage model are stronger compared with the bivariate probit and sample selection models. These findings suggest that shippers of fresh produce have a higher likelihood to join a shipping association over a freight forwarder. The parameter estimates for dummy variables representing other products (P1 and P2) were statistically insignificant in all models. Therefore, there is no strong evidence that shippers of these products are more likely to choose a shipping association. The variable SPOT, which represent shippers of small volume and irregular shipments, was also found to be insignificant, indicating that that spot shippers are less likely to join a shipping association than other shippers.

6. Conclusions

OSRA has apparently been successful in its goal of promoting a more market driven environment where freight rates are determined through private contracting between shippers and carriers. Private contracting has increased substantially and conferences have disbanded and been replaced with discussion agreements. This paper re-examines the contractual decisions between shippers and carriers in the ocean liner industry. We analyze the same dataset of 81 agribusiness shippers used by Stewart and Inaba with similar statistical modeling methods. A

difference between our model and theirs is that instead of having only one categorical variable Volume in the first stage model, we include two dummy variables, representing the small and large size into our model. By doing this, we are able to distinguish the effects of different ranges of shipping volume on the shipper's contractual decision. The limit of a model having only one categorical variable Volume is that it only can tell us whether volume affects shipper's decision but unable to tell us the differences in the impacts of different ranges of volume.

Different statistical models are estimated to determine which factors influence the shipper's decision to contract with carriers. Consistent with previous study by Stewart and Inaba we found that a shipper's size likely plays an important role in determining a shipper's ability and willingness to negotiate service contracts on their own. Shippers of fresh produce may be more likely to join a shipping association than shippers of other products, probably caused by the tradition of these commodities working with production and marketing orders/associations overtime.. However, there is no significant difference in the decision to join a shipping association between shippers of lumber/engineered wood or meat/poultry products. Furthermore, there is no strong evidence supporting that shippers of small volume with irregular shipments are less likely to join a shipping association than to contract with a freight forwarder.

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