Pacific Highway Commercial Vehicle Operations

Border Policy and Logistical Efficiency in a Regional Context

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Activities of commercial vehicles just before or just following international border crossings are not well understood. Logistical responses to border crossings are believed to increase miles traveled empty, total travel times, and total vehicle emissions. Analysis of observational data and surveys taken by commercial carriers at the Cascade Gateway border crossings (between Whatcom County, Washington, in the United States and lower British Columbia in Canada) improves understanding of how the border and associated policies and regulations affect logistics operations, both in manner and in scope. Findings suggest that the border creates logistical incentives for trucks to deadhead (cross the border without carrying goods as part of a cross-border round-trip journey) and to make staging stops near the border for border-related transloading. The Free and Secure Trade program, as observed in the Cascade Gateway region, unintentionally amplifies the existing negative logistical incentives created by the border.

Anecdotal evidence suggests that the border creates logistical inefficiencies, increasing truck miles traveled, empty truck travel, and fuel emissions. Near-border trucking logistics refers not to delays caused by queuing at the border but to routing, scheduling, stopping, and transferring that would not exist without the presence of the border. Current near-border operations practice is not well understood by the research community, but anecdotal evidence suggests that significant logistical inefficiencies are created by the border because of differences in size and weight restrictions, corporate structures, driver work rules, private-sector business models, international trade regulations, and communication mechanisms of the adjoining countries.

This paper has two objectives: to describe logistics practices near the U.S.–Canada border at Blaine, Washington, as uncovered through recent surveys of border crossers, and to examine the use and impacts of the Free and Secure Trade (FAST) program in the region. In meeting these objectives, the research reveals truck activity that would be unlikely to occur if the border were not present. For reasons consistent with private-sector incentives, the border creates stops and empty trips. The research also reveals that FAST is underused in the Cascade Gateway region, that its use is dominated by empty trucks, and that the program provides additional incentive to carry out logistical activities that result in increase in stops, vehicle miles traveled, and emissions.

This research was enabled by a data collection effort carried out in June and July 2009 on near-border operations for commercial vehicles at the Pacific Highway crossing between British Columbia, Canada, and Washington State (see Figure 1). To address the first objective of describing near-border logistics practices in the Cascade Gateway region, this paper answers the following questions: what is inefficient near-border activity, to what extent do these inefficiencies exist, and how are they associated with specific border policies? While the logistical activities undertaken may be consistent with carriers' incentives, inefficiencies refer to regional inefficiencies such as additional stops, extra vehicle miles, and increased emissions. To address the second objective of examining FAST in the regional context, this paper answers the question of whether there is evidence that the program provides incentives for less inefficient operations at Pacific Highway by promoting quick and predictable crossing times for empty trucks.

Motivating this analysis are the high number of empty trucks observed crossing the border and the low use rates of FAST. The data analyzed here represent not only a specific region but a specific time frame. Therefore, all analysis must be considered in the context of the temporal and geographic attributes of the regional trade during the study period. As Goodchild et al. observed, the commodity mix of cross-border trade in the Cascade Gateway region is quite different than that for trade along the eastern portion of the U.S.–Canada border. A comparison of the Cascade Gateway region with the Detroit, Michigan–Windsor, Ontario, Gateway shows that the Detroit–Windsor Gateway is dominated by manufactured goods that cross in a time-sensitive business environment, while the Cascade Gateway region sees high traffic in relatively less time-sensitive wood, paper, and plastics (*1*).

The data also represent a period of time during which the Pacific Highway border saw a significant trade imbalance. Looking at all modes of transportation, in 2009, U.S. imports from Canada were valued at almost $225 billion (U.S. dollars), while U.S. exports to Canada were valued at just over $200 billion. While there is some seasonal variation, values for June 2009 (when most of these data were collected) demonstrate this same relationship, with just over $18 billion in southbound trade and almost $17 billion in northbound trade. For Pacific Highway border trade by truck, the imbalance is even more pronounced: during June 2009, northbound truck trade was valued at $342 million and southbound was valued at $700 million (*2*).

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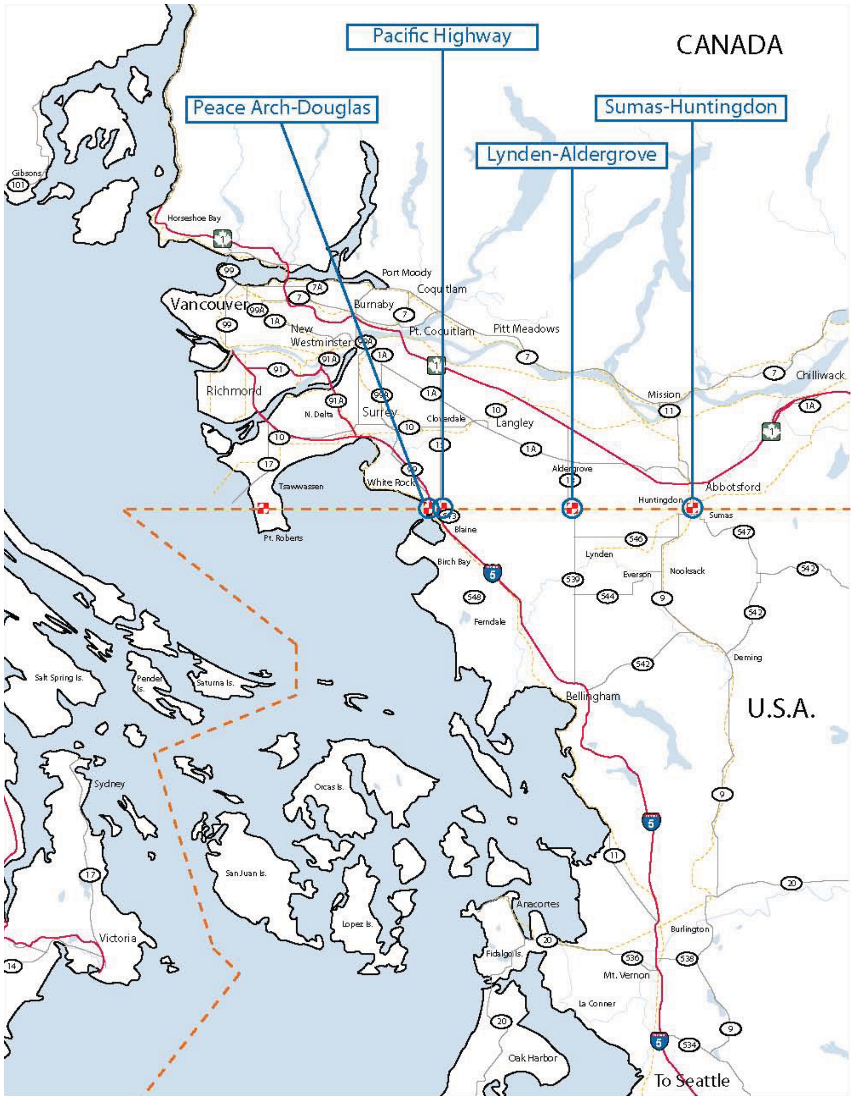

FIGURE 1 Regional map identifying the study location at Pacific Highway (courtesy of International Mobility and Trade Corridor Project).

LITERATURE REVIEW

Unnecessary Stops

One logistical and environmental border cost considered is the number of unnecessary stops made at near-border facilities. While these stops may be rational for individual transportation providers, their description as inefficient is based on the logic that the stops would not have occurred if the border had not been present. Before the 1980s, because of higher transportation rates in Canada, small businesses often avoided using Canadian carriers by privately transporting goods across the border to interline (transport goods by two or more transportation lines) with U.S. carriers, a practice that both encouraged U.S. firms to locate closer to the border and caused Canadian carriers to drastically reduce their rates (*3*).

Jones argues that regulations involving foreign truck entry distort markets not only by affecting the number of trucks entering the country but the freight infrastructure along the border as well (*3*). The United States, deregulating its trucking sector with the Motor Carrier Act of 1980, greatly reduced entry and exit barriers for trucks. Subsequently the number of trucking establishments (e.g., terminals, transportation brokers, and warehouses) along the border decreased. However, when the Canadian government similarly eased entry and exit barriers in 1987 with the Motor Vehicle Transportation Act, the number of near-border trucking establishments increased. As Jones found, the commercial zones around the U.S.–Canada border crossings saw a 47% increase from 1977 to 1991 in the number of businesses categorized by Standard Industrial Classification code 421 (trucking and courier services, except air). Examining this trend, Jones found that from 1977 to 1986, the rate of these establishments remained fairly constant at an average of 0.15 per million dollars of trade. After 1987, when Canada began allowing previously limited numbers of U.S. trucks to cross more freely into Canada, the rate of brokers per value of trade rose substantially until 1991, averaging around 0.195 establishments per million dollars of trade. The increased competition and cabotage laws accompanying deregulation created incentives for truckers to include an empty cross-border leg as part of an international round trip. This caused an increase in near-border trucking facilities to help truckers consolidate loads and reduce deadheaded (empty return trip) miles (*3*).

FAST Program

FAST is a joint U.S.–Canada initiative allowing expedited border crossing for low-risk shipments for which the driver, carrier, and shipper have all been vetted by the respective border security agencies. At certain major border crossings, including Pacific Highway, FAST has dedicated lanes that greatly improve border crossing time and predictability over the general purpose lanes. However, FAST is underused at the Pacific Highway border. Customs and Border Protection data estimate that in 2008 only 8% of eligible U.S.-bound shipments at the Pacific Highway border crossing used FAST, compared with 44% at the Detroit–Windsor crossing, 31% at Port Huron, Michigan–Sarnia, Canada, and 23% at Buffalo, New York–Fort Erie, Canada. Of the 16 border crossings for which U.S.-bound FAST data were available, only two crossings had lower percentages of FAST use: Massena, New York, and Sweetgrass, Montana, neither of which has dedicated FAST lanes (*4*). A 2008 Border Policy Research Institute policy brief estimated that in October 2007, less than 5% of trucks at Pacific Highway used FAST, compared with 23% of trucks at the Buffalo–Fort Erie border (*5*). The institute pointed out the dominant use of FAST by empty trucks at Pacific Highway (73% of southbound trucks and 41% of northbound trucks): "The large number of empty trucks crossing the [Pacific Highway] border could be linked either to market-driven commodity flows or to policy-based flaws in the design of freight-inspection processes." (*5*) This analysis suggests that one explanation could be related to FAST requirements. The shipper, carrier, and driver must all be FAST-approved to use the FAST lane; however, carriers and drivers are often more strongly associated with each other and can more easily implement FAST requirements; these factors create an incentive for only carrier and driver to enroll in FAST (*6*). Furthermore, there is a known lack of FAST-approved shippers (*7*).

Commodity also plays a role in FAST use rates. As Goodchild et al. have noted, FAST is underused at Pacific Highway when comparing border crossing use along the eastern portion of the U.S.–Canada border, where border crossings see higher levels of goods movement between factories on both sides of the border. Goodchild et al. noted that at the Pacific Highway border crossing, bulk and empty container–pallet trucks preferred the FAST lane, while manufacturing and food commodities were less likely to use the FAST lane (*1*). Arguably, FAST works poorly at borders such as Pacific Highway, where securing supply chains is difficult because of large amounts of agricultural and less-than-truckload shipments (*5*).

Examining how FAST provides incentives for trucks to cross empty can be understood by considering costs associated with variability and duration of border crossing delays. Taylor et al. calculated that in the years following September 11, 2001, uncertainty in border crossing times was estimated to be responsible for $1.99 billion per year in costs impacting manufacturers, and that the likely costs of delay and uncertainty constituted 1.58% of the total value of cross-border truck trade (*8*). In a study measuring the costs of border delays, consultants calculated that border delays cost the Canadian trucking industry between $231 million and $433 million in 2004 (*7*).

Globerman and Storer explain that these factors impact border crossing operations because longer waiting times impact costs such as fuel and hourly pay, and variability impacts inventory costs and an increased allotment for travel times (*9*). Examining variability at Pacific Highway, Goodchild et al. noted that goods movement at Pacific Highway are not as time sensitive as those that are in more time-intensive environments such as the Detroit–Windsor Gateway. Hence variability of crossing times at Pacific Highway is not a major concern, and building in extra buffer time is a common strategy to manage border service time variability (*10*). In their review of strategies to address border crossing time variability, although they discussed reduction of activities on cross-border trade, they did not investigate the strategy of deadheading through the FAST lane, possibly sacrificing the acquisition of a load for a backhaul (return) leg in exchange for the convenience of quickly and reliably crossing empty using the FAST lane.

Based on previous assessments that FAST is not well-suited for trade at Pacific Highway, this research describes near-border operations in the Cascade Gateway region and shows how FAST impacts this logistical environment. FAST was designed to assist in the movement of materials quickly and efficiently across borders, but at Pacific Highway the data indicate that FAST is heavily used to relocate empty trucks—and provides incentives to replace loaded truck trips in both directions with multiple truck trips that deadhead across the border in one direction.

In the Cascade Gateway, methods to more efficiently use the existing infrastructure have been discussed and, to some extent, explored. On some occasions, for example, the southbound FAST lane at Pacific Highway is opened to general traffic to ease congestion in the general purpose lanes when the FAST lane is underused. A congestion-based toll was studied by Roelofs and Springer, but they found that without adding an extra lane and booth such a solution was unlikely to be implemented or even go beyond the planning stages (*11*). There has also been some analysis of potential revisions to FAST to make it appeal to more shippers, thereby increasing use of the FAST infrastructure (*5*). While other solutions may have been discussed by individuals or small groups, no apparent incentive programs to encourage FAST participation have been implemented or studied.

DATA SOURCES

Observational and Survey Data Sets

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 International Mobility and Trade Corridor Project sheds light on these inefficient operations. During June and July of 2009, observational data were collected by the consortium at the three commercial border crossings of the Cascade Gateway: Pacific Highway, Lynden, Washington–Aldergrove, British Columbia, and Sumas, Washington–Huntingdon, British Columbia. Data were collected in 2009 at Pacific Highway on Mondays through Thursdays during various hours between 9:00 a.m. and 9:00 p.m. on the days of June 15 through 18 and 22 through 25. Instructions to complete an Internet-based survey were distributed to all trucks observed ($n = 2{,}979$). Unless stated otherwise, all analysis referring to "observational data" is based on data collected at Pacific Highway, the busiest of the three border crossings and the only one with FAST infrastructure.

For the 2,979 trucks to which surveys were distributed, 215 unique survey responses were received, of which 211 were analytically useful. This data set is referred to as the survey data. The surveys themselves capture information for a single cross-border round trip. If a truck made more than one round-trip that day, the data collected account for only the first round trip. Because very few incidents of multiple single-day round trips were observed, analysis in these cases was limited to the first round trip.

Preliminary Data Analysis

Although the data do not reveal which trips were part of a same-day round trip and which were part of longer trips, it is possible to identify trips that would be unlikely to have been part of a same-day round trip. Given the hours-of-service regulations of the U.S. Federal Motor Carrier Safety Administration (maximum 14 hours on duty, 11 hours driving time) (*12*) and the Canadian Council of Motor Transport Administrators (maximum 14 hours on duty, 13 hours driving time) (*13*), a cross-border driver would be expected to drive no more than 11 hours in a single day. Assuming a generous average travel speed of 65 mph (105 km/h) yields a maximum likely same-day distance of 715 miles (1151 km). Thus, for the observed data, distances are rounded down to assume that any leg of more than 350 miles (563 km) is not likely part of a same-day round trip, and the analysis focuses on such regional trips. Of the 3,914 observed trips for which distances were calculated, regional trips accounted for the majority of Cascade Gateway commercial traffic, with 74.9% of trucks traveling less than 350 miles from origin to destination. This trend has been observed in previous studies (*1*). Furthermore, of the 25.1% of trucks that traveled more than 350 miles, 23.6% were empty; of the 75.0% of regional trips, 37.9% were empty, indicating that regional trips may be of more interest in an efficiency analysis.

EVIDENCE OF INEFFICIENT NEAR-BORDER ACTIVITY

Border-Induced Stops

Anecdotal evidence and previous research by Jones suggest that goods may be staged near the border so that equipment or drivers can be exchanged before crossing (*3*). The concentration of near-border activity can be measured by examining the concentration of origins and destinations by distance from the border. To determine the extent of this concentration that can be plausibly attributed to the border, population is considered as a rough surrogate for economic demand, and the ratio of stops to population is examined to gauge a level at which stops could be attributed to the border. While alternative metrics for economic demand could be used, population data are sufficient to capture the order of magnitude effects that the border has on transportation activity. Facility type, as indicated on the survey, is also examined to determine the nature of the trips made.

Using ArcGIS (a software suite) and population data obtained from Esri, a provider of geographic information system software, Figure 2 shows a high concentration of cross-border truck destinations (obtained from the observational data) per capita near the border. Locations near the border generate several orders of magnitude more destinations per capita than other locations. The cities with the highest destination per capita ratio are Blaine, Washington (abutting the border at Pacific Highway), followed by Ferndale, Washington, just to the south of Blaine along the Interstate 5 corridor. This concentration of freight activity on the U.S. side of the border validates assumptions of a buildup of U.S. near-border freight facilities.

Examination of the facility type sheds further light on the phenomenon of near-border freight operations. 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 associated social costs (emissions, fuel consumption, noise pollution, and safety concerns).

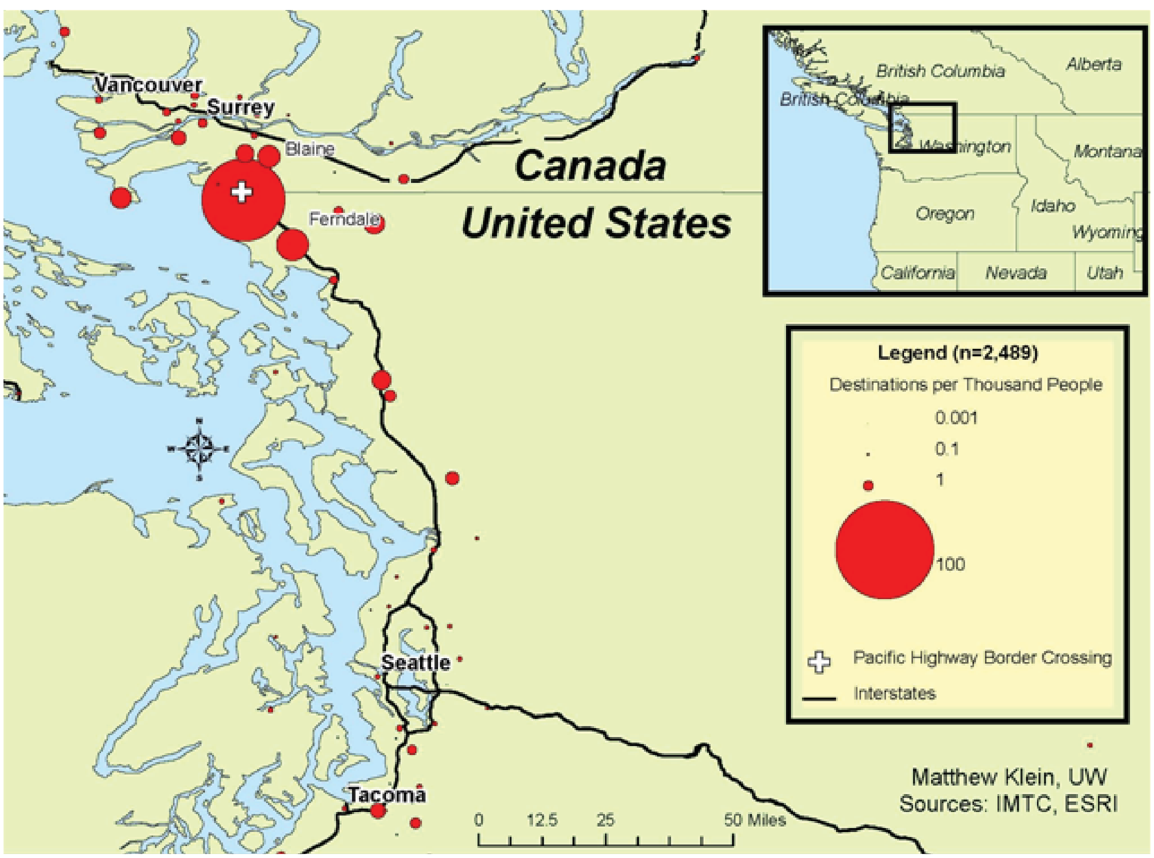

FIGURE 2 Destinations per capita.

Assuming that trips made to receivers' business locations, intermodal facilities, farms, raw materials locations, or distribution centers are classified as necessary stops and would occur whether the border existed or not, it is possible to bound the amount of unnecessary trips involving 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 repackaging activities that reduce logistics costs. However, in a minimum stopping environment, trucks would travel only from shipper to receiver locations. For all northbound trips with goods, Figure 3 identifies at what type of facility each northbound trip originated and how far from the U.S. border that facility was located. Distances traveled were calculated by geocoding city and border locations (because of privacy concerns, city level was the highest level of resolution for which geographic information was available). Straight-line distances between city centers and the border were calculated to estimate distances traveled. This shows that, for northbound deliveries originating within 25 mi (40 km) of the border, the most common originating facility type is a trucking facility, with distribution centers as the second most common facility type. The data also indicate relatively few business locations near the border.

Border-Induced Empty Trips

The second metric is empty truck crossings. In the study period, 18% of northbound trips and 46% of southbound trips were empty. Though the regional trade imbalance at the time of the study suggests that southbound trucks were necessarily empty more often than northbound trucks, other factors impact empty trip patterns, such as specific commodity flow directions and equipment specialization. An analysis of individual commodity flows reveals which commodity types see more or less empty trip rates as necessitated by the levels of commodity trade (this assumes trucks serve only one commodity in both directions).

A less visible cause of empty truck trips, however, is the cost–benefit tradeoff, which determines whether or not a driver should return more quickly (and with less administrative cost) without cargo or search for cargo to make the return trip more profitable. The following sections demonstrate that increasing driving distance correlates with lower deadhead rates, and that FAST-lane traffic displays an exaggerated relationship between driving distance and deadhead rates.

FACTORS OF BORDER-RELATED EFFICIENCY

Factors that influence near-border operational inefficiency can be considered to be in one of two categories: market-related factors (such as commodity flow and trucking operations in a deregulated market) and policy-related factors (those not determined directly by market forces). In this paper, FAST is investigated as a policy-related factor influencing inefficient operations. Observations are discussed that can be made about the aggregate logistical behavior of shippers and carriers near the border without investigating the strategies, motivations, or decisions of specific fleets or logistics managers. While these motivations can provide insight into the effectiveness of policy changes, more detailed analysis of motivations informing business decisions in a complex market and regulatory environment is beyond the scope of this paper. Previous work from the same research group has considered fleet-specific responses to border crossing–time variability (*10*).

Market-Related Factors

Distance

This research demonstrates that generally the farther a truck travels from the border, the more likely it is to obtain a backhaul load to cover the costs of returning across the border. Figure 4 shows this relationship by examining backhaul rates from the survey data, excluding destinations with fewer than five trips. Locations such as Seattle and Tacoma, Washington, which are relatively distant from the border, see a higher rate of trucks that deliver to these locations and secure backhaul loads for the cross-border return trip.

Examining the observational data for all three border crossings reveals more nuanced trends in the relationship between distance and load rates. In this section, origin–destination distances are compared with trip-segment distances to and from the border alone. Figure 5 compares northbound origin–destination distances with northbound origin–border distances, revealing statistically significant relationships between load ratio and both distance measurements. Here northbound border–destination distances are excluded because of the short distances involved in driving between the border and Canadian destinations. The figure demonstrates that the further a truck travels, for both total origin–destination and border-to-destination distances, the more likely the truck is to obtain a load for its backhaul trip.

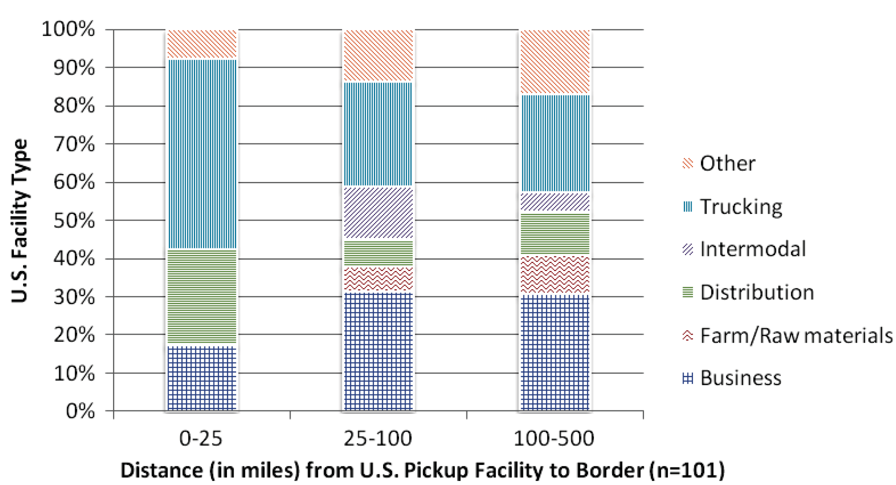

FIGURE 3 U.S. facility types by distance.

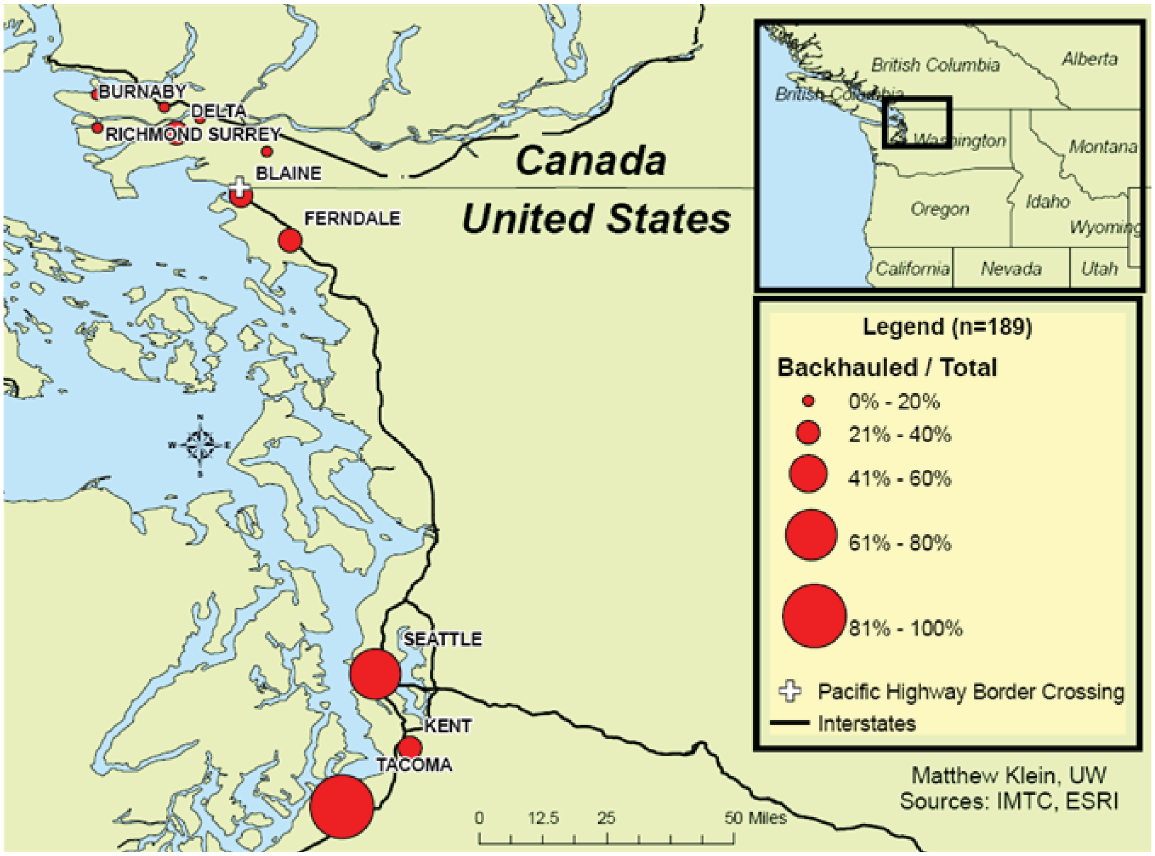

FIGURE 4 Backhaul ratios by delivery location.

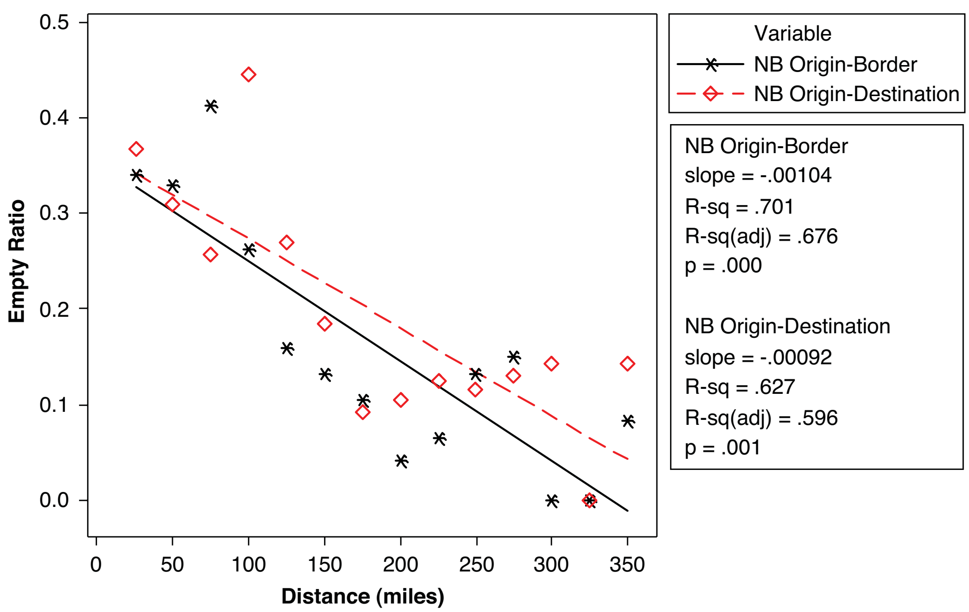

FIGURE 5 Northbound distances and load ratios.

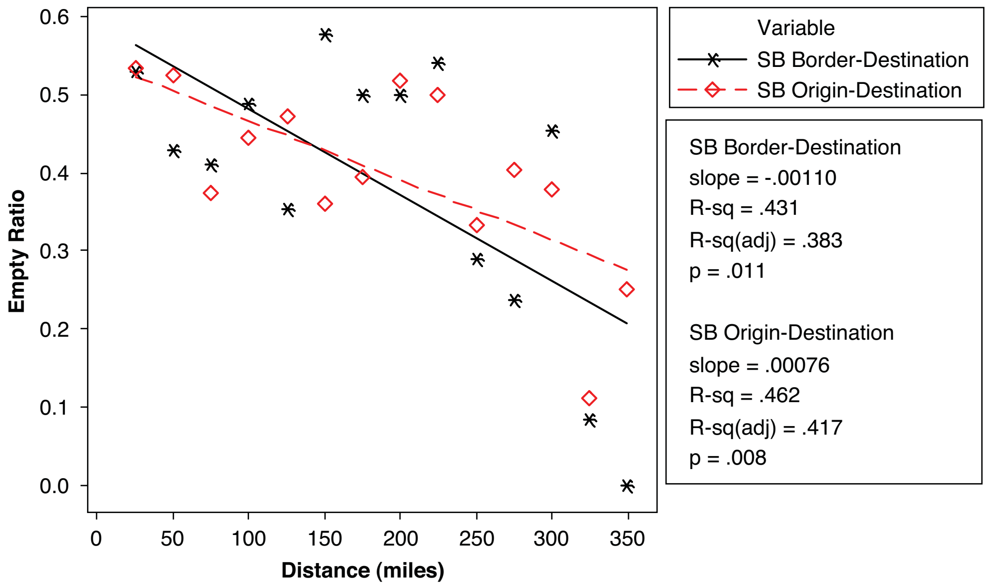

FIGURE 6 Southbound distances and load ratios (SB = southbound).

Figure 6 compares southbound origin–destination and border–destination distances, similarly excluding the southbound origin–border distances because of the short trip lengths involved. The results are similar to the northbound results in that there is a linear relationship, albeit less statistically significant than northbound regression results. Comparing these figures reveals that the origin–border and border–destination distances demonstrate empty rates that are steeper than origin–destination rates over distance traveled. Because the former calculations use border as the origin when measuring distance, the steeper slopes and higher near-border rates indicate that while there is a relationship where shorter trips see higher empty rates, the position of the border exaggerates this rate, resulting in more empty trips closer to the border.

Commodity

With the trade imbalance present at the time these data were observed, a certain amount of trucks must necessarily reposition empty across the border. In addition, equipment specifications and spatial and temporal distributions of demand reduce use rates. Examining trade imbalances for specific commodity types allows for the use of commodity-level backhaul rates to surmise what proportion of empty trucks are necessarily empty (because of commodity-specific trade imbalances) and how much excess capacity is crossing the border (although there may still be business-driven reasons for empty travel). This analysis is based on an assumption that equipment limitations only allow a truck to transport goods of a single commodity type in both directions. Chemical and farm goods often require specialized equipment such as refrigeration and specialized trailers; therefore, load matching may be limited within a commodity category.

Within this constraint, an analysis of the backhaul rates observed in the survey data determines how much potential for backhaul has or has not been used. For the six most common commodity categories observed in the survey data (reflecting summer trade), the following crossing patterns exist: manufactured goods, miscellaneous goods, and semifinished goods cross the border at near parity (less than 10% excess flow in either direction of travel); a majority of wood products move southbound; a majority of food and beverage goods move northbound; and the vast majority of farm goods move northbound.

Within each commodity category, the ideal rate of backhaul is calculated considering flow balance and the single commodity truck constraint. The "ideal" backhaul rate is based on an assumption that no trucks should be empty in the direction with more commodity movement. Assuming just enough trucks are used to meet this criteria, the ideal backhaul rate is the percentage of these trucks that would backhaul, given a load in the direction with less overall commodity movement.

Figure 7 compares these ideal backhaul rates with the actual backhaul rates observed in the survey data. Wood commodities see almost ideal backhaul rates, while movement of farm goods exhibits unused backhaul capacity. This could be explained by the need for specialized equipment to move certain types of farm goods and the time sensitivity of transporting perishable goods. Other commodities such as food and beverage, manufactured, miscellaneous, and semifinished goods use only between 30% and 50% of ideal backhaul capacity.

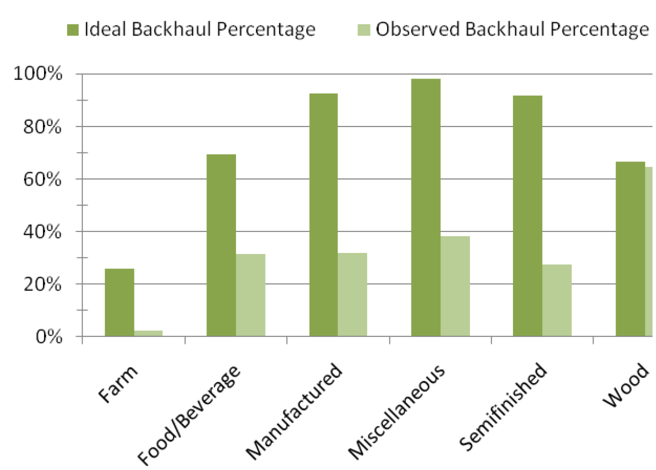

FIGURE 7 Ideal and observed backhaul rates by commodity.

FAST Impact

The 2009 observational data show that 14% of all trucks used the FAST lane at Pacific Highway crossing (25% southbound and 3% northbound). Of loaded trucks alone, only 6.5% in the observational data set used the FAST lane (1.2% northbound and 14% southbound). For each direction of travel, approximately two-thirds of all trucks using the FAST lane were empty.

The high rate of empty trucks using the FAST lane suggests that the FAST program at Pacific Highway may be providing an incentive to deadhead across the border rather than to seek out a backhaul load. Figure 8 identifies northbound trips by facility type of origin and the distance from the border for all trips that contained an empty southbound leg, categorizing trips by southbound lane choice. Of the southbound trucks that crossed empty only a short distance into the United States, having used the FAST lane as part of a trip where goods were moved northbound, the vast majority picked up goods at a trucking facility. This suggests FAST trucks (most of which are empty) are more likely to visit trucking facilities than are trucks using the general purpose lanes.

Another way to examine the operational incentives provided by FAST is to examine the relationship between distance and load status for trucks that use the FAST lane and those that do not. As before, the focus is on activities on the U.S. side of the border because of the longer distances involved, thus providing the ability to better differentiate the impact of distance on load status. Examining southbound Pacific Highway trips and aggregating trips into 50-mile bins, Figure 9 shows that while all empty trucks have a higher likelihood of crossing empty if destined for a facility near the border, those using FAST show a stronger sensitivity to the relationship between load status and distance. This suggests that the ability to cross the border quickly and reliably with the FAST lane creates further incentive to cross the border empty. For trucks in the standard lanes, each 100 mi (161 km) reduces the empty ratio by 10%; while for trucks using the FAST lanes, each 100 mi reduces the empty ratio by almost 30%.

CONCLUSIONS

Through analysis of unique survey data, this paper provides novel information about near-border logistical activities, the extent to which inefficiencies are present in these logistics, and the role that FAST and the border itself play in amplifying them.

Near-Border Operations

Describing near-border operations provides evidence of the clustering of logistical activities near the border. Using population as a surrogate for economic demand, near-border locations produce several orders of magnitude more demand for cross-border truck trips. The majority of near-border trucking activities occur at trucking facilities, indicating demand for staging activity created by the border.

The analysis also reveals a linear relationship between distance and load status. The farther into a country a truck travels to deliver goods, the more likely it is to obtain a backhaul load for the return journey. These backhaul rates differ by commodity type. Using survey data to infer what commodity an empty truck could be able to transport, trucks carrying commodities such as manufactured and miscellaneous goods did not use backhaul capacity as efficiently as trucks carrying wood products. Comparing border–destination segments with total origin–destination trip legs suggests that the border itself amplifies the linear relationship between distance and load status.

FAST Program

FAST is underused at the Pacific Highway border, considering that a third of the physical infrastructure is dedicated to trucks and, compared with other major northern borders, that the majority of users cross without a load. Addressing concerns of duration and predictability of border crossing times, empty trucks are able to use FAST to quickly deadhead across the border. In terms of the metrics

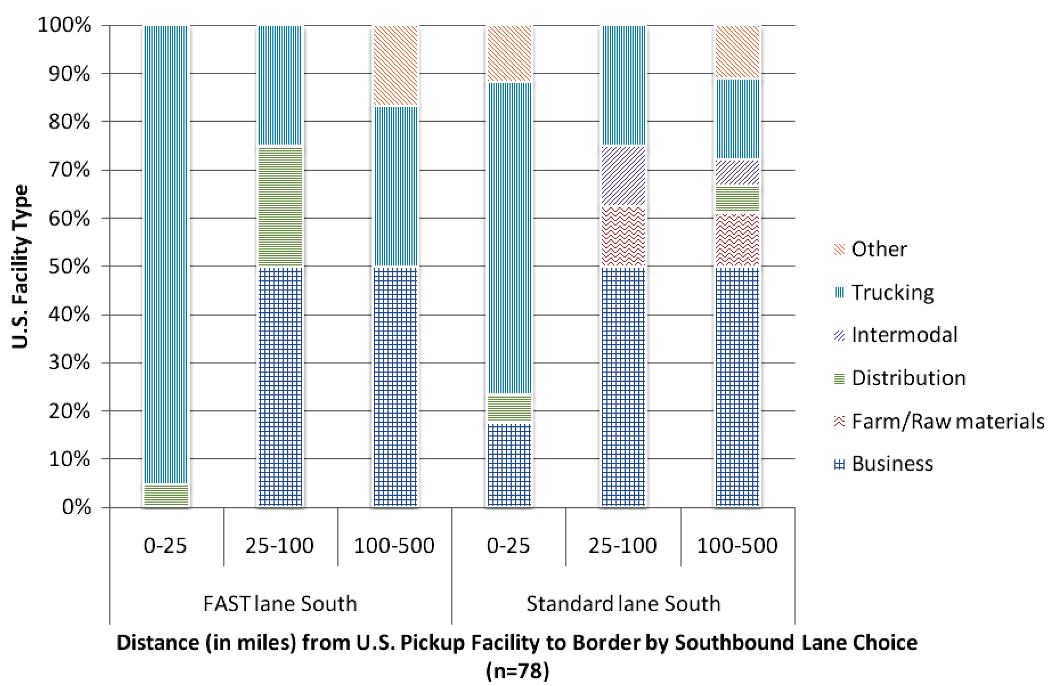

FIGURE 8 U.S. facility type by distance and southbound lane choice.

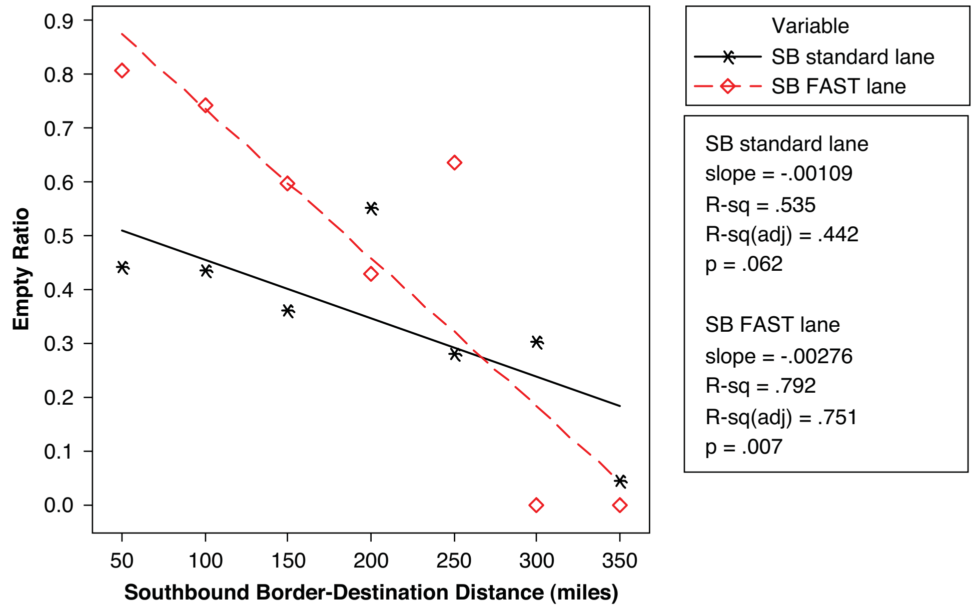

FIGURE 9 Southbound distances and load ratios by lane choice.

of inefficient near-border operations (near-border staging and empty trips), the data suggest that these inefficiencies are increased by the border and that FAST use correlates with amplified effects of these metrics. For trucks that deadheaded across the border to locations not far beyond the border crossing, those using the FAST lane were more likely to be destined for trucking facilities, while those using the standard lanes were more likely to be destined for distribution or business locations. Also, while proximity to the border correlates with higher rates of crossing the border empty, use of the FAST lane exaggerates this relationship. This suggests that FAST incentivizes trucks to cross empty at the Pacific Highway border rather than obtain a backhaul load.

This initial research into the topic of near-border logistics has provided interesting results and significant implications for border policy decisions. The magnitude of empty-trip rates using southbound FAST facilities is cause for concern. However, before making recommendations for policy or infrastructure changes, a more detailed understanding of industry-specific behaviors is needed. Future and ongoing research will collect additional data on border-crossing logistics so that industry-specific responses can be analyzed.

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