You Can't Manage What You Can't Measure… Following the announcement of the Canada – U.S. "Beyond the Border" (BtB) vision, there has been increased emphasis upon *measurement* of various things associated with national borders. Many of the specific elements within the BtB plan include an associated metric, so that bureaucrats and the public are able to measure progress toward realization of the vision. Of course, BtB is not the only border-related policy goal adopted by governments—other goals have been established by Canada, the U.S., and states and provinces. This article focuses upon two such policy goals: the U.S. National Export Initiative (NEI), and the effort to "green the border" (i.e., to reduce the ecological impacts associated with cross-border transportation) undertaken by B.C. and Washington State. We make use of generic time-series trade and transportation datasets maintained by federal agencies, demonstrating the usefulness of such data for the measurement of progress toward policy goals. We also make use of point-in-time data that was generated by our institute for a specific project, demonstrating the value of and need for ongoing research projects designed to measure activities at the border.

Progress of the National Export Initiative. In response to the economic malaise that had prevailed in 2009, President Obama unveiled the NEI in his 2010 State of the Union address. The goal of the NEI is to double U.S. exports within a span of five years relative to the baseline established in 2009. In this section we seek to understand how trade with Canada (the U.S.'s largest trading partner) is contributing toward realization of the NEI's goal, as evidenced by the *volume of goods rolling north* across the Canada – U.S. border. This focus is chosen because attempts are underway (pursuant to the BtB plan) to streamline the processes used to clear rolling stock (trucks and trains) through the ports-of-entry (POEs) located at the border. How important are those POE-specific efforts to the overall goal of doubling U.S. exports?

Figure 1 reveals the magnitude of goods exports to Canada in relation to overall U.S. exports. The NEI is not specific to *goods*, but also is inclusive of *services*, and Figure 1A shows that the goods

Figure 1. Importance of Large Canada – U.S Crossings Within the Context of Overall U.S. Exports in 2009, Baseline Year for the NEI

1A. Total U.S. Exports[1]
($ billions)

100.0%	Total Exports	1,570.8
32.0%	Services	502.3
68.0%	Goods	1,068.5

1B. Destination of Exports
($ billions)

1,068.5	Goods Exports	100.0%
863.8	All Other Nations	80.8%
204.7	Canada	19.2%

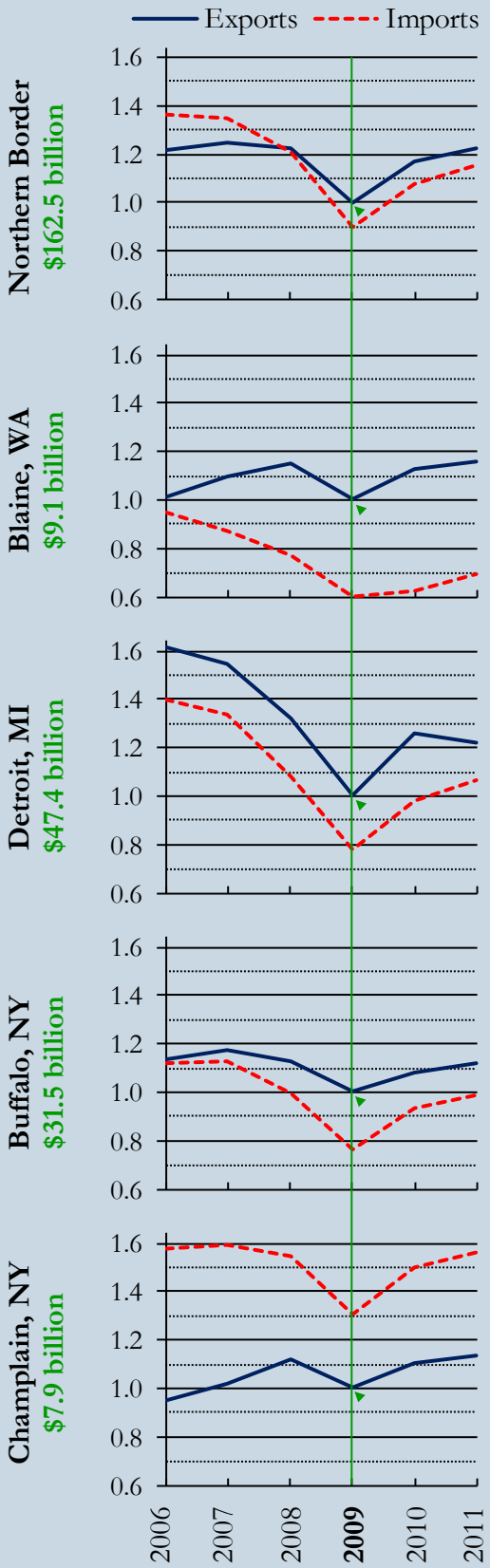
1C. Mode of Exports to Canada[2]
($ billions)

100.0%	Exports to Canada	204.7
69.6%	Truck	142.5
9.8%	Rail	20.0
9.5%	Other	19.5
7.7%	Air	15.8
2.1%	Vessel	4.3
1.3%	Pipeline	2.6
0.0%	Mail	0.0

1D. Export Volumes by Port
($ billions)

162.5	Truck/Rail Exports	100.0%
47.4	Detroit - Windsor	29.2%
31.5	Buffalo - Niagara	19.4%
9.1	Blaine	5.6%
7.9	Champlain - Rouses Pt.	4.8%
66.5	76 Other USCBP Ports	40.9%

Figure 2. Proportional Changes in Trade Volume over Time, Relative to Each Locale's 2009 Export Volume[3] (Combined Truck + Rail Modes)



sector accounted for 68 percent of the overall 2009 export volume of $1.57 trillion. Canada was the largest export destination for U.S. goods in 2009, at 19.2 percent of overall goods exports (Figure 1B). Figure 1C reveals the prominence of the truck and rail modes with respect to the flow of goods across the border—the two modes together accounted for 79.4 percent of the northbound flow, $162.5 billion in all. It now can be deduced that the northern border POEs handled 15.2 percent of the goods exported from the U.S. in 2009 (i.e., $162.5 billion out of $1.07 trillion).

Figure 1D shows the way in which goods are funneled through a small number of POEs. In the remainder of this section we focus upon the four large crossings identified in Figure 1D, which together handled almost 60 percent of the northbound flow. The dollar volumes shown in bold green font provide a linkage to Figure 2.

Figure 2 shows proportional changes in the amount of goods carried across the border (truck + rail) at various POEs, relative to the 2009 export volume observed at each locale. The top graph relates to the whole northern border and is thus useful for gauging progress toward the NEI's goal of doubling exports. As shown in the vertical axis legend, the dollar value of exports in 2009 amounted to $162.5 billion. To build the graph, that value is equated to 1.0 (highlighted by the small green arrow), and trade volumes in other years are expressed relative to that 2009 export value. For example, exports in 2011 reached a level 22 percent higher than the 2009 baseline (i.e., the solid blue line has a value of about 1.22 for the year 2011). For all years other than 2009, trade-deflation factors[3] were applied to nominal-dollar trade data retrieved from the North American Transborder Freight database.[2] The graphs therefore are representative of changes in the volume of *goods*, decoupled from inflationary effects. Many interesting things can be gleaned from Figure 2:

- Two years into the NEI, the border-wide volume of goods exported to Canada increased by 22 percent, regaining the level that existed prior to the economic meltdown. At this rate, goods exports to Canada by truck and rail will not double by 2014.
- For goods moving by truck and rail, the U.S. achieved a trade surplus with Canada after 2008 (i.e., the solid blue line crosses above the dashed red line). However, if the air, vessel, and pipeline modes had been included, the situation would be different. Those modes were omitted in order to focus upon the burden faced at the land POEs.

- An integrated manufacturing sector straddles the border, such that a downturn affects both imports and exports. But resource commodities, which *also* are affected by a downturn, are a greater presence within the import stream. With impacts to both resources and manufacturing, imports from Canada declined more steeply leading up to 2009, but then rebounded more strongly. Imports of Canadian goods increased by 28 percent (i.e., from 0.9 to 1.15) during the same period that exports of U.S. goods increased by 22 percent. A successful NEI will benefit Canada as much as the U.S.
- Unlike Detroit, the other three POEs share the trait of having recovered to (or exceeded) pre-meltdown levels as of 2011. Given that Detroit is the POE that is most heavily associated with the manufacturing sector (see Figure 5), this speaks to continued weakness in the manufacturing sector.
- Champlain is the only POE that shows a persistent trade deficit. Referring again to Figure 5, note that Champlain accommodates a goods-profile unlike that of the other POEs—imports are heavily skewed toward resources (wood, ores, metals), and exports are less skewed toward manufactured goods.

Having already referred to Figure 5, we must briefly mention its design. It, too, is based upon the North American Transborder Freight database. Queries were performed to retrieve trade volumes (in nominal dollars) with respect to thematic groupings of 2-digit codes within the Harmonized Tariff Schedule—our groupings are seen at the bottom of the figure. Deflation factors were again applied, such that differences observed between the 2009 and 2011 graphs are indicative of changes in the volume of goods traversing a POE.

Figure 5 makes clear that there are regional variations in the kinds of goods traded across the border, with manufacturing being a more significant component in the Great Lakes region (Buffalo, Detroit) than at the continental margins. And the variations seen in Figure 5 are interrelated with the trade volumes in Figure 2, as exemplified by our earlier comments about Champlain and Detroit. The commodity profile of a given port is also related to transportation-mode characteristics at that port, as will shortly be seen in Figures 3 and 4.

Progress Toward a "Green Border." Canadian and U.S. federal transportation agencies are jointly pursuing an initiative to "green the border"—i.e., to encourage a transition to environmentally sustainable transportation

Figure 3. Percent of Overall Freight (Truck + Rail Modes Combined) Moving by Truck, Based Upon Value of Freight[2]

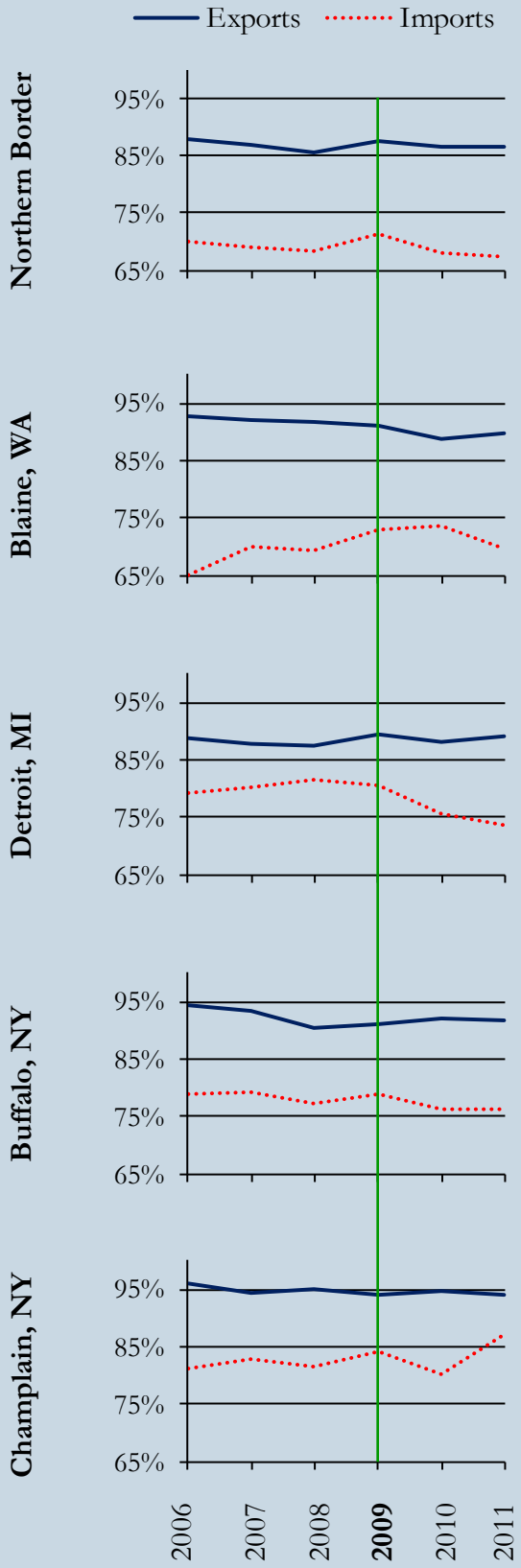
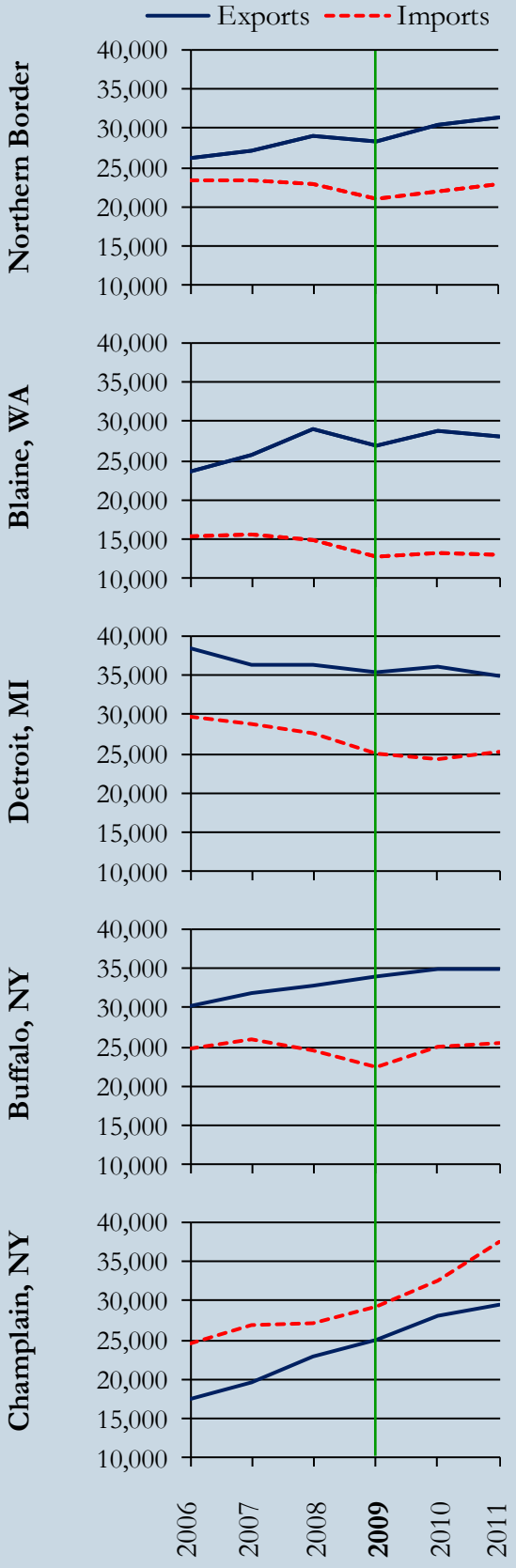


Figure 4. Freight Value Per Truck in 2009 U.S. Dollars[4]



practices. A similar agenda is being pursued by B.C. and Washington State. In this section we look within federal time-series datasets for evidence of increases in freight efficiency, and then turn to an example of the use of (and need for) other POE-specific data.

Aside from economy-wide market factors that affect transportation (e.g., rising fuel costs), there are factors unique to cross-border shipping. Paperwork burdens or driver-safety regulations might influence a carrier's ability to procure a cross-border backhaul. Border congestion related to truck-borne freight might cause a shipper to consider a shift to the rail mode. Federal datasets can be used to explore whether there has been a gradual shift from truck mode to rail (a more fuel-efficient mode) and whether the trucks traversing the border are, on average, achieving higher load factors.

Figure 3 shows the proportion of cross-border freight carried by truck over a six-year period. A decline in the proportion would be evidence of a shift to the rail mode, but there is little evidence of such a trend. The most notable decline is apparent with respect to U.S. imports transiting Detroit since 2009. Since Detroit accommodates trade that is associated with the auto sector, and new cars are often shipped by rail, it's likely the decline was caused by an *increase in rail shipments* of finished goods to the U.S. market as the auto sector revived.

Most apparent in Figure 3 is the lesser reliance upon trucking for conveyance of imports. The import stream consists of relatively higher proportions of resource commodities, which are extracted in locations well north of the border (thus resulting in lengthier trips to markets) and are suitable for bulk shipment in rail cars. Conversely, exports to Canada are typically destined for locations close to the border, necessitating shorter trips. Load compositions and the geography of origin-destination pairs have resulted in a persistent pattern of trucks less able to procure southbound backhauls and trains less able to procure a northbound load.

Figure 4 depicts the average value of freight within each truck in 2009 dollars. A "greener border" would be reflected by an upward trend over time, as carriers achieve higher load factors. Again, the most obvious pattern is the prevalence of lower values for imports, which is a manifestation of the relative difficulty of procuring southbound backhauls. Also evident is a pattern in which the highest values for both imports and exports are exhibited at Detroit and Buffalo, the POEs most influenced by high-value manufacturing activity. Champlain is the oddball, with a clear rising pattern, as

Figure 5. Commodity Profiles of Trade at Various Locales[3]

Truck + Rail Combined, All Values in Billions of 2009 Dollars

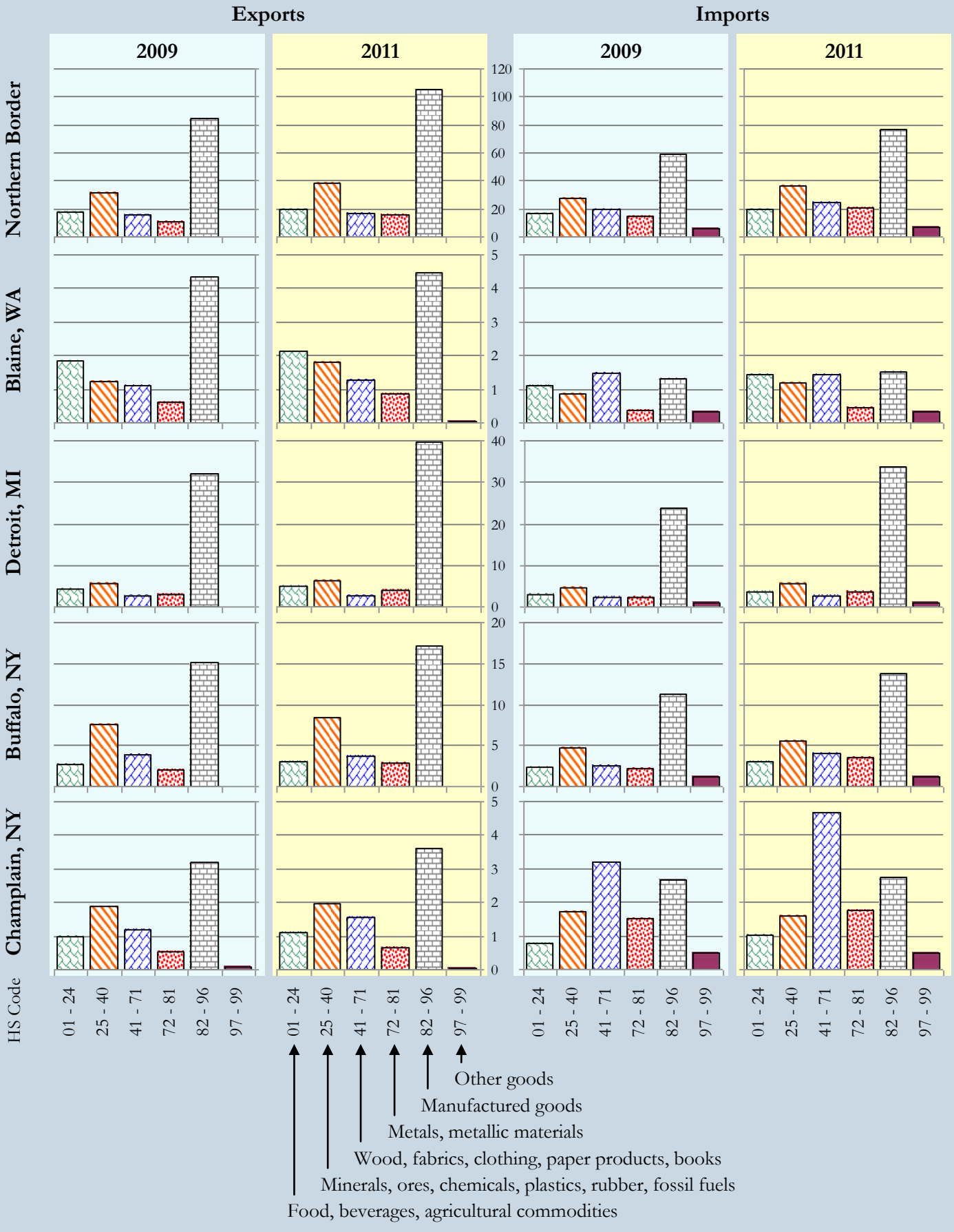
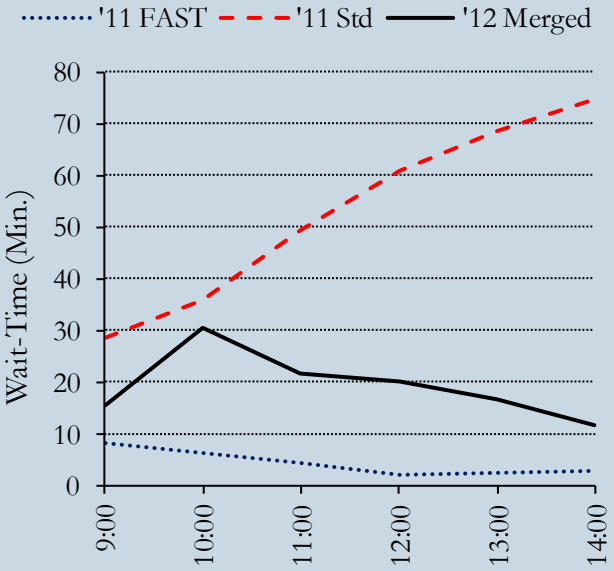


Figure 6. Parameters of Operations Before and After Modification of POE, Southbound Pacific Hwy[5]

	Truck Type	Booths	Arrivals at POE (Peak 5 Hrs. Total)	Arrivals per Booth	Sec. to Service Truck
2011	FAST	1	62	62	79
	Standard	2	256	128	102
	Combined	3	318	106	98
2012	Merged	3	402	134	86

Figure 7. Truck Wait-Times Before and After Modification of POE, Southbound Pacific Hwy[5]



well as an import stream of higher value. However, a close examination of the data revealed that Champlain's relatively small trade volume makes it more susceptible to distortions of the average. For example, imports of HS Code #71 (precious stones, precious metals, pearls) surged by $1.7 billion from 2009 to 2011, equating to an average of $5,500 per U.S.-bound truck, which accounts for most of the upward trend shown by the dashed red line. We are left to conclude that Figure 4 provides no evidence of a shift toward a "greener border."

At the continental scale, metrics derived from federal datasets have failed to show that cross-border freight transport has become more efficient in a systemic way. But *improving the process occurring at the POE* is another way to gain efficiency. At the Pacific Highway POE in Blaine, Washington, a three-year effort resulted in a large reduction in the delays experienced by trucks. The effort was dependent upon measurement of the real-time progress of hundreds of individual trucks as they traversed the POE in the southbound direction. This data was used to develop a simulation model with which "what if" analyses could be performed. In the historic configuration, the POE had three inspection booths, one of which was dedicated to trucks making a FAST-compliant trip. (FAST is a trusted-shipper program jointly offered by Canada and the U.S., meant to expedite cross-border trips for drivers, carriers, and shippers that have been vetted by customs agencies.) The model predicted that delays would be reduced if the dedicated FAST booth was instead made available to all traffic, so a pilot test was done. Figure 6 shows how the POE was operating in 2011, prior to modifications. The figure includes two important metrics—the *amount of time necessary to service a truck* at the booth, and the *traffic burden per booth* (number of arrivals at the POE over a peak five-hour span, divided by the number of booths). Prior to the pilot test, the stream of FAST traffic posed a relatively small burden of 62 trucks, and each truck was serviced relatively quickly (79 seconds). FAST trucks thus experienced almost no delay, as seen in Figure 7. The burden of standard truck traffic was greater, though, as were service times at the booth, with the result that standard trucks experienced large delays. After modifying the POE to use all three booths for a merged traffic stream, overall delays (and associated greenhouse gas emissions) were greatly reduced, despite the fact that the overall traffic burden had grown. While the BtB plan emphasizes the importance of wait-times as a metric of the performance of individual POEs, it is other metrics, such as the traffic burden per booth, that are key to reducing wait-times and improving operational efficiency at the POE.

Summary

- The "Beyond the Border" initiative has heightened the emphasis upon the use of metrics to gauge the performance of the Canada – U.S. border.
- One border-related policy goal of the U.S. is to double exports within a five-year period (2010 through 2014), pursuant to the National Export Initiative (NEI). As Canada is the U.S.'s largest export market, this goal implies increased traffic at the northern border ports-of-entry (POEs).
- Generic time-series trade and transportation datasets maintained by federal agencies are useful for gauging progress toward the NEI's goal. While the NEI pertains to both goods and services, the POEs are primarily impacted by *goods crossing the border by truck and train*. In 2009, the NEI baseline year, 15.2 percent of U.S. goods exports (i.e., $162.5 billion out of $1.07 trillion) were transported to Canada via trucks and trains. 59 percent of those goods flowed through four of the large POEs—Detroit, Buffalo, Champlain, and Blaine.
- Two years into the NEI, the border-wide volume of goods exported to Canada increased by 22 percent, regaining the level that existed prior to the economic meltdown. At that rate, a doubling of goods exports to Canada will not be realized within the NEI's five-year horizon.
- In the initial two-year period, goods imports from Canada increased by 28 percent. Because of the integrated nature of North American manufacturing, the success of the NEI will benefit Canada as much as the U.S.
- With respect to goods crossing the border via truck and rail, the U.S. has enjoyed a trade surplus with Canada since 2008. However, a trade deficit exists if the air, vessel, and pipeline modes are taken into account. Energy imports via pipeline are particularly significant.
- Efforts are underway to "green the border"—i.e., to encourage a transition to environmentally sustainable transportation practices. Federal datasets can again be used to explore "greening" metrics such as whether there has been a shift from truck mode to rail (a more fuel-efficient mode) and whether trucks traversing the border are, on average, achieving higher load factors. Over the six-year span from 2006 through 2011, little evidence exists of such changes.
- "Greening the border" can also involve POE-specific operational modifications intended to reduce congestion and delay. To undertake such modifications, POE-specific data is required. For southbound truck traffic at the Pacific Highway POE (Blaine), a three-year effort involving field data collection and simulation analysis resulted in operational modifications (e.g., alternate usage of booths and roadway approaches) that yielded large reductions in delay. POE-specific metrics and research have great utility in the effort to "green the border."

Endnotes

1. Figures 1A and 1B based upon Exhibits 1 and 13 within "U.S. International Trade in Goods and Services—Annual Revision for 2009" published by the U.S. Census, retrievable at: http://www.census.gov/foreign-trade/Press-Release/2009pr/final_revisions/
2. Figures 1C, 1D, and 3 based upon North American Transborder Freight database maintained by the U.S. Bureau of Transportation Statistics, accessible at: http://www.bts.gov/programs/international/transborder/TBDR_QA.html
3. Trade data retrieved from database cited in note (2). Deflation factors published by the U.S. Bureau of Labor Statistics. Export factors found in Table 2, retrievable at: http://www.bls.gov/web/ximpim/beaexp.htm; and import factors found in Table 1 ("All imports excluding petroleum"), retrievable at: http://www.bls.gov/web/ximpim/beaimp.htm
4. Freight value data retrieved from database cited in note (2). Annual 1-way truck counts derived from the "Border Crossing/Entry" database maintained by the U.S. Bureau of Transportation Statistics, accessible at: http://www.bts.gov/programs/international/transborder/TBDR_BC/TBDR_BCQ.html
5. Data collected by BPRI field crews in March/April 2011 and in August 2012.

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