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Steven Globerman
Western Washington University

Paul Storer
Western Washington University

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Steven Globerman, Ph.D.
College of Business and Economics
Western Washington University

Paul Storer, Ph.D.
College of Business and Economics
Western Washington University

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Border Policy Research Institute
Western Washington University
Bellingham, Washington
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About the Border Policy Research Institute

The BPRI focuses on research that informs policy-makers on matters related to the Canada – U.S. border. Policy areas of importance include transportation and mobility, security, immigration, energy, environment, economics, and trade.

Border Policy Research Institute
Western Washington University
516 High Street
Bellingham, WA 98225-9110
(360)650-3728

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1. INTRODUCTION

In recent years, private sector managers in both Canada and the United States have expressed concerns about a "thickening" of the Canada-U.S. border with resulting adverse consequences for continued integration of the North American economy and, more specifically, for Canada-U.S. trade.[1] Several factors have been identified as particularly relevant contributors to higher costs associated with bilateral trade. They include more frequent and closer inspection of goods crossing the border owing to stricter health and safety regulations and heightened security against acts of terrorism. The added delays and uncertainties imposed upon commercial shipments, particularly from Canada to the U.S., arguably add to the costs of shipping goods across the border, thereby discouraging trade at the margin.

While research studies have not been unequivocal in identifying adverse impacts on bilateral trade intensity, there is evidence that since the 9/11 terrorist attacks, the real (inflation-adjusted) value of Canada-U.S. trade flows has fallen short of what might be expected given historical economic experience. Globerman and Storer (2008, 2009) and Grady (2008) identify post-9/11 border security procedures as contributing significantly to bilateral trade "shortfalls," especially shortfalls in Canadian exports to the United States. Other authors have directly identified significant additional costs associated with post-9/11 border security regulations.[2] The costs arise from various sources, including administration and clerical burdens associated with satisfying more demanding reporting requirements for shipping goods and qualifying for special "trusted traveler" programs, delays resulting from increased inspections of goods in transit, and increased inventory levels needed to ensure timely shipments in the face of unpredictable border crossing times, among others.

Governments at all levels in Canada and the United States have implemented policies to address at least some of the sources of the increased costs adversely affecting bilateral trade. For example, road and port infrastructure programs have been undertaken to expand the physical capacity of individual border crossing points on both sides of the border.[3] The infrastructure programs have involved planning and funding by agencies of the two federal governments, as well as by states, provinces and individual cities. On the other hand, programs associated with expediting commercial and passenger traffic in the context of border security procedures remain the sole responsibility of the federal governments, as do initiatives related to staffing and managing border ports.[4] Since national security is primarily a responsibility of the federal government, it seems reasonable for administration of ports, including interior land ports, to be centralized in the federal government bureaucracy; however, to the extent that the costs and consequences of relatively uniform border security and related policies differ across geographic locations, such centralization could lead to inefficiencies and regional inequities. At the least, relevant differences across ports by geographic locations should be acknowledged by federal government decision-makers, whether or not decision-making responsibility is devolved to lower levels of government.[5] Where relevant differences across border crossing locations can be incorporated into policies to reduce cost burdens on bilateral trade without

[1] For some discussions of these concerns, see Goldfarb (2007), Ackleson (2009) and Sands (2009).
[2] The relevant studies are summarized and reviewed in Globerman and Storer (2008).
[3] Ackleson (2009), among others, highlights an inadequate number of entry lanes and of associated staffing at land border crossing ports as limiting the volume of bilateral trade flows.
[4] See Globerman and Storer (2008) and Sands (2009) for a discussion of a number of initiatives, including the Free and Secure Trade (FAST) program.
[5] In this context, *relevant* differences are those that affect transportation costs in a significant way. For example, Bradbury and Turbeville (2008) highlight differences in overall trade volumes, as well as in the composition of trade flows, that exist across various Canada-U.S. border crossing points.

compromising national security, some port-specific variations in administration would seem to make sense.

Sands (2009), among others, has called for a substantial increase in responsibility on the part of local and regional communities to shape border security policies and procedures in recognition of important regional differences in economic conditions, the history of cooperation between state and provincial governments, the population sizes of border communities and so forth.[6] Empirical evidence that trade shortfalls in the post-9/11 period vary across major land ports along the Canada-U.S. border provides some indirect support for claims that a "one-size-fits-all" program to ensure security of commercial shipments from terrorism and/or health risks is potentially inefficient and possibly inequitable for specific groups of producers and consumers, depending upon their geographic locations.[7] Unfortunately, the evidence on the geographic impacts of government policy on cross-border shipping costs is extremely limited, so that the practical importance of the policy changes recommended by Sands and others is unclear.

This study is intended to help address our limited understanding of how the costs of transporting commercial goods between Canada and the United States differ geographically. Specifically, our study addresses the question of whether and by how much the cost of shipping goods from Canada to the United States differs across geographic locations in the United States. Since concerns continue to be expressed about the impacts of post-9/11 border security measures on transportation costs, our study also identifies whether and how the costs of shipping goods from Canada to the United States have changed over time, particularly in the post-2001 period.

While ideally we would like to identify and assess differences in shipping costs at the level of the individual port, the available data do not permit this level of disaggregation. Specifically, the data required to estimate shipping costs are taken from the United States International Trade Commission, and they are reported on the basis of country of origin, commodity and customs district of entry into the United States. Hence, the analysis of shipping costs must be undertaken at the customs district level. For our analysis, we focused initially on the nine U.S. customs districts containing land ports on the Canada-U.S. border. We subsequently dropped the Duluth customs district from our sample, because changes in the identity of the ports included in this district that took place during our sample time period made analysis of transportation costs over the sample time period unreliable for that district.[8]

Our study adds to existing knowledge of post-9/11 border security developments and Canada-U.S. economic integration in several ways. One is its use of a measure of transportation cost that has not been employed in previous research focusing on the impacts of post-9/11 border security developments. Ultimately, concerns expressed about a "thickening" of the Canada-U.S. border relate to increased (direct and indirect) costs associated with shipping goods, particularly from Canada to the United States. To our knowledge, our study is the first to use time series data on transportation costs in order to identify whether those costs increased in the post-9/11 time period. Second is our systematic effort to identify whether a thickening of the border, as measured by transportation costs, has been relatively uniform across the Canada-U.S. border or whether some locations have experienced more significant thickening relative to other locations. Third is our evaluation of transportation cost differences across commodities and whether the differences identified are

[6] Lovecraft (2007) makes a similar argument in the context of Canada-U.S. environmental management.

[7] See Globerman and Storer (2009) for evidence of differences across ports in the impacts of post-9/11 border security procedures on trade flows.

[8] The full set of eight customs districts and the ports within each district are reported in Appendix 1.

plausibly related to post-9/11 border security developments. Any such differences might help explain variations in transportation costs across customs districts, including differences in the post-9/11 period.

In summary, we find some evidence that transportation costs associated with importing goods from Canada into the United States declined more rapidly in the pre-9/11 period than in the post-9/11 period. This finding adds to the evidence that post-9/11 border security-related developments have thickened the border between Canada and the United States. We also find significant differences across U.S. customs districts in the behavior of transportation costs over time. Specifically, there is evidence that adverse movements in transportation costs in the post-9/11 period were more severe for some customs districts than for others. Furthermore, the differences appear to be more closely related to the capability of ports within customs districts to respond to border-related security developments than to differences in the mix or nature of the commodities passing through the ports. This finding provides some support for recommendations that U.S. policies dealing with border security incorporate regional differences into the policy-making process.

The rest of our study proceeds as follows. Section 2 describes our transportation cost metric. Section 3 discusses how transportation costs for U.S. imports from Canada have varied over time and across customs districts. Section 4 examines the behavior of the cost ratio at the individual commodity level, both for all customs districts, as well as for individual customs districts. Section 5 identifies and evaluates other characteristics of customs districts that might influence the behavior of transport costs, particularly when comparing the pre- and post-2001 experiences. Finally, a summary and conclusion section is presented in Section 6.

2. MEASUREMENT OF SHIPPING COSTS

Our broad measure of shipping costs follows the method used by Frankel (1997) and Anderson and van Wincoop (2004). The measure is calculated by comparing U.S. importers' reported customs value of imports including freight and insurance costs (the CIF value) to the values reported excluding freight and insurance (the FOB value).[9] Presumably, the costs created by security-related procedures, as well as regulatory-related obligations imposed upon Canadian exporters will be manifested over time in higher costs of freight and, possibly, insurance as well. For example, the documented costs associated with longer waiting times to cross the border, as well as adjustments to shipping patterns in response to increased uncertainty about the time required to cross the border, presumably will contribute to a higher ratio of CIF value to FOB value (henceforth the *ratio*) to the extent that the higher costs are passed through to importers.[10]

The transport cost ratio data that we use in this study are derived from import documents such as U.S. Customs and Border Protection Form 7501. These documents require importers of record to disclose separate figures for the commercial value of their imports and for the combined cost of freight and insurance charges. For U.S. imports from Canada, reported customs charges can include both foreign inland freight charges and post-importation freight costs. The inclusion of pre- and post-importation freight and insurance charges means that changes in our transport cost ratios will reflect some combination of pure variations in the cost of crossing the border and fluctuations in

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[9] All variables used in this study, as well as the sources for the variables, are reported in Appendix 2. Technically, the ratio is defined as the CIF value minus the FOB value divided by the FOB value multiplied by 100 or [(CIF – FOB)/FOB] x 100.

[10] For a summary of evidence concerning increased security-related transportation costs incurred by Canadian exporters related to shipping goods across the border, see Globerman and Storer (2008) and Goodchild, Globerman and Albrecht (2008).

other transportation cost factors such as fuel costs or the distances traveled within Canada and the United States. While we have no direct way to control for changes in factors such as distance traveled between the points of origin and destination, we will minimize the potential impact of these factors by comparing transport cost ratios before and after 9/11. There is little reason to believe that shipping distances for Canadian exports changed in a systematic way after 2001. Furthermore, any changes in transportation distances that are uniform across customs districts will not affect our analysis, because we focus on transport cost differences over time between customs districts. In a later section of this paper, we will check the robustness of our results by examining the fraction of imports that clear at ports located away from the physical border. To anticipate the results of this exercise, we find little evidence that changes in shipping distances explain the evolving nature of our transport cost ratios.

Our calculated ratio implicitly captures a variety of potential influences on shipping costs. Perhaps the most obvious shipping cost determinant is the nature of the goods being shipped. All other things constant, heavy and bulky goods will cost more to ship than light and compact goods. Hence, low value-to-weight goods will have higher calculated ratios than high value-to-weight goods. Obviously, the greater the distance over which goods are shipped, the higher the shipping costs, other things constant. Transportation companies facing greater competition both within and across transportation modes are likely to charge lower mark-ups than those facing limited competition. Such differences in competitive conditions should also be reflected in the calculated ratio. Productivity changes in shipping, and other activities related to logistics, will affect the calculated ratio as well.[11] Thus, it seems reasonable to expect that shipping costs will differ across North-South transportation corridors to the extent that those corridors differ with respect to factors such as volume and composition of commodity shipments, transport modalities used and so forth. Shipping costs may also change over time depending upon changes in these factors, as well as changes in productivity.

Furthermore, if changes in factors such as productivity are not uniform across geographical locations, they might contribute to observed differences across locations when comparing pre- and post-9/11 time periods. In this case, it might be an error to infer that post-9/11 border security developments are the main cause of location differences in transportation costs over time. In later sections of this report, we consider evidence addressing the broad issue of what factors might be contributing to regional differences in transportation costs in the pre- and post-9/11 period.

In the next section of this study, we report data on the behavior of the ratio over time for our sample of customs districts.

3. THE BEHAVIOR OF THE RATIO OVER TIME AND BY CUSTOMS DISTRICT

Table 1 lists the eight major customs districts in our study and reports the total value of imports from Canada (in nominal U.S. dollars) for each district for the years 1989-2008. Table 2 reports the percentage increase in imports on an annual basis for 1990 through 2008 for each of the customs districts. Clearly, the eight customs districts in our sample differ in terms of absolute volume of imports processed. Furthermore, import activity increased at different rates across our sample of customs districts over the period 1990-2008.

Figure 1 reports the calculated values of the transportation cost ratio for total imports from Canada crossing through land ports within each customs district in each of the years from 1989-2008. There

[11] Frankel (1997) and Hummels (2001), among others, identify declining shipping costs over time linked to improvements in productivity.

TABLE 1:
Nominal Import Volumes by Customs District

District	1989	1990	1991	1992	1993
Buffalo, NY	$17,037,289,362	$17,383,987,105	$16,816,407,954	$18,982,140,625	$22,110,639,441
Detroit, MI	$33,364,276,392	$32,833,409,012	$33,154,481,398	$36,768,036,210	$41,562,488,614
Great Falls, MT	$3,081,675,598	$3,607,705,152	$3,544,342,572	$3,679,535,124	$4,194,866,663
Ogdensburg, NY	$8,411,547,900	$8,950,921,496	$9,078,612,274	$9,226,461,744	$10,456,217,204
Pembina, ND	$3,852,927,012	$4,022,141,952	$3,973,318,721	$4,403,483,805	$5,145,147,669
Portland, ME	$2,226,446,040	$2,425,226,975	$2,323,999,011	$2,293,150,751	$2,518,500,769
Seattle, WA	$4,105,656,465	$4,285,463,067	$4,158,274,660	$4,730,920,224	$5,365,951,418
St. Albans, VT	$3,807,546,061	$4,728,633,543	$4,735,325,273	$4,811,828,896	$4,959,955,634
8 District Total	$75,887,364,830	$78,237,488,302	$77,784,761,863	$84,895,557,379	$96,313,767,412
District	**1994**	**1995**	**1996**	**1997**	**1998**
Buffalo, NY	$24,820,943,896	$26,347,872,305	$26,572,462,119	$27,162,900,886	$32,488,541,836
Detroit, MI	$51,123,617,281	$57,947,797,230	$62,614,727,706	$68,498,718,976	$68,123,193,259
Great Falls, MT	$4,979,892,887	$4,682,383,808	$5,203,354,011	$5,949,680,220	$6,022,934,292
Ogdensburg, NY	$11,276,739,118	$13,074,368,869	$14,408,306,685	$15,656,082,763	$16,661,844,608
Pembina, ND	$5,922,682,974	$6,979,234,674	$7,287,783,241	$7,574,759,161	$7,878,654,324
Portland, ME	$2,716,848,300	$3,079,690,313	$3,373,799,638	$3,654,227,363	$3,677,831,573
Seattle, WA	$6,196,371,291	$6,719,748,776	$8,039,688,654	$9,574,898,490	$10,266,777,618
St. Albans, VT	$5,541,206,445	$6,628,011,931	$7,054,365,489	$7,016,692,195	$7,439,131,685
8 District Total	$112,578,302,192	$125,459,107,906	$134,554,487,543	$145,087,960,054	$152,558,909,195
District	**1999**	**2000**	**2001**	**2002**	**2003**
Buffalo, NY	$35,806,247,474	$34,079,525,132	$31,249,022,312	$31,060,902,500	$32,173,669,651
Detroit, MI	$78,111,576,373	$87,508,068,378	$82,747,424,603	$84,526,966,423	$89,160,283,315
Great Falls, MT	$7,641,030,100	$10,869,408,219	$14,471,616,323	$12,265,260,683	$14,325,982,210
Ogdensburg, NY	$18,084,926,599	$21,791,137,585	$20,123,639,264	$19,226,485,809	$19,427,481,037
Pembina, ND	$8,479,164,708	$10,691,027,708	$9,999,325,157	$9,340,203,496	$9,042,452,986
Portland, ME	$4,198,570,627	$5,018,693,428	$5,186,388,972	$5,060,710,190	$5,397,182,489
Seattle, WA	$11,852,765,533	$14,653,489,804	$12,614,953,352	$10,349,675,930	$11,416,432,188
St. Albans, VT	$7,817,028,637	$8,583,307,026	$8,468,931,436	$7,681,239,785	$8,786,683,540
8 District Total	$171,991,310,051	$193,194,657,280	$184,861,301,419	$179,511,444,816	$189,730,167,416
District	**2004**	**2005**	**2006**	**2007**	**2008**
Buffalo, NY	$36,798,886,597	$38,079,329,299	$40,174,048,089	$40,262,083,633	$40,734,639,988
Detroit, MI	$100,296,811,873	$108,922,392,639	$111,672,485,985	$111,837,876,135	$102,851,069,946
Great Falls, MT	$17,189,393,299	$21,348,311,762	$21,761,137,374	$23,461,003,021	$28,345,134,577
Ogdensburg, NY	$21,839,874,991	$25,304,185,585	$26,842,354,609	$26,174,755,567	$27,360,722,103
Pembina, ND	$10,653,134,294	$12,403,917,176	$13,647,725,917	$14,658,560,605	$16,989,357,940
Portland, ME	$6,153,639,059	$6,918,972,840	$7,135,203,564	$6,835,661,925	$7,428,941,714
Seattle, WA	$13,336,843,884	$15,193,962,125	$15,906,899,872	$15,767,143,027	$17,196,899,267
St. Albans, VT	$9,292,432,099	$11,436,236,877	$10,241,561,173	$9,984,955,960	$9,273,359,276
8 District Total	$215,561,016,096	$239,607,308,303	$247,381,416,583	$248,982,039,873	$250,180,124,811

TABLE 2:
Annual Growth Rates for General Import Volumes by Customs District

District	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Buffalo, NY	2.0%	-3.3%	12.9%	16.5%	12.3%	6.2%	0.9%	2.2%	19.6%	10.2%	-4.8%	-8.3%	-0.6%	3.6%	14.4%	3.5%	5.5%	0.2%	1.2%
Detroit, MI	-1.6%	1.0%	10.9%	13.0%	23.0%	13.3%	8.1%	9.4%	-0.5%	14.7%	12.0%	-5.4%	2.2%	5.5%	12.5%	8.6%	2.5%	0.1%	-8.0%
Great Falls, MT	17.1%	-1.8%	3.8%	14.0%	18.7%	-6.0%	11.1%	14.3%	1.2%	26.9%	42.3%	33.1%	-15.2%	16.8%	20.0%	24.2%	1.9%	7.8%	20.8%
Ogdensburg, NY	6.4%	1.4%	1.6%	13.3%	7.8%	15.9%	10.2%	8.7%	6.4%	8.5%	20.5%	-7.7%	-4.5%	1.0%	12.4%	15.9%	6.1%	-2.5%	4.5%
Pembina, ND	4.4%	-1.2%	10.8%	16.8%	15.1%	17.8%	4.4%	3.9%	4.0%	7.6%	26.1%	-6.5%	-6.6%	-3.2%	17.8%	16.4%	10.0%	7.4%	15.9%
Portland, ME	8.9%	-4.2%	-1.3%	9.8%	7.9%	13.4%	9.5%	8.3%	0.6%	14.2%	19.5%	3.3%	-2.4%	6.6%	14.0%	12.4%	3.1%	-4.2%	8.7%
Seattle, WA	4.4%	-3.0%	13.8%	13.4%	15.5%	8.4%	19.6%	19.1%	7.2%	15.4%	23.6%	-13.9%	-18.0%	10.3%	16.8%	13.9%	4.7%	-0.9%	9.1%
St. Albans, VT	24.2%	0.1%	1.6%	3.1%	11.7%	19.6%	6.4%	-0.5%	6.0%	5.1%	9.8%	-1.3%	-9.3%	14.4%	5.8%	23.1%	-10.4%	-2.5%	-7.1%
8 District Total	3.1%	-0.6%	9.1%	13.4%	16.9%	11.4%	7.2%	7.8%	5.1%	12.7%	12.3%	-4.3%	-2.9%	5.7%	13.6%	11.2%	3.2%	0.6%	0.5%

FIGURE 1: Transportation Cost Ratio for All Commodities by Customs District

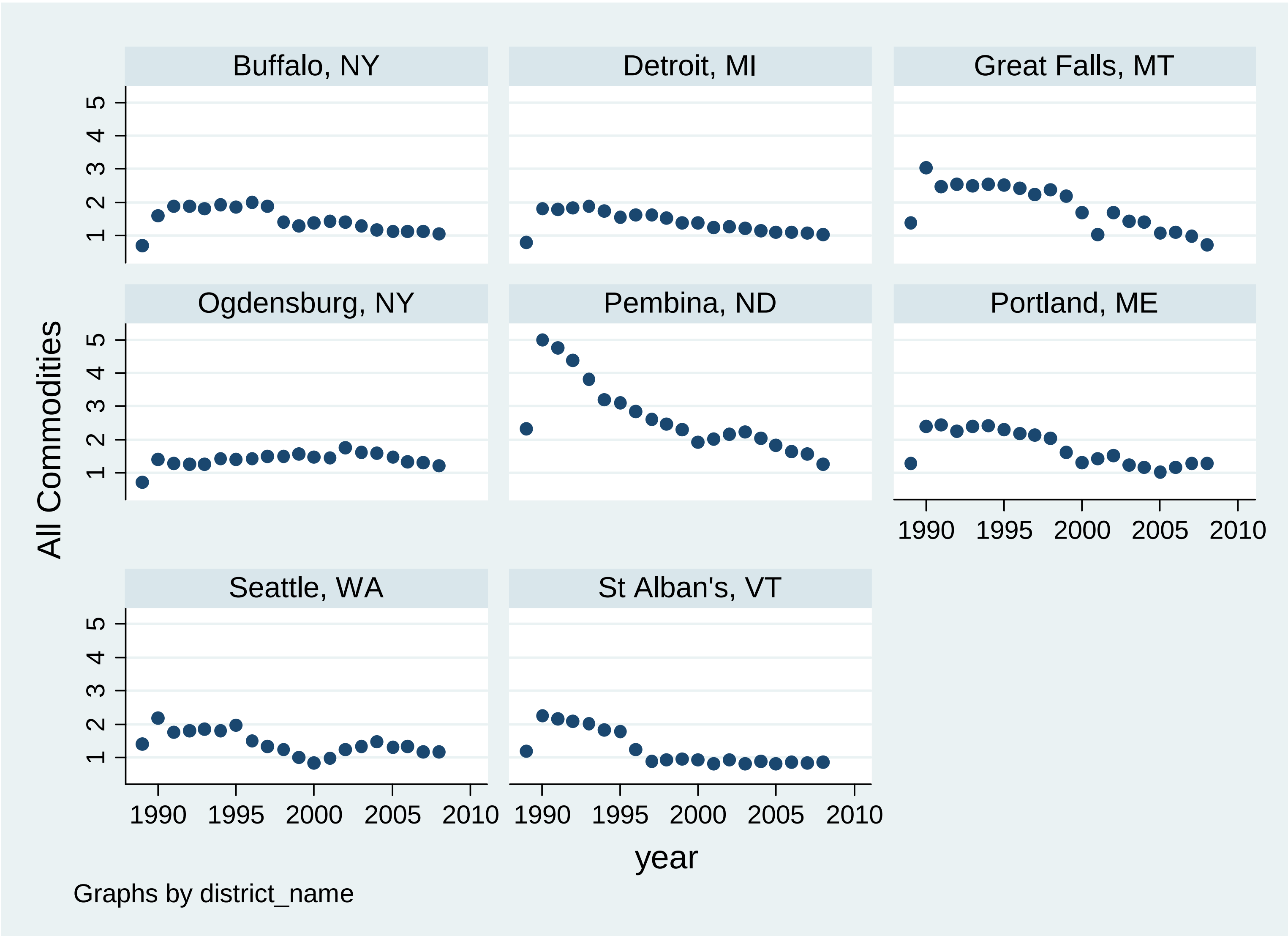
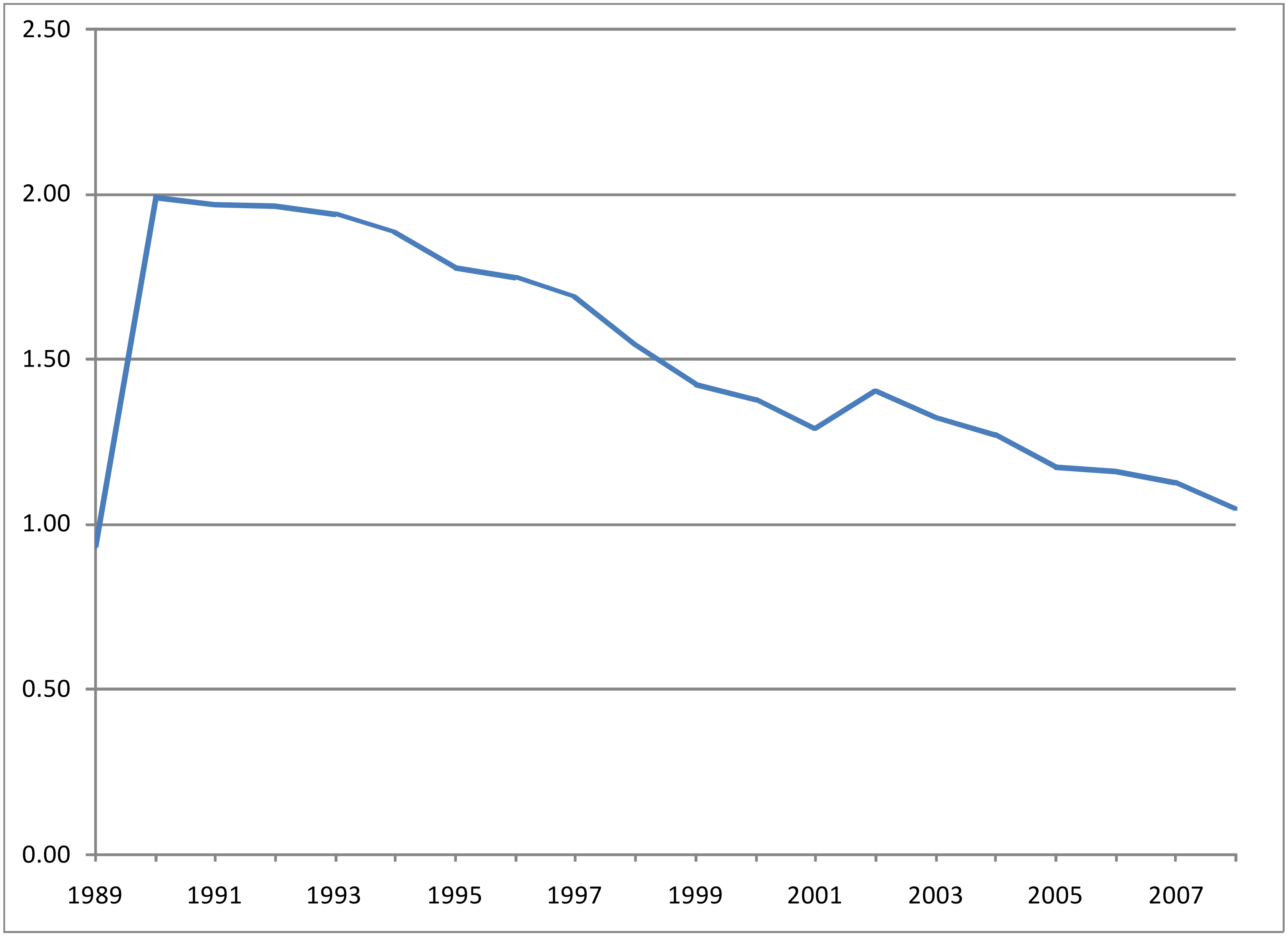


FIGURE 2: Transportation Cost Ratio for All Commodities and for the Top 8 Customs Districts



is a clear and dramatic upward spike in the calculated ratio for every customs district from 1989 to 1990. The sharp increase was ostensibly due to a dramatic (almost 30%) increase in the price of oil between the two years. Hence, a more meaningful picture of changes in transportation cost over time would be gleaned by abstracting from this initial large increase in oil prices so as to focus on the data for 1990-2008.

In this regard, it can be seen from Figure 1 that the transportation cost ratio differs in absolute value across districts. Of more interest are the differences across customs districts in the movement of the ratio over time. For example, for a number of districts (Buffalo, Detroit, Great Falls and Pembina), the ratio decreases more or less constantly over the full sample period with the exception of a modest increase in 2001-2002. It seems reasonable to infer that this latter increase was related to border security developments and the associated border crossing delays in the immediate aftermath of the 9/11 terrorist attacks; however, in the case of some other districts (Portland, Seattle, and St. Albans) the trend in the declining ratio prior to 2001 does not continue in the post-2001 period.

For all imports aggregated across the eight sample customs districts, Figure 2 shows that the ratio decreased from 2002 onwards, following an increase from 2001-2002; however, the decrease is noticeably slower in the period 2002-2008 compared to the period 1990-2001.[12] The continued decrease in the ratio post-2002 might reflect the fact that other factors contributing to lower transportation costs more than offset the specific impact of border security-related procedures post-9/11 on transportation costs. Productivity gains in transportation are an obvious candidate in this regard. Estimates for the United States show that labor productivity in local trucking grew by 5.2% per year, while productivity in rail grew by 5.1% per year over the period 1990-2000 (U.S. Department of Transportation, 2003). A continuation of such productivity improvements in the post-2000 period could help explain why the calculated ratio continued to decline for most of the sample districts.[13]

Hence, the decrease in the ratio for most districts post-2001 should not be interpreted as evidence that border-related security measures had no significant and lasting impact on shipping costs for goods imported into the U.S. from Canada. As noted above, productivity gains in the transportation industry may have offset any measurable cost increases associated with post-9/11 border security developments. In addition, border delays and associated uncertainties may have led to a substitution away from goods with relatively high shipping costs to those with lower shipping costs, a phenomenon identified by Hummels (2001), among others. Finally, shortfalls in Canadian exports to the United States could have contributed to the observed decreases in the ratio post-2001 by reducing congestion at border crossings and increasing pressure on carriers to charge lower freight rates.

Whatever the factors influencing transportation costs, the data summarized in Figures 1 and 2 suggest that there are important differences in the pre- and post-2001 behavior of the transportation cost ratio. Furthermore, differences in the pre- and post-2001 behavior of the ratio are not identical across customs districts. Specifically, the trend towards lower transportation costs appears to have

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[12] This is seen by comparing the flatter slope of the curve from 2000-2008 to the steeper slope from 1990-2001.

[13] Lim and Lovell (2009) provide evidence of productivity improvements in rail transportation over the more recent period 1996-2003.

slackened in the later period compared to the earlier period. Furthermore, the slackening is more marked for some districts than for others.

Differences in the behavior of the ratio over time for the aggregate of customs districts, as well as across customs districts, are further illustrated through regression analysis. We first separated the sample time period into two sub-periods: 1990-2000 and 2001-2008. The time periods were chosen to correspond as closely as possible to pre and post-9/11 border crossing conditions. For the sample of customs districts as a whole, as well as for each individual customs district, a simple linear model was estimated for each sub-period, where the dependent variable is the calculated ratio and the independent variable is a linear time trend. The results of the regression analysis are reported in Table 3. Specifically, the estimated coefficient for the linear time trend is reported for each district for the two sub-periods. It can be seen that there was a statistically significant (at the ten-percent level) downward trend in shipping costs for seven of the eight districts in the first sub-period.[14] Conversely, Ogdensburg has a notable increasing trend in shipping costs.

The downward trend in shipping costs continues for most districts in the post-2001 period; however, the estimated negative time trend coefficient is statistically insignificant for Portland and St. Albans, and it is positive, albeit statistically insignificant, for Seattle. The smaller (in absolute value) negative estimated time trend coefficient for Pembina in the second sample period is not significantly different from zero but, when comparing the second sub-period to the first, the change in the time trend coefficient is statistically significant. Hence, for almost half the sample, the trend to lower shipping costs was slowed or even reversed in the post-2001 period. There appears to be no change in the trend for Buffalo, Detroit and Great Falls, whereas there is a statistically significant reversal of the pre-9/11 trend towards higher shipping costs for Ogdensburg.

Table 4 reports the results of a regression model in which a coefficient is explicitly estimated for a change in the time trend value of the ratio starting in 2001. Specifically, Table 4 reports the estimated coefficient for the change in the time trend for each of the eight sample districts along with the statistical significance levels of the estimated coefficients. A positive coefficient indicates that the ratio decline was slowing in the post-2001 period compared to the pre-2001 period. A negative coefficient suggests that the decline was actually faster post-2001. When estimated across all imports, it is seen that only one customs district (Ogdensburg) experienced a faster and statistically significant decline in the transportation cost ratio post-2001; however, four districts (Portland, St. Alban's, Seattle and Pembina) experienced a slower (and statistically significant) decreasing trend in the ratio post-2001.

In summary, there is some evidence of a post-9/11 slowing of the declining trend in transportation costs across our sample of customs districts, with specific customs districts experiencing a particularly marked change in this trend relationship. Such differences suggest that post-9/11 border security-related developments imposed larger or smaller disadvantages across regions in terms of facilitating imports from Canada depending upon the location of border crossings. However, before drawing any strong inference along these lines, it is worth looking at the behavior of the cost ratio at the level of the individual commodity.

[14] Clearly, the absolute values of the estimated coefficients differ across the districts; however, it cannot be determined if the differences are statistically significant.

TABLE 3:
Split-Sample Time-Trend Regressions by Customs District

	Time Trend Variable		Regression Constant Term	
Customs District	**1990-2000**	**2001-2008**	**1990-2000**	**2001-2008**
Buffalo	-0.040 (8%)*	-0.054 (<0.1%)	1.96 (<0.1%)	2.05 (<0.1%)
Detroit	-0.048 (< 0.1%)	-0.034 (<0.1%)	1.93 (< 0.1%)	1.67 (<0.1%)
Great Falls	-0.082 (0.1%)	-0.084 (6.9%)	2.90 (<0.1%)	2.48 (0.6%)
Ogdensburg	***0.025***** (0.4%)	***-0.058*** (1.9%)	1.26 (<0.1%)	2.38 (<0.1%)
Pembina	***-0.307*** (<0.1%)	***-0.120*** (0.3%)	5.15 (<0.1%)	3.70 (<0.1%)
Portland	-0.092 (<0.1%)	-0.031 (22.4%)	2.69 (<0.1%)	1.74 (0.3%)
Seattle	***-0.116*** (<0.1%)	***0.008*** (75.4%)	2.27 (<0.1%)	1.13 (2.5%)
St. Albans	***-0.160*** (<0.1%)	***-0.002*** (75.8%	2.51 (<0.1%)	0.886 (<0.1%)
All 8 Districts	***-0.065*** *(<0.1%)*	***-0.044*** *(<0.1%)*	2.14 (<0.1%)	1.90 (<0.1%)

*Percentages shown in parentheses are significance levels for the null hypothesis that the coefficient is equal to zero.

Time trend coefficients are shown in ***bold italics* when the coefficient values are significantly different (at the 1% level) between the 1990-2000 and 2001-2008 periods.

TABLE 4:
Estimated Coefficients for Changes in Time Trend of Transport Cost Ratio Post-2001

District	Estimated Coefficient*
Portland	0.061 (8%)
St. Alban's	0.157 (< 1%)
Ogdensburg	-0.084 (<1%)
Buffalo	-0.014 (66%)
Seattle	0.124 (10%)
Great Falls	-0.002 (96%)
Pembina	0.187 (<1%)
Detroit	0.014 (22%)
All 8 Districts	0.021 (6.2%)

* Numbers in parentheses are the probabilities that the coefficients are significantly different from zero.

TABLE 5:
Frankel's Measure: Top Commodities
All Districts – Various Years

HTS-2 Code	Ratio 1995	Ratio 2002	Ratio 2008
1	1.9	1.5	1.0
3	1.1	0.7	0.5
27	2.4	1.4	0.7
39	2.1	2.3	1.7
44	4.2	3.1	2.6
47	2.9	3.4	2.7
48	3.0	3.5	2.8
76	1.1	1.7	0.6
84	1.2	0.8	0.7
85	1.2	0.7	0.8
87	1.0	0.6	0.5
98	1.5	1.1	1.0

4. BEHAVIOR OF THE RATIO BY COMMODITY AND BY DISTRICT

Table 5 reports the transportation cost ratio value for 12 two-digit HTS commodities for selected years aggregated across all of the sample customs districts.[15] It is unsurprising to observe that the transportation cost ratio varies across commodities. It is also not surprising to observe that the ratio varies over time for the various commodities. In the majority (62%) of cases, the ratio declines over the period 1995-2002. Such decreases in the ratio are consistent with productivity improvements in the transportation sector. While virtually all commodities exhibit decreases in the ratio over the period 2002-2008, the decreases in the ratio appear to be more modest in the 2002-2008 period. This observation is consistent with our econometric evidence discussed earlier, which showed a flattening of the declining transportation cost ratio in the post-2001 time period.

Differences across commodities in the transportation cost ratio are further illustrated in Figures 3-10. Specifically, the ratios are plotted for eight of the commodities listed in Table 5 over the sample time period. The data are reported for each of our sample customs districts. Several inferences can be readily drawn. One is that changes in the ratio over time differ across customs districts. For example, the ratio for mineral fuels is virtually unchanged over much of the sample period in the case of Ogdensburg, whereas it decreases, increases and then decreases again quite noticeably for Buffalo. In the case of paper products, the ratio is noticeably lower in the post-2001 period for the Portland district, whereas it is higher in the post-2001 period for St. Albans and Ogdensburg.

A second inference is that changes in the ratio over time are not identical across commodities within any customs district. For example, there are marked increases and decreases in the ratio for Buffalo over the sample period in the case of mineral fuels. In contrast, the ratio is relatively unchanged other than the increase from 1989-1990 for plastics in the case of Buffalo. Conversely, while the ratio for mineral fuels is relatively invariant in the case of Ogdensburg, the ratio for plastics increases fairly steadily and noticeably for Ogdensburg.

In summary, the information presented in Figures 3-10 supports the assumption that transport costs differ across commodities. Hence, one must acknowledge the possibility that the flattening-out of the declining transportation cost ratio post-2001 might reflect a changing import commodity mix over time. Specifically, there could have been a relative increase in the share of imports accounted for by relatively transportation cost-intensive commodities in the post-9/11 period.

4.1 Changes in Overall Commodity Mix

Table 6 reports the two-digit HTS codes for the five leading U.S. commodity imports from Canada for selected years. Clearly, there are overlaps in commodity categories across the sample years. In particular, commodities 27 (mineral fuels), 84 (mechanical equipment) and 87 (automotive products) combined account for almost 50% or more of total imports in each sample year. The fact that the import commodity mix over time was dominated by the same relatively small set of commodities suggests that changes in the commodity mix of U.S. imports from Canada are unlikely to be a major contributor to the behavior of the overall transport cost ratio over time, although the change in the relative positions of the top two commodities between 2004 and 2008 does have some potential impact on the level of the ratio and its trend over time.

[15] These commodity groups constitute relatively large Canadian export categories accounting for 68% of U.S. imports from Canada in 2008.

FIGURE 3: Transportation Cost Ratio for Mineral Fuels (Chapter 27) by Customs District

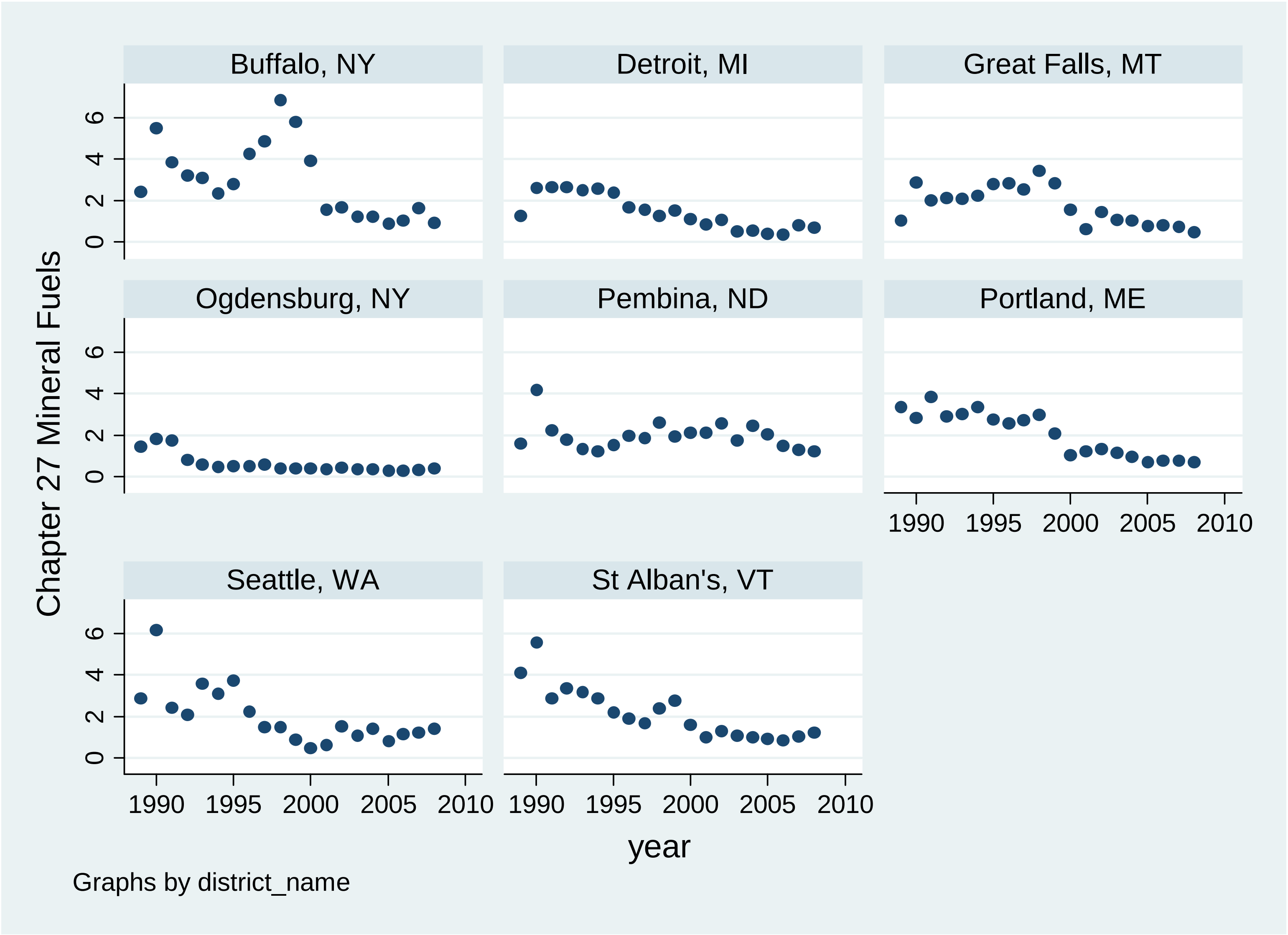

FIGURE 4: Transportation Cost Ratio for Plastics (Chapter 39) by Customs District

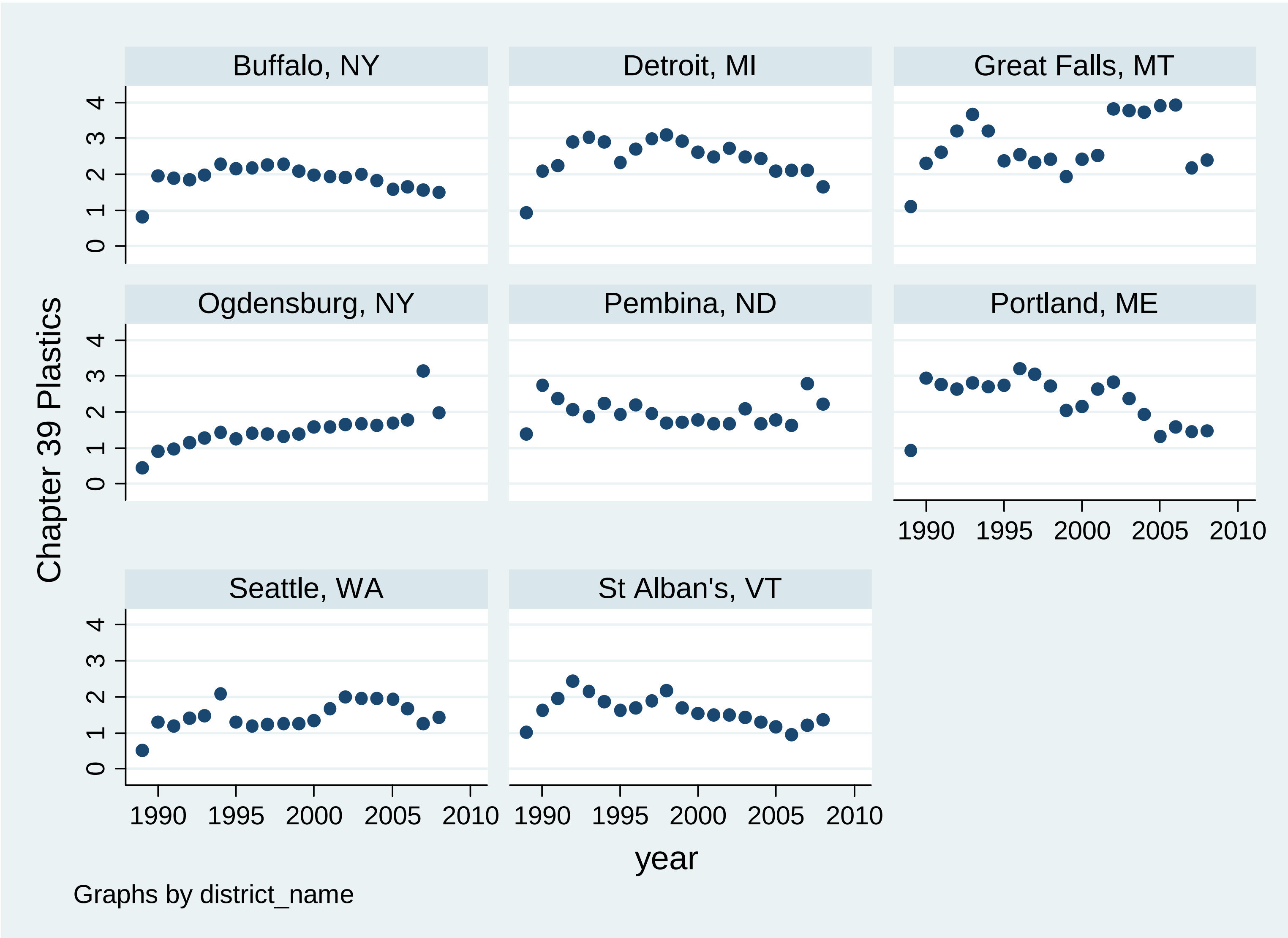

FIGURE 5: Transportation Cost Ratio for Wood Products (Chapter 44) by Customs District

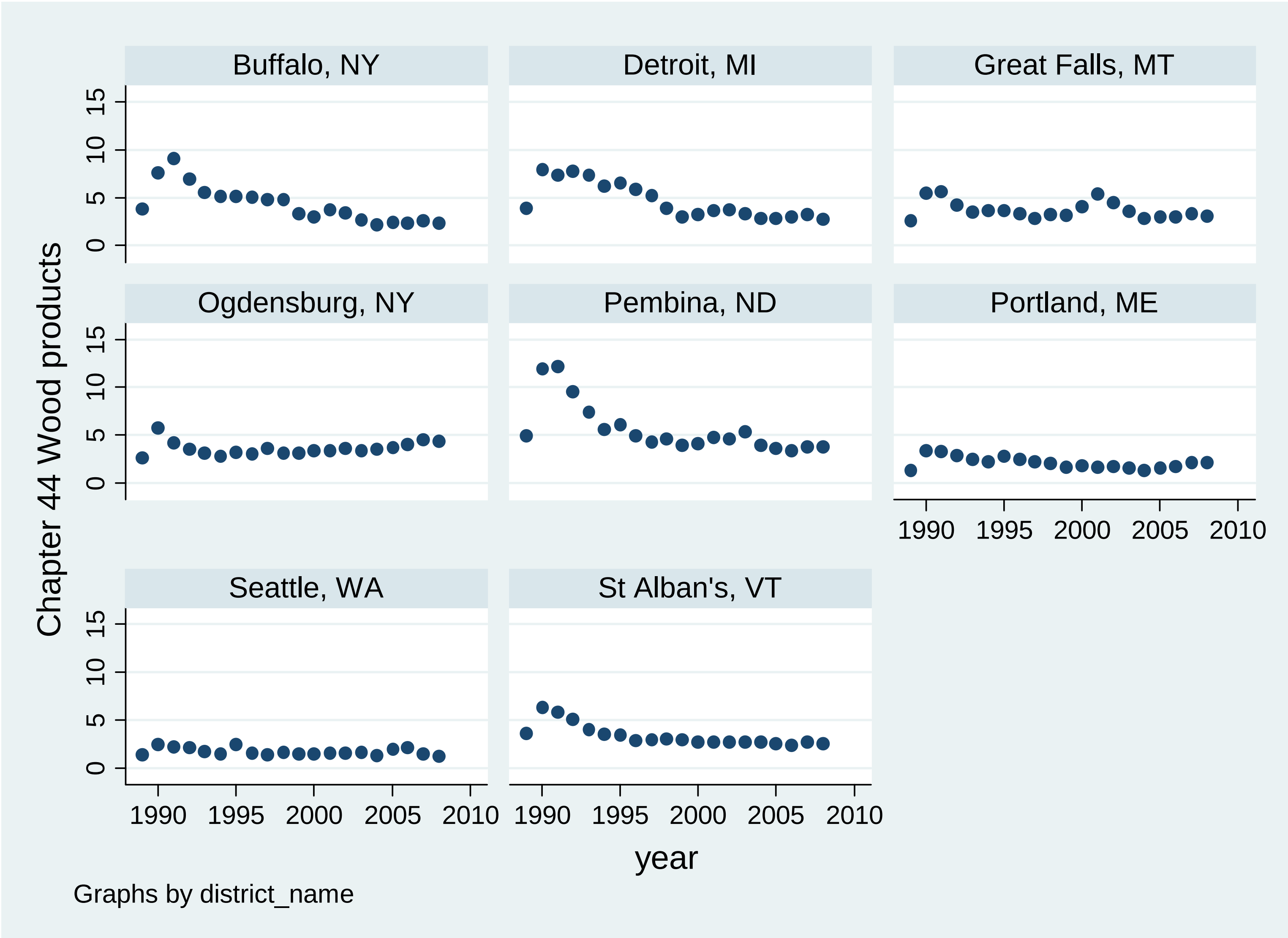

FIGURE 6: Transportation Cost Ratio for Paper Products (Chapter 48) by Customs District

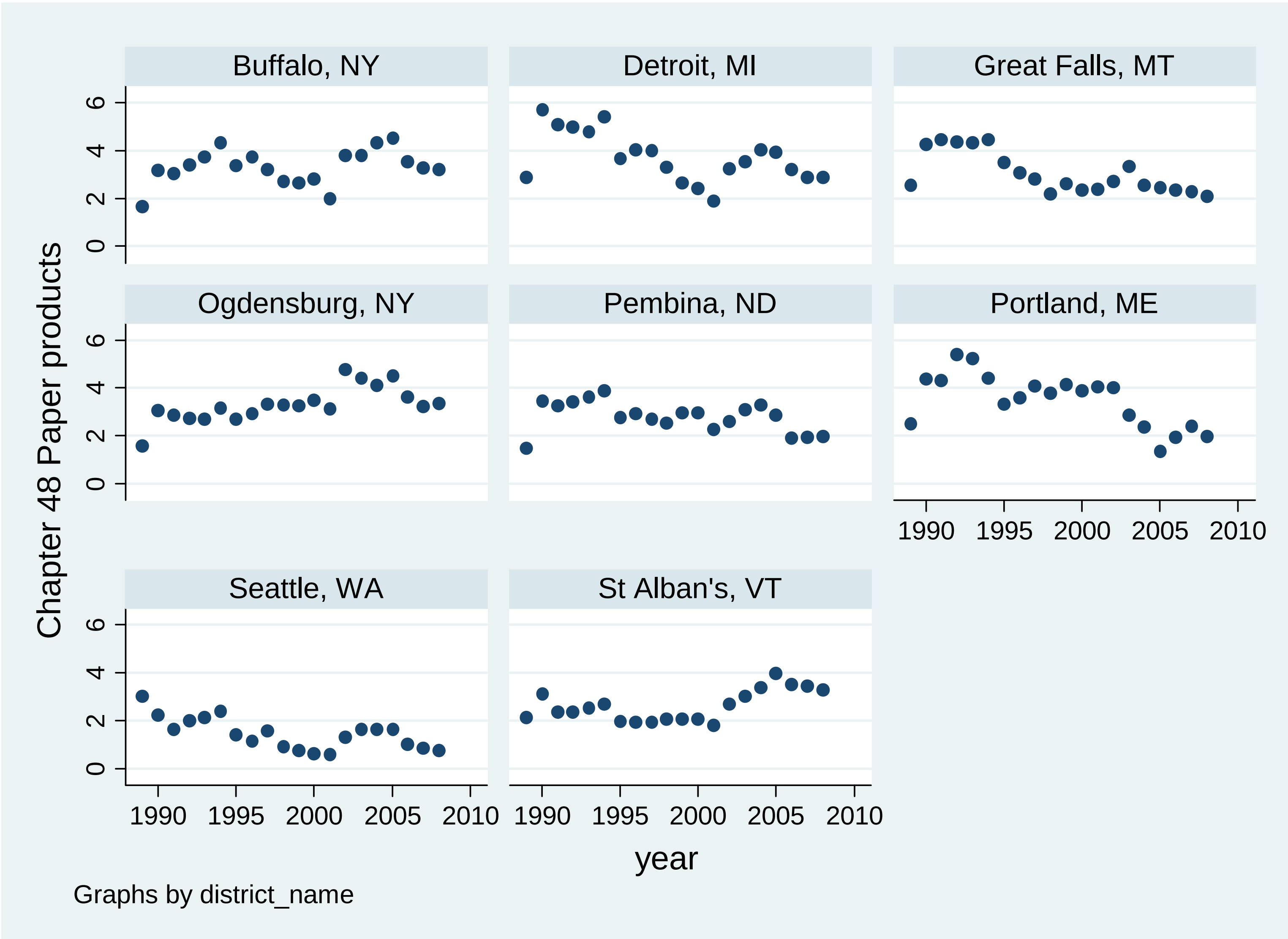

FIGURE 7: Transportation Cost Ratio for Aluminum Products (Chapter 76) by Customs District

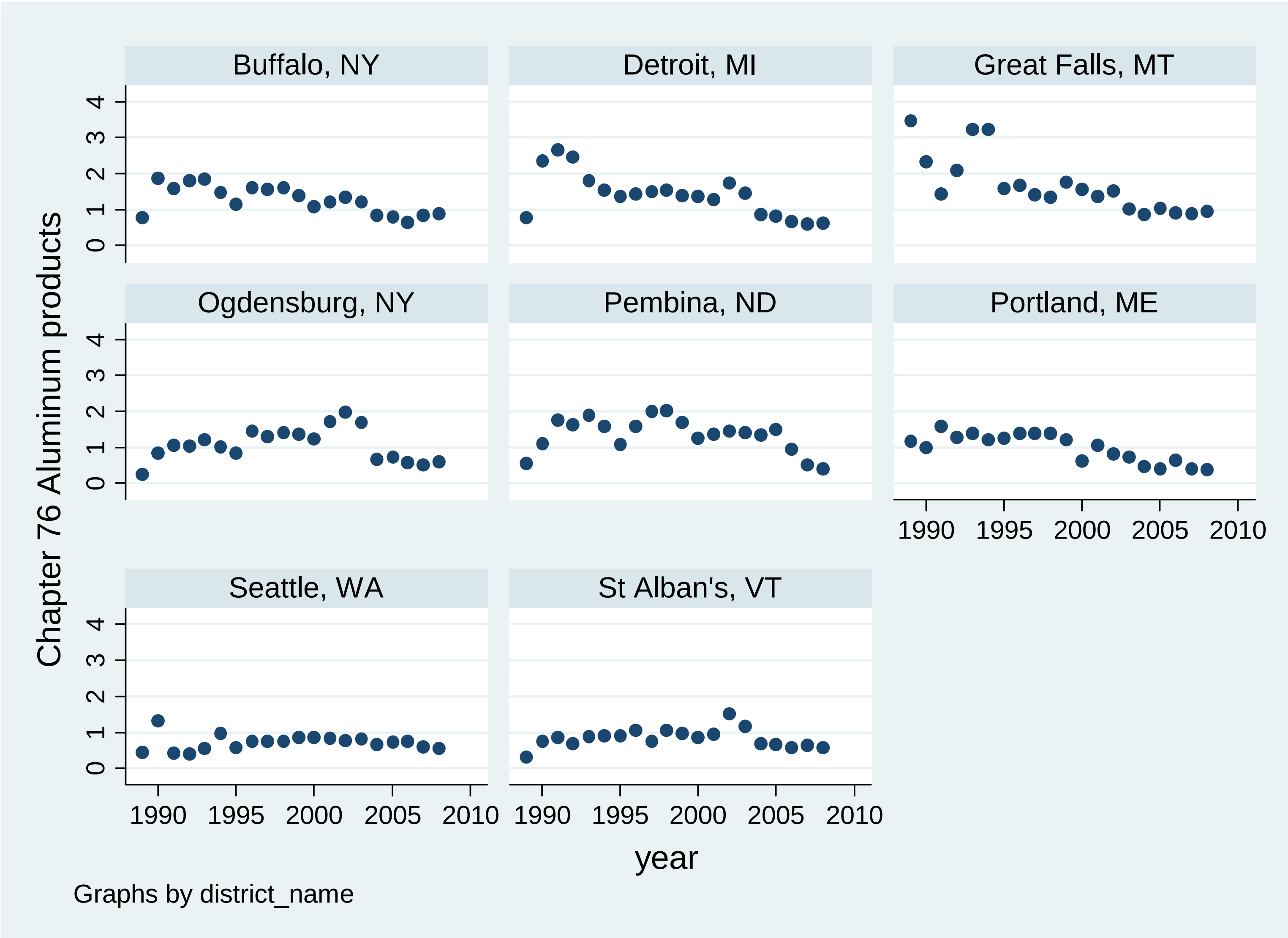

FIGURE 8: Transportation Cost Ratio for Mechanical Machinery (Chapter 84) by Customs District

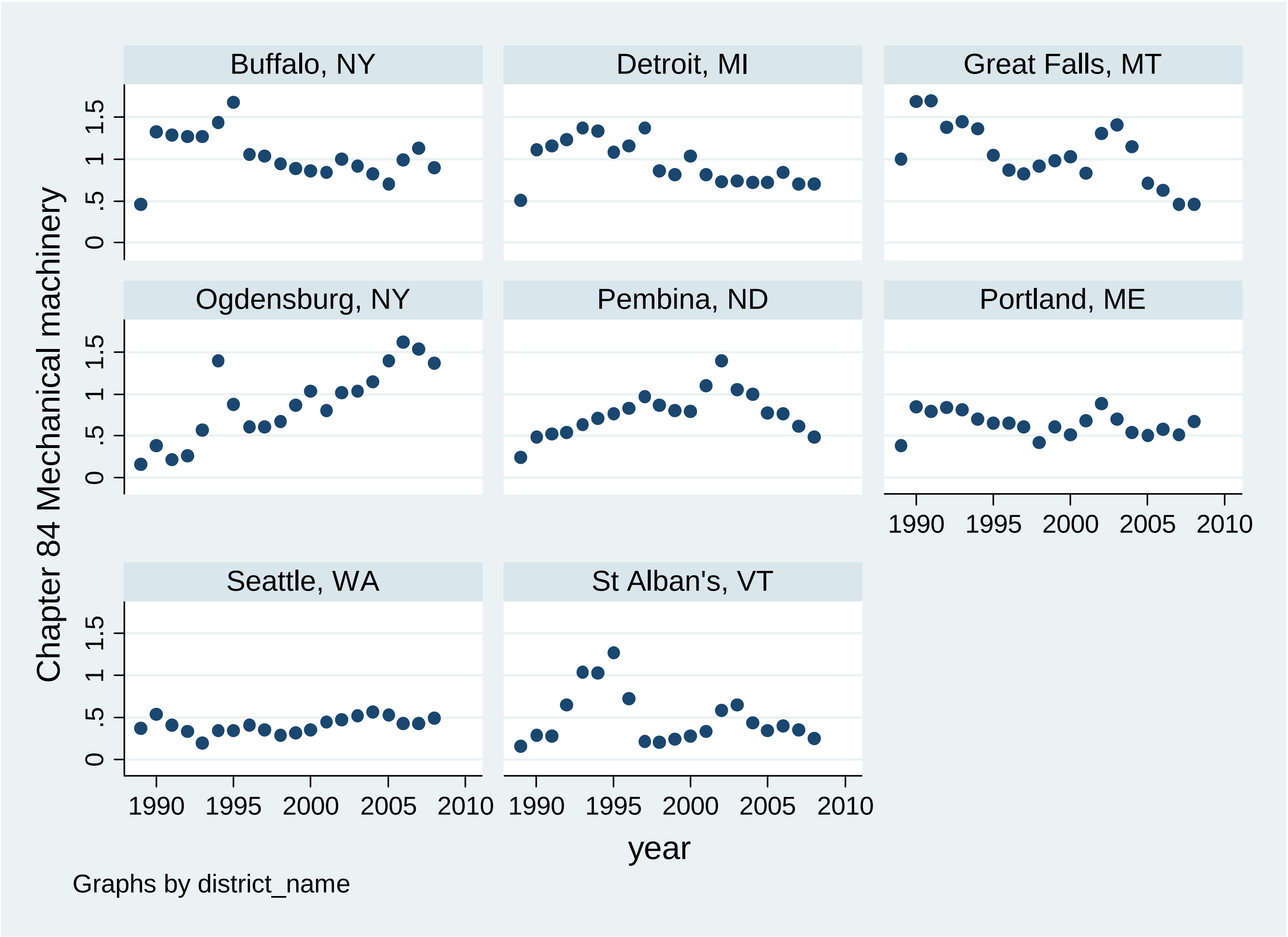

FIGURE 9: Transportation Cost Ratio for Electrical Machinery (Chapter 85) by Customs District

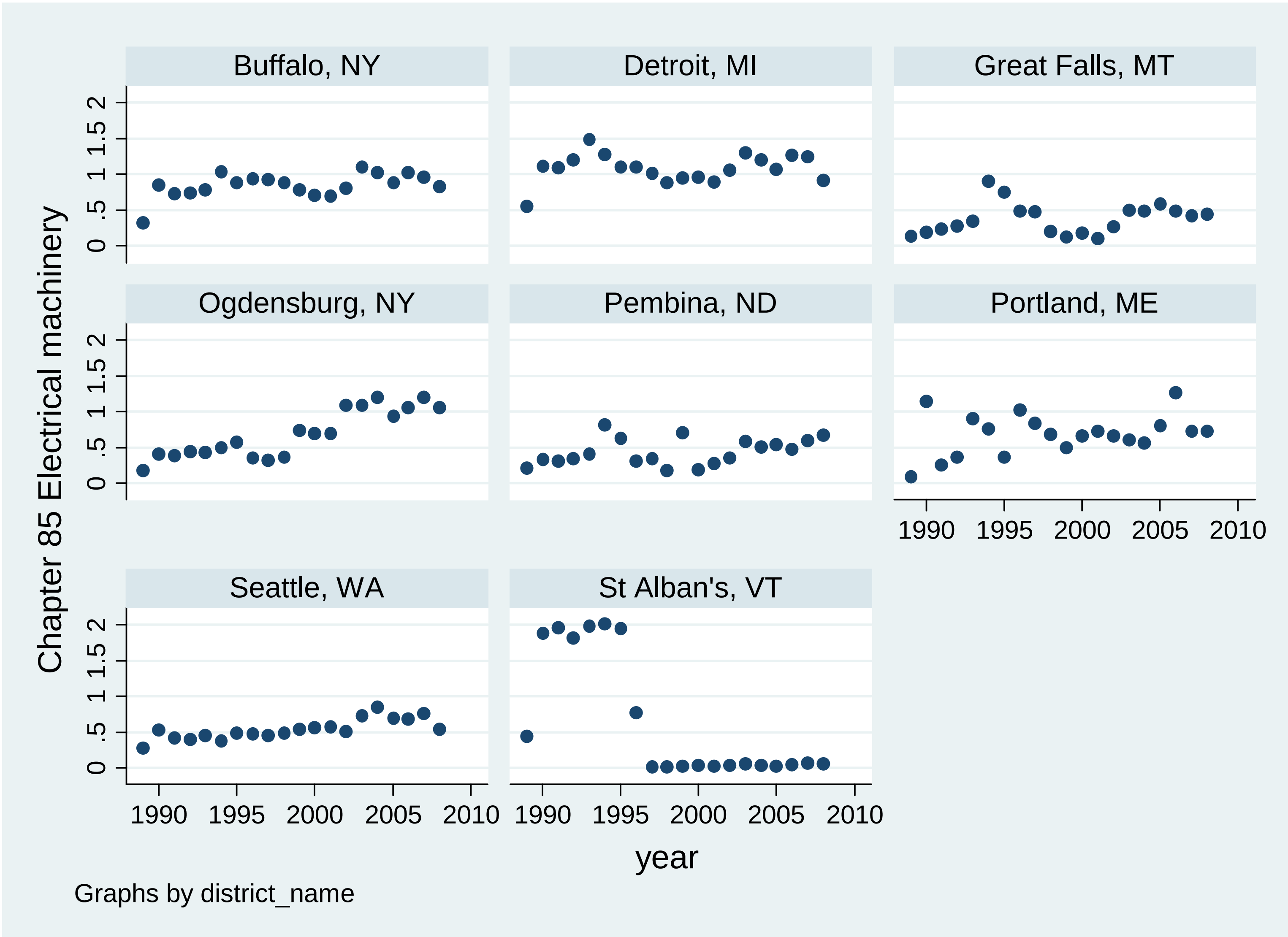

FIGURE 10: Transportation Cost Ratio for Automotive Products (Chapter 87) by Customs District

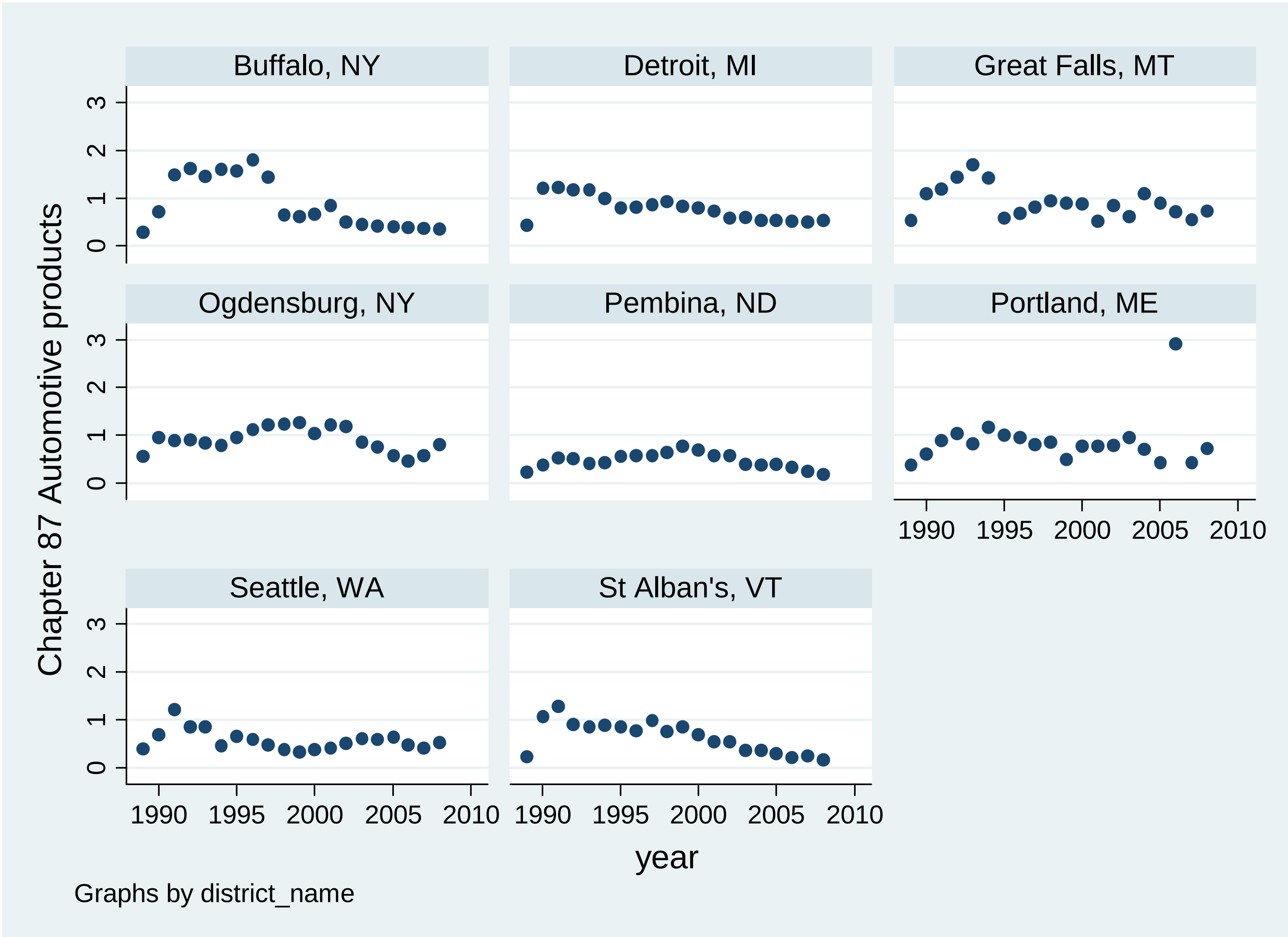

TABLE 6:
Top five HTS Import Commodities
(All Customs Districts)

Year	C1	C1%
1991	87	28.3
	27	11.3
	84	8.0
	48	6.7
	85	5.4
1998	87	26.5
	84	9.2
	27	8.4
	85	5.6
	44	5.5
2004	87	23.1
	27	19.1
	84	7.0
	44	5.5
	48	3.9
2008	27	33.3
	87	14.2
	84	6.4
	39	3.2
	85	3.0

4.2 Changes in Commodity Mix by Districts

Our analysis in the previous section identified differences in the cost ratio across different customs districts over time. Such differences reflect some combination of changes over time in the mix of commodities passing through the ports within each district and changes in the cost ratio for specific commodities over time within individual customs districts. To the extent that the commodity mixes are relatively constant over time, the different post-2001 cost ratio experiences of the different customs districts are consistent with the notion that some districts were more adversely affected than others by post-9/11 border security developments, given their mix of commodity imports.

Table 7 reports the five leading HTS commodities imported into each of the customs districts for three sample years. There is clearly some persistence in the leading import categories for most customs districts over the three sample years. While there are certainly changes in the specific percentages for individual commodities, and even changes in rank order over the sample years, the leading import categories are, by and large, the same for most districts over the full time period. For example, commodities 87 and 84 account for approximately 47% of imports entering through Buffalo in 2000 and around 30% in 2008. Commodities 87 and 27 account for around 41% of imports entering through Detroit in 2000 and around 45% in 2008. Imports entering through Great Falls are dominated by Commodity 27 in all three years. For Seattle, Commodities 27 and 44 account for 55% of imports in 2000 and around 51% in 2008. For St. Albans, commodities 85 and 88 account for around 38% of imports in 2000 and around 34% in 2008. On the other hand, there is less persistent dominance in a few commodity categories for Ogdensburg, Pembina and Portland.

In sum, one cannot dismiss the possibility that changes over time in the transport cost ratios for individual customs districts reflect changes in commodity mixes within those districts; however, the persistence of relatively large shares accounted for by the same few commodity categories in most districts makes this possible explanation for why the ratio flattened out more in some districts than in others post-2001 less than compelling. In particular, there were four districts identified earlier as showing a noticeable flattening of the cost ratio: Portland, St. Albans, Seattle, and Pembina. With the arguable exception of Pembina, all show a relatively unchanged distribution of commodity imports. In addition, we have conducted "what if" analyses of how the ratios would have evolved in time in each district if the commodity shares had remained unchanged at their beginning and end-of-sample values. In most cases, the differences between these counterfactual constant-commodity-mix ratios and the actual observed ratios are small, reinforcing the inference that changing commodity mixes have made, at most, a relatively small contribution to the evolution of district cost ratios over time.

4.3 Commodity Vulnerability to Border Security-Related Disruptions

Yet another way in which commodity composition might be responsible for differences across customs districts in the transport cost ratio over time is the possibility that some commodities are more vulnerable to border security-related disruptions than other commodities. In this context, districts that experienced a greater flattening out of the transport cost ratio post-9/11 may have had an import mix that is more intensive in vulnerable commodities. One way to measure the vulnerability of the import mix passing through each customs districts is shown in part (a) of Table 8. The values reported are calculated by taking commodity-level vulnerability index values as estimated by Goldfarb and Robson (2003) and averaging the commodity-level values using the import volumes as weights for the various commodities within each district.

Table 8(a) shows that the range of district-level vulnerability measures is relatively narrow for the eight districts. More interesting, the districts where ratios showed a greater tendency to flatten-out

TABLE 7:
Top five HTS – 2 Import Commodities

	Buffalo		Detroit		Great Falls	
	HTS	**%**	**HTS**	**%**	**HTS**	**%**
1989	87	37.5	87	51.6	27	56.1
	84	11.6	84	10.9	1	1.5
	85	4.5	48	4.5	87	5.4
	75	4.1	76	2.8	44	4.8
	98	3.8	85	2.4	98	3.6
2000	87	36.7	87	32.1	27	47.7
	84	10.0	27	8.4	85	8.1
	85	5.3	84	8.3	2	7.5
	98	4.7	98	5.2	98	6.6
	39	3.5	85	4.8	44	6.3
2008	87	22.1	87	35.3	27	70.5
	27	20.2	27	10.0	84	6.2
	84	7.7	84	9.4	31	4.5
	39	4.5	76	4.8	2	2.4
	85	3.4	39	4.1	98	2.2
	Ogdensburg		**Pembina**		**Portland**	
	HTS	**%**	**HTS**	**%**	**HTS**	**%**
1989	87	17.7	27	13.7	3	38.7
	48	15.1	44	9.8	47	15.3
	76	9.4	47	9.5	27	9.0
	84	8.1	31	7.6	48	6.7
	98	4.6	84	6.5	44	5.3
2000	85	13.4	85	9.3	27	23.0
	27	10.0	27	8.7	3	20.5
	48	9.7	44	8.5	44	9.4
	76	5.8	87	6.6	47	67
	71	5.5	48	6.6	48	5.5
2008	27	19.4	27	11.3	27	41.6
	71	9.2	84	9.1	3	16.9
	76	9.5	31	7.7	48	5.8
	48	7.6	39	7.6	47	4.4
	84	5.2	10	5.1	40	4.0
	Seattle		**St. Albans**			
	HTS	**%**	**HTS**	**%**		
1989	44	27.1	85	2		
	48	13.8	48	13.8		
	27	7.6	44	7.2		
	84	5.9	84	5.8		
	87	5.8	87	5.4		
2000	27	39.6	85	21.8		
	44	15.4	88	16.3		
	98	7.0	44	7.8		
	48	5.0	27	7.0		
	84	3.6	48	6.9		
2008	27	41.1	88	26.4		
	44	9.4	27	12.0		
	48	5.2	85	8.0		
	84	4.7	84	7.7		
	98	3.4	48	6.8		

TABLE 8:
Vulnerability Index Analysis

8(a) District-level Vulnerability Index Values

District	Weighted-Average Vulnerability Index
Buffalo	6.4
Detroit	6.3
Great Falls	4.4
Ogdensburg	5.5
Pembina	5.5
Portland	4.7
Seattle	4.3
St Albans	6.1

8(b) Industries and Overall Vulnerability to Border Disruptions

HTS Numbers	Goldfarb-Robson Index
1	6.4
2	6.8
3	5.4
27	2.6
31	4.8
37	6.0
39	6.0
40	5.0
44	6.0
47	5.0
48	4.8
71	5.0
75	4.6
76	4.6
84	4.6
85	6.0
87	6.6
98	6.0

after 2000 (such as Portland and Seattle) also have relatively low district-level vulnerability index values. The results in Table 8(a) therefore suggest that observed differences in time trends for the district transport cost ratios after 9/11 did not systematically reflect variation in the vulnerability of the districts to disruption. If anything, there is a negative linkage between the two phenomena. For example, the two districts with the highest district-level vulnerability index values, Buffalo and Detroit, show the least evidence of a flattening out of the transport-cost ratio after 9/11.

Perhaps a better understanding of these district-level vulnerability index results is provided by part (b) of Table 8 in which we report the relevant HTS number and the related estimated value of the Goldfarb-Robson index of the overall vulnerability of that commodity to border disruptions. The Goldfarb-Robson index was calibrated on a scale of 1-10. It should be noted that their index is subjectively estimated based on different attributes of a commodity such as its time sensitivity and its susceptibility to physical tampering.

What is notable about the data in part (b) of Table 8 is the similarity of the index values across the various commodities. Simply put, there is not much difference across major commodity imports from Canada in their vulnerability to border security-related disruptions. Hence, it is not surprising that our results from Table 8(a) suggest that differences among customs districts in the behavior of the cost ratio over time don't seem to reflect differences across customs districts in the vulnerability of commodity imports to border security related disruptions. Indeed, the only commodity showing a relatively low vulnerability value is HTS 27 – mineral fuels. According to Table 7, the Portland and Seattle customs districts show the greatest relative increase in the share of imports accounted for by HTS 27 between 2000 and 2008. Yet Portland and Seattle, as noted earlier, show a post-2001 flattening-out of the declining transport cost ratio. In fact, the increased post-2001 importance of mineral fuel imports in those two districts should have contributed to a dampened impact of border-related security disruptions and a more rapidly declining ratio. Hence, on the basis of the evidence, we are led to conclude that customs districts differ in their ability to respond to border security-related disruptions for reasons unrelated to their commodity import mixes.

5. OTHER DISTRICT CHARACTERISTICS

Several other factors might be considered as possible explanations of the behavior of the transportation cost ratios as summarized in Figures 3-10. One such additional factor is modes of shipping used in different customs districts. Specific modes may be more or less efficient depending upon fuel prices, the physical infrastructure available to the mode, e.g. road surfaces, rail tracks, switching yards and so forth, and the economies of scale attainable by the specific mode.[16] Obviously, specific modes will also be more or less efficient depending on the specific commodities carried. For example, rail is more efficient than trucks for high-weight and bulky commodities such as coal.

While it is fairly straightforward for us to describe district-level differences in transportation modes, it is impossible for us to identify the relative efficiencies of the transportation mode configurations for our sample customs districts. The factors determining the efficiencies are simply too complex; hence, it is not possible to evaluate directly whether and to what extent differences across districts in the behavior of the transport cost ratio over time reflect changes in mode availability and usage patterns.

[16] For some empirical evidence on the importance of both transportation and communication infrastructure on transport costs, see Limao and Venables (2001).

5.1 Modes of Transport

It is possible to identify changes over time in modes of transportation by customs districts. Table 9 reports the percent of imports by transportation mode for each of the sample customs districts for selected years from 1996-2008.[17] Specifically, Table 9 reports the unweighted average of the mode share for each district in each sample year. As can be seen, trucks account for the single largest mode share over the sample period for all districts with the exception of Great Falls, where pipeline became the single largest mode beginning in 2002. It is also clear that the share of imports accounted for by trucks generally declines across our sample of customs districts in the post-2000 period. The degree to which this occurs varies across districts. For example, declines are quite notable for Portland, Seattle and Pembina. In the case of Portland, the shift away from trucks appears to be towards vessels (included in the "other" category). In the case of Seattle, the shift away from trucks is towards pipelines. For Pembina, the shift from trucks is primarily towards rail. Since commodity shipments by truck are generally viewed as most likely to suffer increases in the security-related component of shipping costs, these shifts would suggest that districts such as Seattle and Portland should have experienced more rapid declines in the transport cost ratio over time, rather than the greater flattening-out that we actually observe.

On the other hand, the shift away from trucks post-2002 is quite modest in the cases of Buffalo and Detroit. It is tempting to draw an inference that the net advantages of using trucks changed more dramatically for Portland, Seattle and Pembina than for Buffalo and Detroit. Interestingly, the former three districts also showed a more substantial flattening of the transport cost curve than did the latter two in the post-2002 period compared to pre-2002. In a later section, we will consider possible explanations (such as the FAST program) for why the trucking mode might have been less adversely affected by post-2001 border security developments in Buffalo and Detroit compared to other districts. At this point, one might conclude that the behavior of the transport cost ratio for Portland, Seattle and Pembina would have been even less favorable than identified earlier had the mode shifts discussed in this section not taken place.

5.2 Location of Ports of Entry and Clearance

As noted earlier, ideally we would like to analyze variations in transport costs at the port level focusing specifically on U.S. ports receiving imports from Canada. Unfortunately, as noted in our introduction, requisite data to analyze transport cost differences at the port level are not available to researchers outside of U.S. federal government agencies. However, since attributes of the ports located within customs districts can influence the calculated transportation cost ratio for each district, ignoring port characteristics can potentially obscure important determinants of the transportation cost ratio over time for individual customs districts.

One potentially relevant attribute is the distance of ports within a district from the source of origin of shipments from Canada. The greater this distance, the higher the shipping costs, other things constant. Moreover, if the average shipping distance changes over time, the calculated transportation cost ratio for a customs district should also change, other things constant. Hence, differences identified over time in the transport cost ratio when comparing customs districts may, in part, reflect changes in average distances of commodity shipments from points of origin in Canada to destination ports in each U.S. customs district.

Average shipping distances can change either because points of origination of exports from Canada move further from the border and/or because imports are processed at U.S. ports further removed

[17] The first year for which information on mode is available for our customs districts is 1995.

TABLE 9:
Percent of Imports by Mode – Various Years

	Percent of Imports by Mode: 1996			
District	Truck	Rail	Pipeline	Other
Portland	58.2%	7.7%	2.7%	31.4%
St. Albans	79.6%	9.0%	1.0%	10.4%
Ogdensburg	81.6%	11.7%	4.2%	2.5%
Buffalo	70.7%	26.3%	2.0%	1.0%
Seattle	61.3%	18.4%	19.0%	1.3%
Great Falls	54.7%	13.1%	31.8%	0.4%
Pembina	62.3%	27.8%	7.1%	2.8%
Detroit	66.3%	31.5%	1.9%	0.3%

	Percent of Imports by Mode: 1998			
District	Truck	Rail	Pipeline	Other
Portland	81.5%	10.6%	3.1%	4.8%
St. Albans	87.8%	10.1%	1.2%	0.9%
Ogdensburg	83.1%	10.4%	4.0%	2.5%
Buffalo	67.1%	31.0%	0.8%	1.1%
Seattle	59.4%	14.4%	23.9%	2.3%
Great Falls	55.8%	12.4%	31.7%	0.1%
Pembina	65.2%	28.2%	3.5%	3.1%
Detroit	73.2%	24.7%	1.9%	0.3%

	Percent of Imports by Mode: 2000			
District	Truck	Rail	Pipeline	Other
Portland	87.8%	3.1%	3.4%	5.7%
St. Albans	71.2%	10.6%	4.9%	13.3%
Ogdensburg	82.8%	8.1%	5.6%	3.5%
Buffalo	72.4%	25.2%	1.7%	0.7%
Seattle	48.7%	12.0%	30.0%	9.3%
Great Falls	44.1%	10.5%	45.4%	0.1%
Pembina	67.5%	25.6%	4.0%	2.9%
Detroit	63.6%	33.5%	2.6%	0.3%

	Percent of Imports by Mode: 2002			
District	Truck	Rail	Pipeline	Other
Portland	77.3%	3.9%	15.7%	3.2%
St. Albans	59.7%	8.5%	3.8%	28.0%
Ogdensburg	84.2%	7.2%	5.8%	2.8%
Buffalo	69.3%	23.1%	7.2%	0.3%
Seattle	68.6%	17.1%	12.3%	2.0%
Great Falls	35.1%	9.1%	55.5%	0.3%
Pembina	67.6%	25.6%	4.0%	2.9%
Detroit	63.2%	34.1%	2.6%	0.1%

	Percent of Imports by Mode: 2004			
District	Truck	Rail	Pipeline	Other
Portland	61.7%	3.4%	15.1%	19.8%
St. Albans	64.8%	9.6%	3.2%	22.4%
Ogdensburg	79.2%	9.5%	8.9%	2.3%
Buffalo	64.5%	23.4%	10.7%	1.4%
Seattle	51.6%	23.0%	19.6%	5.8%
Great Falls	22.9%	9.8%	66.8%	0.5%
Pembina	61.9%	32.7%	3.4%	2.0%
Detroit	62.4%	32.9%	3.9%	0.8%

	Percent of Imports by Mode: 2006			
District	Truck	Rail	Pipeline	Other
Portland	54.2%	5.0%	15.1%	25.7%
St. Albans	53.0%	12.6%	4.0%	30.4%
Ogdensburg	73.1%	13.9%	10.1%	2.8%
Buffalo	66.8%	17.7%	13.5%	2.0%
Seattle	48.5%	21.8%	23.9%	5.8%
Great Falls	23.1%	8.8%	67.7%	0.4%
Pembina	57.0%	34.0%	3.5%	5.5%
Detroit	63.5%	30.6%	5.4%	0.5%

	Percent of Imports by Mode: 2008			
District	Truck	Rail	Pipeline	Other
Portland	51.8%	5.3%	15.7%	27.2%
St. Albans	51.0%	16.8%	5.6%	26.6%
Ogdensburg	69.7%	13.0%	11.9%	5.3%
Buffalo	62.0%	18.3%	15.7%	4.0%
Seattle	41.5%	16.3%	33.3%	8.9%
Great Falls	22.3%	9.8%	67.5%	0.4%
Pembina	49.0%	44.1%	3.8%	3.0%
Detroit	61.1%	29.1%	8.6%	1.2%

from the border. To be sure, the bulk of imports from Canada are processed at ports located at the border. Essentially all imports were processed at the border in the cases of Ogdensburg, Buffalo, Pembina and Detroit in 2008. For that same year, approximately 75% of imports into the Portland and St. Albans districts came through ports located at the border, whereas less than 60% of imports into the Seattle and Great Falls districts passed through border ports.

Commodities processed at "inland" border ports are essentially in-bond goods or mineral products transported by pipeline. Since we do not have a time series for the percent of imports clearing through ports at the border, we cannot draw any inferences about the potential importance of changing shipping distances on the behavior of the transport cost ratio over time at the district level. However, given the growth of pipeline-related shipments into Seattle and Great Falls over the post-2001 period, it is plausible that average shipment distances increased over the post-2001 period, at least for these two customs districts.[18] On the other hand, given that any increases in shipping distances were associated with a more intense use of a mode (pipelines) whose transport costs are relatively insensitive to distance, it is unclear if presumed changes in shipping distances for the two districts would have had any substantive impact on the behavior of the transport cost ratio over our sample period calculated for those two districts. Indeed, the strong increase in unit prices observed in the late-2000s for mineral fuels shipped by pipeline would, if anything, tend to lower transport costs as a fraction of the total value of the shipment.

5.3 Concentration of Imports by Port

The concentration of imports by port within customs districts might also have an influence on transportation cost differences across customs districts. In particular, a concentration of imports processed by a small number of ports might provide port administrators with more political influence which, in turn, should better enable port administrators to acquire additional workers and other resources needed to restore service levels closer to those prevailing pre-9/11. This impact could be further amplified if the shippers and transport companies using these concentrated ports themselves have political influence. Port concentration might also make those ports higher-priority locations for capital investments to alleviate border security-related congestion. Finally, a concentration of imports in a particular geographic location could signal a corresponding concentration of production capacity. The close geographic proximity of participants in manufacturing value chains should enable firms to coordinate responses to border-related security disruptions more effectively than would be possible for firms interacting with each other over greater distances.

In short, we expect customs districts in which import shipments are concentrated in a few ports to be more able to respond effectively to border-related security disruptions. As a result, those same customs districts are less likely to show a flattening-out of the transportation cost ratio in the post-2001 period.

In fact, there are fairly substantial differences across customs districts in the concentration of shipments through individual ports. For example, essentially all imports into the Buffalo district enter through a single port (Buffalo-Niagara Falls). In the case of Detroit, three ports account for virtually all of that district's imports (Detroit, Port Huron and Sault Ste. Marie). On the other hand, imports to the Portland and Seattle districts are distributed across a significantly larger number of ports. As discussed in an earlier section of this report, the latter two districts show a noticeable flattening-out of the transportation cost ratio post-9/11, whereas the first two districts exhibited no

[18] The growth of pipeline-related shipments for these two districts is presumably associated with the growth in imports of mineral fuels through those two districts.

such flattening-out. The evidence is thus consistent with variations in port concentration playing some role in explaining the observed post-9/11 differences in district-level transport-cost trends.

5.4 FAST Availability and Utilization

In the wake of 9/11, the U.S. and Canadian governments worked together to produce the Smart Border Accord, which was signed on December 12, 2001. One program included in the Agreement was a harmonized commercial processing system known as Free and Secure Trade (FAST). The FAST Program is designed to expedite the clearance of commercial shipments at the border for pre-approved participants including importers, carriers and truck drivers. In principle, participation in FAST allows for shipments to be cleared more quickly and with more predictability as to timing, since repeated and detailed security inspections at the border are not required of FAST participants. Hence, districts in which FAST shipments account for a relatively large share of total imports should enjoy lower transportation costs than districts in which FAST shipments account for a relatively low share of imports, other things constant.

Unfortunately, published information on the share of imports eligible for FAST approval by port, or district, is unavailable. Nor is consistent time series information readily available to allow us to identify the capacity of ports within each district to process commercial shipments under the FAST Program. From internal documents created and supplied to us by the U.S. Customs Border and Protection Agency, we are able to identify when FAST became operational in different ports, the number of commercial lanes available for use in each of those ports, as well as the number of lanes dedicated specifically to FAST-approved imports. These data are reported in Table 10 and provide some insight into the capabilities of ports within districts to process imports through the FAST Program. Also reported in Table 10 is the percentage of shipments processed through the FAST Program as a share of total imports processed at the specific port.

It can be seen that Detroit and Port Huron have relatively high proportions of FAST shipments, as do the Buffalo ports. On the other hand, the two ports on the border of British Columbia and Washington State (Oroville and Blaine) have relatively low proportions. This phenomenon might be explained by the fact that goods crossing into the ports of Detroit, Port Huron and Buffalo from Canada are more likely to be carried by Full-Load trucks that, in turn, are dedicated to carrying products manufactured by large and vertically integrated transportation equipment manufacturers. Conversely, goods entering through the ports of Oroville and Blaine are likely to be more varied and produced by smaller, non-integrated producers. This supposition is supported by the observation that there is a greater use of less-than-carload (LTC) freight shipments in the Western ports than in the ports bordering Ontario (Bradbury and Turbeville, 2008). Companies using LTC freight shipments are likely to find membership in FAST less advantageous than vertically integrated companies that are able to ship using full-load trucks, since shipments can only be expedited under FAST if all goods on a truck are shipped by FAST-approved companies.[19] There are also substantial fixed and sunk costs associated with applying for FAST approval which makes membership in FAST less economical for smaller companies and shippers. The relatively large fixed costs associated with receiving FAST approval might help explain the much lower percentage of shipments that are FAST approved in Oroville and Blaine compared to Detroit, Port Huron and Buffalo. The latter districts contain the large, multinational automobile manufacturers and other large industrial companies for whom FAST membership is likely to be financially viable.

[19] The carrier and the driver must also be FAST-approved. See Bradbury and Turbeville (2008).

TABLE 10:
FAST Lane Capacity, Utilization, and Opening Dates

Port	# of Lanes	FAST Dedicated Lanes	Estimate FAST as % of all shipments	Date of opening
Detroit	14	5	44%	Dec-02
Port Huron	3	2	31%	Dec-02
Sault Ste. Marie	2	0	15%	Aug-06
Buffalo/Peace Bridge	7	0	23%	Dec-02
Buffalo/Lewiston Bridge	4	1	23%	Dec-02
Champlain	5	1	17%	Dec-02
Ogdensburg	3	0	16%	Aug-06
Massena	1	0	5%	Aug-06
Alexandria Bay	3	0	20%	Jul-02
Derby Line	2	0	13%	Dec-02
Highgate Springs	1	0	9%	Dec-02
Houlton	2	0	12%	Jul-05
Oroville	2	0	8%	Aug-06
Blaine	3	1	8%	Nov-04
Sweet Grass	2	0	3%	Aug-04
Pembina	3	0	21%	Aug-03

There is a great deal of uncertainty surrounding the effectiveness of FAST and other Trusted Trade Programs in facilitating faster or less costly border crossings for commercial shipments. Moens (2010) suggests that many shippers who are enrolled in secure and trusted cargo and driver programs find little return for their investment in those programs. In particular, trucks and truckers enrolled in these programs find themselves in long waiting lines to get to their expedited lanes and are pulled over for inspection frequently despite their "secure" status.

Regardless of the overall effectiveness of the FAST program, it is likely that ports with a higher proportion of FAST shipments are more capable of mitigating border-related security disruptions than are ports with a substantially lower proportion of FAST shipments.[20] As a consequence, the latter are more likely than the former to exhibit a flattening-out of the transportation cost ratio post-2001. Indeed, the Portland and Seattle customs districts exhibit the most marked flattening-out of the transportation cost ratio.

6. OVERALL CONCLUSIONS

This study adds to accumulated evidence of the adverse impacts of post-9/11 border security-related developments on Canadian exports to the United States. Specifically, we show that a trend of declining transportation costs for U.S. imports from Canada, that was quite marked in the period from 1990-2001, slowed significantly post-2001. To our knowledge, this is the first study that directly examines transportation cost changes over time for Canada-U.S. trade flows. Hence, it represents a new source of evidence on the widely discussed "thickening" of the Canada-U.S. border.

Perhaps of even greater interest, our study documents that changes in transportation costs over time differ across U.S. customs districts receiving imports from Canada. Specifically, the flattening-out of the declining transportation cost ratio post-2001 was statistically significant for certain customs districts but not for others. For example, the transportation cost ratio decline slowed significantly in the cases of Seattle and Portland customs districts but did not slow significantly for the districts of Detroit and Buffalo. In this context, our study provides some evidence that the thickening of the border post-9/11 is not uniform across the entire Canada-U.S. border. Rather, border-related security developments seem to have caused differentiated impacts across border crossing locations.

We consider various possible explanations for the differentiated impacts. Most of the factors considered cannot plausibly account for the observed differences in geographic patterns of border thickening post-9/11. The two factors whose impacts were consistent with observed changes in the cost ratios were the concentration of trade within a small number of ports and the availability of the FAST program. Interestingly, both of these factors are "policy related" in the sense that they either reflect explicit policy choices (in the case of FAST) or the level of political influence (in the case of port concentration). Thus, our overall story is one of regional variations in transport cost changes that were induced by the security response to 9/11 but whose relative regional impacts were then mitigated or reversed by policy-related responses. For example, we might have expected the Detroit district to have suffered a greater deterioration of transport costs than the Seattle district based on comparisons of district-level vulnerability to disruption. In fact, the impacts of the differential implementation of policies such as FAST seem to have been more than enough to offset geographic differences in vulnerability to disruption.

[20] The more effective utilization of FAST by ports in the Detroit and Buffalo districts might also help explain the relatively small switch away from trucking to other transport modes in those two districts.

The analysis provided in this paper confirms the view that there are important regional differences in the characteristics of cross-border transportation costs. Our results also show that border policies result in differential regional impacts, even if, indeed, perhaps because, they are implemented in a single national program. Taken together, our findings suggest that some regional "fine-tuning" of border policies might be necessary to ensure an efficient and equitable outcome of those policies across the various ports and districts on the Canada-U.S. border.

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APPENDIX 1:
Customs, Districts and Ports

District	Port Name	
Portland, ME	Portland, ME Bangor, ME Eastport, ME Jackman, ME Vanceboro, ME Houlton, ME Fort Fairfield, ME Van Buren, ME Madawaska, ME Fort Kent, ME Bath, ME	Bar Harbor, ME Calais, ME Limestone, ME Rockland, ME Jonesport, ME Bridgewater, ME Portsmouth, NH Belfast, ME Searsport, ME Lebanon, Airport, NH Manchester User Fee Airport, NH
St. Albans, VT	St. Albans, VT Richford, VT Beecher Falls, VT Burlington, VT	Derby Line, VT Norton, VT Highgate Springs/Alburg
Ogdensburg, NY	Ogdensburg, NY Massena, NY Cape Vincent, NY Alexandria Bay, NY	Champlain-Rouses Point, NY Clayton, NY Trout River, NY
Buffalo, NY	Buffalo-Niagara Falls, NY Rochester, NY Oswego, NY Sodus Point, NY Syracuse, NY	Utica, NY TNT Skypak Swift Sure Courier Service Binghampton Regional Airport, NY
Great Falls, MT	Raymond, MT Easport, ID Salt Lake City, UT Great Falls, MT Butte, MT Turner, MT Denver, CO Porthill, ID Scoby, MT Sweetgrass, MT Whitetail, MT Piegan, MT Opheim, MT	Roosville, MT Morgan, MT Whitlash, MT Del Bonita, MT Wildhorse, MT Kalispell Airport, MT Willow Creek, Havre, MT Natrona County International Airport Arapahoe County Public Airport, CO Eagle County Regional Airport, CO

Seattle, WA	Seattle, WA Tacoma, WA Aberdeen, WA Blaine, WA Bellingham, WA Everett, WA Port Angeles, WA Port Townsend, WA Sumas, WA Anacortes, WA Nighthawk, WA Danville, WA Ferry, WA Friday Harbor, WA Boundary, WA Laurier, WA Point Roberts, WA	Kenmore Air Harbor, WA Oroville, WA Frontier, WA Spokane, WA Lynden, WA Metaline Falls, WA Olympia, WA Neah Bay, WA Seattle-Tacoma International Airport U.P.S Avion Brokers & SEATAC DHL Worldwide Express Airborne Express & SEATAC Yakima Air Terminal Grant County Airport UPS Courier Hub
Pembina, ND	Pembina, ND Portal, ND Neche, ND St. John, ND Northgate, ND Walhalla, ND Hannah, ND Sarles, ND Ambrose, ND Fargo, ND Antler, ND Sherwood, ND Hansboro, ND Maida, ND Fortuna, ND	Westhope, ND Noonan, ND Carbury, ND Dunseith, ND Warroad, MN Baudette, MN Pinecreek, MN Roseau, MN Grand Forks, ND Crane Lake, MN Lancaster, MN Williston Airport, ND Minot Airport, ND Hector International Airport, ND
Detroit, MI	Detroit, MI Port Huron, MI Sault Ste. Marie, MI Saginaw/Bay City, MI Battle Creek, MI Grand Rapids, MI Detroit Metropolitan Airport, MI	Escanaba, MI Marquette, MI Algonac, MI Muskegon, MI Grand Haven, MI Rogers City, MI Detour, MI

APPENDIX 2:
Sources of Data Used in the Paper

Data Series	Source	Tables/Figures with Series
Nominal value of U.S imports from Canada (abbreviated as "FOB value")	U.S. International Trade Commission DataWeb Web site. Series name: "General Customs Value" http://dataweb.usitc.gov/	Tables: 1, 2, 6, 7.
Nominal value of U.S imports from Canada including freight and insurance charges (abbreviated as "CIF value")	U.S. International Trade Commission DataWeb Web site. Series name: "General CIF Imports Value" http://dataweb.usitc.gov/	(only used to calculate the trade cost ratio)
Trade cost ratio	Calculated as 100*[(CIF value – FOB value) / FOB value]	Tables: 3, 4, 5, 11 Figures: 1-11
Goldfarb-Robson index of vulnerability to disruption of freight flows	Appendix A from Goldfarb and Robson "Risky Business: U.S. Border Security and the Threat to Canadian Exports," CD Howe Border Papers Series, March 2003. Index values by 5-digit NAICS code were converted to 2-digit HTS codes.	Tables: 8 and 11.
U.S. nominal imports from Canada by mode of transportation.	U.S. Bureau of Transportation Statistics, North American Transborder Freight Date Web site. http://www.bts.gov/programs/international/transborder/TBDR_QA.html	Table: 9.
FAST program introduction dates and numbers of FAST lanes	U.S. Customs and Border Protection.	Table: 10.
FAST utilization rates for the FAST program	Surveys conducted by the Western Washington University Border Policy Research Institute.	Table: 10.

APPENDIX 3:
List of HTS Numbers and the Corresponding Commodity

HTS Number	Commodity
1	Live animals
2	Meat
3	Fish and shellfish
10	Cereals
27	Mineral fuels
31	Fertilizers
37	Photographic or cinematographic products
39	Plastics
40	Rubber Products
44	Wood products
47	Pulp products
48	Paper products
71	Precious stones and metals
75	Nickel products
76	Aluminum products
84	Mechanical machinery
85	Electrical machinery
87	Motor vehicles
88	Aircraft and Spacecraft
98	Special categories