Near-border operations and logistical inefficiencies at the Peach Arch border: an analysis of 2009 CVO survey data (draft report)

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Introduction

Anecdotal evidence suggests that logistical inefficiencies are created by the border, increasing truck miles traveled, empty truck travel, and air emissions. While these dynamics are poorly understood, we recognize that these logistics are not improved by the border. By near border logistics we refer not to delays due to queuing at the border itself, but the routing changes, schedule impacts, and added stops and transfers that would not exist without the border. This report describes logistics practices near the US-Canada border at Blaine, Washington, discovered through a recent survey of border crossers.

Background

This research was enabled by a data collection effort regarding near border operations for commercial vehicles at the Pacific Highway Border Crossing between British Columbia, Canada, and Washington, United States (see Figure 1). The data collection and analysis effort was supported by a consortium of agencies and organizations concerned about border delay and inefficient border operations. This consortium includes researchers at the University of Washington, the Border Policy Research Institute at Western Washington University, and the International Mobility and Trade Corridor (IMTC) Project which is convened by the Whatcom Council of Governments. IMTC members include US Customs and Border Protection, the Canadian Border Services Agency, Washington State DOT, British Columbia Ministry of Transport, and other regional and local organizations concerned about cross-border trade and transportation.

Current near border operations practice is not well understood by policy makers, but anecdotal evidence suggests that due to differences in size and weight restrictions, corporate structures, driver work rules, business models, international trade regulations, and communication mechanisms, significant logistical inefficiencies exist near the border. For example, through interviews with regional carriers we are aware that significant numbers of drivers are unwilling or legally unable to cross the border, that carriers must dedicate specific vehicles in their fleet to cross-border operations to meet both region's standards, and/or choose to meet the more restrictive standard for weight and combination when crossing and traveling in the other region.

The recent survey and data analysis enables an evaluation of the logistical inefficiencies created by the border and to contribute to efforts to improve near border logistics by reducing empty truck miles, border delay, and their associated air emissions. This research aims to answer the questions: what is inefficient near border activity and how does the border contribute to operational inefficiencies? To

answer these questions, this research will first address the concept of near-border operational inefficiencies, define and explain metrics to determine operational inefficiencies, and evaluate those factors which cause these inefficiencies.

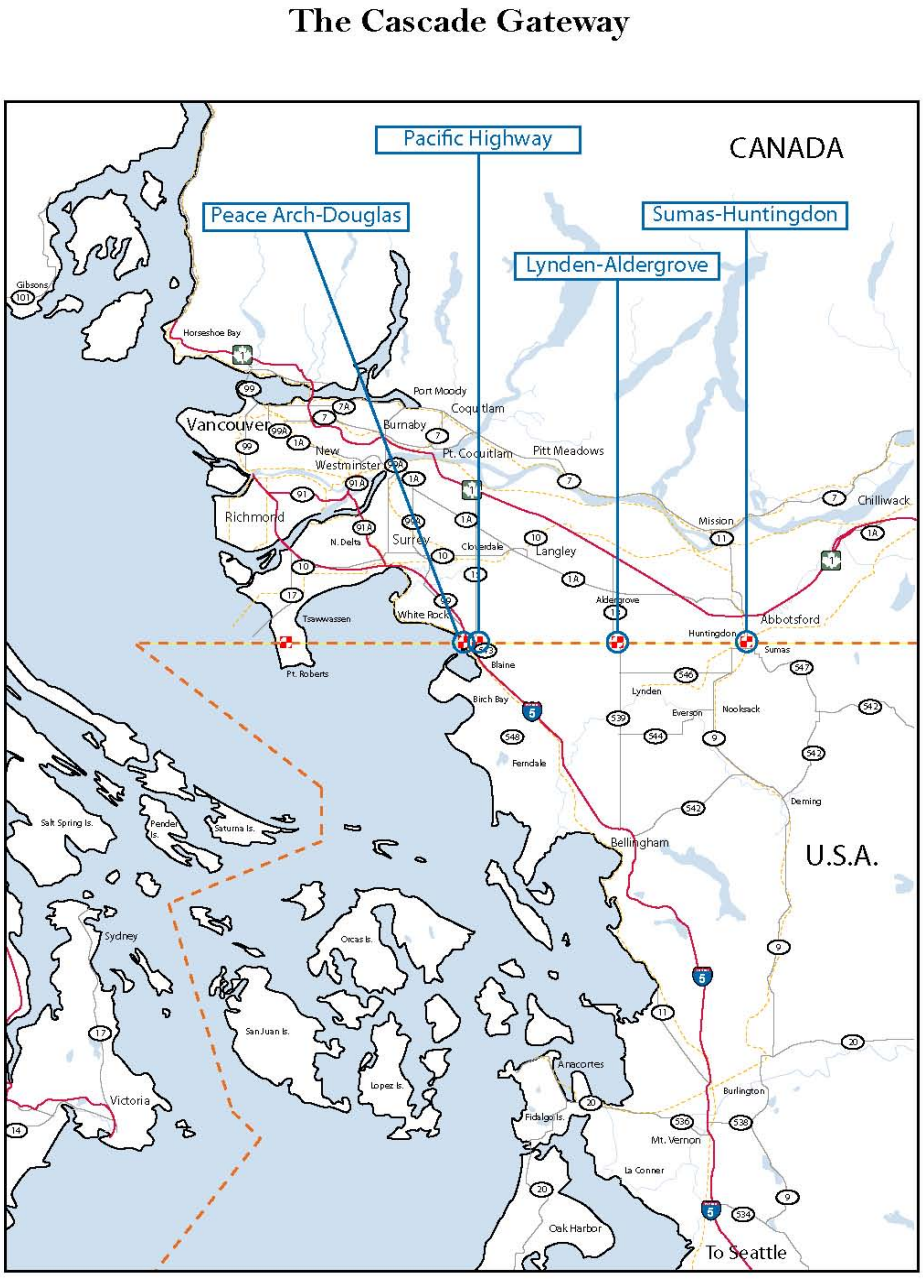

Figure 1: Regional Map identifying the study location at Pacific Highway (courtesy of IMTC)

What is inefficient near-border activity?

Inefficient logistical activities can manifest themselves in several ways, and this paper will consider three primary metrics to evaluate inefficient trucking operations influenced by the border. The first metric concerns the frequency and extent of empty trips made both across and tangential to border crossings. The second metric examines what is considered to be a suboptimal use of the Free and Secure Trade (FAST) lanes. The third metric concerns what can be considered "unnecessary" near-border activities, which refers to those logistical activities which occur near, and can be attributed to, the border. All three metrics will be considered throughout this paper when considering the various factors which cause inefficient border operations.

Empty miles and crossings

The first metric and most visible manifestation of border inefficiency, empty truck crossings, can be partially explained by the regional trade imbalance. In 2009, US imports from Canada were valued at almost $225 billion dollars, and US exports to Canada were valued at just over $200 billion. While there is some seasonal variation, values for June 2009 (when this survey was conducted) demonstrate this same relationship, with just over $18 billion in southbound trade and almost $17 billion in northbound trade. For goods moving only by truck, the US exports more to Canada (almost $12 billion in June 2009) than is imported from Canada (just over $8 billion). For trade only between Washington and British Columbia (BC), the relationship is more imbalanced, with Washington exporting to BC more than twice as much as it imports from BC. This ratio is maintained if we consider imports and exports not just from Washington, but also Oregon and California, and if we consider not only BC, but also Alberta (all data from the Bureau of Transportation Statistics).

Though the regional trade imbalance means that more southbound trucks will be empty than northbound trucks, this is not the only reason for empty trips. Other factors such as specific commodity flow directions and equipment specialization also impact empty trip patterns. A less visible cause of empty truck trips though is the cost-benefit tradeoff which determines whether or not a driver should return more quickly without cargo or search for cargo to make the return trip more profitable. The availability of return cargo is a function of the spatial and temporal density of similar truck trips.

Suboptimal FAST use

In the Cascade Gateway, it has also been observed that trucks are not participating in the FAST programs at projected rates, which means that, as long as FAST lines are empty, there is room for the border to operate more efficiently. As a third metric of inefficient trips, FAST use will be analyzed to better understand what trip attributes are linked with FAST use to gain insight into how the program could be operated more efficiently.

Unnecessary stops

Anecdotal evidence suggests goods may be staged near the border, so that equipment or drivers can be exchanged prior to the crossing, thus providing the basis of using this second metric of unnecessary stops. The same anecdotal evidence leads us to believe that cabotage laws and varying enrollment in FAST causes these types of staging activities near the border. However measuring this phenomenon has

proven challenging. To some extent the concentration of activity in Canada near the border presents evidence of staging, but this also reflects the geography of the Vancouver region and it's role as an importing port for Canada and Surrey, the location with concentrated logistics activity, as a logical location for this activity relative to Vancouver. Examining commodity patterns and FAST usage, we find suggestions, but not evidence, of staging.

Data Sources

To answer these questions we examined data made available through the cooperative efforts of a consortium including members from the University of Washington, the Border Policy Research Institute at Western Washington University, and the IMTC. Over several weeks in June and July of 2009, observational data was collected by the consortium at the Peace Arch border and, for eight of these days (June 15-18 and 22-25, 2009, all Mondays through Thursdays), instructions to complete an internet-based survey were distributed to all trucks observed. As such, all observational data analyzed here has been filtered to only consider those observations for which surveys were distributed, and is considered as the population data throughout this analysis. Accordingly, the data from the survey responses is considered as the sample data.

Operational data

Characteristics of population data

As was mentioned earlier, at the Pacific Highway border crossing more goods travel by truck north into Canada than south in to the U.S. **Error! Reference source not found.** shows relatively constant levels of empty trips in both the northbound and southbound directions for the dates and directions for which significant observational data was collected. The data clearly reflects the predicted imbalance in trade, but as suggested earlier, the trade imbalance is only a partial explanation for this trade discrepancy, and the magnitude of empty trips in both directions indicates that other reasons than a trade imbalance cause a significant amount of empty trips.

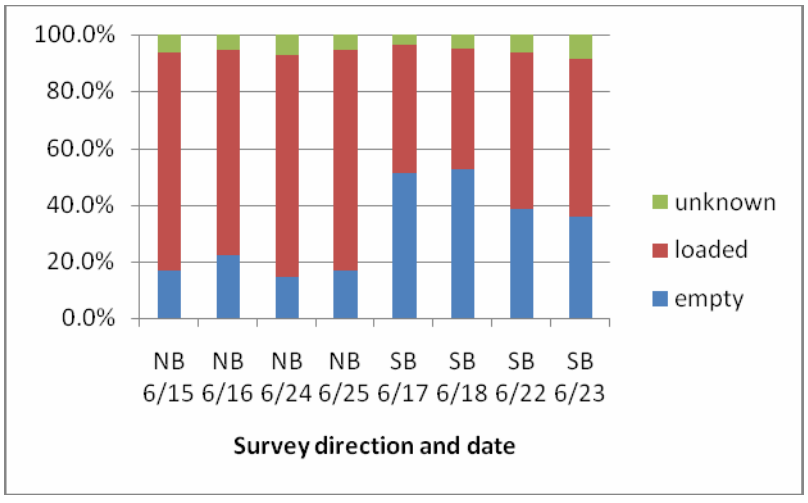

Figure 2: observed empty trips for survey dates

Survey data

Of the 215 unique survey responses, we found 211 of these to be useful in our analysis. Each request for a survey response included a unique survey number to be entered in the online survey but only 201 unique survey numbers were identified. Some survey entries had no survey number but contained useable data, so for these surveys a dummy survey number was created. Some survey responses contained duplicate survey numbers and, in the cases where the information appeared to be describing the same trip, the duplicate data was removed. If trip data was unique even though the survey number was duplicated, both entries were considered to be unique entries and one survey response was given a dummy survey number. The final survey data set after this filtering contained records for 211 unique trips.

In the following analysis, distances traveled were determined by calculating straight-line distances between geocoded city centers. Since the data was cleansed of location information more specific than that at the city-level, city-level information was the most precise location data available. Commodities as described in the survey responses were manually categorized using two-digit SCTG codes[1] (see Appendix 1 for categorization).

The surveys themselves capture information for a single cross-border round-trip. If a truck made more than one round-trip that day, then data collected is only for the first round trip. Figure 3 helps understand three trip-type categorizations used in this analysis: “backhauled” refers to trucks which crossed the border outbound after picking up or starting the day loaded with cargo in its initial country and subsequently picked up cargo for delivery on the backhaul trip; “did not backhaul” refers to trucks which traveled outbound with cargo but returned empty on the backhaul leg; “initial crossing empty” refers to trucks crossed the border outbound without any cargo and picked up cargo to cross back into the initial country for delivery on the backhaul leg.

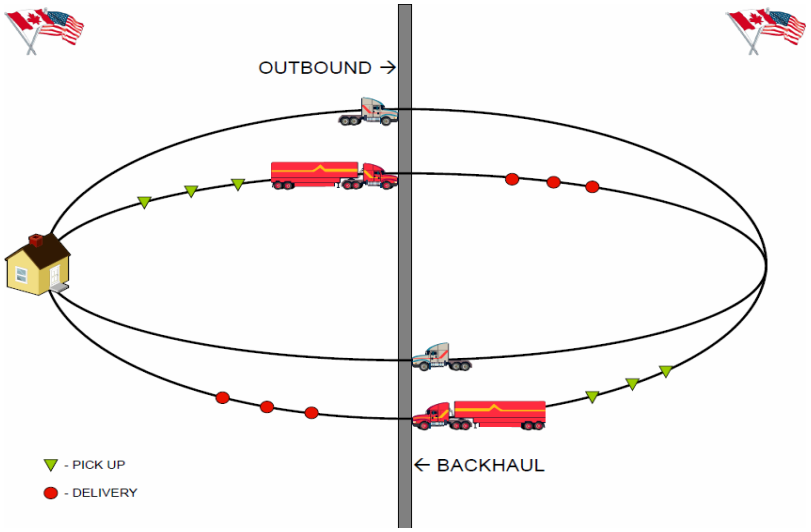

Figure 3: border-crossing schematic

[1] http://www.statcan.gc.ca/subjects-sujets/standard-norme/sctg-ctbt/sctgclass-ctbtclasse-eng.htm

Correcting survey data:

Weighting for Carrier Representation

Before analyzing the survey data, the results were weighted to reflect inconsistent response rates. Figure 4 shows the proportional and actual response rates by individual carriers in both the observational and survey data. Though the population data is comprised of approximately 35% Canadian carriers, U.S. carriers responded to more than half of the surveys distributed.

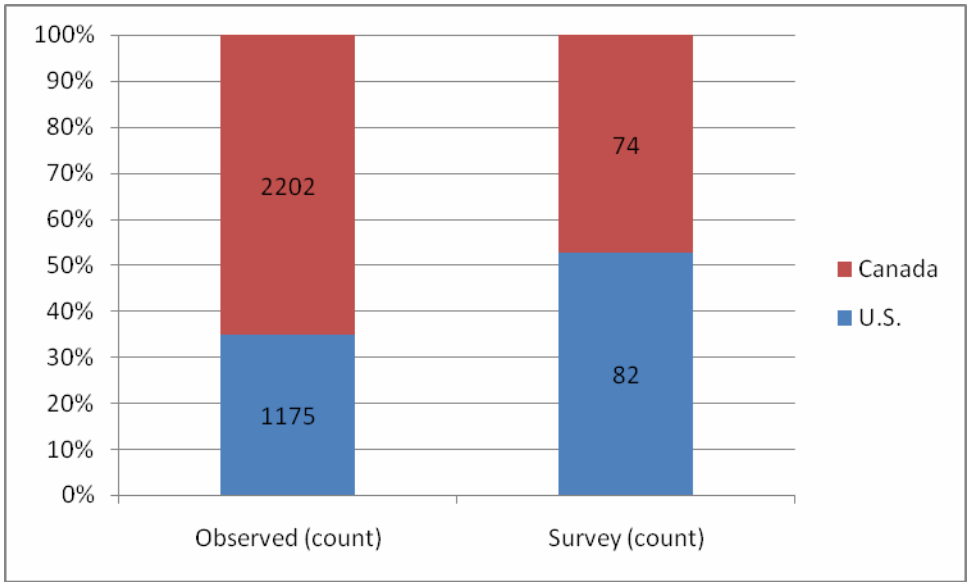

Figure 4: Carrier counts

In studying this discrepancy we discovered some apparent confusion among survey respondents as to how many surveys to complete. The surveys were distributed to drivers at the border with instructions to have the dispatcher complete the survey, and as several dispatchers handled many trucks receiving surveys, some dispatchers were unclear as to how many surveys to complete. As one respondent commented: “I have received 8 of your survey request are you looking for each on to be fill out?[sic]”. To demonstrate this confusion, Figure 5 shows the number of observations of any carrier observed at least 25 times in the population, and Figure 6 shows the number of responses by any single carrier in the sample which responded more than once (all carriers identified by home country and randomized carrier ID to protect identity). To compensate for inconsistent response rates by individual carriers, all values in the sample data set were weighted so that all *carriers* rather than *trips* were represented equally.[2]

[2] Survey results for whose carrier could not be identified were assigned a carrier weighting value of one

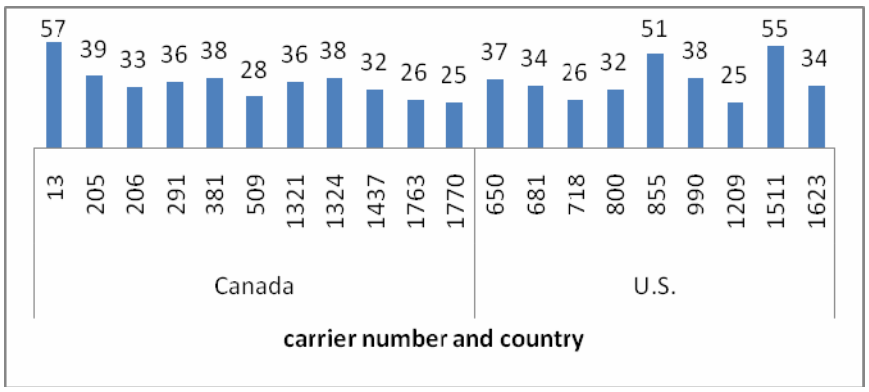

Figure 5: Carriers observed at least 24 times in the observational data during the survey period

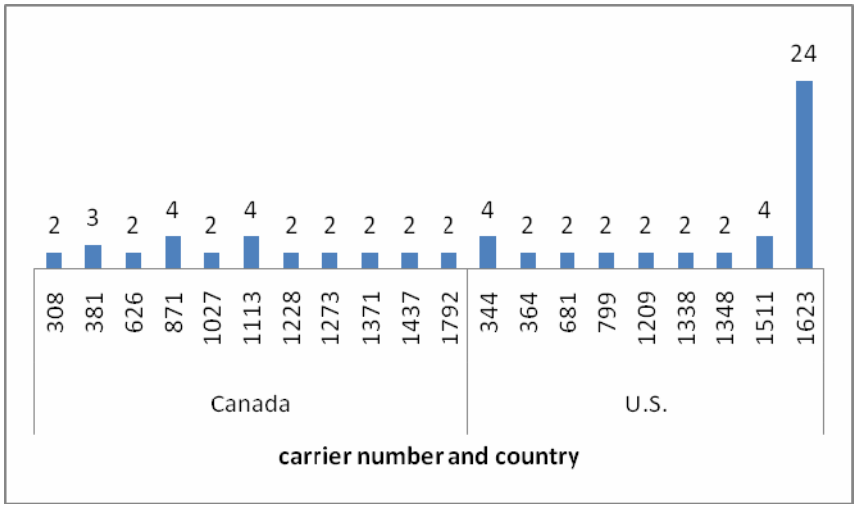

Figure 6: Carriers which responded more than once to the survey

As Figure 7 shows, weighting the data in this way aligns the carrier bias of the survey data closer to the observed data by bringing the ratio of Canadian carrier response above fifty percent, though a significant U.S. response bias is still evident.

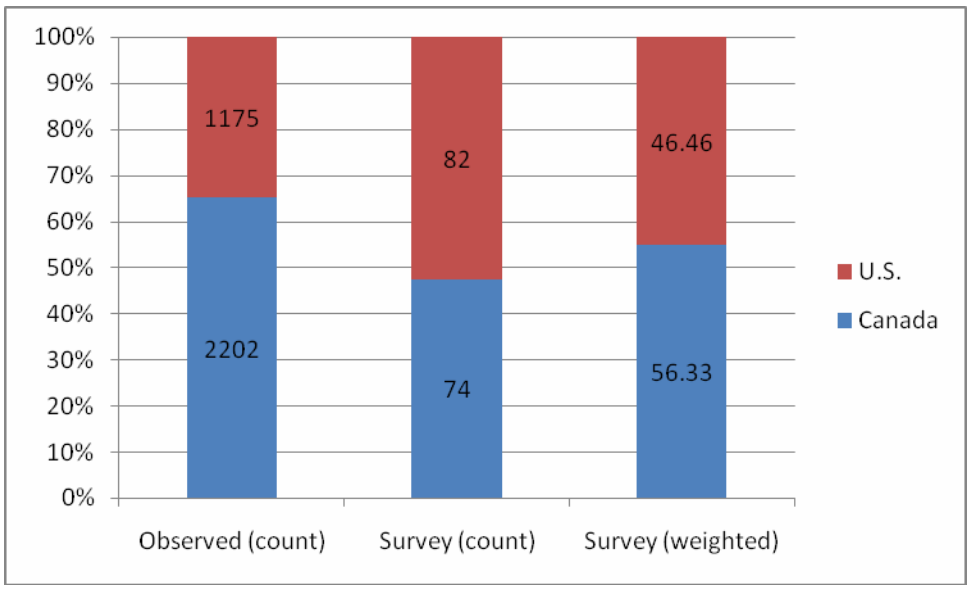

Figure 7: Actual and weighted carrier counts

Measuring inefficient near-border activity

Using the metrics for inefficient trips defined earlier requires examining various trip attributes and how they interact to cause inefficient near-border trucking operations.

Earlier we raised the question as to whether or not there is a cost-benefit tradeoff between the decisions to return more quickly without cargo or to search for cargo to make the return trip more profitable. We attempt to answer this question by first looking at the distances which trucks drive and how this relates to the prevelance of an empty trip in either direction. We will also look at how different commodity movements create inefficient border crossing trips and how the country of the truck carrier influences operational efficiency. In all of these cases, inefficieny will be determined by the frequency and distance of empty miles driven, suboptimal FAST use, and near-border staging.

Distances Traveled and Inefficient Trips

The following figures show the relationship between distances driven from pickup to the border and from the border to delivery. Figure 8 displays distance profiles for the population data while Figure 9shows population data for the sample data[3]. Both show the same general profile: the x-axis shows the direction of travel and distances driven from pickup to the border, while the magnitude of the colored bands on the y-axis represents the distances driven from the border to delivery. Northbound trips tend to originate from a variety of distances to the border, while the vast majority of deliveries in Canada occur within 25 miles of the border. Conversely, southbound trips tend to originate from within 25 miles of the border while delivery distances tend to vary widely.

[3] For the population data, origin and data are indicated as collected. For the sample data, origin is the last (or only) stop before crossing the border, and destination is the first (or only) delivery destination.

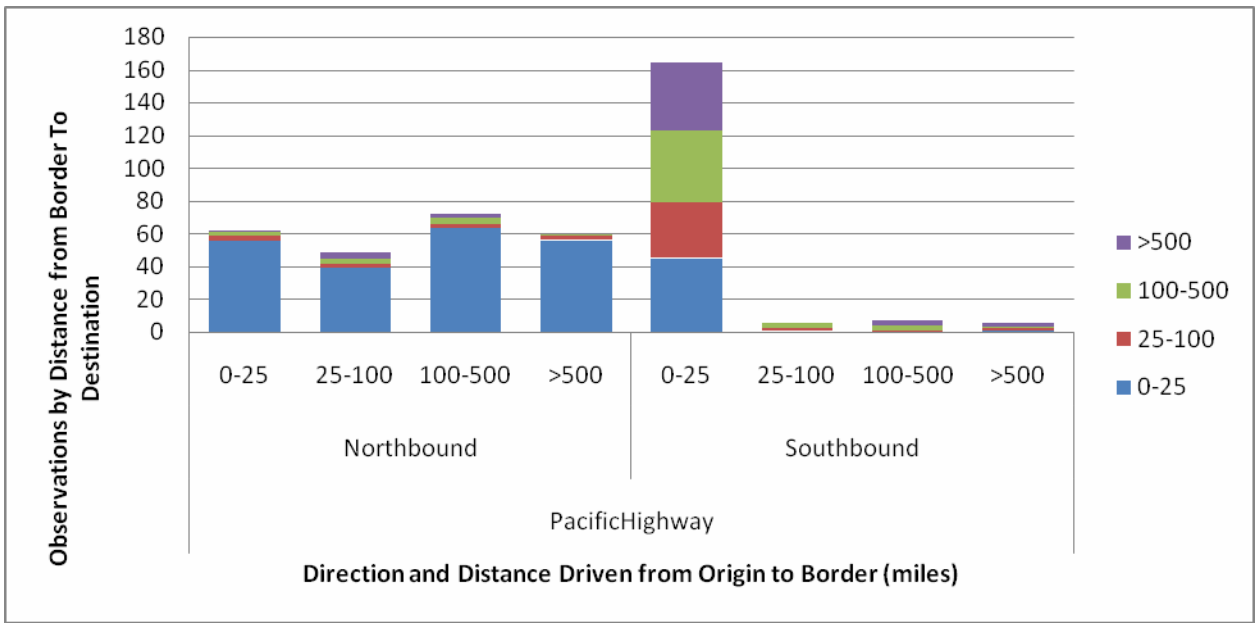

Figure 8: Population delivery distance profile

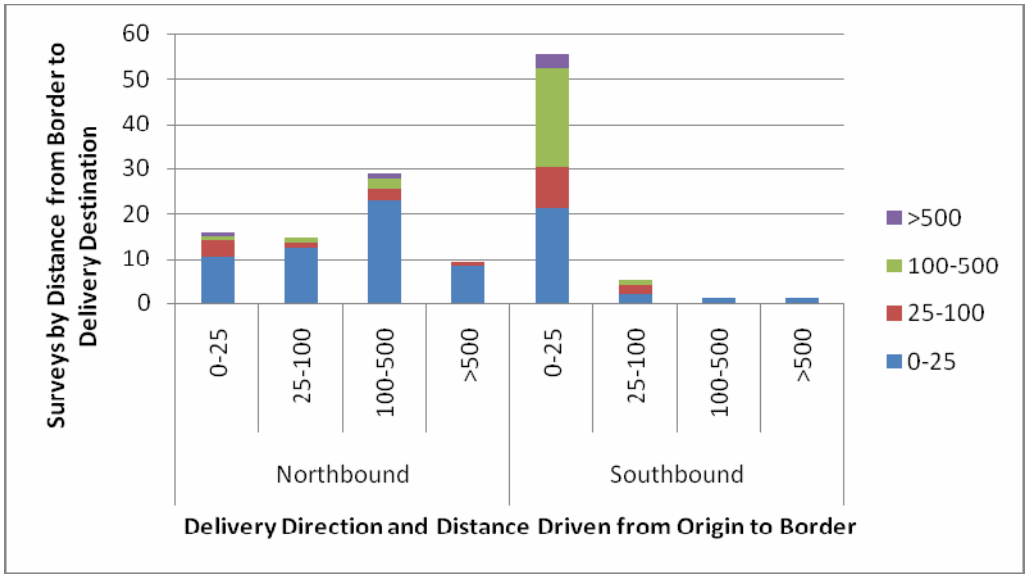

Figure 9: Sample delivery distance profiles

The survey however reveals a different pattern altogether for backhaul patterns. In Figure 10we see that, for trucks delivering in the U.S. and picking up a backhaul load destined for Canada, the probability that a load will be backhauled rises as distances rise (up to and including 100 to 500 mile range), but most of the deliveries are made within 25 miles of crossing the border into Canada. Conversely, for trips which deliver into Canada and backhaul into the U.S. most of these backhaul loads are picked up within 25 miles of the border but delivered a variety of distance into the U.S.

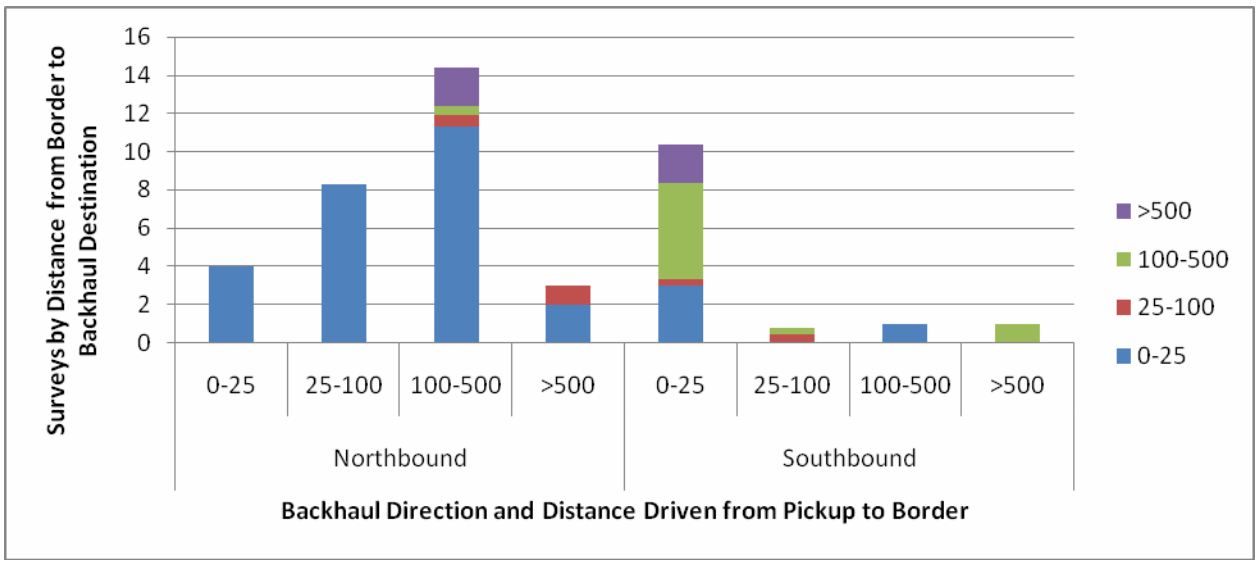

Figure 10: Sample backhaul delivery distance profiles

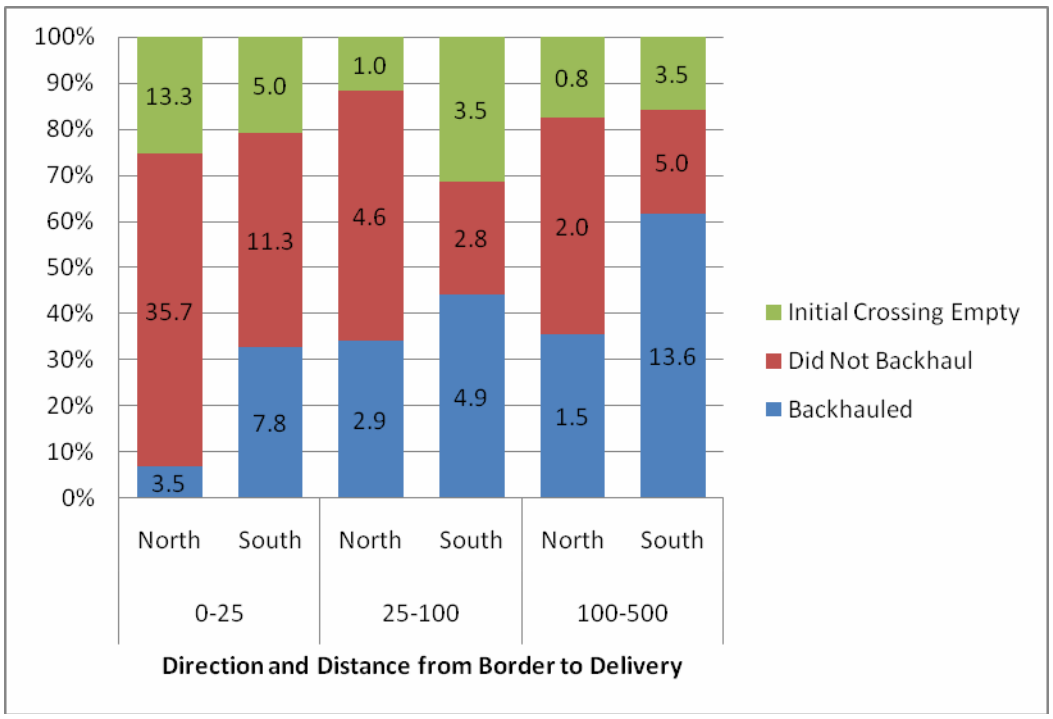

Figure 11: Likelihood of backhaul by distance driven after crossing the border

Figure 11 further examines this phenomenon, comparing the distance driven to pick up a load by the probability that that trip backhauled a load. Trips for deliveries greater than 500 miles can be ignored as statistical outliers, and at delivery distances over 500 miles, we can assume that such a trip would not be completed within one day[4] and as such is not a regional trip *per se.* Focusing on the regional trips with deliveries of less than 500 miles, we see a significant trend in backhaul patterns within the regional

[4] A round trip of 1,000 miles at 65 mph would require more than 15 hours of driving time.

context. **As the distance driven from border to delivery increases, so does the likelihood that the driver will find a load to backhaul.** The distances for trips without backhaul and trips which initially crossed empty can be evaluated similarly in this light since they both involve an empty trip in one direction to support the delivery in the opposite direction.

Commodities and Inefficient Trips

How does commodity type relate to empty trip miles? As implied earlier, supply and demand dictates which products are likely to travel in which direction. The question regarding operational efficiencies related to the border is: are there certain commodities for which a truck is more likely to be able to find a load to backhaul in the opposite direction? Figure 12, from left to right in order of decreasing backhaul proportions, seems to indicate that certain products such as wood, printed matters, waste and scrap, miscellaneous, manufactured and semifinished goods have high backhaul rates when compared to chemical, farm, energy and fuel and raw materials.

What these goods with low backhaul rates have in common is the need for specialized equipment. Chemical, energy and fuel products and other raw materials often move by equipment designed to move only specific products in bulk. Agricultural products also require specialized equipment, such as refrigerated trailers, and the regional nature of agriculture makes it unlikely that similar products will travel in both directions. Most of the goods with high backhaul rates seem to share the possibility of being transported with less specialized equipment, such as manufactured, miscellaneous and semifinished goods. Goods which are categorized as wood is a more surprising result. As categorized here, wood goods include products which fall into the SCTG categories describing logs and other wood in the rough as well as wood products. Timber would require more specialized material for transport whereas certain processed wood products could be carried without specialized equipment.

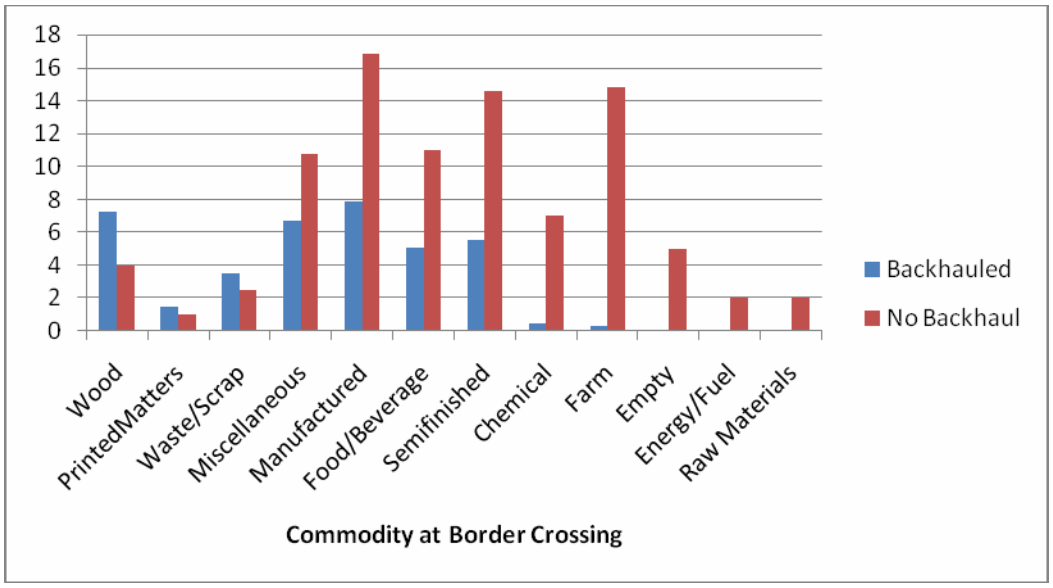

Figure 12: Commodity and Backhaul (in order of decreasing backhaul rates)

Further examining these specific commodity patterns, Figure 13 shows that, although wood products are often backhauled, northbound trips are less likely than southbound trips to backhaul. Manufactured and semifinished goods on the other hand show a high proportion of southbound trips for which there is no backhaul component.

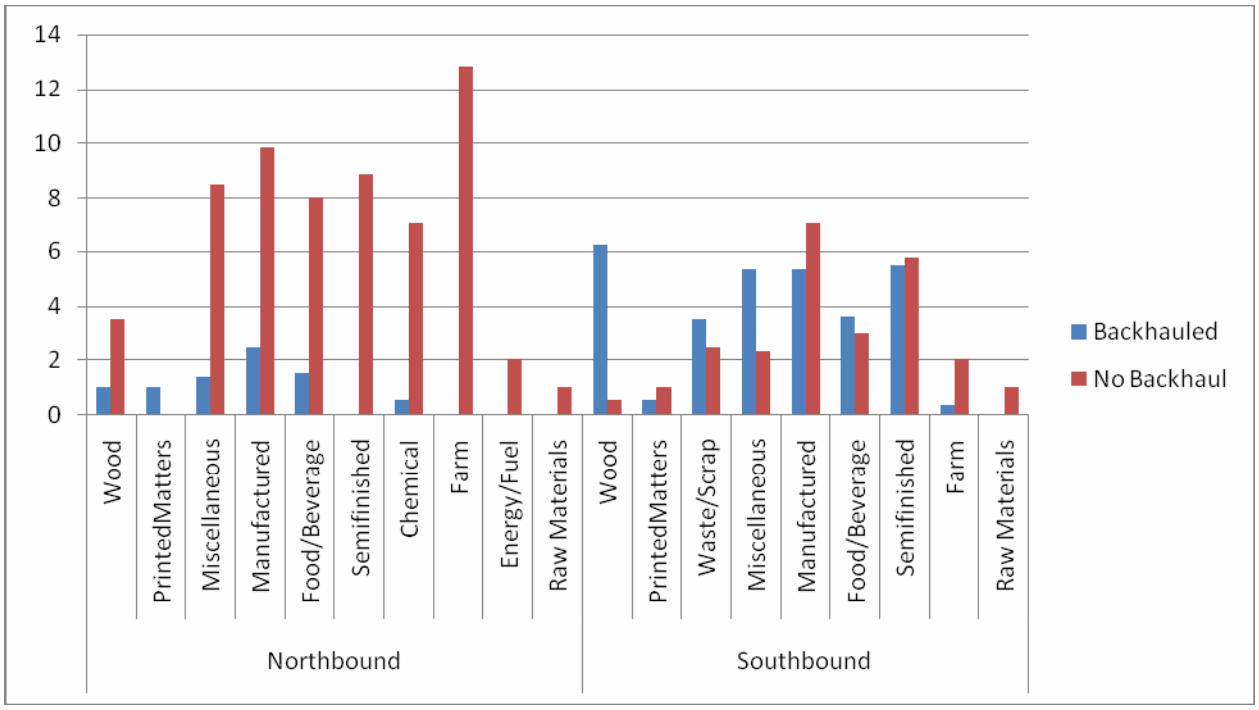

Figure 13: Commodity and backhaul by direction of initial delivery

Manufactured and semifinished goods defy the trade balance pattern by showing high rates of southbound deliveries without any backhaul. This begs the question: what is driving this decision to return empty without a load? Figure 14 looks at this phenomenon more closely, with the x-axis showing manufactured and semifinished goods by direction traveled and whether or not a load was backhauled and the y-axis showing the distance the truck traveled to deliver the commodity after crossing the border. Looking first at northbound trips, we see that the majority of manufactured and semifinished goods fit the general trade pattern of delivering a short distance into Canada without returning without a backhaul, but southbound sees a large proportion of trips which delivered to various distances without finding a backhaul. Further research is necessary to explain the lack of backhaul in the northbound direction.

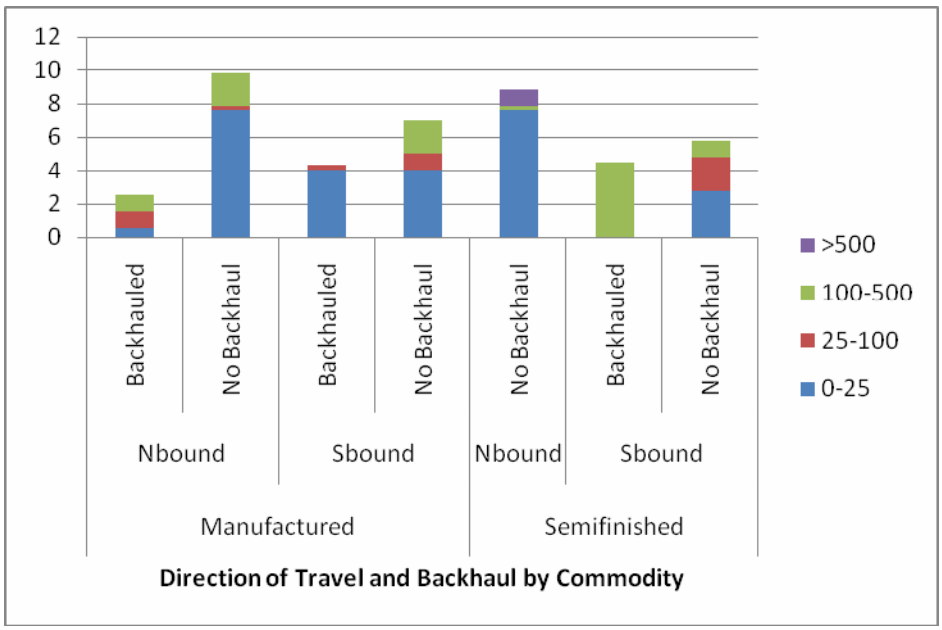

Figure 14: Distance traveled for certain commodities by direction of delivery and backhaul status.

Another measure of inefficiencies possibly linked to the border is the distance a truck travels empty in order to reposition itself to pick up a load to backhaul. The implications for the border is that, since cabotage laws prohibit a truck from most types of trips which pick up and deliver a load wholly within a foreign country, the options for a truck to find a load near its delivery location are limited. Figure 15 indicates which commodities for which companies are willing to take the longest empty repositioning trips in order to ensure a backhaul load. However, the data for repositioning trips beyond 25 miles are too few to draw any conclusions about this type of activity.

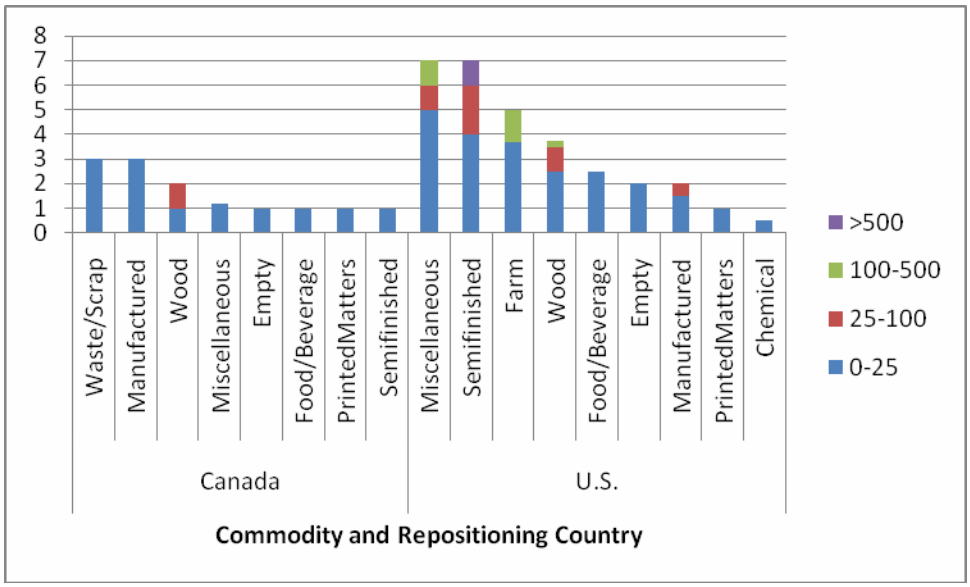

Figure 15: Repositioning distances driven to pick up a backhaul load by commodity and repositioning country.

As a final measure of trip efficiency by commodity type, we explored if there was any correlation between commodity type and FAST use. Figure 16 and Figure 17 show northbound and southbound FAST use for different commodity types, but no significant patterns appear. This issue has been considered in other, albeit limited studies, which show that bulk commodities and empty containers tend to use the FAST lane more than other cargo types.

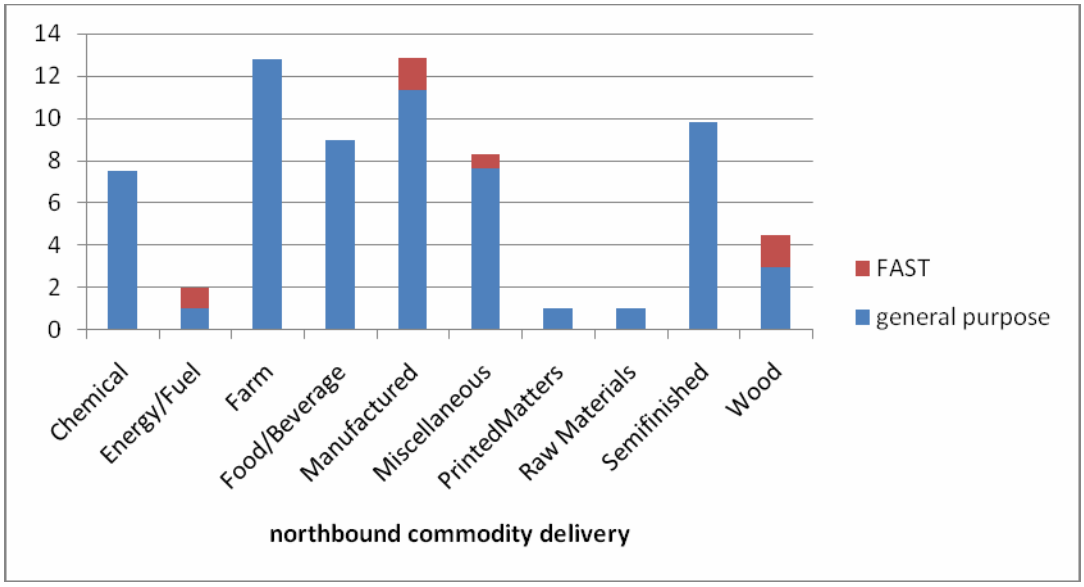

Figure 16: FAST use by northbound commodity delivery

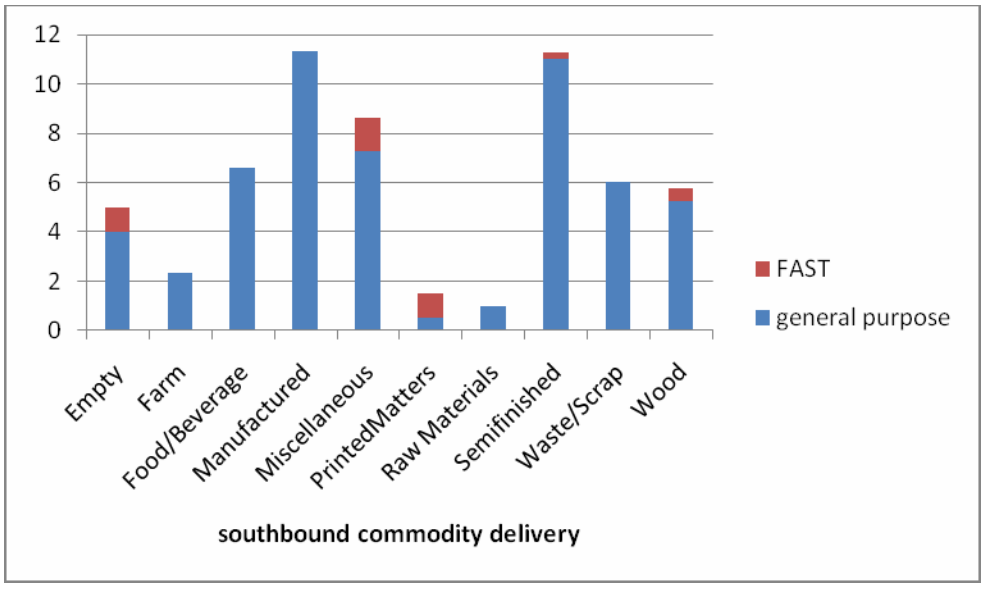

Figure 17: FAST use by southbound commodity delivery

Carrier Attribute and Inefficient Trips

Carrier Country

Another way to understand empty trip miles is to examine the relationship between the carrier country and type of trip taken. Figure 18 shows that Canadian carriers cross empty less often than their U.S. counterparts. Looking at this concept another way, Figure 19 shows the percentage of products which were delivered to each country by the importing carrier country, indicating that carriers from both countries import goods equally into Canada but Canadian carriers import the majority of goods which cross south into the U.S. This demonstrates an apparent advantage for Canadian carriers when transporting goods to the U.S. which correlates with a prevalence of empty truck trips into the U.S. by U.S. carriers.

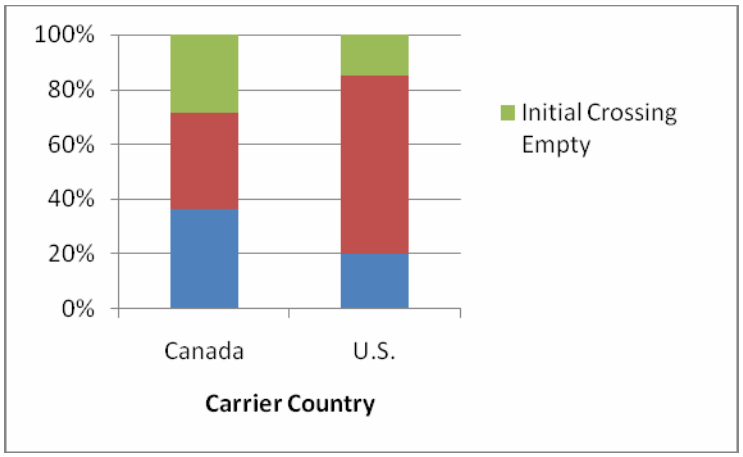

Figure 18: Border crossing load status by carrier country

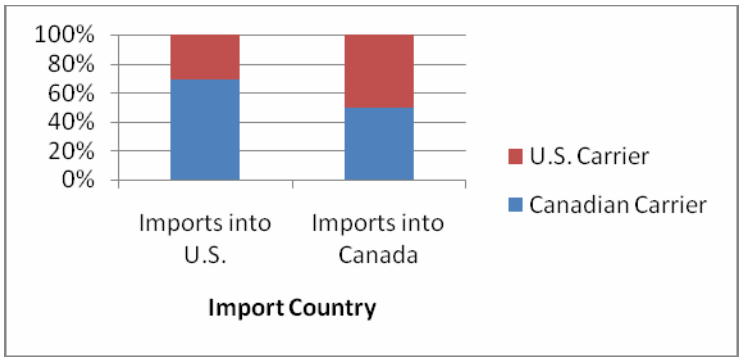

Figure 19: Carrier country by country of import

Along with a high rate of empty U.S. trucks traveling to the U.S. is a higher rate of FAST use for U.S. carriers in the same direction. Figure 20 demonstrates that FAST use is fairly consistent by carrier and direction, at about 5%, whereas southbound FAST use by U.S. trucks is above 20%. Further examining trends in southbound FAST use, Figure 21 shows that southbound FAST is most widely by first U.S. then Canadian carriers who delivery northbound and travel empty into the U.S. using the FAST lane. Looking

further into southbound FAST use, Figure 22 indicates that, for all southbound deliveries, few Canadian trucks use southbound FAST. The first two columns indicate trucks which started in Canada and delivered south (little FAST use); the third column shows that more than half of the trucks which crossed empty into Canada to pick up (U.S. based trucks) used FAST on the return.

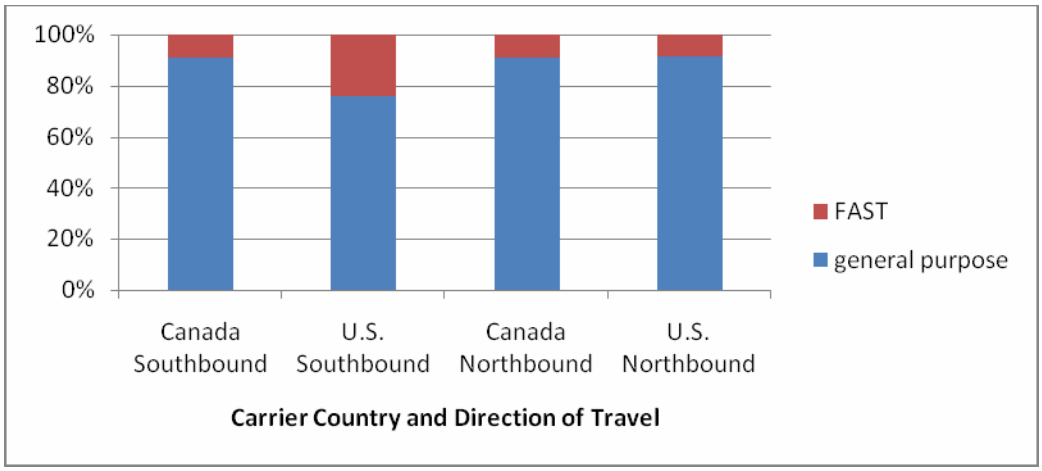

Figure 20: FAST use by carrier country and direction of travel

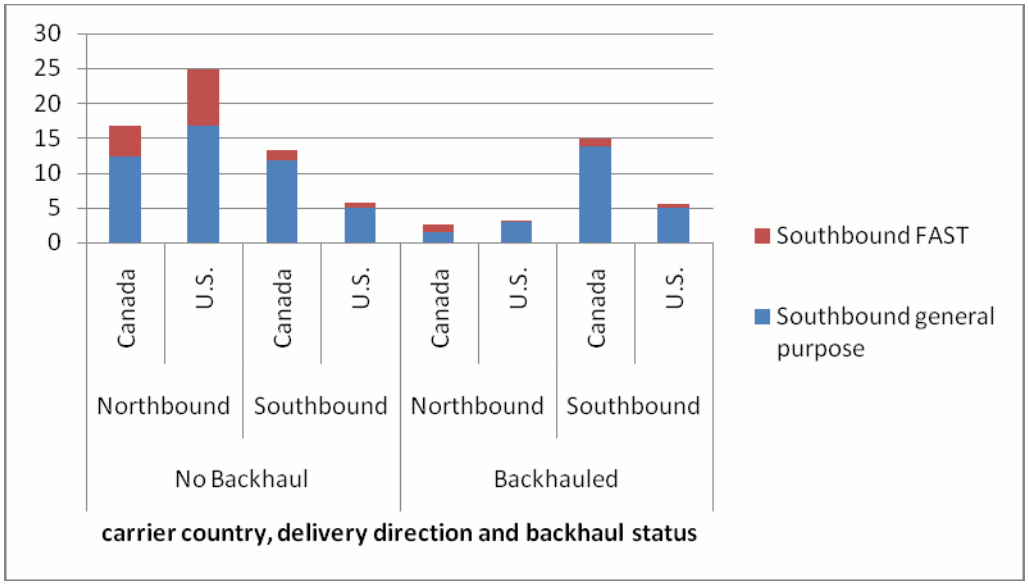

Figure 21: Southbound FAST use by carrier country, delivery direction and backhaul status.

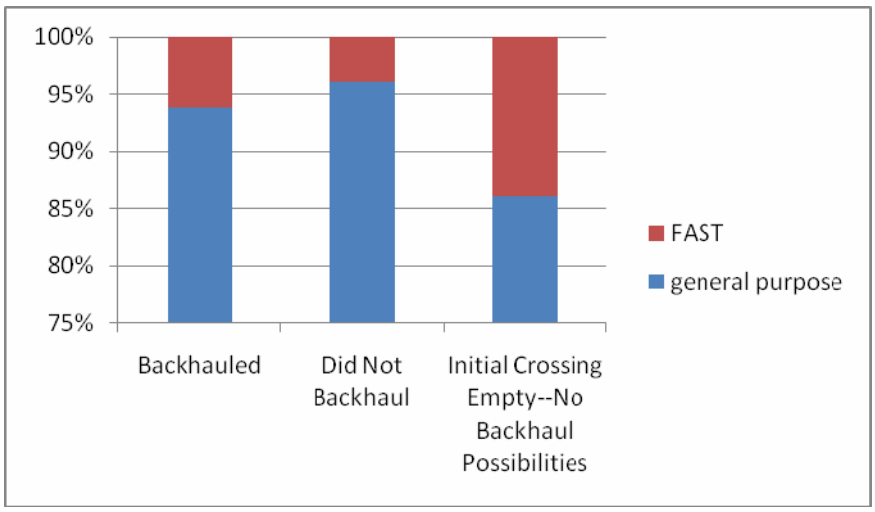

Figure 22: FAST use for southbound deliveries by round trip type

Carrier Size

Does carrier size allow for greater operational efficiency by larger companies? With more staff, more equipment and a larger pool of drivers, is a larger company able to coordinate more efficient trips? To answer this question, we divided the carriers into small, medium and large groups based on the population data. Figure 23 shows the distribution of carrier observations, with each vertical line representing an individual carrier and its magnitude representing the number of observations. Using this data to determine carrier size, we determined small carriers as those with one or two observations, medium carriers as those with three to nine observations, and large carriers as those with more than nine observations[5]. With these carrier size categories, we see in Figure 24 that there is a small increase in efficiency with carrier size. The magnitude of these counts as shown within the bar graphs raises the question as to whether or not this increase is a significant observation.

[5] Of the 211 records in the sample set, 26 were not identified by carrier name. These 26 observations are categorized as carrier size "unknown".

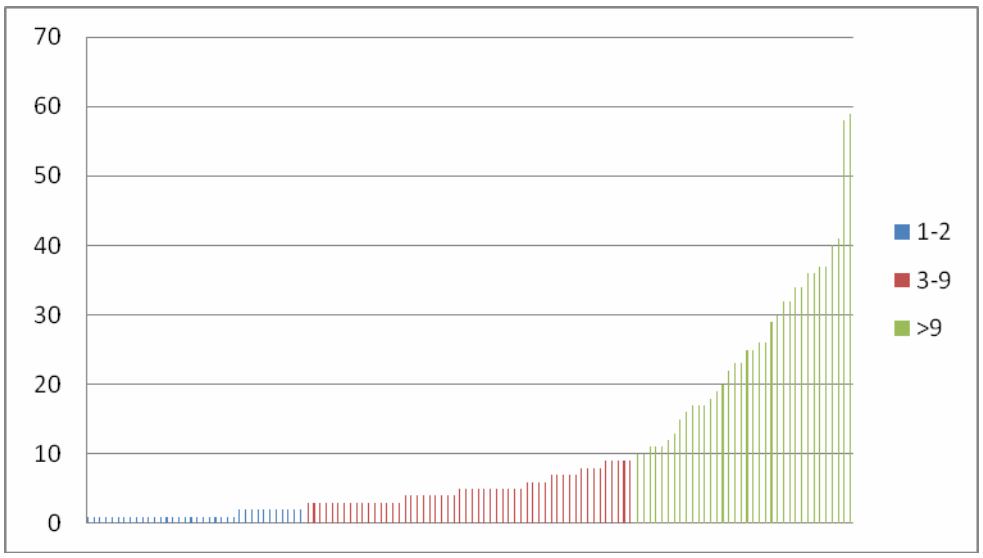

Figure 23: Assumed carrier size categories for observed carrier counts.

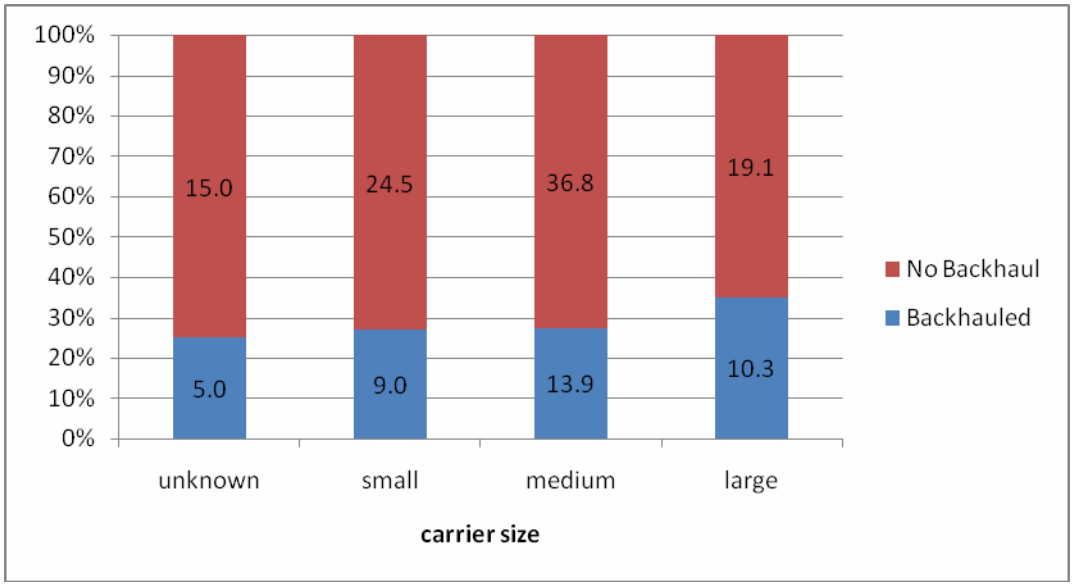

Figure 24: Backhaul rates by carrier size

In addition to backhaul rates, carrier size also correlates positively with FAST use. Figure 25 and Figure 26 reveal that for both northbound and southbound FAST use, although southbound FAST use sees increased utilization compared to northbound, FAST usage in both directions does increase with carrier size.

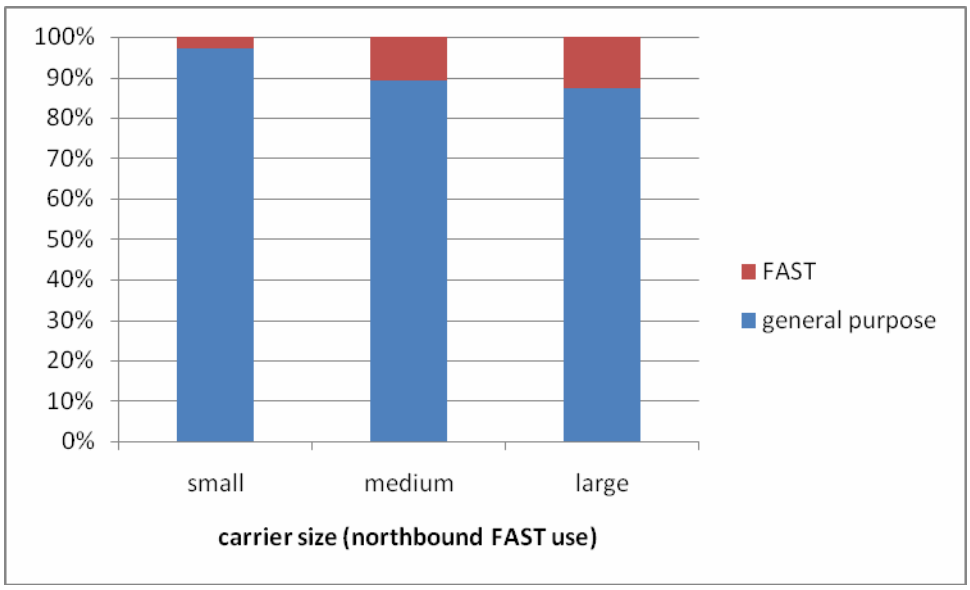

Figure 25: Northbound FAST use by carrier size

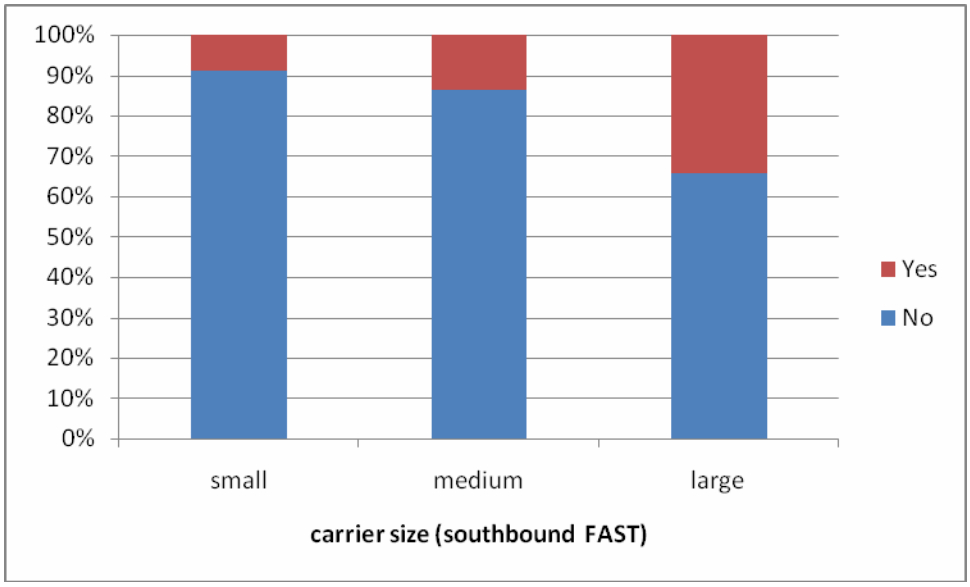

Figure 26: Southbound FAST use by carrier size

Facility Type and Inefficient Trips

To what extent does the border create un-necessary stops at regional logistics facilities? Each trip must originate at the cargo's source, and ultimately arrive at the receiver's business location. While some intermediate stops are made at warehousing and distribution center locations for cost and inventory efficiencies, these trips increase vehicle miles traveled and the associated social costs (emissions, fuel consumption, noise pollution, safety concerns). Assuming trips made to receiver's business locations, intermodal facilities, farms or raw materials locations, or distribution centers are classified as necessary

stops, and would occur whether the border existed or not, we can identify the percentage of trips made to trucking company facilities. Trips to a trucking company facility may demonstrate unnecessary trips generated by the border, but may also be made for sorting or repackage activities which reduce logistics costs. Figure 27 (for delivery) and Figure 28 (for pickup) show that stops at trucking company facilities are in the minority, and general only present for manufactured and miscellaneous goods

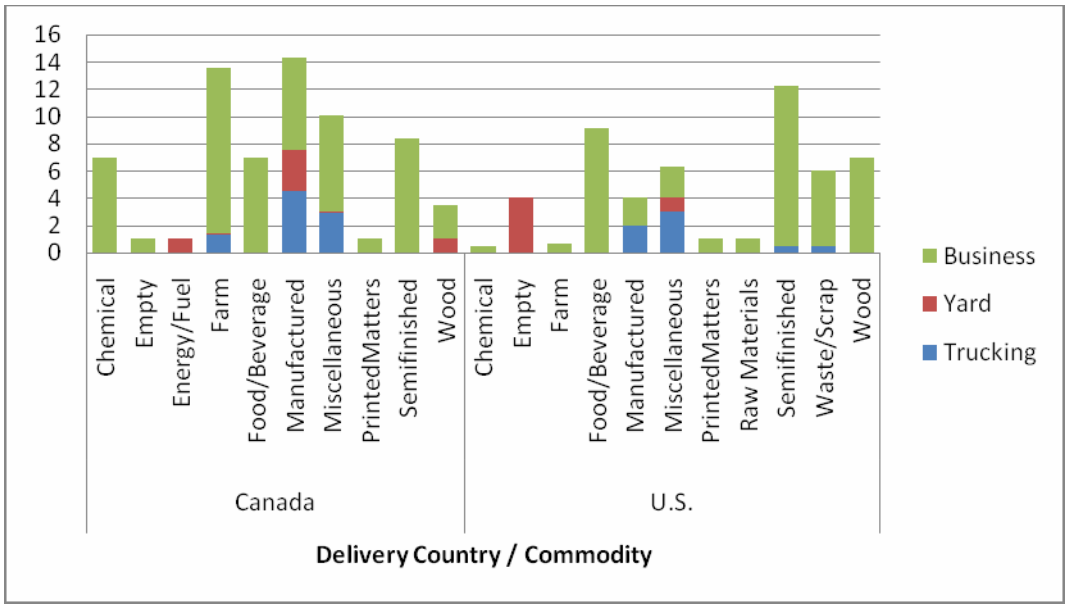

Figure 27: **Deliveries by location and commodity type (for first delivery).**

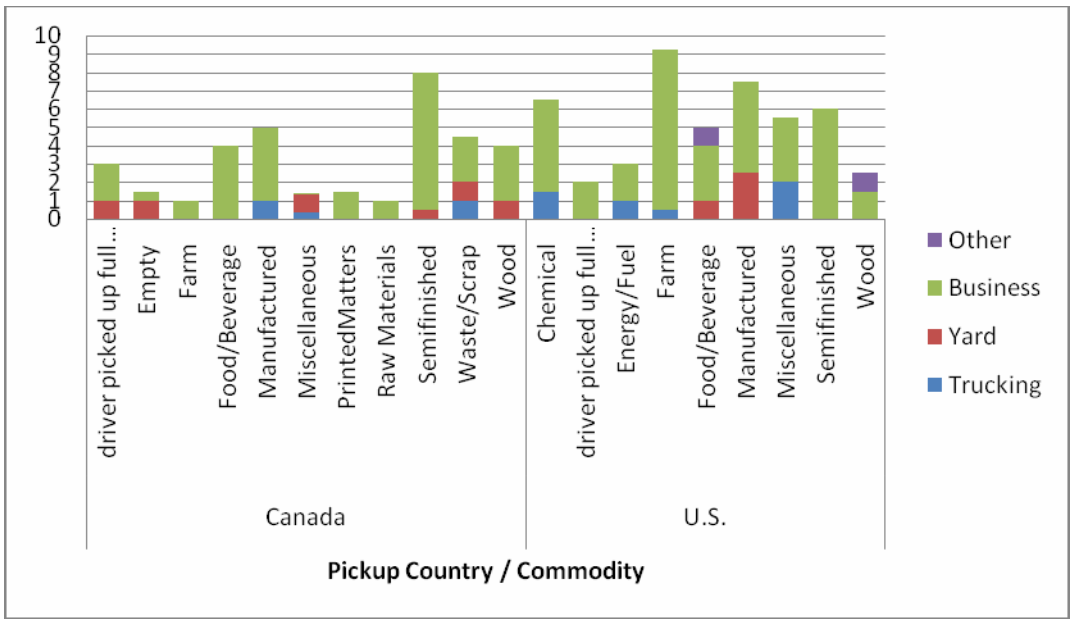

Figure 28: **Pickups by location and commodity type (for last pickup).**

Though the above commodity-based analysis indicates that the border is not generating a large number of un-necessary stops at near border facilities, anecdotal evidence suggests that shipments are often grouped together before crossing the border to take advantage of the FAST lanes. This theory is tested by separately analyzing southbound and northbound deliveries by pickup facility type.[6]

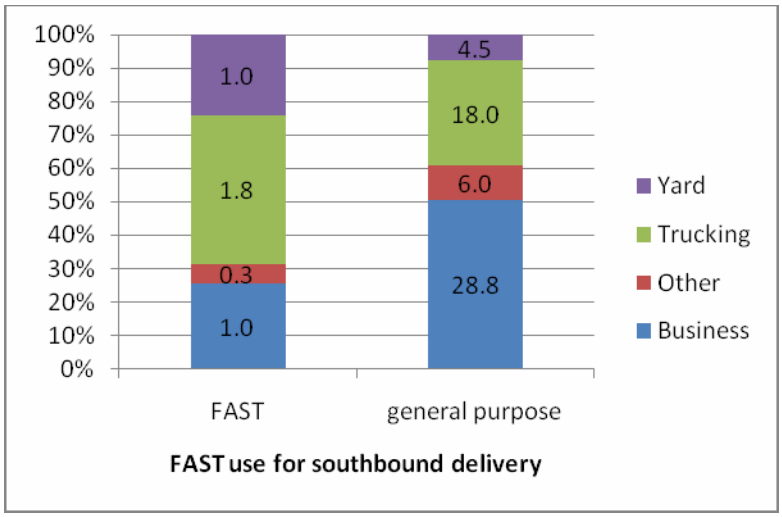

Figure 29: Southbound FAST use by pickup location type

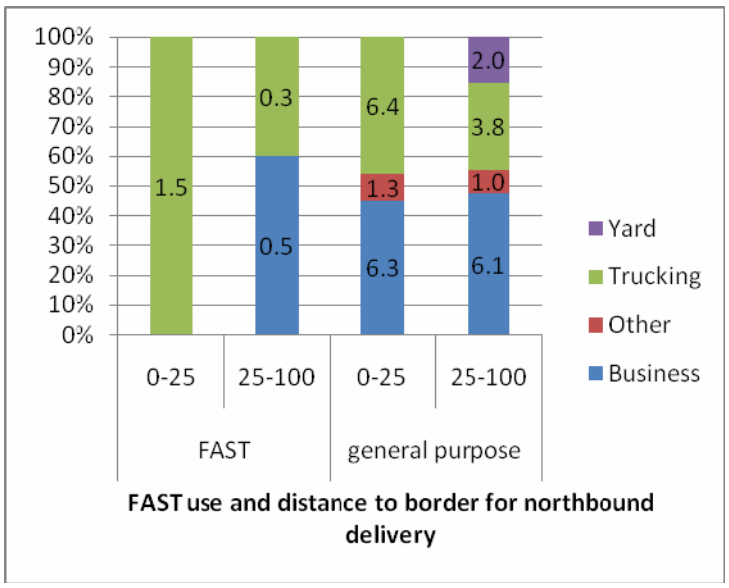

Figure 30: Northbound FAST use and distance from pickup location to the border by pickup location type

First, Figure 29 shows southbound trips by pickup facility type and FAST use (distance was ignored since the vast majority of southbound trips originate within 25 miles of the border). Though the numbers are small, they suggest a trend in trucks using the FAST lane originating from trucking or yard facilities.

[6] "Business" facility types are distribution centers, farm or raw materials locations, or receiver's or shipper's business location; "Trucking" facility types are trucking company facilities; and "Yard" facility types are intermodal facilities.

Similarly, Figure 30 looks at northbound trips by pickup facility and FAST type, but in this case looking specifically at pickup locations within 25 miles of the border and between 25 and 100 miles of the border. Again, though the numbers are small, they demonstrate a large proportion of trucks using FAST which originate from trucking facilities near the border. Given the dearth of economic activity south of the border to explain such activity, it is possible that this activity could be explained by trucks staging shipments in order to cross using FAST facilities.

Findings

To determine how the border creates near-border logistical inefficiencies, we established three metrics for operational inefficiency: empty trips, suboptimal FAST use, and unnecessary stops. To evaluate these metrics we evaluated the significance of commodity type, carrier country, carrier size, and facility type.

Finding 1: The Cost of Backhaul vs. the Price of Empty Trips

Describing border activities, we found that trip distance profiles generally match the population and economic distribution near the border, with a concentration of activity near Vancouver in the north, and more widespread activity south through the U.S. Within this context, we found that there was an inverse relationship between backhaul and distance traveled. The further into a country a truck traveled to deliver goods, the more likely it was to search out and find a backhaul load for the return journey, even if it meant traveling empty for significant distances to reposition for a backhaul load. From this we can deduce a cost-benefit tradeoff which is taking place within the decision to cross back over the border empty or to seek out a backhaul leg for the return journey. Given that the relationship between distance and backhaul, and assuming a certain level of knowledge and rational business decision-making, operational decisions are being made that returning empty after a short trip is a better business decision than taking the time and resources to seek out a backhaul load.

Finding 2: Nationalism

Despite the general trade imbalance characterized by more goods flowing north than south, Canadian carriers carry more trade than U.S. carriers. Though carriers of both countries are responsible for a similar level of imports into Canada, Canadian carriers are responsible for approximately three quarters of all imports into the U.S. This means that, while Canadian carriers are more efficient by making more backhaul trips, their U.S. counterparts are highly inefficient, accounting for the majority of empty trips across the border.

Finding 3: Size Matters

We hypothesized that larger carrier companies, with greater resources available, would be able to coordinate more efficient trips. The data indicate that this is indeed the case, as determined with two metrics. First, larger carrier size was associated with increased backhaul rates, and second, larger carriers used FAST lanes more often.

Finding 4: Suggestions of Staging

Anecdotal evidence suggests that staging occurs near the border which would not occur if it were not for the presence of the border itself. A commodity-based analysis does not reveal much about this

activity, but looking at FAST use based on pickup location type and proximity to the border suggests that some level of staging is occurring at trucking locations in order to consolidate shipments for FAST use. Though the evidence is not conclusive, the anecdotal evidence is not disproved by the data analyzed.

Future Research

After completing this research, we believe that future research should explore the possibility of quantifying the cost-benefit decisions made regarding empty and full backhauls and evaluate policies could be formulated to encourage more efficient trip activities in the form of less empty border crossing. Another avenue of possible future research is the question of the causes of the Canadian-biased carrier imbalance. This could be addressed by examining driver and equipment cabotage laws as well as carrier-shipper relations. Yet another possibility is to further explore the phenomenon of the inherent efficiency advantages realized by larger carriers, especially regarding resources to match empty loads and FAST utilization. Finally, the question of near-border staging deserves a greater level of attention. Anecdotal evidence suggests that this activity exists, and the data suggests that this evidence is valid but is not significant enough to either confirm or deny the phenomenon.

Appendix 1

Categorization by SCTG code:

New Categorization	SCTG Code(s)
Farm	1 2 3 4
Food/Beverage	5 6 7 8
Miscellaneous	9 43 99
Raw materials	10 11 12 13 14
Energy/Fuel	15 16 17 18 19
Chemical	20 21 22 23
Semi finished	24 28 30 31 32 33
Wood	25 26
PrintedMatters	27 29
Manufactured	34 35 36 37 38 39 40
Waste/Scrap	41
Empty	42