EXCHANGE RATE IMPACTS ON WEST COAST CONTAINER PORT TRAFFIC

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Abstract

Rapid growth in Asia–North American trade resulted in a corresponding surge in container traffic at North American ports. Since the downturn in traffic in 2008, competition has further intensified with the entry of the Port of Prince Rupert. For the ports, the sensitivity of port traffic to relative costs (elasticity) among competing ports and inland routings is a key factor in developing strategies to maintain and expand their business.

Previous studies of the elasticity of West Coast container port traffic have concluded that traffic routings are highly sensitive to cost increases. However, the major change in West Coast container port market shares 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 2011. This is difficult to reconcile with a high elasticity since the Canadian dollar increased by 36% against the U.S. dollar over this period, which led to higher port and inland transportation costs relative to U.S. ports for Pacific Rim import traffic.

The methodology used for previous studies focused on microeconomic analysis of the costs of shipping containers via different ports and inland routes in a single time period. This paper analyzes the differential effects of changes in macroeconomic variables (in this case the exchange rate) on port competitiveness through the impacts on costs and demand, measured over a decade. The exchange rate is considered as an exogenous variable affecting consumers' choices between domestic and imported goods, and relative Canada/U.S. intermodal rail costs.

The impact of exchange rate changes is explored through a regression analysis of port market shares on Canadian Pacific Rim imports and relative rail costs. The results indicate that while the appreciation of the Canadian dollar had a negative impact on Lower Mainland container traffic due to higher inland costs, the effect was outweighed by increases in import volumes due to the reduction in the prices of imported goods. Estimates of Canadian Pacific Rim imports transhipped through U.S. ports suggest that the share of U.S. ports in Canadian traffic increased substantially over this period as a result of higher relative inland transportation costs. The paper highlights the influence of the differential impacts of changes in macroeconomic variables on port competitiveness.

Exchange Rate Impacts on West Coast Container Port Traffic
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Background

Rapid growth in Asia–North American trade resulted in a corresponding surge in container traffic at North American ports. Total West Coast container traffic grew from 17 million TEU's in 2002 to almost 25 million TEU's in 2007. Competition for Asian import traffic among the major ports (Los Angeles, Long Beach, Oakland, Seattle, Tacoma, Portland and BC Lower Mainland ports) was intense, with significant investments in port and associated infrastructure to accommodate increased volumes. Since the downturn in traffic in 2008, competition has further intensified with the entry of the Port of Prince Rupert. For the ports, the sensitivity of port traffic to relative costs (elasticity) among competing ports and inland routings is a key factor in developing strategies to maintain and expand their business.

Previous studies of the elasticity of West Coast container port traffic have concluded that traffic routings are highly sensitive to cost increases. However, the major change in West Coast container port market shares 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 2011. This is difficult to reconcile with a high elasticity since the Canadian dollar increased by 36% against the U.S. dollar over this period, which led to higher port and inland transportation costs relative to U.S. ports for Pacific Rim import traffic.

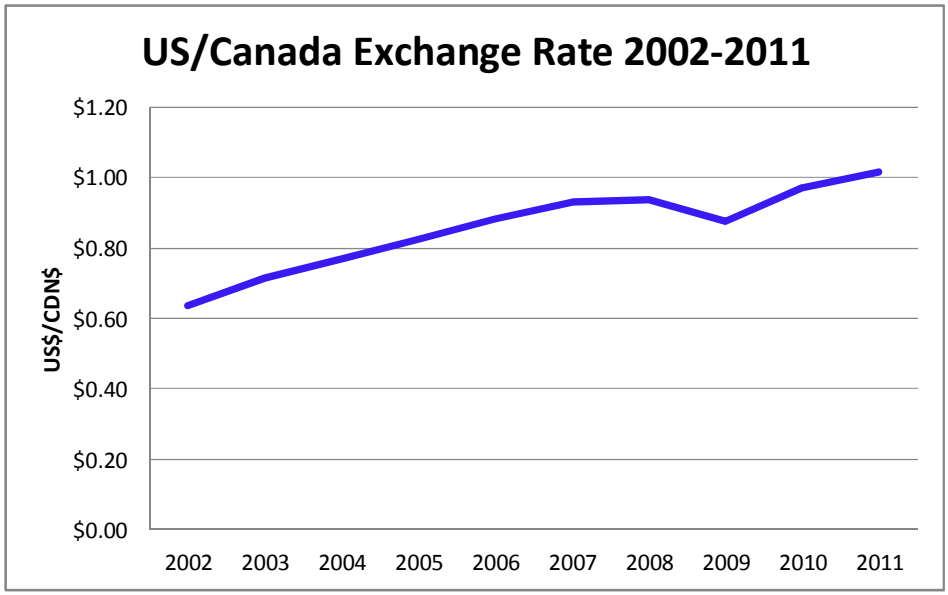


Figure 1 U.S./Canadian Dollar Exchange Rate 2002 – 2011

The methodology used for previous studies focused on microeconomic analysis of the costs of shipping containers via different ports and inland routes in a single time period. This

paper analyzes the differential effects of changes in macroeconomic variables (in this case the exchange rate) on port competitiveness through the impacts on costs and demand, measured over a decade. A literature search did not yield any previous studies with a similar focus.

Previous Studies

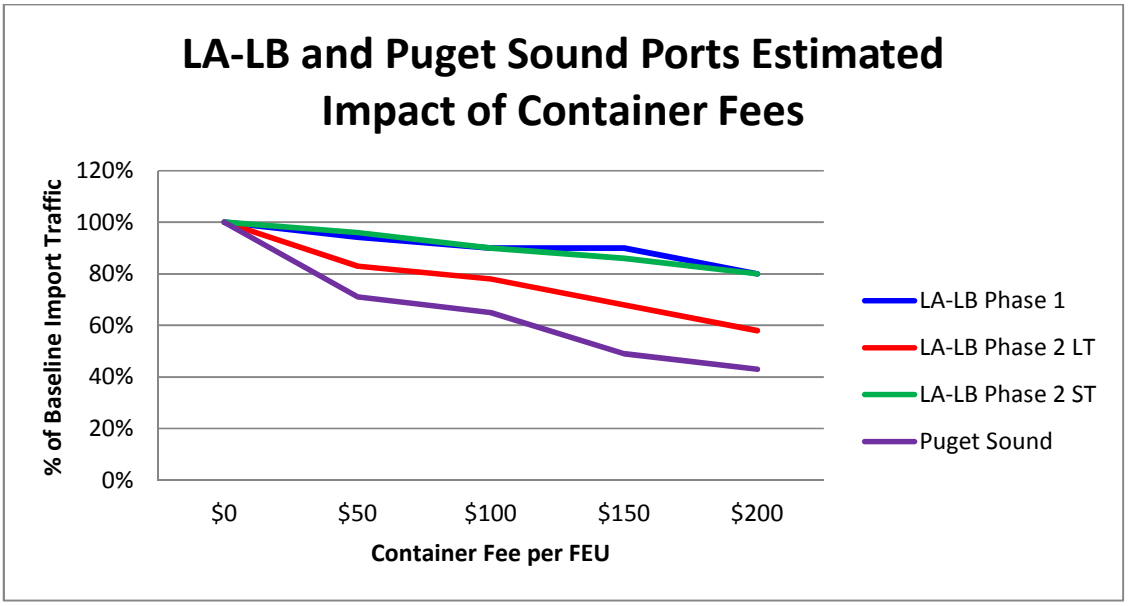
The primary sources reviewed for purposes of this paper are the first and second phases of the Port and Modal Elasticity undertaken by Leachman and Associates for the Southern California Association of Governments (SCAG)(1). A brief review of the methodology and results of these studies is given below.

In Phase 1 of the SCAG study a microeconomic model was developed to assess the long term impacts of container fees to finance infrastructure investments to accommodate growth in container traffic. The model allocated imports among ports and modes so as to minimize total transportation and inventory costs from the point of view of importers. Data on transportation costs was obtained directly from shippers and transportation service providers. Inventory costs in the model are based on the value of goods imported and transit times for alternative routings. The distribution of value for goods imported from Asia was estimated using a combination of U.S. Customs and PIERS data combined with data from the Pacific Maritime Association on the distribution of container sizes used for imports. These values were then applied to 83 major importers and 19 "proxy miscellaneous" importers based on the composition of imports for each from PIERS data. Total North American demand for containerized imports from Asia was allocated among 21 destination regions based on regional population and income levels. Modal options included direct rail for international containers (IPI), direct truck and local dray, transload rail, and transload truck and local dray.

The elasticity estimates in the Phase 1 study were long term in nature because the model did not take into account existing capacity constraints nor the impact of traffic shifts on transit times as a result of congestion. The Phase 2 model was expanded to include these factors through the development of a methodology for estimating congestion impacts based on queuing theory. The model was calibrated to 2005 and 2006 trade data and shipper costs were based on levels prevailing in April 2007.

A separate study on the elasticity of traffic through the Puget Sound ports of Seattle and Tacoma based on the Phase 1 model was conducted by Leachman and Associates in 2008 as part of a larger Freight Investment Study undertaken for the Washington State Joint Transportation Committee.(2) This study estimated that the Puget Sound ports' traffic was extremely sensitive to cost increases, with a reduction in volume of approximately 25% for a container fee of $30 per TEU.

Approximate estimates of the impact of container fees on import traffic for the Ports of Los Angeles and Long Beach from the two SCAG studies, and for the Puget Sound ports, are illustrated below. The Phase 2 study estimates suggest a much higher elasticity than the Phase 1 study.



Source: Leachman et al (1), (2)

Figure 2 Leachman Impact of Container Fees LA-Long Beach and Puget Sound Ports

Exchange Rates and Transportation Costs for Lower Mainland Container Traffic

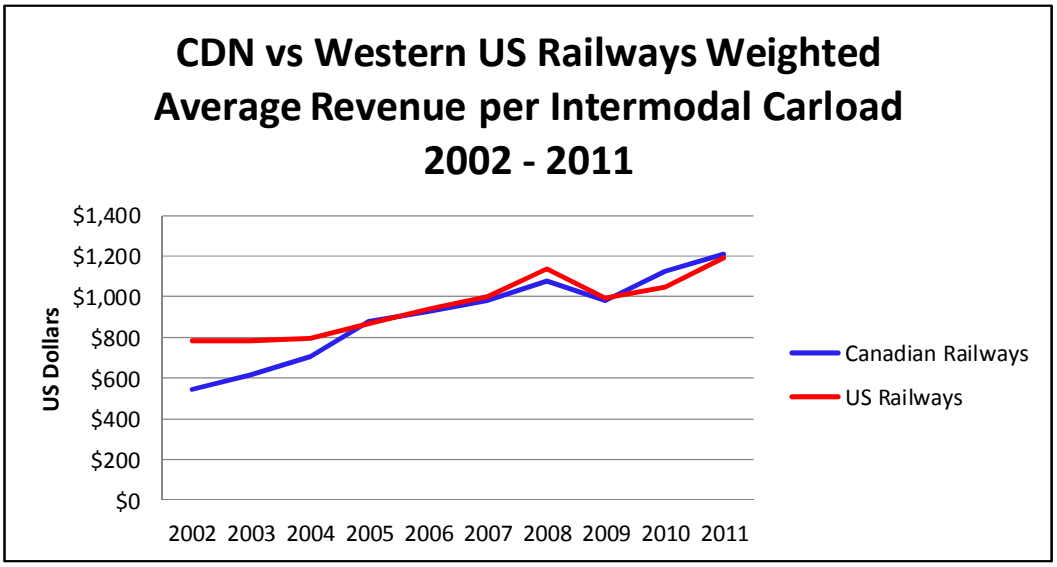
The costs of shipping containers through the Vancouver Gateway can be disaggregated among inland, port and ocean transportation costs. This facilitates the analysis of the impact of exchange rate changes, which vary among these categories; most notably, changes in the exchange rate are unlikely to affect ocean container rates directly since these are paid in U.S. dollars.

Inland transportation costs represent a significant portion of total delivered costs. In 2007, Maersk claimed that inland transportation costs accounted for two thirds of total transportation costs to inland destinations.(3) Intermodal rail costs are particularly critical for Lower Mainland container traffic. On-dock rail shipments typically account for 65% to 70% of import traffic.

Ideally an analysis of intermodal rail costs for shipments through West Coast ports would be based on sufficiently detailed data to evaluate cost differentials among specific routings and traffic segments (i.e. international vs domestic intermodal traffic). Practically this data is difficult to obtain, based primarily on confidential contracts between shippers and railways. For purposes of this study, aggregate intermodal revenue per carload among the Canadian (CN and CP Rail) and U.S. western Class 1 railways (BNSF and UP) provides 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,(4) and intermodal carload 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.



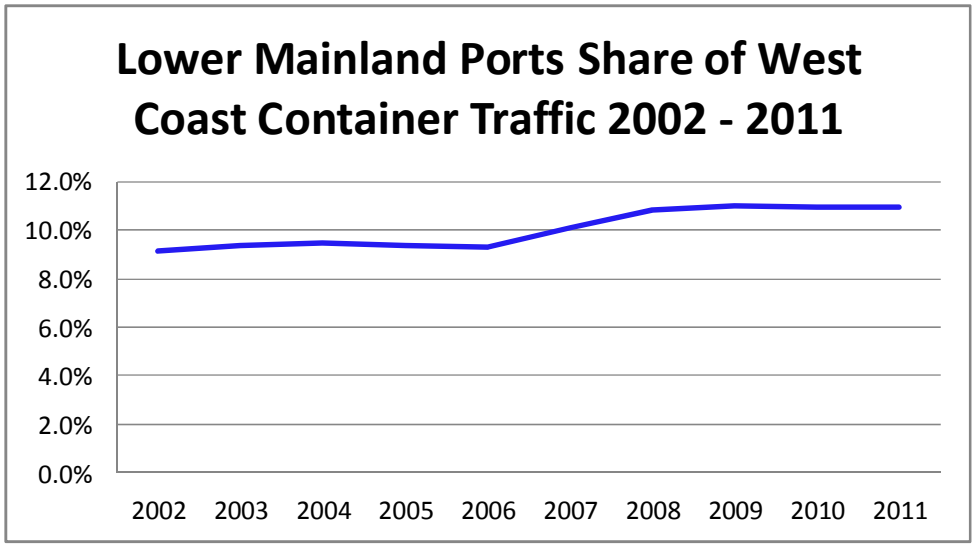
Source: Railway Annual Reports

Figure 3 Canadian and Western US Class 1 Railways' Revenue per Intermodal Carload

The data show a rapid escalation in Canadian dollar revenue per carload for the Canadian railways. On a US dollar basis, revenue per carload increased by 123% from 2002 to 2011. This is consistent with the rapid escalation of costs in US dollars due to the increased value of the Canadian dollar. On a weighted average basis, Canadian and US average revenue per carload has been similar since 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 from 9.1% in 2002 to 10.9% in 2011. The increase in the Lower Mainland's market share took place primarily over the period from 2006 to 2009 when the value of the Canadian dollar increased significantly.

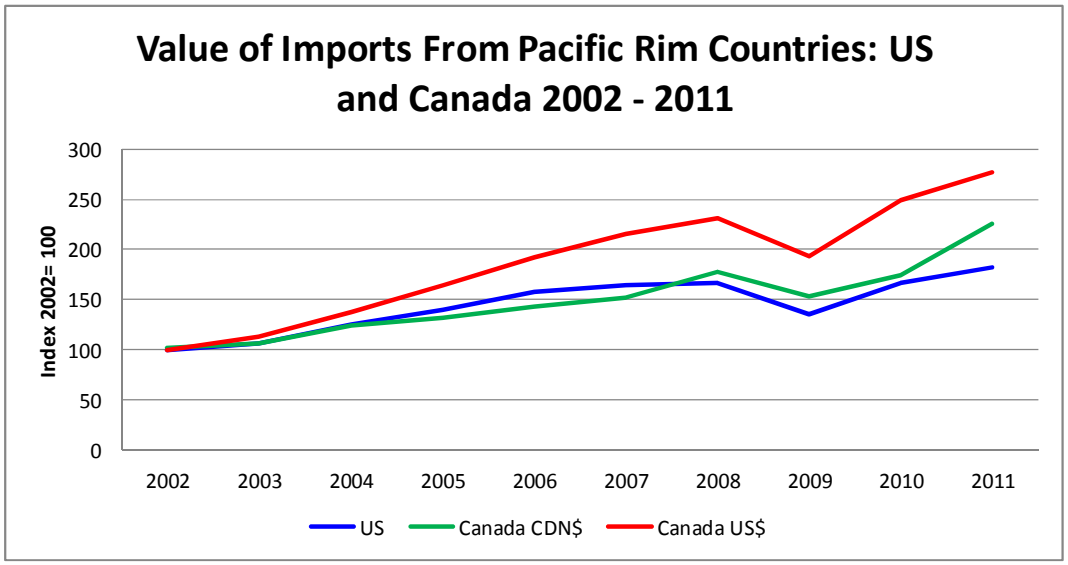


Source: Port Websites

Figure 4 Canadian Ports Share of West Coast Container Traffic 2002 – 2011

In order to more fully assess port performance it is useful to examine the specific origin/destination markets served by the Lower Mainland ports. Detailed data on the origins and destinations of containerized freight handled at the Port of Vancouver were published in 2006.(4) The Canadian market accounted for 94.5% of import traffic and 97.8% of export traffic. U.S. traffic accounted for only 3.4% of total traffic. In 2011, approximately 6% of container imports through the Lower Mainland were destined for the U.S.(5)

The overwhelming reliance of Lower Mainland port traffic on the Canadian market suggests that the performance of the Lower Mainland ports should be assessed relative to Canadian trade volumes rather than on total West Coast traffic. 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 2007. From 2007 to 2011, Canadian imports grew faster than U.S. imports. Due to the appreciation of the exchange rate the growth in Canadian import values in U.S. 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.



Source: Statistics Canada, U.S. Bureau of Census

Figure 5 Value of Imports from Pacific Rim Countries U.S. and Canada 2002 – 2011

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 linear regression of the index of the value of imports (in Canadian dollars) on indexes of personal disposable income and the ratio of import to domestic prices gives an adjusted R^2 of .87 with appropriate signs for the coefficients. The actual and fitted values are shown below.

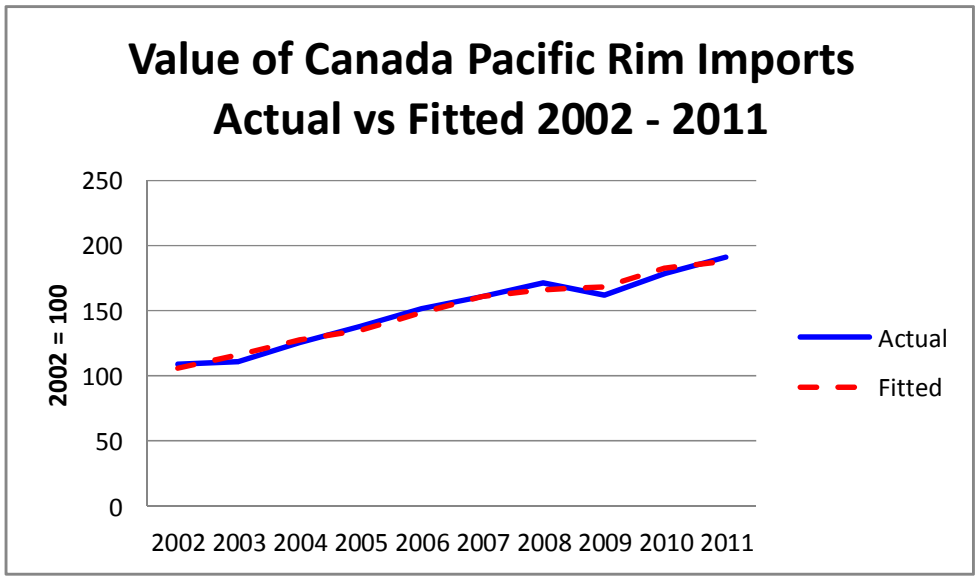


Figure 6 Actual vs Fitted Canada Pacific Rim Imports 2002 – 2011

The performance of Lower Mainland and U.S. West Coast ports container traffic relative to the value of imports from Pacific Rim countries is profiled below. The data indicate that growth in traffic for both groups lagged the growth in trade value. Starting in 2006, the gap is more pronounced for the Lower Mainland.

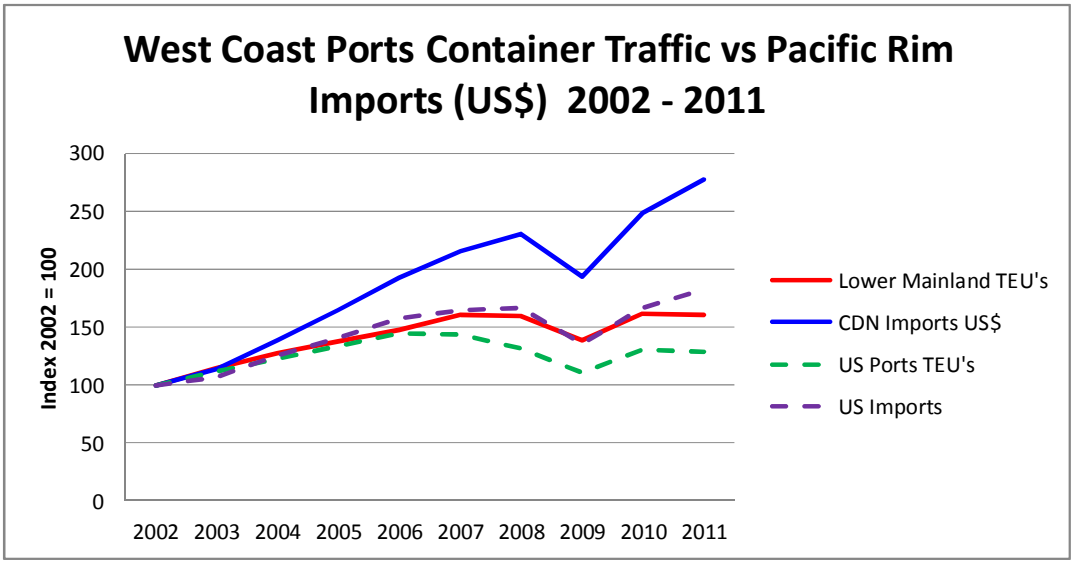


Figure 7 West Coast Ports' Container Traffic vs Pacific Rim Imports 2002 – 2011

The Lower Mainland share of West Coast container traffic relative to the Canadian share of the total value of U.S. and Canadian imports is shown below. Note that growth in the Lower Mainland market share lagged behind the relative growth of Canadian imports.

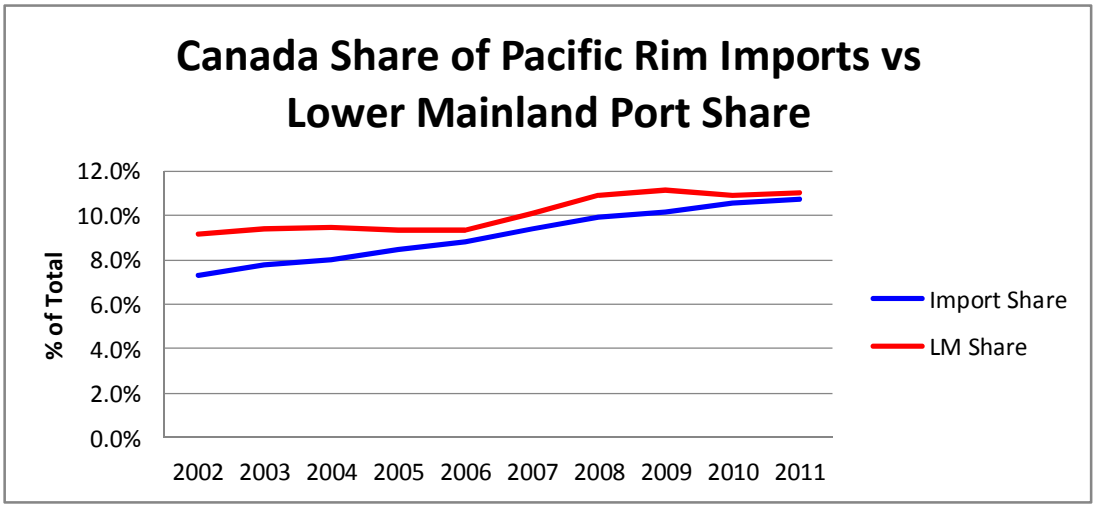


Figure 8 Canada Share of Pacific Rim Imports vs Lower Mainland Port Share 2002 – 2011

Elasticity of Lower Mainland Port Traffic

The methodology for estimating the impact of exchange rates on Lower Mainland container traffic 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 2011, 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 purposes of this study. For purposes of the regression analysis, we have 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 is used to estimate the partial elasticity of port traffic based on intermodal rail costs.

A linear regression of the Lower Mainland's share of West Coast container traffic from 2002 to 2011 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 yields an adjusted R^2 of .93 with all variables significant at the 95% level. The estimated regression equation is shown below:

Lower Mainland TEU Share = .05 +.902 (Canadian Import Share) – .033 (Canadian/U.S. Rail Cost Ratio)

Actual vs fitted data is shown below.

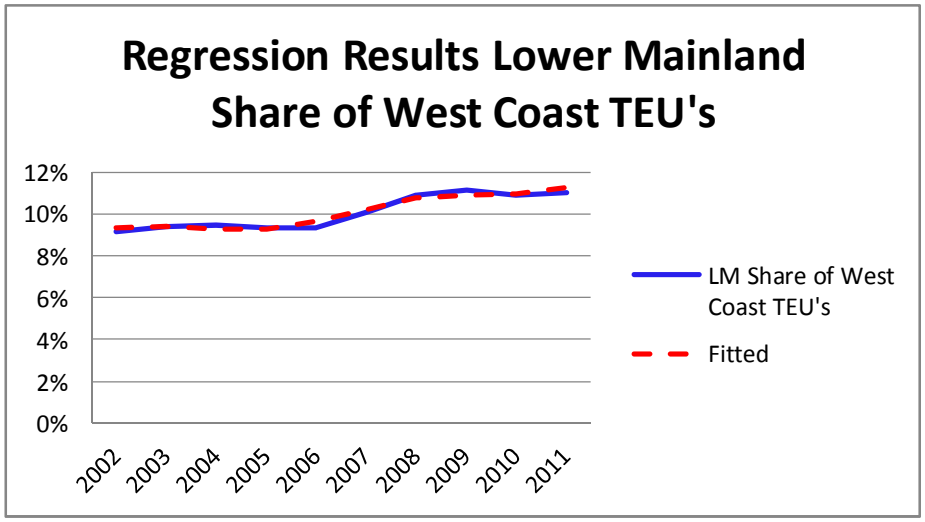


Figure 9 Actual vs Fitted Lower Mainland Market Share 2002 – 2011

Based on this regression, the partial elasticity of Lower Mainland container traffic to rail rate increases is .30. Assuming an ocean shipping rate of $1800 per FEU, this would result in a total elasticity estimate of .75. This is much lower than estimates for U.S. ports in the Leachman studies. Leachman's estimates indicated elasticity for Inland Point Intermodal (IPI) traffic of approximately 15.0 for LA/Long and 20.0 for the Puget Sound ports.

Based on the regression equations, the net impact of an increase in the value of the Canadian dollar relative to the U.S. dollar on the Lower Mainland market share of West Coast container traffic is positive, because the positive impact on Canadian imports more than offsets the negative impact of higher inland costs.

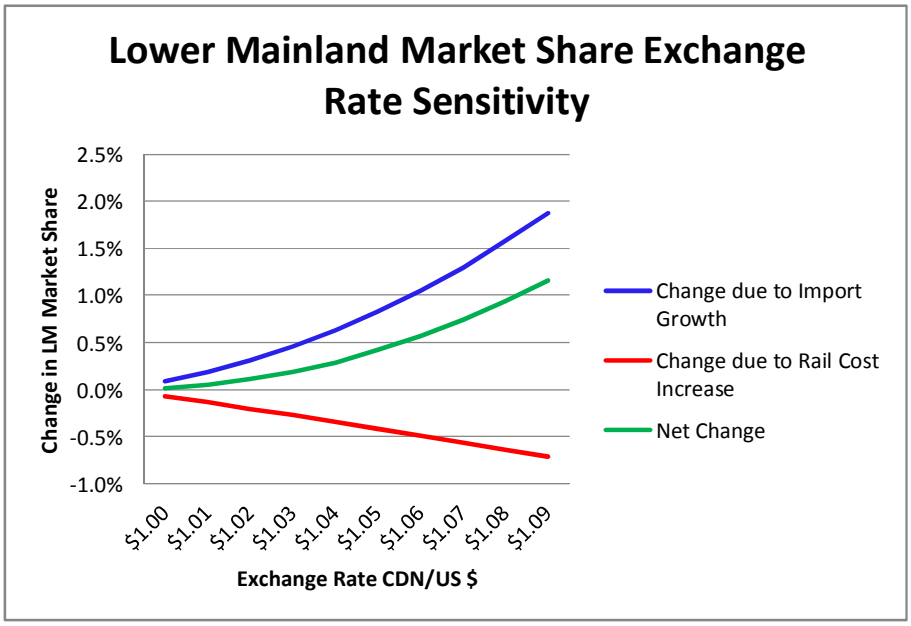


Figure 10 Lower Mainland Market Share Exchange Rate Sensitivity

Alternative Routings

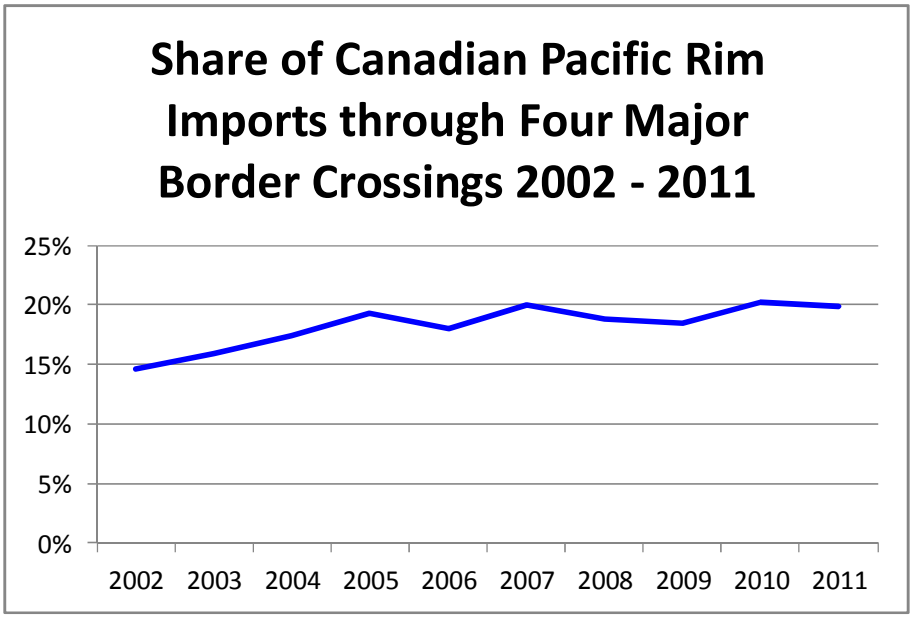
The data suggests that the Lower Mainland share of Canadian import traffic from Asia has declined. A portion of this traffic appears to have been diverted to the Port of Prince Rupert. Other alternative routings for this traffic can be deduced from Statistics Canada import trade data.

Data on imports available from Statistics Canada includes details of value and quantity by commodity, country of origin, port of clearance and mode of transport. This data enables estimation of the level of Canadian import traffic through U.S. ports. Conceptually, Pacific Rim imports through U.S. ports could be identified by mode of transport (truck or rail). However, the mode of transport reported in the trade data cannot be relied on due to the methodology used to collect the statistics. This variable represents the last mode of transport to the port of

clearance. Thus for a container unloaded at the Port of Vancouver which travels by rail to Toronto and is drayed to a sufferance warehouse, the mode of transport is recorded as truck. Based on this data, 35% of Canadian imports from Asia arrived by truck in 2009(6). For this reason, data on Pacific Rim import traffic cleared at land border crossings is used to identify shipments via U.S. ports.

The data available for purposes of this analysis was limited by costs. Detailed data on shipment quantities of imports from China by port of clearance for 2003 and 2004 was available from a previous study. This data showed that in 2003, 34% by tonnage and 42% by value of imports arrived at the port of clearance by truck. The share arriving by rail was approximately 1% by both tonnage and value. Four border crossings - Windsor (Ambassador Bridge), Pacific Highway, Sarnia (Blue Water Bridge), and Fort Erie (Peace Bridge) – accounted for 76% of traffic in 2004.

The 2003 and 2004 data was used as a guide in purchasing data for use in this analysis. Data on the value of imports from Pacific Rim countries through these four border crossings from 2000 through 2011 was purchased from Statistics Canada. The share by value of Canada's Pacific Rim imports cleared through these crossings from 2002 to 2011 is shown below.



Source: Statistics Canada

Figure 11 Share of Canadian Pacific Rim Imports - Four Major Border Crossings

The negligible share of rail in Canadian Pacific Rim import traffic is reflective of the lack of direct rail connections to major Canadian markets for U.S. Class 1 railways. The closest access of the Western U.S. Class 1 railways to major Eastern Canadian markets is Chicago, 521 miles (840 km) by road from Toronto via either the Ambassador Bridge or Blue Water Bridge. None of

the U.S. Class 1 railways has intermodal facilities in Canada. The shares of Pacific Rim imports by value among the top four land border crossings are shown below.

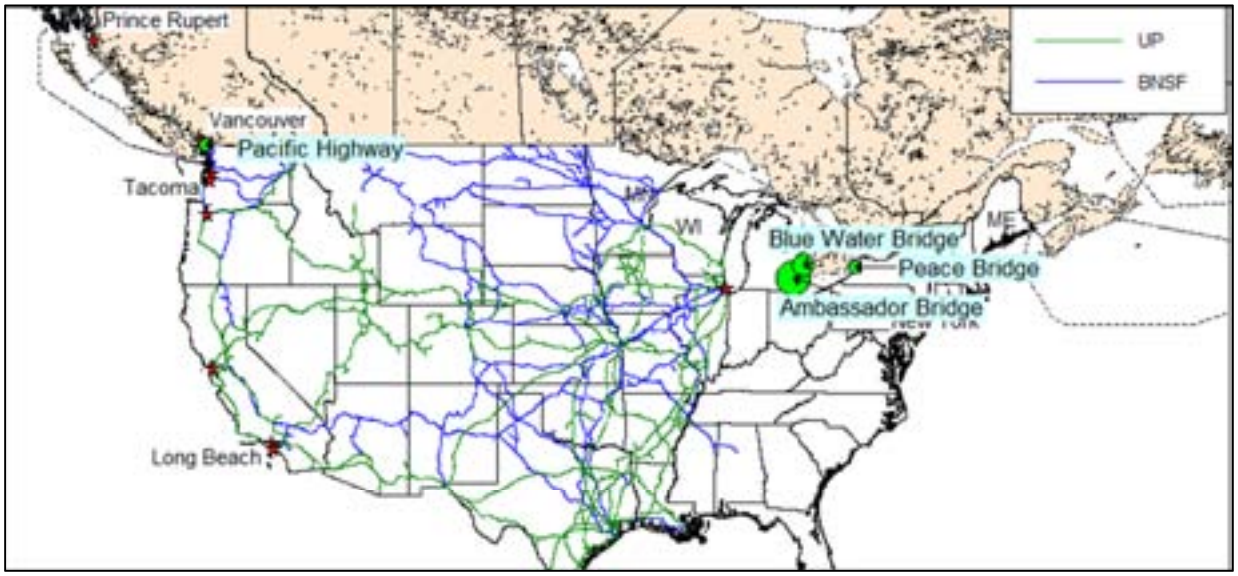


Figure 12 Top Four Border Crossings Shares of Pacific Rim Imports 2011

The routing of these shipments can be inferred from the location of the border crossings:

- The Ambassador Bridge and Blue Water Bridge crossings lie on the major highway routes connecting the major intermodal hub of Chicago to major Southern Ontario population centres including Toronto. The most probable routing for this traffic is through U.S. West Coast ports. These two crossings accounted for 14% of Canada's Pacific Rim imports by value in 2011.

- The Peace Bridge between Buffalo NY and Fort Erie provides a link between U.S. East Coast ports (particularly New York/New Jersey) and Southern Ontario.

- The Pacific Highway crossing between Seattle and the Lower Mainland provides access to the Lower Mainland local market and the Canadian rail system for inbound traffic from the Ports of Seattle and Tacoma.

As a means of testing the hypothesis that the increase in relative intermodal rail costs has increased the share of Canadian imports transhipped via U.S. ports, a regression analysis of the share of Canadian imports cleared at the four major land border crossings was carried out. The regression results are shown below:

Land Border Share = .040 + .152 (Canadian/U.S. Rail Cost Ratio)

This equation provides an adjusted R^2 of .90 with all variables significant at the 95% level.

This analysis puts a different perspective on the competitiveness of the Lower Mainland relative to U.S. ports. While the Lower Mainland's share of West Coast TEU traffic increased, the share of the core Canadian market declined, as evidenced by the 4.5% increase in the share of Canadian imports by value through the major land border crossings.

Conclusions

This analysis provides a coherent picture of the major factors influencing Lower Mainland port traffic from 2002 to 2011. 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 partial elasticity of port traffic to relative transportation costs is found to be -.30. Based on an estimate of ocean costs of $1800 per FEU, total cost elasticity is estimated at .75, significantly lower than values found in previous studies for U.S. West Coast ports. It appears that the Lower Mainland has actually lost market share in its core market, and that the largest portion of traffic lost to competing ports enters Canada by truck through land border crossings in Eastern Canada.

There are a number of characteristics of the destination market which may be responsible for the relatively low elasticity of Lower Mainland container traffic.

- 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.

Due to these constraints, routing of Canadian imports through U.S. ports requires use of a multimodal approach. The Canadian trade data indicate that the largest share of Pacific Rim imports routed through the U.S. enters via the Ambassador and Blue Water Bridges by truck. 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.

The lower growth rate of traffic across the Pacific Highway crossing, which provides the option of trucking containers from the Ports of Seattle and Tacoma to Lower Mainland intermodal yards, suggests that shippers are using the U.S. West Coast ports to bypass the Canadian railways, rather than simply bypassing the Lower Mainland ports.

The findings of this research highlight the influence of the differential impacts of changes in macroeconomic variables on port competitiveness. The microeconomic models developed in the Leachman studies suggested that container traffic routings are extremely sensitive to increases in costs. However, the example of the Lower Mainland ports shows that where cost increases result from a shift in macroeconomic variables, the loss of traffic due to increased costs may be offset by other impacts in the economy. In the case of Lower Mainland, the analysis indicates that increases in inland transportation costs attributable to the increase in the value of the Canadian dollar resulted in a reduction in traffic; however the impact was more than offset by the increase in import traffic resulting from lower relative import prices.

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1 Leachman & Associates LLC In Association with T. Prince & Associates LLC, Strategic Directions LLC, & George R. Fetty & Associates, Inc. *Modal Elasticity Study* Prepared for Southern California Association of Governments, Sept. 8, 2005. Leachman & Associates LLC *Final Report Port and Modal Elasticity Study Phase II* Prepared for Southern California Association of Governments, Sept. 14, 2010.

2 Cambridge Systematics, Inc. in association with the Puget Sound Regional Council, Gill Hicks & Associates, Foster Pepper PLLC, BST Associates and Dr. Robert Leachman *Freight Investment Study* prepared for Washington State Joint Transportation Committee January 2009. Dr. Leachman's analysis is included as Appendix B in the report.

3 "Shippers wait to see whether other carriers will follow Maersk's lead in restructuring inland network" *Shipping Digest* February 26, 2007

4 MariNova Consulting Ltd. and Partners *Use of Containers in Canada* Transport Canada TP T-8080-06-175 December 2006 p. 19.

5 Courtney Tower "Trade Winds Shift at Canadian Ports" *Journal of Commerce* January 13. 2012.

6 Table EC13: Canada's Imports by Origin, Destination and Mode of Transport, Transport Canada *Transportation in Canada.*