Evaluation of the Substitutability between U.S. and Canadian

Softwood Lumber

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Abstract: Softwood lumber trade between the United States and Canada has worldwide attention due to its economic importance and for lengthy dispute. Most studies have focused on welfare effects of the dispute, while few studies have evaluated the question of likeness of product. This study evaluates the substitutability between U.S. and Canadian softwood lumber including other countries' softwood lumber. Price elasticities are derived from the linear approximation of the Almost Ideal Demand System. The results show that softwood lumber imports to the U.S. from various countries are indeed substitutes for U.S. softwood lumber. The Morishima elasticities of substitution indicate that other countries have a higher degree of substitutability than Canadian softwood lumber.

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Worldwide, the United States is the largest consumer of softwood lumber and Canada is the largest producer. In 2004, these countries consumed and produced 44% and 28% respectively of the world's total production and consumption of softwood lumber (USDA, 2006). The bulky nature of softwood lumber and the proximity of the two countries have made the United States and Canada important trading partners. In 2004, the United States imported approximately $7.4 billion worth of softwood lumber, 90% of which was imported from Canada (USITC, 2006). Imported Canadian softwood lumber represents 41%[1] of softwood lumber consumed in the United States. Overshadowing the economic importance of this trade relationship, however, has been the decades-long lumber trade dispute.

Since 1981, four softwood lumber disputes between Canada and the United States have focused on the U.S. claim that Canadian softwood lumber is subsidized and sold in the U.S. at below the cost of production. To address this claim, the United States established countervailing and antidumping duties on Canadian softwood lumber based on the determinations of the U.S. Department of Commerce.

The Dispute

In Canada, stumpage fees are not determined by the market; instead the Canadian government grants softwood lumber companies the harvest rights to the standing timber on Crown Lands in exchange for service and maintenance obligations (e.g., road-building, protection against fire, disease, and insects) (WTO, 2003). The United States considers this practice to be a subsidy to Canadian lumber producers who ultimately export their lumber to the United States. The United States claims that selling the

standing timber in the open market, as is done in the U.S., would fetch higher stumpage prices than the current exchange policy used in Canada. Higher stumpage fees would reduce the Canadian share of the U.S. softwood lumber market allowing U.S. lumber producers to have a higher share of the market.

In response, Canada argues that the services provided by the softwood lumber companies should be taken into account in computing the stumpage fees. In addition, Canada contends that its vast endowment of forest land provides a natural competitive advantage over its competitors, that U.S. firms are not efficient, and furthermore it opposes U.S. intervention into Canadian sovereignty.

The U.S. softwood lumber producers claim that imports from subsidized Canadian softwood lumber cause loss of sales and jobs. U.S. consumer groups assert that such detriment could not occur because Canadian softwood lumber is not a substitute for U.S. softwood lumber (ACAH, 2002). Currently, all softwood lumber imports from Canada falling under the Harmonized Tariff Schedule (HTS) code 440710 are subject to a tariff of 22 %. This is a high level of aggregation which arguably protects some U.S. lumber producers unnecessarily.

Objective

This study evaluates the substitutability between U.S. and Canadian softwood lumber by computing price elasticities derived from the linear approximation of the Almost Ideal Demand System (LA/AIDS). Whether or not Canadian lumber is subsidized falls outside the scope of this study. But if subsidies exist, Canadian lumber can only be detrimental to the U.S. lumber producers to the extent that their products are substitutes. Absent

close substitutability, U.S. producers cannot be injured and therefore the case for protective policies is weakened.

Literature Review

A myriad of articles relate to this very trade dispute, however two specifically address the issue of substitutability. Nagubadi et al. use a translog cost function for the housing industry by accounting for six species of lumber which include: Spruce and Fir (and Lodgepole Pine, and Spruce), Southern Pine, Douglas Fir, Hem Fir (and White Fir, and other fir), Cedar, and others (Ponderosa Pine, other pine, Redwood, Eastern White Pine, other eastern softwoods, Western White Pine, Sugar Pine, other western softwoods). Their results show that substitutability exists between Canadian Spruce-Pine-Fir (SPF) and the untreated U.S. Southern Yellow Pine (SYP). Other products appear to be independent markets, and some are even complements of U.S. products. In contrast, Lewandrowski et. al., by developing a short term stochastic model using mathematical programming from an inventory approach, found that imports of Canadian lumber do compete with U.S. lumber in the U.S. market.

This study adds to the small literature by utilizing the LA/AIDS and calculating price elasticities to analyze the substitutability of U.S. softwood lumber with that from countries other than Canada (Mexico, Brazil, and New Zealand).

Methodology

The linear approximation to the AIDS model arose following the recognition that the estimation of non-linear models can be troublesome. Deaton and Muellbauer argued that with collinear prices, it may be appropriate to use the Stone Price Index to approximate the variable for commodity prices (P_j). The budget-share equation for each country is:

$$S_i = \alpha_i + \sum_j \gamma_{ij} \ln(P_i) + \beta_i \ln\left(\frac{M}{P^*}\right) \qquad (1)$$

where αi is the constant coefficient in the *i*th share equation, γij is the slope coefficient associated with the *j*th good in the *i*th share equation, p_j is the price on the jth good. M is the total expenditure on the system of goods given by

$$M = \sum_{i=1}^{n} p_i q_i \qquad (2)$$

in which q_i is the quantity demanded for the *i*th good. *P** is the price index defined by the Stone Price Index is

$$\ln P^* = \sum_j S_j \ln P_j \qquad (3)$$

The Stone Price Index does not involve model coefficients; then it is not invariant to scaling in prices and therefore we normalize them by the mean of prices. After substituting the stone price index in (1) and with some simplifications we obtain the expression to be estimated:

$$S_i = a_i + \sum_j \gamma_{ij} \ln(P_j) + \beta_i \ln(M) - \beta_i \ln(\sum_j S_j \ln(P_j)) \qquad (4)$$

Notice that the share equations are linear in the parameters. Using Monte Carlo simulation, we estimate this seemingly unrelated regression (SUR). When estimating the parameters of this system we need to impose certain restrictions: symmetry, adding up, and homogeneity. In the same order these are: $\gamma_{ik} = \gamma_{ki}$; $\sum_{i=1}^{n} \alpha_i = 1$, $\sum_{i=1}^{n} \beta_i = 0$, $\sum_{i=1}^{n} \gamma_{ik} = 0$

$\forall k$; and $\sum_{k=1}^{n} \gamma_{ik} = 0$ $\forall i$.

In the estimation process, we omitted one share equation to avoid singularity of the error covariance matrix. Also, we do not need to impose all the adding up restrictions because we only estimate five equations out of six. However, we will use these restrictions to recover the coefficients for the omitted equation. One advantage of the AIDS model is that the homogeneity and symmetry restrictions are easily imposed and tested.

In the HTS system, imports of softwood lumber are assigned the following 6 digit code 440710. The description at this level of aggregation is labeled: wood sawn or chipped lengthwise, sliced or peeled, whether or not planed, sanded or finger-jointed, of a thickness exceeding 6 millimeters, coniferous (USITC Database). Softwood lumber quantity and price data for the Canada, Mexico, Brazil, and New Zealand was retrieved from the USITC database using the HTS number. Prices were obtained by dividing customs values of imports by the imported volume. These prices do not include tariffs.

Quantities for the United States were retrieved from Production, Supply and Demand tables from the USDA. U.S. prices were obtained by dividing export values by quantity exported. These data was obtained from the Online Statistics Database of the Food and Agricultural Organization of the United Nations. Quantities are measured in cubic meters, and prices are measured in US dollars.

Results

Table 1 reports the results of our estimation. The R-square for the system of equations is 0.93. In this experiment, the tests of overall significance and likelihood ratio also show low p-values which reject the null hypotheses.[2] These encouraging results strongly explain the demand behavior of softwood lumber for the United States. In Table 1,

LNSP1, LNSP2, LNSP3, LNSP4, LNSP5, and LNSP6 correspond with the natural

logarithm of the U.S. lumber price, Canadian lumber price, Mexican lumber price,

Brazilian lumber price, and the price of lumber form New Zealand respectively and the

expenditure shares are indexed in a consistent manner. Using these results, we compute

the own and cross price elasticities for the compensated and uncompensated case using

the formulas developed by Alston and Green for the LA/AIDS.

Table 1. Estimation Results [a]

VARIABLE	LNSP1	LNSP2	LNSP3	LNSP4	LNSP5	LNSP6	LNX	LNP
Share 1	**0.1827**	**-0.1806**	**-0.0006**	**-0.0013**	**-0.0012**	**0.0009**	**-0.0591**	**-0.0591**
	0.5791	*-0.6271*	*-0.2514*	*-0.1031*	*-0.1091*	*0.1101*	*-0.5491*	*-0.5491*
Share 2	**-0.1806**	**0.1764**	**-0.0002**	**0.0030**	**0.0013**	**0.0000**	**0.0570**	**0.0570**
	-0.6271	*0.6708*	*-0.0936*	*0.2753*	*0.1289*	*0.0013*	*0.5805*	*0.5805*
Share 3	**-0.0006**	**-0.0002**	**0.0003**	**0.0008**	**-0.0001**	**-0.0002**	**0.0007**	**0.0007**
	-0.2514	*-0.0936*	*1.0266*	*2.1959*	*-0.4141*	*-0.6791*	*0.8053*	*0.8053*
Share 4	**-0.0013**	**0.0030**	**0.0008**	**-0.0003**	**-0.0005**	**-0.0017**	**0.0006**	**0.0006**
	-0.1031	*0.2753*	*2.1959*	*-0.2926*	*-0.8388*	*-2.3851*	*0.1402*	*0.1402*
Share 5	**-0.0012**	**0.0013**	**-0.0001**	**-0.0005**	**0.0003**	**0.0003**	**0.0002**	**0.0002**
	-0.1091	*0.1289*	*-0.4141*	*-0.8388*	*0.5298*	*0.5983*	*0.0431*	*0.0431*

[a] Coefficients are in bold, t-statistic is in italics

The uncompensated price elasticities can be found in Table 2. These own price

elasticities are negative, which is consistent with demand theory. The uncompensated

price elasticities of demand show that other countries' softwood lumber is a complement

to U.S. softwood lumber with the exception of New Zealand.

Table 2. Uncompensated Price Elasticities

	United States	Canada	Mexico	Brazil	Chile	New Zealand
United States	-0.66	-0.25	-0.0008	-0.002	-0.002	0.002
Canada	-0.63	-0.54	-0.0007	0.01	0.003	-0.0003
Mexico	-1.00	-0.42	-0.71	0.82	-0.11	-0.24
Brazil	-0.47	0.80	0.24	-1.09	-0.15	-0.50
Chile	-0.42	0.40	-0.03	-0.17	-0.91	0.08
New Zealand	0.22	-0.12	-0.12	-0.89	0.13	-0.59

When adjusting for income effects, compensated price elasticities in Table 3, we find that all countries under this study become substitutes for U.S. softwood lumber. The results of Table 3 indicate that U.S. demand for softwood lumber from these exporting countries is more responsive to changes in U.S. price than the U.S. demand for domestic softwood is to changes in prices of imported softwood. This is suggestive of strong demand for domestic wood in the U.S. which is likely a function of the logistical difficulties of importing softwood. Additionally, when U.S. price changes, cross price elasticities for Brazil, Chile, and New Zealand are greater than Canada's and Mexico's. This would indicate a higher substitutability for softwood lumber coming from Brazil, Chile, and New Zealand.

Table 3. Compensated Price Elasticities

	United States	Canada	Mexico	Brazil	Chile	New Zealand
United States	-0.07	0.06	0.0001	0.002	0.001	0.003
Canada	0.12	-0.14	0.0004	0.01	0.007	0.002
Mexico	0.07	0.15	-0.71	0.82	-0.10	-0.23
Brazil	0.29	1.20	0.24	-1.10	-0.15	-0.49
Chile	0.26	0.76	-0.03	-0.17	-0.90	0.08
New Zealand	1.11	0.35	-0.12	-0.89	0.13	-0.59

Allen and Morishima elasticities of substitution where also computed. However, only the latter are presented in this paper. We do not report the Allen elasticities because they were sensitive to the small expenditure shares of Mexico, Brazil, Chile, and New Zealand as compared to Canada. That is, the expenditure shares predetermined the relative magnitudes.

The Morishima elasticity of substitution, reported in Table 4, is used to measure the change in relative softwood lumber demand from different countries for a change in a price. In the first column, Morishima elasticities confirm the previous compensated cross

price elasticity results. The Morishima elasticity for Canadian relative to U.S. softwood lumber demand, with respect to a change in the U.S. softwood lumber price, is the second smallest elasticity arising from a change in the U.S. price. Furthermore, the smallest Morishima elasticity of substitution arising from a change in the Canadian price is for the ratio of demand for Canadian softwood lumber relative to demand for U.S. softwood lumber. These results imply that softwood lumber from the countries other than Canada are closer substitutes for U.S. domestic softwood. This would appear to strengthen the Canadian case in the softwood dumping dispute.

Table 4. Morishima elasticities of substitution

	United States	Canada	Mexico	Brazil	Chile	New Zealand
United States		0.21	0.71	1.09	0.90	0.59
Canada	0.19		0.71	1.10	0.91	0.59
Mexico	0.14	0.29		1.91	0.80	0.35
Brazil	0.36	1.34	0.95		0.75	0.09
Chile	0.33	0.90	0.67	0.92		0.67
New Zealand	1.18	0.49	0.58	0.20	1.04	

Summary and Conclusions

The softwood lumber dispute between U.S. and Canada is one of the longest and costliest in recent trade history. Arguments surrounding the imposition of trade barriers have centered on the role of Canada's unique approach to forest management. Most studies have focused on welfare effects, while few studies have evaluated the question of likeness of product. As a contribution towards filling this gap in the literature, we have evaluated the substitutability between U.S. and Canadian softwood lumber using the Linear Approximate Almost Ideal Demand System (LA/AIDS).

The results show that softwood lumber imports to the U.S. from various countries are indeed substitutes for U.S. softwood lumber. Elasticities of substitution using the

Morishima definition indicate that other countries have a higher degree of substitutability with U.S. domestic product compared to Canadian softwood lumber. The consequence to trade is that if the United States imposes trade barriers against Canada, other countries with whom trade is not restricted could easily substitute for Canadian lumber in the U.S. market. This would nullify the protective effect of the barrier from the U.S. perspective. It is important, however, to note that there might result in a substantial welfare effects which would manifest in the form of a transfer of welfare from Canadian softwood exporters to softwood exporters from Brazil, Chile, Mexico, and New Zealand. U.S. consumers might also experience some welfare losses due the imperfect substitution between Canadian and other sources of softwood in the U.S. market. U.S. producers would benefit but less so than their foreign competitors.

Future research should make a distinction between the different varieties of Canadian and U.S. softwood lumber. U.S. production would need to be categorized along side the HTS system used when importing softwood lumber or a standard for comparison would need to be established. Then, the same procedure used in this study can be applied, allowing us to better understand the market for different softwood lumber varieties.

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[1] Authors' calculation based on imports data from the USITC Online Database, and consumption data from the PS&D Online Tables.

[2] Test of the overall significance = 45.295; Chi-square with 20 d.f.; p-value= 0.00101

Likelihood ratio test of diagonal covariance matrix = 360.65; Chi-square with 10 d.f.; p-value= 0.00000

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