FACTORS ASSOCIATED WITH OWN-ACCOUNT TRUCKING IN CANADA

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Introduction

Underpinning most market transactions is at least one network, whether telecommunications, financial or transportation. On the transportation network, much of the goods movement involves a trucking component, from manufacturers and others to wholesalers and retailers as well as directly to customers. While some firms act as for-hire carriers, delivering goods for a wide variety of client companies, some firms employ their own private fleet of trucks to deliver goods to their customers. Still other firms employ a mix of their own trucks with for-hire carriers.

Statistics Canada's business surveys are broken down by industry and, as such, firms that operate their own trucking fleet will be classified to other industries (e.g. manufacturing, retail). So, some trucking activity takes place internally within the firm rather than as a market exchange between two firms. This means that the overall contribution of trucking to the economy is underestimated using conventional national accounting. For instance, according to the 2012 American Commodity Flow Survey, over one-third of all goods shipped in the United States by value (36%) and by weight (37%) are moved by private trucking.

In Canada, Monteiro (2011) estimated that private trucking could account for as much as 85% of urban and 75% of inter-provincial truck movements. Therefore there is a clear need to better understand the role of private trucking in Canada. In particular, this research will inform the redesign of Statistics Canada's Trucking Commodity Origin Destination (TCOD) survey to include private trucking. Filling this data gap will also improve the information available to Transport Canada and other policy makers that are grappling with an understanding of how to facilitate better freight movement.[1]

The paper begins with a selective review of literature on outsourcing in general and on the decision to operate own-account or private trucking specifically. Next, the data used for the analysis are presented along with some descriptive statistics. Then, a multivariate binary choice mode is specified in order to determine those factors statistically associated with the use of private trucking. Results from the model are examined in some detail before the paper concludes by pointing to future research needs.

Review

Much of the focus of the academic literature is on choices between different modes of shipping, such as choosing among rail, marine and trucking (Kanafani, 1983; Hensher & Button, 2000; Prentice & Prokop, 2016).[2] Since cost minimization and the timing of deliveries are primary factors in mode choice, there are parallels with a firm choosing between own-account and for-hire trucking. Often the discussions regarding this choice take place in industry publications and the author is lobbying for one alternative or another depending on affiliation. In the era of deregulation and globalization, much of the research emphasis appears to be on the larger issue of outsourcing logistics or freight related activities (Mostafa & Roorda, 2016).

We start with a classic paper on the nature of the firm that first raised the importance of transaction costs in determining which tasks will be done in-house and which will be contracted out, thus determining firm size (Coase, 1937). In this vein, cost and complexity of management are most often cited in opposition to private fleet operation (Payne, 2007). There are however, two types of costs: variable and fixed. Variable costs are those that increase with the number of shipments. Fixed costs, on the other hand, can often remain the same as the number of shipments increases. Thus, with increasing shipments, variable costs take on a greater share of total cost while fixed costs shrink as a share.[3]

The Decision to Operate a Private Fleet

It is within this larger context of outsourcing that we examine the prevalence of private trucking. In addition to the upfront cost of establishing a shipping facility, purchasing or leasing a fleet as well as hiring a logistics management team are fixed costs incurred if operating a private fleet. Before making the decision to invest in facilities and vehicles, there are certain considerations. As economies of scale are usually necessary for own-account trucking, it is typically companies with a larger number of shipments that operate private fleets (Farris & Pohlen, 2008). That is, the fixed costs can be averaged across a larger number of shipments.

And as a fleet grows it becomes practical to have maintenance activities carried out by an in-house team of mechanics. In some cases however, the need for specialized trucks for unique types of goods may necessitate the operation of a private fleet even at small volumes. So we expect that the prevalence of private trucking will also vary by type of industry. That being said, we should still expect number of shipments, and possibly the size of the company, to be positively correlated with the likelihood of using private trucking.

Lynch (2007) cites other reasons for operating private trucking, such as improved customer service through anytime-deliveries and the driver doubling as a salesperson. Other advantages of private operations may include greater control, reduced damage to goods in transit, lower transit times, an increase in bargaining power with for-hire carriers, and reduced costs (Farris & Pohlen, 2008). Similarly, reducing the length of trips when a truck is not carrying any cargo, known as "deadheading", is a consideration for any carrier but adds to the complexity of operating a private fleet (Payne, 2007).

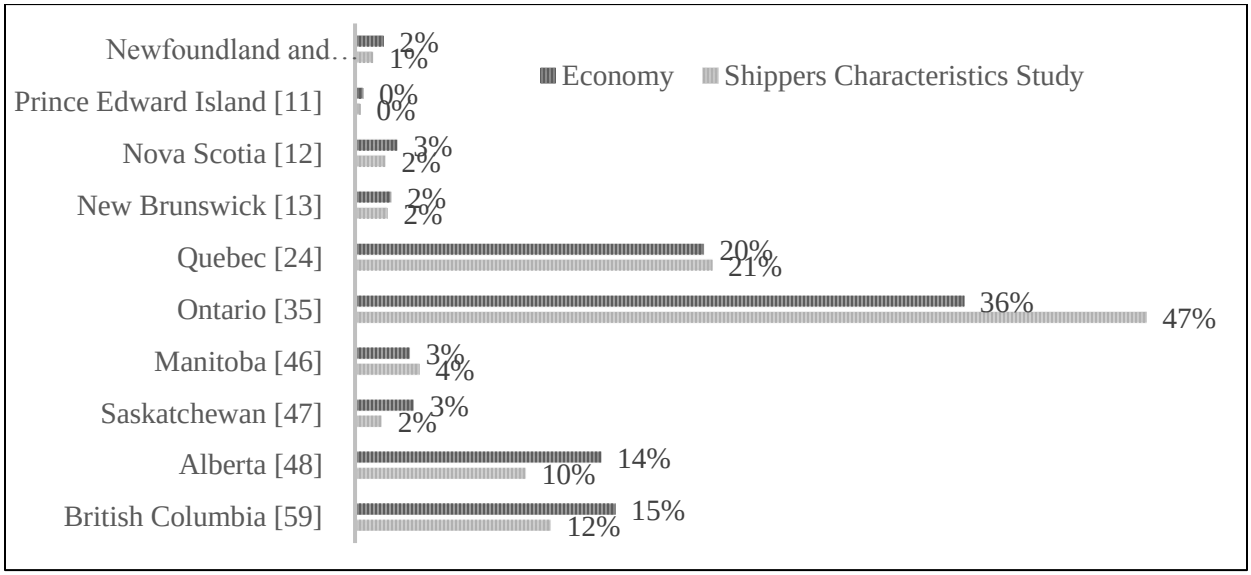
In some cases, firms operating a private fleet also offer their service as a for-hire firm in order to minimize underutilization of their fleet on the return journey (Farris & Pohlen, 2008). So organizationally, some private trucking services are operated as a cost centre while others are operated as a profit centre. Finally, bargaining with a union may result in both greater costs and complexity (labour agreements) so that higher than average unionization rates of truck drivers has been raised as an argument in favour of using for-hire trucking companies rather than own-fleet operation (Farris & Pohlen, 2008).

Analysis

Data and Sample

In order to learn more about the role private trucking in the economy, Statistics Canada conducted a Shippers Characteristics Study (SCS) in March of 2016. With support from Transport Canada, the SCS was implemented to partly inform costing of a commodity flow survey by estimating the typical number of shipments across various industries. The study frame was constructed using the January 2016 Business Register (BR) along with the membership rolls of various trucking associations. Establishments from the later were restricted to those with $1.3 million in revenue or more. In the end, more than 2,400 enterprises were selected from several North American Industry Classification System (NAICS) industries.

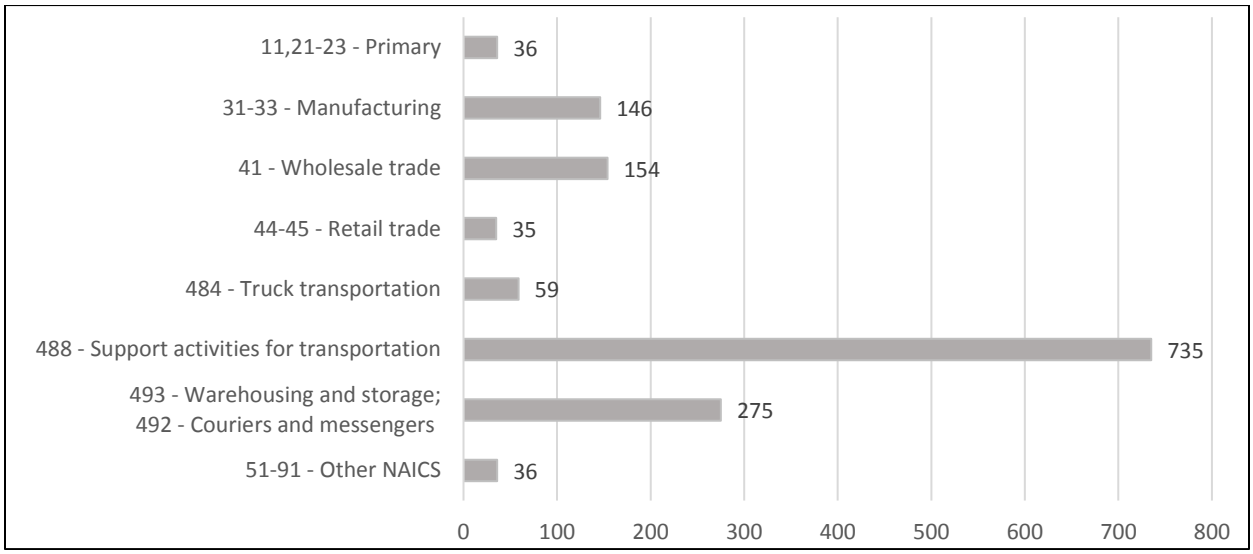
Selection was based on non-trucking enterprises (i.e. not NAICS 484) having an establishment classified as either Trucking (NAICS 484), Warehousing (NAICS 4931) or Freight Transportation Arrangement (NAICS 4885). The end result was a frame of 2,709 establishments from across the country (Figure 1) and from different sectors (Figure 2) that were asked about their shipping activities. The geographic distribution of this sample is similar to the distribution in broader economy with perhaps the minimum revenue requirement explaining a concentration of firms in Ontario.



Sources: CANSIM Table 552-0003 Canadian business counts (December 2015) and SCS (2016)

Figure 1. Distribution of SCS establishments by province

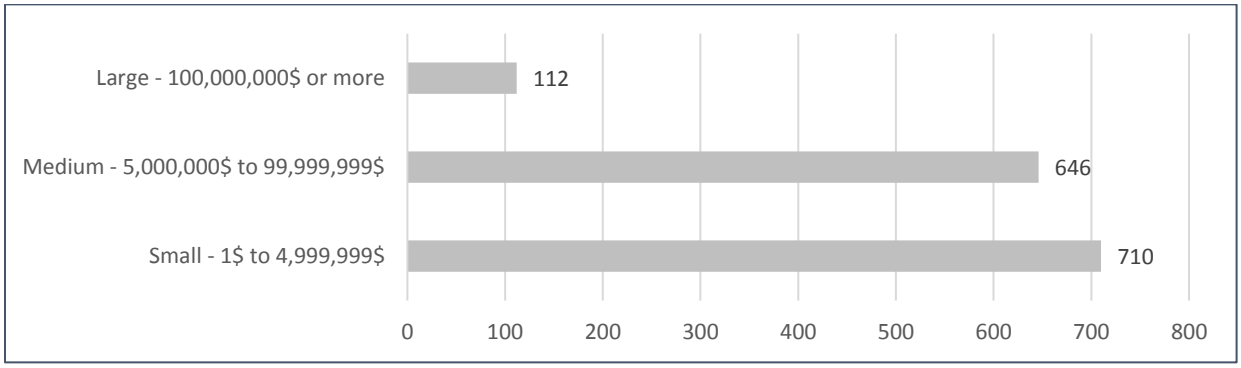
From this sample, 1,836 establishments (68%) responded that they have outbound shipping of which 1,477 (80%) reported the number of outbound shipments in a typical week.[4] With this subset of firms across industry, the largest group is Support Activities for Transportation (488) which includes freight forwarders and custom brokers (Figure 2).



Sources: Statistics Canada, SCS (2016)

Figure 2. Distribution of SCS establishments by industry

We initially considered establishment size, based on the estimated BR revenue (Figure 3). Establishments reporting no revenue were reclassified as missing and excluded from the analysis. As mentioned, the revenue of a firm is expected to be a factor since larger entities may benefit more from the use of private fleet. The average revenue of in-sample establishments is $73.4 million. Those establishments classified to manufacturing, wholesale or retail trade tended to have above average revenues (data not shown).



Sources: Statistics Canada, SCS (2016)

Figure 3.Distribution of SCS establishments by revenue size

The sample was drawn without weights representative of the economy and, as a result, the estimates obtained are only applicable to this sample of establishments. That being said, a sample of this size is sufficiently large enough to conduct microeconomic analysis on the factors that influence their behaviour.

From the responding establishments, a subset was selected to determine which characteristics distinguish those that used private trucking from those that used for-hire carriers. Establishments were selected that: 1) reported conducting shipping activities in a typical week; 2) reported a non-zero number of shipments; 3) were not classified to the Truck Transportation subsector (NAICS 484); and 4) had non-zero revenue in the BR. There were 1,406 establishments selected for further analysis.

Of this subset, nearly half of the businesses surveyed from the Atlantic Provinces operated a private fleet compared to only 28% in Quebec (Table 1). Since Ontario was more or less the same as the national average, it was used as the reference group for the regional binary variables. More than three quarters (77%) of the establishments from the Primary sector (e.g. resource extraction) use own-fleet shipping (Table 2). Manufacturing was closest to the national average and, as such, was used as the reference group for the industry binary variables.

Table 1. Establishments with private trucking by region

Region	Total	Engaged in Private Trucking	
Atlantic	70	34	49%
Quebec	257	72	28%
Ontario	705	254	36%
Prairie	197	83	42%
BC and Territories	177	71	40%
Canada	1406	514	37%

Table 2. Establishments with private trucking by industry

NAICS Sub-sector	Total	Engaged in Private Trucking	
Primary (11, 21-23)	35	27	77%
Manufacturing (31-33)	145	60	41%
Wholesale (41)	153	78	51%
Retail Trade (44-45)	35	19	54%
Support Activities for Transportation (488)	731	183	25%
Couriers and Messengers (492); Warehousing and Storage (493)	273	129	47%
Other NAICS	34	18	53%
Canada	1406	514	37%

Methods and Model

A binomial choice model is commonly used in examining the choice of shipping mode (Samimi, Kawamura & Mohammadian, 2007). In general, a binary choice model represents the decision made when faced with a pair of choices and takes on one of two possible values, one or zero (Greene, 2012). Since this mode choice most closely relates to the decision of using a for-hire company or an own-account fleet, we also used this approach. In our model, the dependent variable is the likelihood that the firm operates their own fleet. It is equal to one (1), if the company used a private trucking for any of their shipments, and zero (0) otherwise. In the SCS study, establishments that reported using road for outbound shipments were asked if they did so using their own trucks.

The independent or explanatory variables were examined to see how they influence the likelihood that a firm operates a private fleet: Number of shipments, industry and province. The model was specified using the natural logarithm of number of shipments to account for the relative importance of changes in these variables at low levels rather than at higher levels.[5] Variables for industry and province were also included to reflect differences in behaviour across geographies and industries. For example, population density (people or businesses) may have an influence on whether there are sufficient volumes to operate a private fleet profitably as well as on the actual availability of for-hire trucking companies.

To identify traits associated with establishments that operate private trucking, the model was specified as:

Uses Private Trucking (1 or 0)

$$= \beta_0 + \beta_1 * ln(\#\ of\ Shipments) + \beta_i * Region_i + \beta_j * Industry_j + \varepsilon$$

Again, as part of the SCS establishments reported how many outbound shipments were made in a typical week and the modes used for these shipments. The industry classification and geographic location were obtained from the BR.

Results

As expected, the number of shipments had a positive and significant (5% level) effect on the likelihood that an establishment operates a private fleet (Table 3). Other significant influences were geography and industry. Located in the Atlantic region (when compared to Ontario) had a positive and significant influence. We expect this may relate to a smaller regional market with perhaps less for-hire competition.

Classified to the Primary sector (when compared to the manufacturing sector) was also positive as expected; likely related to the need for more specialized equipment (Farris & Pohlen, 2008). In contrast, being classified to the Support Activities for Transportation subsector (NAICS 488) had a negative effect as did being located in Quebec (when compared to Ontario), but at the 10% significance level.

Table 3. Binary Choice Model Coefficients

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > ChiSq
Intercept	1	-0.7791	0.2182	12.7524	0.0004
log_C1002_shipments	1	0.0982	0.0294	11.1884	0.0008
ATL	1	0.551	0.2629	4.3914	0.0361
QC	1	-0.2979	0.164	3.2985	0.0693
PRAIRIE	1	0.073	0.175	0.174	0.6766
BC	1	0.1613	0.1828	0.7792	0.3774
Primary_NAICS	1	1.7708	0.4415	16.0844	<.0001
NAICS_41_Wholesale	1	0.3607	0.2361	2.3337	0.1266
NAICS_Retail	1	0.4951	0.3835	1.6667	0.1967
NAICS_488	1	-0.6735	0.1909	12.4477	0.0004
NAICS_492	1	0.9643	1.264	0.582	0.4455
NAICS_493	1	0.2318	0.2104	1.2134	0.2707
Other_NAICS	1	0.574	0.3807	2.2739	0.1316

The odds that an establishment in Quebec operates a private fleet were only 74% of establishments in Ontario (Table 4). This has been attributed elsewhere to the higher rates of unionization in Quebec (Farris & Pohlen, 2008). The odds that a firm in the Primary sector uses private trucking are nearly six times higher than the odds for a firm in Manufacturing, all else held equal. Again, this may be related to the need for specialized fleets (construction, logging, agriculture) or due to the large size of individual shipments. Establishments in the Support Activities for Transportation subsector (NAICS 488) were less likely to operate their own private trucking fleet. If these establishments are supporting road transportation (NAICS 4884), they already have business relationships with for-hire trucking firms that are available to handle the physical movement of goods. Furthermore, having decided to specialize in some other facet of distribution many of these support firms may be organized to outsource the physical movement of goods.

Table 4. Binary Choice Model Odds Ratios

Odds Ratio Estimates			
Effect	**Point Estimate**	**95% Wald Confidence Limits**	
log_C1002_shipments	1.103	1.042	1.169
ATL	1.735	1.036	2.905
QC	0.742	0.538	1.024
PRAIRIE	1.076	0.763	1.516
BC	1.175	0.821	1.681
Primary_NAICS	5.875	2.473	13.959
NAICS_41_Wholesale	1.434	0.903	2.279
NAICS_Retail	1.641	0.774	3.479
NAICS_488	0.51	0.351	0.741
NAICS_492	2.623	0.22	31.239
NAICS_493	1.261	0.835	1.905
Other_NAICS	1.775	0.842	3.744

In summary, the number of shipments is associated with an increased likelihood of operating a private fleet, as expected. Other than the Atlantic region, the geographic variables were not statistically significant at the 5% level. Establishments in the Wholesale, Retail, Warehousing and storage sectors were not significantly different from those in Manufacturing. Firm size, measured by revenue, may have an influence on the likelihood of operating a private fleet within certain industries but not in others.[6] If so, this could be explored by either interacting them in one model or by conducting sector-separate regressions. Moreover, there was some evidence that firm size was being confounded with the industry variables.

There is additional analysis that can be conducted using the SCS data. For instance, it may be insightful to model why establishments use private trucking along a gradient as a share of their shipments by road or in combination with other modes such as marine or rail. In our analysis, the characteristics of the establishment were tested, while those of the shipment were not. Ideally, we would like to include some characteristics of shipments such as, for example, average weight, size or distance.[7] Finally, there is some anecdotal evidence that foreign firms are more likely to outsource shipping activities as they expand into other countries. Outsourcing reduces the necessary capital expenditure and exposure if expansion plans fail. It might be useful to differentiate by country of ownership (available from the BR) in subsequent research.

Summary

This study found that establishments with a higher volume of shipments were more like to operate a private fleet. There were also some notable differences in prevalence by region and by industry. For example, the odds of establishments using private trucking were higher in the Atlantic Provinces and in the Primary sector (NAICS 11, 21-23). Conversely, the odds were lower in Quebec and in the Support activities for transportation (NAICS 488) industries. It is evident that better statistics on the prevalence of private trucking would help to underscore the importance of this activity to the economy. In addition, such statistics would also inform private and public sector decision makers on supply chain optimization and congestion mitigation strategies respectively.

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Endnotes

[1] Research would also benefit from more information on private trucking. Recent work by Statistics Canada developing a Surface Transportation File (Bemrose et. al., 2017) to visualize trade flows would be bolstered by improved measures of physical flows. Currently the private trucking portion is captured by proxy with the file estimates benchmarked to the dollar value calculated from the Input-Output tables.

[2] Prentice & Prokop (2016) note that, in freight transport, each mode of transportation has a comparative advantage in terms of type of commodity, distance shipped, geographic area and specific season.

[3] A similar relationship between costs and volume exists with respect to distance in that fixed costs are spread out over more kilometres with greater distances; this is referred to as "tapering" (Bonsor, 1984).

[4] There were 59 establishments from the Truck Transportation (484) subsector excluded from the regression analysis since they are operating a private fleet by definition.

[5] For example, this way the model will capture the greater relative importance of a firm going from 50 to 150 shipments a week, a 300% increase, than on a firm going from 10,000 to 10,100 shipments, a 1% increase.

[6] The model was run with and without revenue and the results were more or less the same. It is also possible that another measure of firm size, such as the number of employees, would have been significant.

[7] In their absence it is possible that the regional variables are acting as a proxy for distance and other differences in shipment characteristics.