**US and Canadian Port Competitiveness for Asia-Pacific Import Traffic**

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This paper extends research presented in a recent paper entitled Cost Elasticity and Port Choice for West Coast Container Traffic ("Cost Elasticity") (Davies, 2011). Cost Elasticity examined the impact of relative cost increases (particularly the appreciation of the Canadian dollar) on the market share of the Port of Vancouver's share of West Coast container traffic. The elasticity of port traffic was estimated at .39, significantly lower than values found in previous studies for U.S. West Coast ports. Cost Elasticity concluded that the impact of increased relative costs due to the exchange rate was outweighed by the increase in Canadian Pacific Rim imports due to lower prices for imported goods. Based on a sample of Canadian customs data, it appears that the Lower Mainland has actually lost market share in its core Canadian market, and that the largest portion of traffic lost to competing ports enters Canada by truck through land border crossings in Eastern Canada. This result is at odds with conventional wisdom in the U.S. port community which believes that Canadian ports have been dramatically increasing their share of U.S import traffic.

In June 2011 the Bureau of Transportation Statistics (BTS) released a new database on U.S. cargo transhipped through Canadian and U.S. ports. This paper includes a review of this data, and concludes that the BTS data substantially understates the volume of US Pacific Rim imports transhipped by rail via Canadian ports. The estimated total based on BTS data is approximately 50,000 TEU's. Based on information from Canadian sources, recent volumes of Pacific Rim import containers transhipped through the Ports of Vancouver and Prince Rupert totalled approximately 200,000 TEU's per year, or 400,000 TEU's handled by the ports on a round trip basis. This is approximately 1.7% of total West Coast container traffic of 23 million TEU's in 2010. If US Pacific Rim import transhipments by truck are included, this would raise the total by the equivalent of an additional 90,000 TEU's inbound or 180,000 TEU's on a round trip basis; this would increase the share of West Coast TEU traffic transhipped to the US through Vancouver and Prince Rupert to 2.5%.

In sharp contrast, based on Canadian trade data transhipments through the US via the top four land border crossings accounted for approximately 20% of total Canadian Pacific Rim imports by value in 2009. This share grew from approximately 14.6% in 2006 to 19.3% in 2009, in spite of the lack of direct intermodal rail service to Canadian destinations from US West Coast ports and the substantial distance from the Chicago intermodal hub to major markets in Southern Ontario.

This success may be relevant for US West Coast ports in coping with enhanced competition following expansion of the Panama Canal. West Coast ports are currently dependent on CSX and Norfolk Southern for direct intermodal access to Eastern US markets via interline agreements. Following expansion of the canal, these railways may perceive increasing their interline rates for Western intermodal traffic as a win/win strategy:

- It would increase their revenue from West Coast international traffic.
- The increased costs might drive additional traffic to the East Coast ports where they would not have to share revenue with BNSF and UP.

If this occurs, the success of West Coast ports in capturing a substantial share of the Canadian market through transhipment by truck may provide a useful strategic lesson for accessing markets through truck transhipments.

**Previous Research**

Two phases of a major study on port and modal elasticity have been conducted by Leachman and Associates LLC for the Southern California Association of Governments to assess the impact of gateway costs on container traffic levels through West Coast ports. The Leachman studies concluded that a portion of this traffic – particularly low value commodities transported inland in marine containers (Inland Point Intermodal or IPI traffic) - is highly sensitive to additional costs.

However, the data indicates that West Coast container port market shares have been remarkably stable. The most striking change has been the upward trend in the market share of the BC Lower Mainland ports (now combined as Port Metro Vancouver) from 9% in 2002 to 11% in 2009. It is difficult to reconcile this trend with a high elasticity of demand relative to gateway

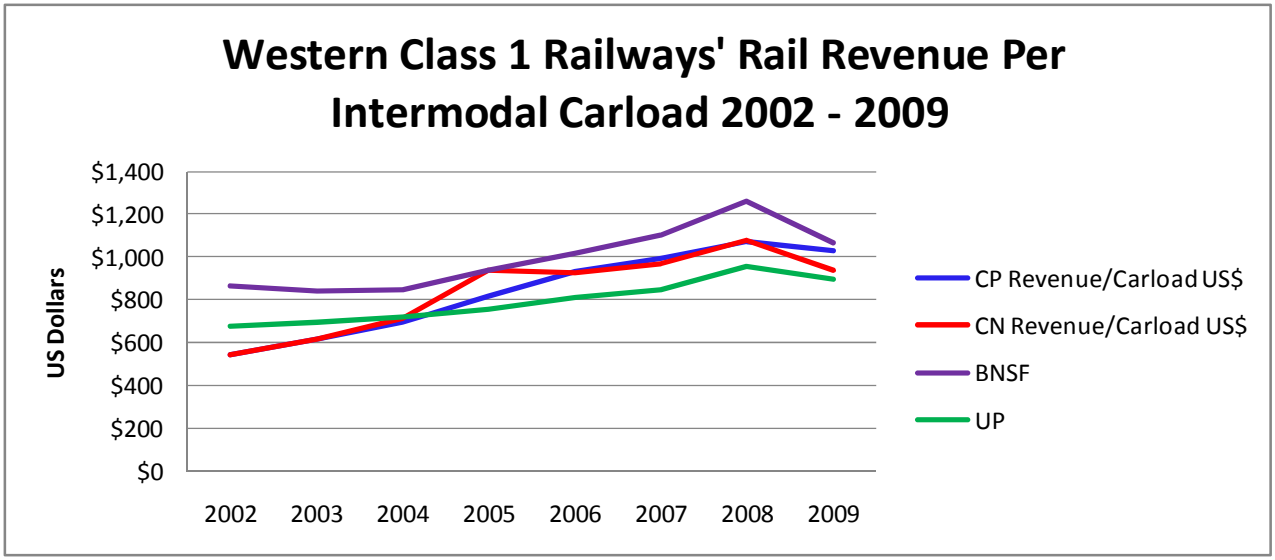
costs. There were two major factors leading to cost increases for the Lower Mainland gateway relative to other West Coast ports over this period.

The first was the substantial increase in the value of the Canadian dollar relative to the U.S. dollar. From 2001 to 2009 the value of the Canadian dollar increased by 36% against the U.S. dollar. Most of this change occurred between 2004 and 2007. The second major factor was an increase in intermodal rail costs. Intermodal rail costs are particularly critical for Lower Mainland container traffic. On-dock rail shipments typically account for 65% to 70% of import traffic. Aggregate intermodal revenue per carload among the Canadian (CN and CP Rail) and US (BNSF and UP) Class1 railways were analyzed to provide an indication of comparative cost increases over the study period. Data on intermodal volumes and revenue for the four Class 1 railways has been assembled from railway annual financial reports and from reports to the Surface Transportation Board,[2] and intermodal carload[3] volumes reported to the Association of American Railroads.

A comparison between average revenue per carload for the Canadian and Western US Class 1 railways in U.S. dollars is shown below. The data shows a rapid escalation in Canadian dollar revenue per carload for the Canadian railways. On a US dollar basis, revenue per carload increased by 90% from 2001 to the peak in 2008.

BNSF and UP revenue per carload differed substantially throughout the period[4]. At the beginning of the period, the Canadian railways' average revenue per carload was lower than UP's, but by 2005 the Canadian rates were higher. On a weighted average basis, Canadian and US average revenue per carload has been similar since 2005.

**Figure 1 Western US and Canadian Class 1 Railways' Revenue per Intermodal Carload 2002 – 2009**




The growth in the Canadian railways intermodal revenue per carload relative to the U.S. levels is only partially attributable to the impact of the appreciation of the Canadian dollar on relative railway costs. A comparison of this ratio to the exchange rate indicates that Canadian revenue per carload increased much more rapidly than the value of the Canadian dollar from 2003 through 2005.

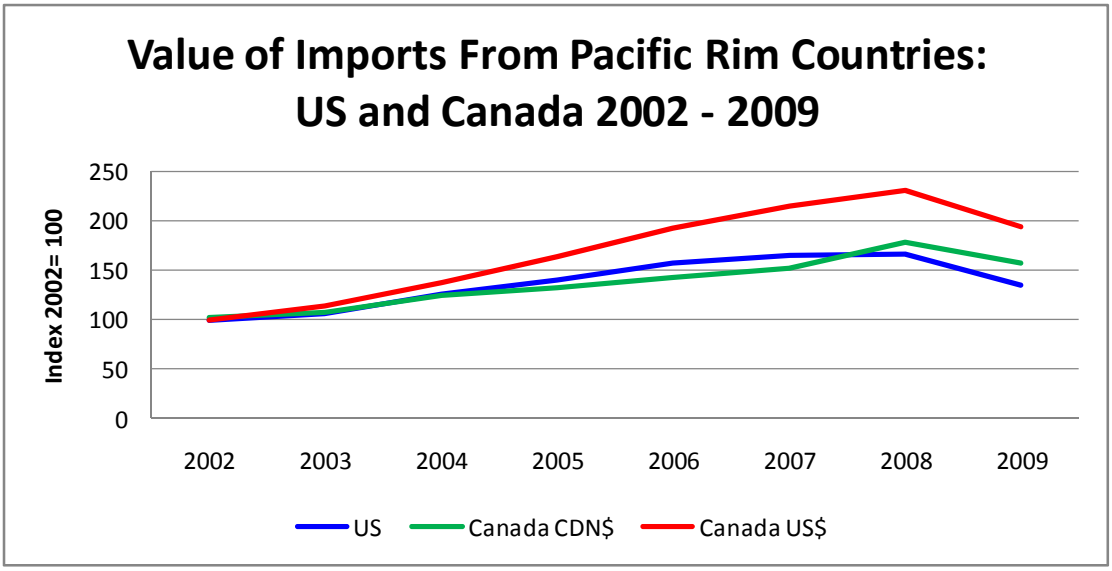
**Trade Performance of the Lower Mainland Ports**

Based on their share of total West Coast container trade, the Lower Mainland ports performed well, with market share increasing by 21% from 2002 to 2009.

Available statistics suggest that Lower Mainland port traffic has traditionally consisted almost entirely of Canadian freight. Statistics on containerized freight handled at the Port of Vancouver indicate that the Canadian market accounted for 94.5% of import traffic and 97.8% of export traffic in 2005. U.S. traffic accounted for only 3.4% of total traffic; of this, the Midwest market (i.e. Chicago) accounted for 89% of import traffic and 63% of export traffic. In 2009, Port Metro Vancouver indicated that 92% of inbound import containers are distributed within Canada (Port Metro Vancouver, 2010).

The overwhelming reliance of Lower Mainland port traffic on the Canadian market suggests that the performance of the Lower Mainland ports should also be assessed relative to the trade volumes in the Canadian market. In domestic currencies, the value of Canadian imports from Pacific Rim countries increased at a rate slightly below that of the U.S. from 2001 to 2009. However, due to the appreciation of the exchange rate the growth in Canadian import values in US dollars was substantially higher. Under the assumption that the composition of this traffic was similar, this would imply an increase in traffic volume which was substantially higher for the Canadian market. For both countries, the largest portion of Asian imports consists of consumer goods.

**Figure 2 Value of Imports from Pacific Rim Countries US and Canada 2001 – 2009**




The growth in Canadian imports can be attributed to growth in personal income, and to the relative decline in import prices which resulted from the increased value of the Canadian dollar. A simple linear regression of the index of the value of import (in Canadian dollars) on indexes of personal disposable income and the ratio of import to domestic prices gives an adjusted $R^2$ of .83 with appropriate signs for the coefficients.

**Cost Elasticity of Lower Mainland Traffic** - The methodology for estimating the elasticity of traffic through the Lower Mainland ports incorporates a regression of market share based on cost differentials. The analysis is based on time series data and includes consideration of the

differential growth rate between Canadian and U.S. Pacific Rim imports from 2002 to 2009, reflected in the Canadian share (measured in U.S. dollars) of total imports.

The cost variable included in the regression is the ratio of Canadian vs Western U.S. Class 1 intermodal revenue per carload, measured in U.S. dollars. Ideally the analysis would incorporate ocean and port costs as well, but data was not available for this study. For purposes of the regression analysis, it was assumed that differentials between port and ocean shipping costs between the Lower Mainland and U.S. West Coast ports were unchanged over the study period. Therefore the equation estimates the partial elasticity of port traffic based on intermodal rail costs.

A simple linear regression of the Lower Mainland's share of West Coast container traffic from 2002 to 2009 on the Canadian share of U.S. and Canadian Pacific Rim imports (in U.S. dollars) and the ratio of Canadian relative to U.S. rail intermodal costs an adjusted $R^2$ of .92 with all variables significant at the 95% level. Based on this regression, the elasticity of Lower Mainland container traffic to cost increases is equal to .39, much lower than estimates for U.S. ports in previous studies.

The results suggest that the impact of the exchange rate appreciation on container traffic through the Lower Mainland has been overwhelmingly positive since the impact on trade volumes of the increasing value of the Canadian dollar is more than four times the impact of higher rail costs (which in fact increased relative to U.S. rates by more than the exchange rate differential).

In spite of data limitations, the analysis provides a coherent picture of the major factors influencing Lower Mainland port traffic from 2002 to 2009. The increase in the share of West Coast container traffic is attributable to the more rapid growth of Pacific Rim imports to the Canadian market due to appreciation of the Canadian dollar. The elasticity of port traffic to relative transportation costs is found to be .39, significantly lower than values found in previous studies for U.S. West Coast ports.

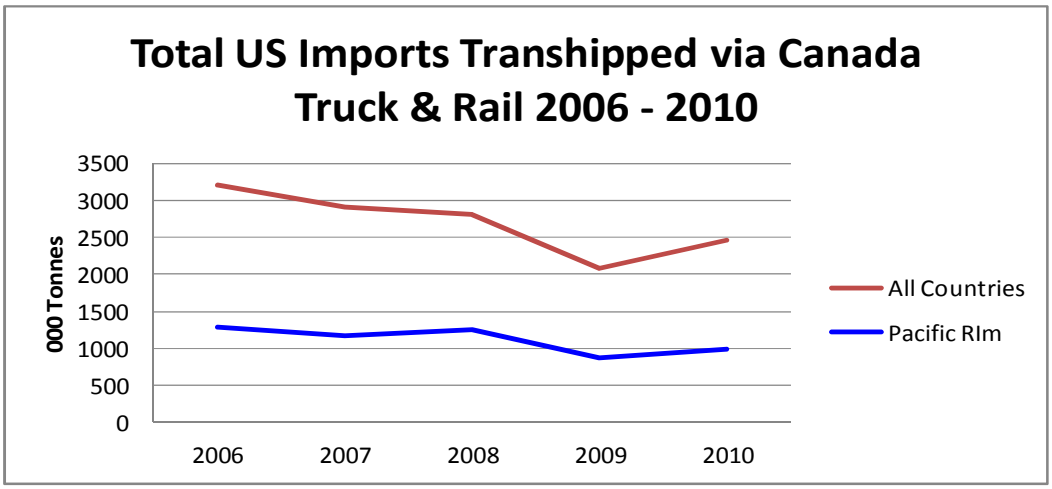
**US Transhipments and the Port of Prince Rupert**

The results of the previous research are at odds with conventional wisdom in the U.S. port community which believes that Canadian ports have been dramatically increasing their share of U.S Pacific Rim import traffic. Cost Elasticity did not analyze the impact of opening of the container terminal at the Port of Prince Rupert in late 2007. This facility has been the major focus of concerns among US West Coast ports over growing transhipments of US imports through Canadian ports.

In June 2011 the Bureau of Transportation Statistics released a new database on U.S. cargo transhipped through Canadian and U.S. ports. This data provides an opportunity for a quantitative analysis of US imports transhipped through Canada, and the impact of the opening of the Port of Prince Rupert.

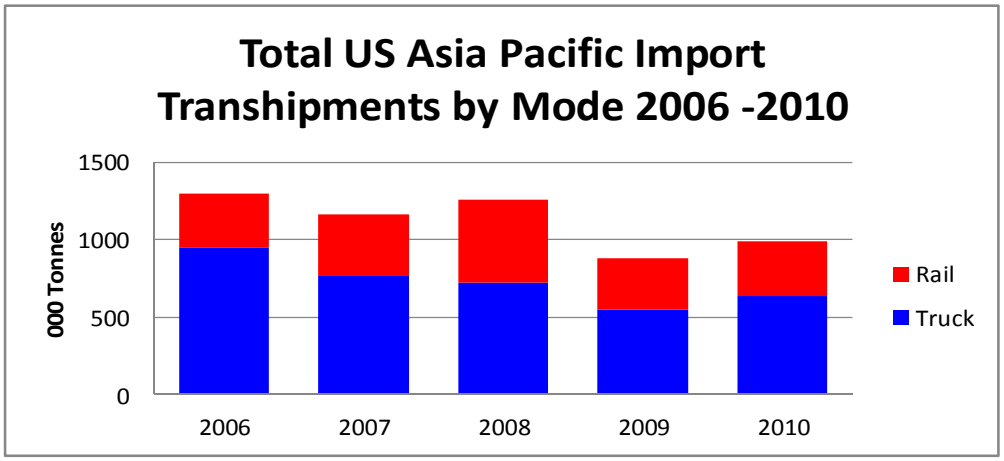
US total and Pacific Rim[5] import transhipments through Canada from 2006 to 2010 are depicted below. Pacific Rim import transhipments totalled 992,500 tonnes in 2010, approximately 40% of total import transhipments. Based on this data, total import transhipments declined every year from 2006 through 2009, before partially rebounding in 2010.

**Figure 3 US Total and Pacific Rim Import Transhipments via Canada 2006 – 2010**




US Pacific Rim import transhipments by mode are shown below.

**Figure 4 US Pacific Rim Import Shipments by Mode 2006 - 2010**




The share of Asia Pacific import transhipments by truck fell from 74% in 2006 to a low of 58% in 2008 before recovering to 64% by 2010.

The BTS data is further disaggregated into containerized and non-containerized shipments for each mode. The data indicate that 92% of truck transhipments were uncontainerized; it seems probable that virtually all truck transhipments involve transferring cargo from marine containers to trucks or domestic containers prior to crossing the US border.

The major concern over growing competitiveness of Canadian ports for US cargo relates to direct rail intermodal shipment of containers from the Ports of Vancouver and Prince Rupert to US destinations. Analysis of the BTS data must be conducted in the context of information from other sources on the volumes of container traffic transhipped in this fashion in recent years.

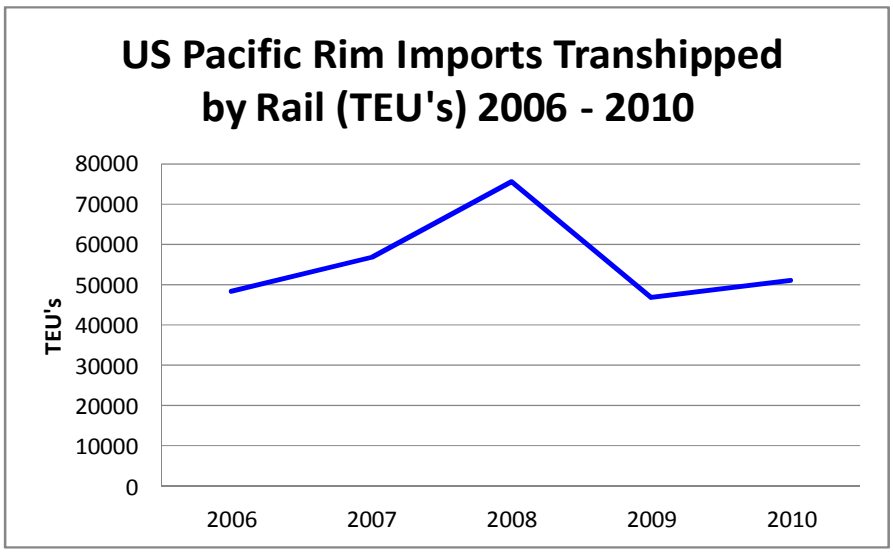
- In 2009 Port Metro Vancouver reported that 92% of their import container traffic remains in Canada (Port Metro Vancouver, 2009). Based on their import traffic of approximately 1 million TEU's in 2009, this implies transhipment of approximately 80,000 TEU's to the US in 2009.

- Based on information from shipping lines involved, approximately 50% of import containers through the Port of Prince Rupert are destined for Eastern Canada, and 50% to US destinations. On this basis, the volume of containerized imports from Pacific Rim countries to the US via the Port of Prince Rupert totalled approximately 130,000 TEU's in 2009.

- Based on this information, the volume of Pacific Rim import containers transhipped to the US through the Ports of Vancouver and Prince Rupert totalled approximately 210,000 TEU's.

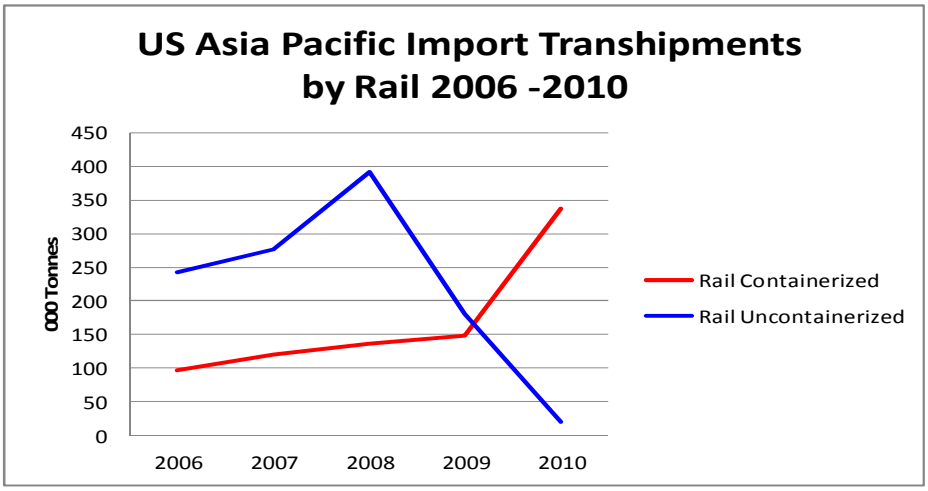
The BTS data on transhipments by rail suggests a substantially lower volume. US Pacific Rim import transhipments by rail based on BTS data totalled 328,000 tonnes in 2009. Assuming an average cargo payload of 7 tonnes per TEU (based on the average for Port Metro Vancouver containerized imports), this would amount to approximately 50,000 TEU's. This is substantially below the level of traffic suggested by Canadian information. Similar estimates from BTS data from 2006 through 2010 are depicted below.

**Figure 5 Estimated US Pacific Rim Transhipments by Rail 2006 – 2010 (TEU's)**




It seems apparent that the BTS data significantly understates Pacific Rim import transhipments by rail. The situation is further confused by anomalies in the classification of rail transhipments between containerized and uncontainerized movements. The data is shown below.

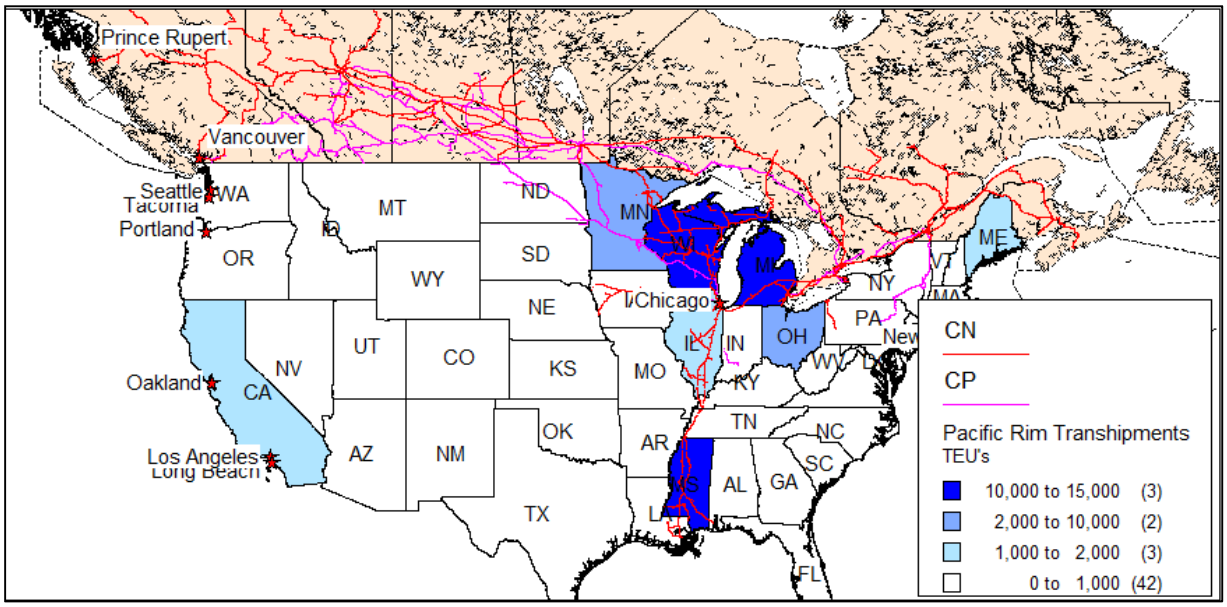
**Figure 6 US Pacific Rim Import Transhipments by Rail Containerized and Uncontainerized**




This data suggests that prior to 2009 the largest portion of rail transhipments were uncontainerized. This appears unlikely; with the exception of vehicles virtually everything imported from Asia through Canadian ports comes in a container[6]; and it seems highly unlikely this cargo is transloaded into railcars prior to transhipment to US destinations (to the author's knowledge, no one in Canada is transloading containers into boxcars). It seems probable that the traffic shown as uncontainerized rail shipments is misclassified; for purposes this paper it is consequently assumed that all Pacific Rim imports by rail are containerized.

The BTS data includes additional detail on state of origin and port of entry for transhipments. The map below shows the distribution of Pacific Rim import transhipments by state for 2010. The most striking feature of the data is the relatively low volume of shipments destined to the states hosting the major Canadian railway intermodal terminals – Illinois (CN and CP in Chicago) and Tennessee (CN in Memphis). This suggests that the under-reporting of rail transhipments may be related to a systematic issue regarding collection and/or processing of the data on intermodal shipments to major terminals.

**Figure 7 US Pacific Rim Import Rail Transhipment Destinations by State 2010**

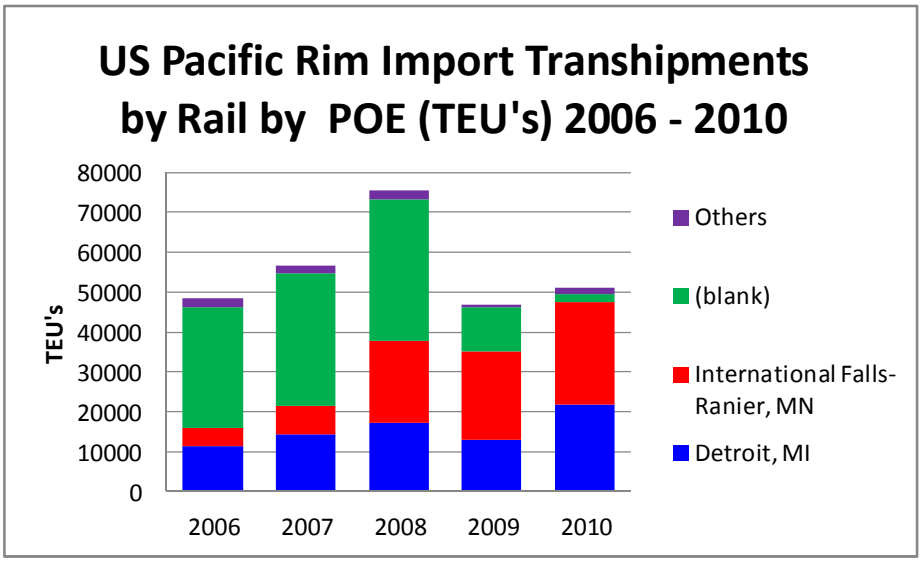



Michigan accounts for the largest share of rail transhipments reported in the BTS data. Based on the commodity composition of the cargo, a major portion of this traffic consists of products related to the auto industry.

It appears likely that the largest portion of the Wisconsin and Mississippi shipments is for a single customer - Ashley Furniture, which has its head office and an intermodal facility at Arcadia, WI and two large plants in Mississippi within two hours drive of Memphis and the CN intermodal terminal. Ashley Furniture was ranked as the 12th largest importer of containers to the US in 2009, with traffic totalling 90,800 TEU's[7].

Analysis of US Pacific Rim import rail transhipments by Port of Entry provides another means of evaluating traffic from the Port of Prince Rupert. Intermodal trains carrying import containers from Prince Rupert travel to Winnipeg where they diverge between Eastern Canadian and US destinations. Trains bound for Eastern Canada continue along the Canadian route to Toronto and Montreal; containers bound for the US on this routing can cross the border at Detroit. Trains bound for Chicago and Memphis are routed on the southbound track crossing the border at the International Falls-Ranier MN border crossing. The distribution of rail transhipments by port of entry from 2006 to 2010 is shown below.

**Figure 8 US Pacific Rim Rail Import Transhipments by Port of Entry 2006 - 2010**




The data shows an increasing share of traffic through International Falls-Ranier; however it is difficult to draw strong conclusions because the largest portion of traffic prior to 2009 does not have a Port of Entry identified.

In summary, the BTS data provides an indication of transhipment patterns for Pacific Rim imports through the Ports of Vancouver and Prince Rupert. However it appears that the BTS data substantially understates actual US Pacific Rim import transhipment traffic through Canadian ports. Based on Canadian information, it appears that recent volumes of Pacific Rim import containers transhipped through the Ports of Vancouver and Prince Rupert total approximately 200,000 TEU's. Doubling this figure to 400,000 TEU's to account for return of the containers via the same ports, this is approximately 1.7% of total West Coast container traffic of 23 million TEU's in 2010. US Pacific Rim import transhipments by truck accounted for the equivalent of an additional 90,000 TEU's or 180,000 TEU's on a round trip basis. Inclusion of this traffic would increase the share of West Coast TEU traffic transhipped to the US through Vancouver and Prince Rupert to 2.5%.

**Lessons For US West Coast Ports – Panama Canal Expansion**

The relatively low elasticity of Lower Mainland container traffic can be attributed to the following factors:

- Intramodal competition in the Lower Mainland's core Canadian market is limited by the lack of direct access by U.S. Class 1 railways. In order to provide direct intermodal service to the major Eastern Canadian market, UP and BNSF would have to interchange traffic with the Canadian railways in Chicago. It is hard to imagine a scenario (short of a merger) which would induce CN or CP to offer an interline rate or level of service which would make the Western U.S. Class 1 railways competitive with the Canadian routing.

- Intermodal competition from trucking is limited by the distance from West Coast ports to Eastern Canadian markets.

US West Coast ports may face a similar situation in their Eastern US markets following expansion of the Panama Canal. Due to the regionalized nature of the US railway system, West Coast ports and the Western Class 1 railways are dependent on CSX and Norfolk Southern for interline service to markets in the Eastern US. Currently this takes place under interline agreements among BNSF and UP and their Eastern counterparts. If liner service to East Coast ports via the Panama Canal becomes more competitive following expansion of the canal, CSX and Norfolk Southern may perceive increasing their interline rates for Western intermodal traffic as a win/win strategy:

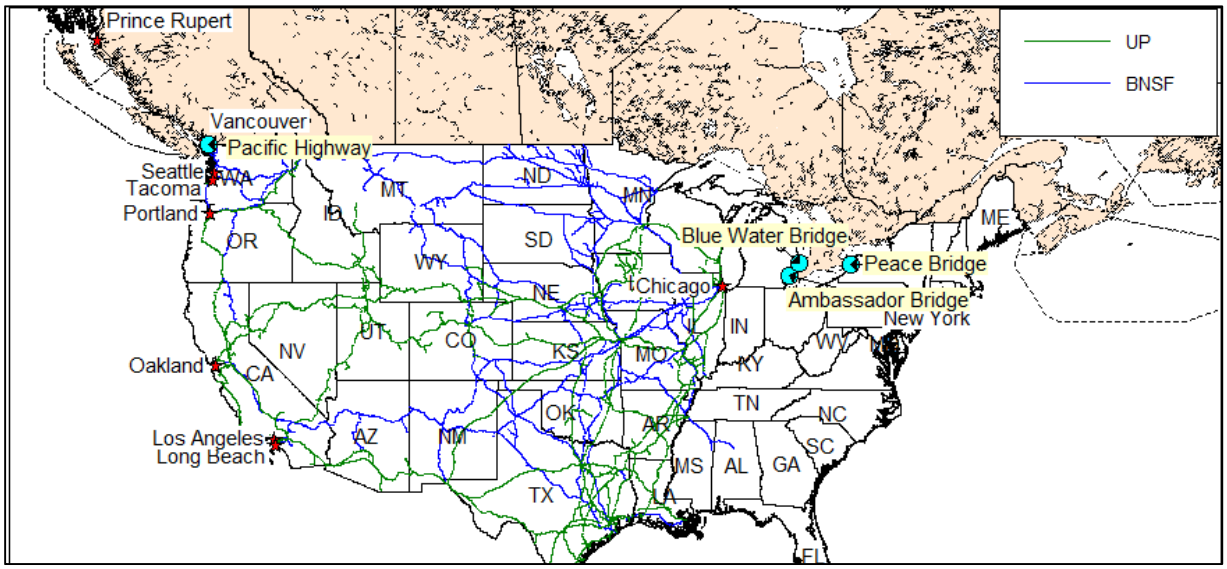
- It would increase their revenue from West Coast international traffic.

- The increased costs might drive additional traffic to the East Coast ports where they would not have to share revenue with BNSF and UP.

In the event this takes place, the lessons from US ports success in increasing their share of the Canadian market may be valuable.

Canadian trade data suggests that US ports have succeeded in capturing a large share of the Canadian Pacific Rim import market. Truck shipments processed through the top four Canada-US land border crossings in 2009 accounted for approximately 20% of the value of Canadian Pacific Rim imports. Locations of the top four border crossings are shown below.

**Figure 9 Top Four Border Crossings Canada Pacific Rim Imports by Truck**




The Ambassador and Blue Water Bridges alone accounted for 13.1% of total Canadian Pacific Rim imports by truck in 2009. The share of Canadian Pacific Rim imports transhipped through these crossings increased by 45%, from 9.0% to 13.1% by value from 2002 to 2009.

The increasing penetration of the Canadian market by US transhipments via these routes seems remarkable given the logistics challenges of inland transport. While it is difficult to determine the exact routing it seems probable that the cargo is either transloaded at a U.S. West Coast port location to a domestic container which is shipped via rail to Chicago and transferred to a truck for final shipment across the border; or shipped in an international container and transloaded to truck at a location in the Chicago area. In either case the shipment would incur transloading and trucking costs, as well as potential additional costs for customs processing and border delays. The distance by truck from Chicago to Toronto is approximately 500 miles (850 km) via either the Blue Water or Ambassador Bridges, with a driving time exceeding 9 hours.

An understanding of the factors which motivate shippers to use the US routing for Canadian imports in spite of these disadvantages may enable the West Coast ports and Western Class 1

Railways to maintain their market share in Eastern US markets following expansion of the Panama Canal. Development of competitive supply chains using truck transhipment could also provide economic opportunities for communities hosting intermodal terminals at the eastern edges of the BNSF and UP networks.

Interesting aspects of this issue include:

- What are the characteristics of the firms and/or products which are transhipped via the US to Canadian destinations?
- How are the additional cost and transit time challenges in transhipping via the US overcome?
- Do the major logistics parks in the Chicago area play a role as Inland Ports for transloading and forwarding of cargo destined for Canada?
- What are the requirements for competitive truck service (i.e. availability of backhaul cargo, etc.).

An understanding of these factors for transhipments to Canada may provide the basis for a similar strategy for maintain the market share of US West Coast ports following expansion of the Panama Canal. This also suggests that ports need to focus their trade development strategies on maintaining and building solid commercial relationships with inland transport carriers, logistics parks and economic development agencies and firms inland.

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[1] The author wishes to thank Darryl Anderson of Wave Point Consulting Ltd. for his assistance in critically reviewing this paper.

[2] Data on intermodal traffic is taken from Class 1 Railroad Annual Reports (Report R-1) to the Surface Transportation Board.

[3] The concept of "intermodal carloads" is not straightforward due to the use of multi-platform car configurations of varying capacity. The data on intermodal carloads reported in railway financial reports appears to be based on the convention of quantifying carloads based on two intermodal units (containers or trailers) per carload.

[4] This may be attributable to a differing mix of international, domestic and expedited services. The contractual arrangements between UP and Intermodal Marketing Companies (IMC's) may also be a factor; for example, UP's legacy contract with Pacer International Inc. provided lower rates for domestic container ("big box") traffic than "market" rates. This agreement was

renegotiated in 2009, with the result that Pacer's rates for domestic containers were to transition to higher "market" prices over a two year period. See Pacer International Inc. Form 10-K - February 23, 2010 pp. 19-20.

[5] Pacific Rim countries include Australia, China, Hong Kong, Indonesia, Japan, Malaysia, New Zealand, Philippines, Singapore, South Korea, and Taiwan.

[6] With the exception of vehicles virtually all Pacific Rim imports unloaded at Canadian ports are containerized; for example excluding vehicles containerized traffic accounted for 86% of Pacific Rim imports at Port Metro Vancouver in 2010. Source: Statistics Overview 2010 Port Metro Vancouver.

[7] Source: PIERS http://www.globaltrade.net/international-trade-import-exports/f/business/pdf/United-States/Transportation-and-Storage-Top-100-Importers--2009.html

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