Journal of Agricultural and Applied Economics, 38,1(April 2006):137–153

Is There an End to U.S.–Canadian Softwood Lumber Disputes?

Stephen Devadoss

I develop a two-country theoretical trade model to show that Canadian subsidies increase lumber supplies and exports to the United States, and the U.S. retaliatory tariff raises U.S. prices and safeguards producers, but hurts consumers. These results underscore the shortsightedness of policy decisions in a bilateral trade dispute, as empirical results from the multiregional spatial equilibrium trade model highlight that both countries pursue myopic policies without taking into account the reactions of other exporters and importers. For instance, after the imposition of U.S. tariffs, other exporters grab the market share lost by Canada in the United States, while Canada augments its exports to other importers.

Key Words: Canadian subsidy, lumber market, U.S. tariff, WTO ruling

JEL Classifications: F13

Continuous friction for more than two centuries in softwood lumber[1] (henceforth abridged as lumber) trade between Canada and the United States further escalated after the Softwood Lumber Agreement expired in 2001. The reason for the prolonged battle in the softwood lumber trade is because of the huge economic value of the bilateral lumber trade, the size of the lumber markets in both countries, and the adverse impact of one country's policies on the other country's lumber market. Lumber trade between the two countries is valued at $7.0 billion annually. The United States is the largest producer, importer, and thus, user of lumber. Canada is the second largest producer but not a major user of lumber, and hence, is the leading exporter. Canada exports about 60% of its lumber production to the United States (Random Lengths, Inc.). Between 1961 and 2003, growth in U.S. lumber demand (92%) far outpaced the growth in U.S. lumber supply (39%). In contrast, during the same period, growth in Canadian supply and exports skyrocketed (318 and 329%, respectively) because of vast endowments of forest lands. Canada's supply of U.S. domestic lumber use rose from 9% in 1961 to 33% in 2003.

Because of the United States' huge appetite for lumber use and imports, Canada's abundant supply and zeal for exporting, and the large volume of lumber trade between the two countries, any domestic policies, trade policies, or exogenous shocks (e.g., strong housing market expansion) have significant impact on the lumber markets in both countries. Furthermore, if one country's policies adversely affect the lumber producers in the other country, the injured party wants its government to enact retaliatory protective measures. Such is the nature of the current impasse.

The crux of this bitter dispute in recent years surrounds the Canadian government

Stephen Devadoss is a professor, Department of Agricultural Economics, University of Idaho, Moscow, Idaho.

The author gratefully acknowledges the helpful review comments of the editor and three anonymous reviewers.

[1] Softwood lumber is used in residential and commercial building construction, furniture, and cabinets.

ownership of forest land, timber subsidies to Canadian lumber producers, exports to the United States at prices below cost of production, and U.S. retaliatory measures of countervailing duties (CVD) and antidumping tariffs. Specifically, the Canadian government grants timber subsidies in the form of low stumpage fees (price of timber) to the lumber companies to harvest standing timber, which is used to manufacture lumber products. The United States alleges that subsidized Canadian lumber exports are dumped in the United States, injuring the U.S. lumber industry (WTO 2002). Based on its finding that Canada subsidizes its lumber producers to a tune of 19.34%, the United States established a combined countervailing and antidumping duty of 27.2% on Canadian softwood lumber in 2002.

Canadian domestic policy and U.S. trade policy significantly impact lumber production and use not only in these two countries, but also in other countries. For instance, U.S. trade restriction of Canadian lumber causes Canada to divert its exports to other importers, thus impacting the lumber market in these countries, which has a spillover effect on other exporters who originally supplied these importing countries. The purposes of this study are to a) develop a theoretical model to examine the underlying cause of the lumber war between Canada and the United States and b) build a multi-regional spatial equilibrium lumber trade model and assess the effects of Canadian timber subsidies and U.S. tariffs on U.S., Canadian, and other major exporting and importing countries' lumber markets.

The rest of the article is organized as follows. Section 2 presents an overview of the U.S.–Canadian lumber trade litigation and reviews the literature that examined these contentious issues. Section 3 discusses the theoretical analysis to examine the effects of the Canadian subsidy and U.S. tariffs on lumber prices, supply, demand, and trade. Section 4 describes the spatial equilibrium model employed to analyze the effects of U.S. and Canadian policies on lumber markets of major exporting and importing countries. Section 5 presents the empirical analysis and discusses the results. The final section provides conclusions and policy implications.

U.S.–Canadian Lumber Disputes and Relevant Studies

For more than two centuries, lumber trade between the United States and Canada has never been very smooth, and numerous trade wars have erupted since 1789 (Reed). The past 25 years of disputes and negotiations surrounding the U.S.–Canadian lumber trade are classified broadly, based on chronological development, under the titles Lumber I (1981–1985), II (1986–1990), III (1991–2000), and IV (2001 to the present). Reed, Rahman and Devadoss, and Devadoss and Aguiar extensively covered the important developments, negotiations, and outcomes of Lumber I–Lumber IV. Here I present a review of articles that studied these issues.

Lumber I (1981–1985)

U.S. lumber producers submitted a petition to the U.S. International Trade Commission (USITC) alleging that various Canadian forest-management policies allowed Canadian lumber manufacturers to harvest timber from government-owned forest land at a nominal stumpage fee. Since 94% of Canadian forest lands are publicly owned, the Canadian government was able to sell timber at low prices to its lumber companies (Rahman and Devadoss). On the basis of this petition, the USITC investigated Canadian stumpage programs in 1983 and found that the amount of subsidies was *de minimis* and did not amount to countervailable subsidies (U.S. Federal Register 1983). The basis of this conclusion, according to Lindsey, Groombridge, and Loungani, is that Canadian stumpage fees are not specific to any industry, rather they are applied to a wide range of businesses such as lumber and wood products; the veneer, plywood, and building board; pulp and paper; and furniture manufacturing industries. Because the United States does not import all these products, Canadian subsidies are not countervailable.

Lumber II (1986–1990)

Using a modified interpretation of U.S. countervailing duty law based on a 1985 court decision as to the definition of an industry, U.S. lumber producers again petitioned for CVDs on Canadian lumber imports (U.S. Federal Register 1986). This court ruling allowed for treating forest product industries (such as wood product and pulp and paper industries) as a single industry. Based on this industry grouping, the U.S. investigation found that the Canadian stumpage programs amounted to a 15% subsidy and were indeed countervailable. Pursuant to this finding, both countries established a memorandum of understanding (MOU) wherein Canada agreed to impose 15% export duties on its lumber products exported to the United States, and both countries agreed to reduce and/or eliminate the export tax if Canada were to increase stumpage fees for timber. Canada did terminate the export tax, as it increased the stumpage fees.

Boyd and Krutilla employed a spatial equilibrium model to analyze the effects of Canadian export restrictions versus U.S. tariffs on lumber imports from Canada on the regional U.S. lumber markets. They concluded that Canadian producers lose substantially from U.S. tariffs but voluntary export restraints lead to about a 40% gain in Canadian producers' profits. Wear and Lee studied the impact of the MOU and found that U.S. consumers lose, U.S. producers gain, and Canadian export tax revenues are greater than the loss in producers' profits. Myneni, Dorfman, and Ames analyzed the welfare impacts of the 1987–1991 Canadian voluntary 15% lumber export tax and the 6.51% import tax, using a simultaneous equations model of the softwood lumber market. They reported that U.S. consumers experienced a loss of $147 million under the export tax policy, but incurred a loss of only $53 million with the U.S. import tax. U.S. producers gained $109 million and $41 million under the export tax and the import tax policies, respectively. The net U.S. impact of the 15% export tax was estimated to be −$38 million, while the net impact of the 6.51% import tax was estimated to be $118 million, including the U.S. tariff revenue.

Lumber III (1991–2000)

In response to the termination of the export tax by Canada, the U.S. government initiated an investigation in 1991 and found that Canadian forest management programs and log export restrictions warrant imposition of countervailable subsidies. In 1992, the U.S. government initially determined that Canada provided its lumber producers about 14.48% subsidies and imposed a 6.51% *ad valorem* tariff on Canadian lumber imports. In 1996, in an attempt to achieve stability and also to resolve this major bilateral trade irritant, at least temporarily, both countries formulated the Softwood Lumber Agreement (SLA), which aimed at restricting Canadian lumber exports to the United States for 5 years beginning on April 1, 1996. The agreement capped Canadian duty-free exports at 14.7 billion board feet (bbf) of softwood lumber, and additional exports of softwood lumber from Canada faced a substantial amount of incremental specific tariffs.

Boyd, Doroodian, and Abdul-Latif analyzed, using a spatial equilibrium model, the impacts of elimination of tariffs by North American Free Trade Agreement (NAFTA) on lumber flows, prices, and welfare in Canada, Mexico, and the United States. Their results showed that NAFTA may have significant effects on lumber trade flows but welfare effects are very minimal. Zhang analyzed the welfare impacts of the 1996 SLA on U.S. and Canadian lumber markets using aggregate U.S. supply and demand and Canadian export supply. The results showed that, because of the SLA, lumber prices in the United States increased by $59.1/mbf, Canadian exports fell by 11.3 bbf, U.S. production increased by 6.5 bbf, and U.S. consumption decreased by 4.3 bbf. Zhang concluded that U.S. consumers' losses ($12.5 billion) are much larger than U.S. producers' gain ($7.7 billion). In addition, Canadian producers benefited by $2.9 billion from the SLA and the receipts from the export fee are $226 million. Van Kooten used a two-region model

(Canada and the United States) to substantiate that Canadian producers are better off under the SLA export cartel than under free trade or an export/import tax. He purported that Canada should oppose U.S. countervailing duties, as these adversely affect the Canadian lumber industry.

Zhang and Sun used analysis of variance and regression equations to study U.S. lumber price volatility for the period 1980–2000, which covers several episodes of lumber disputes. Their results showed that the variation in U.S. housing starts and the declining availability of federal timber increase the volatility of lumber prices, and nominal (real) prices under the SLA in the 1990s were approximately $7 ($4) higher than in the 1980s. Kinnucan and Zhang developed a partial equilibrium model to determine the welfare effects of the 1996 SLA. They considered an eight-equation model including the rest of the world imports of Canadian lumber and Canadian supply exempt from the SLA export restrictions. Their results suggested that, because of the SLA, Canadian consumers gained by $2.59 billion, producers by $0.45 billion, and the treasury by $0.23 billion. U.S. producers benefited by $7.74 billion, and U.S. consumers lost by $12.48 billion. Further, they showed that Canadian export tax of 0.35 is less than the optimal export tax of 0.77, which will generate the maximum net welfare to Canada.

Lumber IV (2001–Present)

Following the expiration of the SLA in 2001, the U.S. government received petitions from U.S. producers alleging that Canadian lumber producers continue to receive timber subsidies and sell lumber in the United States at prices below the cost of production, injuring the U.S. lumber industry (Canada). Based on its investigation, the USITC estimated a single country-wide subsidy rate of 19.34% and applied it to all Canadian lumber producers and exporters (USDOC). But, in spite of several attempts, no durable solution was reached, and the USITC established a combined countervailing and antidumping duty of 27.2% on Canadian lumber in 2002 (USITC). Canada filed three petitions to the World Trade Organization (WTO) and NAFTA panels challenging the legitimacy of the U.S. countervailing duties (Petition I), antidumping duties (Petition II), and the U.S. claim that lumber imports from Canada injure the U.S. lumber industry (Petition III). The United States requested that the WTO and NAFTA panels reject all Canadian arguments and find that U.S. concerns and actions are legitimate.

In its ruling on Petition I, the WTO found that the Canadian stumpage program does subsidize the lumber industry and adequate cause exists for the United States to countervail, but noted that the United States' use of its market prices as a benchmark to determine the amount of benefit of the stumpage program is incorrect (WTO 2003, 2004). With regard to the antidumping (Petition II), the WTO found that the United States is justified in initiating the dumping investigation, but the U.S. computation of the antidumping tariff was excessive. From the investigation of Petition III, the WTO ruled that the imports from Canada inflicted serious injuries on the U.S. lumber industry. In response to the WTO rulings, the United States reduced its tariff from 27.2% to 21.2% in December 2004.

Adams used the elasticities (for U.S. demand and supply, Canadian export supply, and an aggregate non-Canadian export supply to the United States) from the Forest Service's timber assessment projection model to study the effect of a 27.2% U.S. import tariff on Canadian lumber. His simulation results showed that the tariff leads to a 7% average annual reduction in imports from Canada over the period from 2002 to 2010. This contraction is absorbed by the increments in U.S. supply (3.2%) and imports from non-Canadian supply (5.8%) and by the reduction of U.S. consumption (−0.6%) due to higher U.S. prices (4.5%). Devadoss et al. utilized a spatial equilibrium model to examine the effects of a U.S. tariff of 27.2% on lumber markets. Their results indicate that the United States is successful in protecting its softwood lumber producers by limiting imports from Canada, as U.S. production increases by 8.16% as a result of higher prices. However, the United States cannot ful-

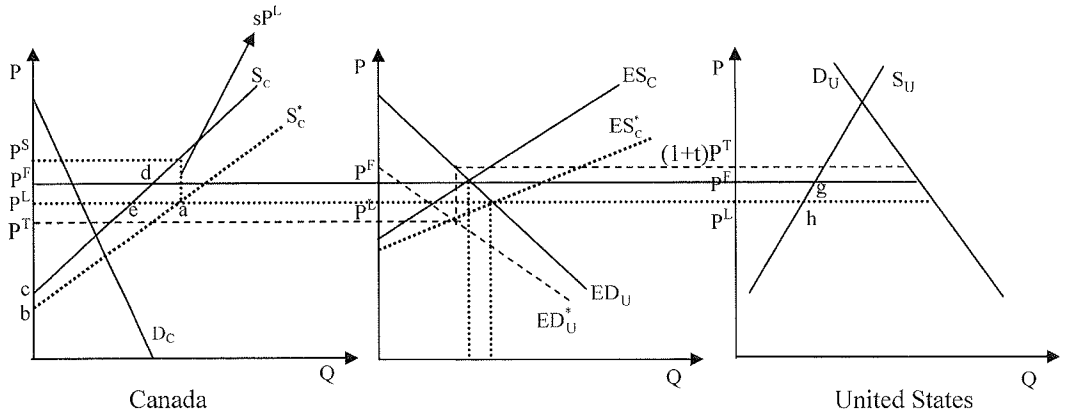

Figure 1. Effects of Canadian Timber Subsidies and U.S. Lumber Tariff

ly accomplish this goal, as non-Canadian exporters (the former Soviet Union, South America, and Scandinavia) fill the void left by the reduced imports from Canada. Even though U.S. softwood lumber producers benefit, the United States incurs overall welfare loss as consumer surplus loss is much higher than producer surplus gain and tariff revenues.

It is important to note that Adams and Devadoss et al. did not incorporate the Canadian timber subsidy in their analysis even though the WTO ruled that Canadian policies do amount to subsidy. Thus, their results do not capture the impact of the subsidy on the U.S. and world lumber market. The focus of this study is therefore to examine the impact of current policy disputes, i.e., Canadian subsidy and U.S. tariff.

Theoretical Analysis

This section develops a U.S.–Canadian trade model to analyze the individual and joint effects of policy instruments (Canadian subsidies and U.S. tariffs) on both countries' lumber markets using a graphical analysis (Figure 1). Canadian domestic lumber supply and demand drawn in the left panel are denoted by S_C and D_C. The excess supply curve originating from Canada is the $ES_C = S_C - D_C$, drawn in the middle panel. U.S. domestic lumber supply and demand depicted in the right panel are denoted by S_U and D_U. The import demand curve emanating from the United States is the $ED_U = D_U - S_U$, drawn in the middle panel. The free-trade price, excluding subsidy and tariff, is given by P^F in Figure 1, which is determined by the intersection of the excess supply and excess demand.

We analyze the impacts of policy intervention sequentially by first considering the effects of subsidy and then the joint effects of subsidy and tariff. Because Canadian stumpage policy is an input subsidy to lumber manufacturers, the Canadian lumber supply function rotates down from S_C to S_C^* by the amount of the *ad valorem* subsidy. This rotates the excess supply curve from ES to ES_C^*, and the new equilibrium is at the intersection of ES_C^* and ED_U with market price in both countries at P^L. Canadian policy increases the exports to the United States, lowers the U.S. prices from P^F to P^L, and reduces the U.S. production from g to h. It is this lower price and the resulting production decline that U.S. producers are concerned about (U.S. producer surplus decreases by area P^FghP^L), though U.S. consumers benefit, as they can buy more lumber at a lower price. In contrast, Canadian policy benefits its lumber producers by lowering the timber price and increasing the producer lumber price ($P^L(1 + s)$) and lumber supply. Canadian producer surplus increases by area ($P^Lab - P^Fdc$) = ($ceab - P^FdeP^L$). Because the Canadian market price decreases to P^L, consumers buy more lumber. As supply increase is more than the demand increase, Can-

ada exports more lumber because of the subsidy.

Next, we analyze the effects of retaliatory tariff imposition by the United States. The U.S. *ad valorem* tariff rotates the excess demand from ED_U to ED_U^*, and the equilibrium is at the intersection of ES_C^* and ED_U^*. The equilibrium U.S. market price is $(1 + t)P^T$. The changes in prices, supply, demand, and trade depend on the magnitude of tariff and subsidies. If the tariff is greater or equal to the subsidy, then U.S. price will be above free-trade price, which will increase supply and decrease demand, resulting in lower imports than the free-trade level. In Canada, market price (P^T) will necessarily fall below the postsubsidy level, which raises the Canadian domestic demand. However, producer price inclusive of subsidy ($(1 + s)P^T$), not shown in the diagram, will be above or below the free-market price. Consequently, supply and exports could be higher or lower than their free-trade levels.

The Empirical Model

We considered a two-country trade model in the theoretical analysis to highlight the effects of Canadian subsidies on the U.S. lumber market and of retaliatory U.S. tariffs on Canadian and U.S. lumber markets. This analysis is consistent with the narrow view of policy decision making in both countries, which ignores the trade flows in a multiregional context. For instance, as was found out by the lumber producers and consumers in both countries, these policy interventions impact not just the lumber markets in these two countries but also the other exporters' and importers' markets. For example, Canada looked to export to other importers, and other exporters grabbed the market share in the United States. To study these multiregional interrelationships, we develop a world spatial equilibrium model (SEM), which is the subject of this section.

To understand the SEM, consider the following inverse demand and supply functions:

$$(1) \quad p_i^d = a_i - b_i y_i, \qquad i = 1, \ldots, n$$

$$(2) \quad p_i^s = c_i + d_i x_i, \qquad i = 1, \ldots, n$$

where a, b, c, and d are coefficients, p_i^d is regional demand price, y_i is quantity demanded, p_i^s is regional supply price, and x_i is quantity supplied in the ith region. The demand and supply shifters are subsumed into their respective intercepts. The algebraic framework of the SEM based on the above demand and supply equations is given as

$$(3) \quad \max_{y_i, x_i, x_{ij}} \sum_{i=1}^{n} (a_i - b_i y_i) y_i - \sum_{i}^{n} (c_i + d_i x_i) x_i + \sum_{i}^{n} s_i \rho_i^s x_i - \sum_{i,j}^{n} x_{ij} t_{ij} - \sum_{i,j}^{n} x_{ij} (\rho_j^d - \rho_i^s) + \sum_{i,j}^{n} x_{ij} \left(\frac{\rho_j^d}{1 + \delta_{ij}} - \rho_i^s \right),$$

subject to

$$(4) \quad \sum_{i=1} x_{ij} \geq y_j, \qquad \forall\ j,$$

$$(5) \quad \sum_{j=1} x_{ij} \leq x_i, \qquad \forall\ i,$$

$$(6) \quad p_i^d \leq \rho_i^d, \qquad \forall\ i,$$

$$(7) \quad p_i^s - s_i \rho_i^s \geq \rho_i^s, \qquad \forall\ i,$$

$$(8) \quad (1 + \delta_{ij})(\rho_i^s + t_{ij}) \geq \rho_j^d, \qquad \forall\ ij,$$

$$(9) \quad y_i, x_i, x_{ij} \geq 0 \qquad \forall\ ij,$$

where x_{ij} is quantity exported from region i to j, t_{ij} is per-unit transport cost from region i to j, δ_{ij} is the *ad valorem* import tariff rate imposed by region j on imports from region i, s_i is the *ad valorem* production subsidy rate in country i, ρ_i^d is market demand price, and ρ_i^s is market supply price. It is important to note the difference between regional price (p) and market price (ρ) as clarified by Takayama and Judge (pp. 135–137). At the optimum, for an interior solution, $p_i^d = \rho_i^d$, and $p_i^s = \rho_i^s$. However, for corner solutions, market prices may differ from regional prices. For example, quantity demanded is zero, if regional demand price (consumers' willingness to pay) is less than the market demand price, and quantity supplied is zero if regional supply price (producers' asking price) is higher than market supply price.

The SEM employs a nonlinear optimization to maximize the net social monetary gain

function, Equation (3), subject to a set of linear constraints, Equations (4)–(9). The net social monetary gain function, instead of quasi-welfare function, is used as the objective function because the *ad valorem* import tariffs and subsidies are modeled (Chapter 13 in Takayama and Judge), and, in this formulation, primal and dual problems are combined. If an *ad valorem* tariff is incorporated in a quasi-welfare function, the optimization does not meet the intergrability condition. That is, the derivative of a quasi-welfare function with respect to the demand and supply does not produce, respectively, demand and supply functions. Consequently, solutions may not be globally optimal. However, if the *ad valorem* tariff is incorporated in the net social monetary gain function, the solution yields global optimum. The net social monetary gain is the sum of all the countries' total sales revenues $[\Sigma_{i=1}^{n} (a_i - b_i y_i) y_i]$ minus total producers' revenues $[\Sigma_i^n (c_i + d_i x_i) x_i]$, plus subsidy receipts $(\Sigma_i^n s_i \rho_i^s x_i)$, minus transportation costs $(\Sigma_{i,j} x_{ij} t_{ij})$, and minus net societal loss arising from import tariffs $[-\Sigma_{i,j} x_{ij}(\rho_j^d - \rho_i^s) + \Sigma_{i,j} x_{ij}(\rho_j^d[1/(1 + \delta_{ij})] - \rho_i^s)]$. Equation (4) states that the total quantity shipped into a region is greater than or equal to the quantity demanded. Equation (5) entails that total shipments from a region are equal to or less than the quantity supplied in that region. Equation (6) constrains regional demand price to be less than or equal to market demand price. Equation (7) entails that regional supply price minus subsidy is greater than or equal to market supply price. Equation (8) states that market supply price in i plus transportation costs adjusted for import tariffs is greater than or equal to market demand price in j. The last constraint (Equation [9]) states that demand, supply, and shipments are nonnegative. The optimization problem is solved using the nonlinear technique in the GAMS software.

Analysis

For this study, we include major softwood lumber exporters and importers in the world. The exporting regions, abbreviations in parentheses, cover the U.S. south (USS), Canada (CAN), the Former Soviet Union (FSU), Scandinavia (SCA), South America (SAM), New Zealand and Australia (NZA), and the importing regions are the U.S. north (USN), the U.S. west (USW), the European Union (EU), Japan (JAP), China (CHI), and Mexico (MEX). Since, in addition to Canada, the United States is the central focus of this study, and following the U.S. Department of Agriculture classification for forest-product analysis, the United States is divided into three regions: the USN, the USW, and the USS. The USN, because of the dense population and limited forest land endowments, is a major importer and lucrative market, and hence, other regions compete intensively to seize market share in the USN. The USW was a major exporter of lumber until recently, but the Endangered Species Act and dwindling forest lands have limited the structural production and, with explosive population growth in California, Nevada, and Arizona, the USW has become a net importer in recent years. The USS is a net exporting region, as the lumber supply from both the public and private forest land exceeds the demand. The division of the United States into these three distinct but important regions is vital for better understanding of the regional effects of U.S.–Canadian disputes.

Data

Supply and demand data was obtained from the Food and Agriculture Organization of the United Nations (FAO). Macroeconomic data were collected from the International Monetary Fund (IMF) and Statistics Canada online databases. Wage data were obtained from the International Labor Organization (ILO). The time series data used for econometric estimation of demand and supply cover the period 1971–2001. Several transportation modes, such as trains, trucks, and ships, are used to carry softwood lumber between regions, particularly in the United States. First, per-unit transportation cost (per cubic meter and per nautical mile) is computed, and second, transportation cost between two ports is computed by multiplying the distance between ports and per-unit cost. The distance information was ob-

Table 1. Demand and Supply Equations Utilized in the SEM

Region	Demand		Supply	
U.S. North	$p = 1{,}811.33 - 54.12y$	$R^2 = 0.94$	$p = -96.42 + 90.94x$	$R^2 = 0.72$
U.S. West	$p = 758.97 - 19.92y$	$R^2 = 0.78$	$p = -166.46 + 15.27x$	$R^2 = 0.78$
U.S. South	$p = 1{,}151.86 - 31.74y$	$R^2 = 0.89$	$p = -241.39 + 12.95x$	$R^2 = 0.72$
Canada	$p = 288.10 - 5.02y$	$R^2 = 0.68$	$p = -558.98 + 11.93x$	$R^2 = 0.78$
Former Soviet Union	$p = 548.48 - 6.16y$	$R^2 = 0.60$	$p = -1{,}492.62 + 24.23x$	$R^2 = 0.96$
Scandinavia	$p = 419.24 - 20.88y$	$R^2 = 0.74$	$p = -235.76 + 13.33x$	$R^2 = 0.81$
South America	$p = 430.46 - 19.43y$	$R^2 = 0.83$	$p = -335.25 + 33.33x$	$R^2 = 0.92$
European Union	$p = 733.51 - 9.38y$	$R^2 = 0.73$	$p = -1{,}766.62 + 75.05x$	$R^2 = 0.94$
Japan	$p = 1{,}763.55 - 56.70y$	$R^2 = 0.68$	$p = -110.61 + 24.41x$	$R^2 = 0.85$
China	$p = 3{,}985.28 - 216.83y$	$R^2 = 0.57$	$p = -13{,}129.63 + 965.25x$	$R^2 = 0.57$
Mexico	$p = 4{,}161.70 - 1{,}270.79y$	$R^2 = 0.32$	$p = -11{,}858.92 + 4{,}153.10x$	$R^2 = 0.80$
New Zealand and Australia	$p = 2{,}140.35 - 493.34y$	$R^2 = 0.75$	$p = -282.05 + 106.43x$	$R^2 = 0.85$

tained from the web pages: "www.distances.com" and "www.indo.com/distance." Railway distance is used to compute the distance between Canada and U.S. regions. Per-unit transport cost was calculated using free-on-board (FOB) softwood lumber export values and cost-insurance-freight (CIF) softwood lumber import values. FOB values were subtracted from CIF values to get the transportation cost of total imports of softwood lumber for every year. Next, the total transportation cost was divided by the total quantity of softwood lumber imports and the distance between the trading partners to obtain the-per unit transportation cost. Finally, multiplying per-unit transportation cost and the distance between a pair of ports yields the transportation cost between regions.

Demand and Supply Equations

To run the SEM, we need to estimate demand and supply functions. The demand was estimated as a function of lumber price, gross domestic product, housing starts, interest rates, and other relevant demand shifters specific to the region. The supply was estimated as a function of lumber prices, log prices, and other input (labor and electricity) prices. Because we need only simple demand and supply functions as given in Equations (1) and (2), nonprice explanatory variables and their coefficients in the estimated equations were summed into the intercept terms. The resulting equations were inverted to express prices as a function of quantities. These equations, reported in Table 1, were used in the SEM. The elasticities of lumber supply in three U.S. regions range from 0.31 to 0.62 and U.S. demand elasticities range from 0.01 to 0.1. These elasticity values are comparable with those used by Adams, found in Myneni, Dorfman, and Ames, and reported by other empirical studies as summarized by Zhang. Canadian lumber demand and supply elasticities are -0.11 and 0.21, which are within the range of empirical findings by Williamson, Hauer, and Luckert; Adams and Haynes; and Bernard et al. For other regions, demand and supply elasticities are also inelastic.

Policy Simulations

We conducted several policy analyses using the SEM to examine the effects of Canadian domestic and U.S. trade-policy interventions. As described previously, the WTO panel did rule that Canadian stumpage policy is indeed an input subsidy to the lumber producers, though the panel did not specifically impute the amount of subsidies. The U.S. government, however, calculated that the Canadian stumpage subsidy amounts to 19.34% and applied this *ad valorem* subsidy as a single coun-

trywide rate to all Canadian lumber producers and exporters (USDOC). Because this subsidy was determined by the United States and because Canada strongly refuted this amount, we treat this subsidy as the upper limit. We consider three levels of subsidies for the analysis: 0% subsidy to examine the free-market policy, 10% subsidy as a midrange level that is palatable to Canada, and the upper limit 19.34% subsidy as computed by the United States. The United States initially imposed a 27.2% tariff in May 2002, but based on WTO rulings that this tariff was excessive, it reduced the tariff to 21.2% in December 2004. We consider three levels of tariff rates: 0% tariff to analyze the effects of free trade, 21.2% tariff to capture the impacts of current U.S. policy, and 27.2% tariff to study the impacts of U.S. policy between May 2002 and December 2004. In all, we conducted nine alternate scenarios: three subsidy policies times three tariff policies as shown in the following table.

		Tariffs		
		0%	21.2%	27.2%
Subsidies	0%	Scenario 1	Scenario 4	Scenario 7
	10%	Scenario 2	Scenario 5	Scenario 8
	19.34%	Scenario 3	Scenario 6	Scenario 9

Once these nine scenarios were run, we compared any pair of scenarios to examine the impacts of different levels of subsidies and tariffs on all the endogenous variables (prices, supply, demand, bilateral trade flow) and also computed welfare measures, such as producer surplus and consumer surplus.

Results and Discussion

We provide a detailed analysis and report the results of a comparison of scenario 2 (10% subsidy and 0% tariff) versus scenario 1 (free-market policies of no subsidy and no tariff) to examine the effect of subsidies and a comparison of scenario 5 (10% subsidy and 21.2% tariff) versus scenario 1 (free-market policies) to analyze the combined effect of subsidy and tariff.[2] Justification for the in-depth analysis of these two comparisons is that, because the WTO concluded that the U.S. determination of a Canadian subsidy at 19.34% is excessive, a moderate level of a 10% subsidy is a reasonable level, and the United States, in response to the WTO rulings, has reduced its tariff to the 21.2% that is currently in existence. Table 2 reports the results of the policy impacts of scenarios 2 versus 1 (under the heading Subsidy) and scenarios 5 versus 1 (under the heading Subsidy and Tariff) on prices, supply, demand, and total volume of trade; Table 3 presents bilateral trade flows for subsidy analysis; Table 4 provides bilateral trade flows for subsidy and tariff analysis; and Table 5 gives the welfare measures. The bilateral trade flows in Tables 3 and 4 are read as exports from the countries listed in the first column to countries listed in the top row or as imports by the countries in the top row from the countries in the first column.

The 10% Canadian subsidy has only modest impact on world markets, as can be seen from the price, supply, demand, total trade volume, and trade-flow changes. As a result of this subsidy, Canadian exports to the USN and USW increase by 0.74% and 2.67%, respectively, and displace USS exports to the USN (Table 3). These increased exports by Canada decrease prices in the United States by $1.31, which results in only a small reduction in supply and expansion in demand (Table 2). Because of lower prices, producer surplus falls and consumer surplus rises in all three U.S. regions, and the net welfare goes up by $39.63 million (Table 5). Because these changes are fairly small, we also examined the effects of a Canadian subsidy of 19.34%, the U.S.-determined level of subsidy (comparison of scenarios 3 versus 1). The impacts (not reported) are only about twice larger than the impacts of a 10% subsidy. Hence, these smaller impacts even at the higher subsidy level of 19.34% suggest that the U.S. retaliatory tariff of 27.2% is too high and casts doubt whether

[2] If one is interested in ascertaining the effects of tariff only, the relevant comparison is scenario 5 versus 2 (for a subsidy rate of 10%).

Table 2. Impacts of Canadian and U.S. Policies on Prices, Supply, Demand, and Total Trade in the World Softwood Lumber Market[a]

		Price		Supply		Demand		Total Trade	
Region	M/X[b]	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff
USN	M	$−1.31	$25.90	−0.01	0.28	0.02	−0.48	0.04	−0.76
		−0.69%	13.56%	−0.46%	9.01%	0.08%	−1.60%	0.14%	−2.85%
USW	M	$−1.31	$24.83	−0.09	1.63	0.07	−1.25	0.15	−2.87
		−0.70%	13.35%	−0.37%	7.04%	0.23%	−4.33%	2.67%	−50.60%
USS	X	$−1.31	$25.90	−0.10	2.00	0.04	−0.82	−0.14	2.82
		0.71%	14.06%	−0.31%	6.09%	0.14%	−2.68%	−5.97%	118.03%
CAN	X	$1.31	$−12.05	1.39	0.40	0.26	2.40	1.13	−2.00
		−0.73%	−6.69%	2.24%	0.64%	1.21%	11.15%	2.79%	−5.00%
FSU	X	$−1.31	$−12.05	−0.05	−0.50	0.21	1.96	−0.27	−2.46
		−0.64%	−5.90%	−0.08%	−0.71%	0.38%	3.50%	−1.89%	−17.42%
SCA	X	$−1.31	$−12.05	−0.10	−0.90	0.06	0.58	−0.16	−1.48
		−0.66%	−6.08%	−0.30%	−2.78%	0.59%	5.45%	−0.73%	−6.75%
SAM	X	$−1.31	$22.22	−0.04	0.67	0.07	−1.14	−0.11	1.81
		−0.78%	13.24%	−0.26%	4.42%	0.50%	−8.46%	−6.78%	114.90%
EUU	M	$−1.31	$−12.05	−0.02	−0.16	0.14	1.28	0.16	1.45
		−0.65%	−6.00%	−0.07%	−0.61%	0.25%	2.26%	0.51%	4.73%
JAP	M	$−1.33	$−12.20	−0.05	−0.50	0.02	0.22	0.08	0.71
		−0.62%	−5.71%	−0.41%	−3.76%	0.09%	0.79%	0.55%	5.09%
CHI	M	$−1.35	$−12.41	−0.001	−0.01	0.01	0.06	0.01	0.07
		−0.61%	−5.62%	−0.01%	−0.09%	0.04%	0.33%	0.22%	1.99%
MEX	M	$−1.51	$4.04	−0.00	0.001	0.00	−0.003	0.002	−0.004
		−0.70%	1.86%	−0.01%	0.03%	0.04%	−0.10%	0.79%	−2.12%
NZA	X	$−1.31	$−8.49	−0.01	−0.80	0.00	0.02	−0.01	−0.10
		−0.74%	−4.77%	−0.28%	−1.85%	0.07%	0.43%	−4.35%	−28.15%

[a] The top values are the differences between scenarios in one million cubic meters for supply, demand, and trade, and in U.S. dollars for price. Comparison of scenarios 2 and 1 is reported under the heading Subsidy and scenarios 5 and 1 under Subsidy and Tariff.

[b] M if it is an importing country and X if it is an exporting country.

Table 3. Impacts of Canadian Subsidies on Bilateral Trade Flows[a]

	USN	USW	USS	CAN	FSU	SCA	SAM	EUU	JAP	CHI	MEX	NZA
USN	−0.01 −0.46%											
USW		−0.09 −0.37%										
USS	−0.14 −6.58%		0.04 0.14%								0.002 0.79%	
CAN	0.18 0.74%	0.15 2.67%		0.26 1.21%				0.43 6.07%	0.37 11.69%			
FSU					0.21 0.38%				−0.29 −2.66%	0.02 0.71%		
SCA						0.06 0.59%		−0.16 −0.73%				
SAM							0.07 0.50%	−0.11 −6.78%				
EUU								−0.02 −0.07%				
JAP									−0.05 −0.41%			
CHI										−0.001 −0.01%		
MEX											−0.00 −0.01%	
NZA										−0.01 −4.35%		0.003 0.07%

[a] The top values are the differences of trade flows between scenarios 2 and 1 in one million cubic meters.

Table 4. Impacts of Canadian Subsidies and U.S. Tariff on Bilateral Trade Flows[a]

	USN	USW	USS	CAN	FSU	SCA	SAM	EUU	JAP	CHI	MEX	NZA
USN	0.28 9.01%											
USW		1.63 7.04%										
USS	3.01 137.54%		−0.82 −2.68%								−0.20 −100%	
CAN	−7.16 −29.13%	−3.12 −54.96%		2.40 11.15%				4.50 64.23%	3.58 114.09%		0.19 NM[b]	
FSU					1.96 3.50%				−2.87 −26.30%	0.41 13.01%		
SCA						0.58 5.45%		−1.48 −6.75%				
SAM	3.39 NM[b]						−1.14 −8.46%	−1.58 −100%				
EUU								−0.16 −0.61%				
JAP									−0.50 −3.76%			
CHI										−0.01 −0.09%		
MEX											0.001 0.03%	
NZA		0.25 NM[b]								−0.34 −100%		0.02 0.43%

[a] The top values are the differences of trade flows between scenarios 5 and 1 in one million cubic meters.

[b] NM means new imports; that is, because imports were zero in the base scenario, it is not possible to compute the percentage change.

Table 5. Welfare Analysis of Canadian and U.S. Policies on the World Softwood Lumber Market (million U.S. dollars)

	Producer surplus		Consumer Surplus		Tariff Revenue/ Subsidy Cost		Net Welfare	
Region	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff	Subsidy	Subsidy and Tariff
U.S. North	−4.14	85.59	39.27	−769.36		620.58	35.13	−63.19
U.S. West	−30.20	593.33	37.74	−698.64		91.07	7.54	−14.24
U.S. South	−43.03	877.51	40.00	−779.20			−3.04	98.31
U.S. Total	−77.37	1,556.43	117.01	−2,247.20		711.65	39.63	20.88
Canada	474.59	−225.58	28.39	273.90	−1,131.90	−1,047.23	−628.91	−998.91
Former Soviet Union	−91.76	−840.97	73.46	685.87			−18.30	−155.10
Scandinavia	−42.62	−386.95	13.93	131.17			−28.69	−255.78
South America	−19.76	342.80	17.76	−287.67			−2.00	55.13
European Union	−34.36	−315.04	74.51	691.95			40.15	376.91
Japan	−17.59	−159.01	36.28	334.76			18.69	175.75
China	−18.68	−171.63	23.45	215.90			4.77	44.27
Mexico	−4.40	11.75	4.70	−12.53			0.30	−0.78
New Zealand and Australia	−5.66	−36.35	5.22	33.83			−0.44	−2.51
Total	162.40	−224.55	394.71	−180.02			−514.53	−682.30

the United States is overzealous in protecting its producers.

Price, quantity, and welfare impacts on other countries are also minimal. Exceptions to these results are impacts within Canada. Canadian supply and exports increase by 2.24% and 2.79%, respectively. Canadian producers gain, including the subsidy receipts, by $474.59 million, and consumers also benefit because of lower prices. However, the net welfare is a large negative because of the huge subsidy cost ($1.13 billion). Next, we discuss in detail the combined effects of subsidy and tariff.

The USN is a major net importer of softwood lumber and most of its exports come from Canada because of the contiguous location. As a result of the U.S. tariff, producers in this region benefit as prices in the USN rise by 13.56% (Table 2). In response to the price increases, lumber supply goes up by 9.01% and demand falls by 1.60%. The U.S. protective policy reduces the USN's total imports by 2.85%, and more importantly, the USN also reallocates its imports from Canada to the USS and SAM (refer to Table 4 for bilateral trade-flow results). Under free trade, no imports were forthcoming from SAM to the USN because all the imports were coming from Canada due to adjacent locality. However, after U.S. imposition of tariffs, SAM does export to the USN, and the USS expands exports to the USN to offset the reduction in imports from Canada. Specifically, imports from Canada fall by 29.13%, imports from the USS rise by 137.54% and from SAM by 3.9 million cubic meters (mcm). Because the USN is not a major lumber producer, rather a large importer, producers gain only modest amounts of producer surplus and consumers are economically hurt as evidenced from the consumer surplus losses of $769.36 million (Table 5).

The USW is also a net importing region. Because of the U.S. tariff, prices in the USW rise by 13.35%, leading to a supply increase of 7.04% and demand decrease of 4.33%. The USW's imports decline significantly (50.60%) because imports from Canada are curtailed by 54.96%. Part of these declining imports is offset by the increased supply in this region (i.e., exports to itself go up by 7.04%) and by a marginal rise in imports from NZA. The USW

experiences significant producer surplus increases ($593.33 million) and consumer surplus losses ($698.64 million).

It is important to observe that, if a U.S. tariff of 21.2% were to counterbalance the Canadian subsidies of 10% exactly, U.S. imports from Canada would not have declined. This implies either the U.S. tariff of 21.2% is high (as Canada contends) or the midrange Canadian subsidy of 10% is too small, which is what the United States would claim because its subsidy computation yielded 19.34%. In addition, from the trade theory, we can garner that subsidy effects are smaller than tariff effects. The intuition for this result is that the subsidy influences the production and does not distort the consumption, and therefore, the trade effect of subsidy is mitigated due to increased consumption. In contrast, the tariff impedes both production and consumption, and hence, leads to larger effects. Thus, any tariff aimed at exactly counterbalancing the adverse effects of the production subsidy has to be smaller than the subsidy. Canada has filed a petition with the WTO to impose sanctions against the United States because Canada considers the U.S. tariff of 21.2% still too high.

The USS is a net exporter of softwood lumber. In response to the U.S. policies, prices in this region increase by 14.06%. As a result of this higher price, quantity supplied rises by 6.09% and quantity demanded declines by 2.68%. U.S. policies of limiting lumber imports from Canada augment the USS's exports to the USN and help to seize the market share in this lucrative lumber market, and the USS also exports to MEX. Because the USS is a major producer and also an exporter, the producer surplus increase is the largest among the three U.S. regions. Consumers in the USS lose the most ($779.20 million) because prices in this region rise more as the USS is crowding out its domestic market by expanding its exports to the USN.

When producer and consumer surpluses are added together, the importing regions of the United States incur losses, as the consumer surplus loss is more than the producer surplus gain. Once we include the tariff revenues, the net welfare gain is a smaller negative for the USN and USW. This shows that the USN and USW are large importing regions and able to minimize the losses by depressing the world market prices through tariff, a la the large importing country-optimal tariff argument. Because the USS is an exporting region, producer surplus gains offset consumer surplus losses, resulting in positive net gains.

Canada is the leading exporter of softwood lumber. Canadian market prices decline by 6.69%, and Canadian demand increases by 11.15%. But the Canadian supply price (i.e., market price plus subsidy) rises, which augments the supply by 0.64%. Because of the U.S. import restrictions, Canadian exports to the USN and USW decline steeply, 29.13% and 54.96%, respectively. As a result, Canada diverts its exports to itself (11.15%), the EU (64.23%), JAP (114.09%), and MEX. The EU and JAP benefit from the U.S. policies, as they receive cheaper imports from Canada. Canadian lumber producers lose by $225.58 million, which includes subsidy payment of $1.05 billion. Thus, without the subsidy, Canadian producers will incur even a bigger loss. As Canada's total exports decline and domestic supply rises because of the subsidy, market prices fall, benefiting Canadian consumers by $273.90 million. The overall Canadian net welfare inclusive of the subsidy cost is a large negative ($998.91 million).

The FSU is also a net exporter of softwood lumber. Neighboring countries, CHI and JAP, are the big export markets for FSU lumber. Because the FSU has to compete with Canada after the U.S. policy, it loses the market share to Canada in JAP and its prices decline by 5.90%. In response to these lower prices, its supply contracts. The FSU's lost export sales in JAP are now diverted to the domestic market (3.50%) and CHI (3.46%). Producers in the FSU lose, consumers gain, and the overall net welfare in the FSU is negative.

SCA, another net exporter of softwood lumber, is impacted by the U.S. and Canadian policies. Most of SCA's exports under free trade go to its neighbor, the EU, because of the adjoining location. However, after the policy interventions by the United States and Canada, SCA loses its market share (6.75%)

in the EU to Canada and absorbs the excess supply by itself (5.45%). The lost market sale in the EU leads to a price decline of 6.08%; consequently, Scandinavian supply contracts and demand expands. Producer surplus losses outweigh consumer surplus gains, resulting in negative net welfare.

SAM exports to the EU under free-market policies. However, after trade distortions by the United States, it switches some of its exports from the EU to the USN by taking advantage of the void left by the loss of Canadian imports and transport-cost savings due to closer proximity to the USN than to the EU. The increase in exports to the USN (3.39 mcm) is more than the decline in exports to the EU (1.58 mcm). As a result, prices in SAM rise by 13.24%, which leads to a higher supply (4.42%) and lower domestic demand (8.46%). Lumber producers in SAM benefit by $342.80 million and consumers are hurt.

The EU is a large net importer of softwood lumber. Its major suppliers are SCA, Canada, and SAM. As the U.S. policy causes Canada to increase export sales to the EU, SCA and SAM reduce their exports to the EU. Because the additional imports from Canada are more than the imports lost from SCA and SAM, prices in the EU decline by 6.00%, which reduces the supply and increases the demand. JAP is also a net importer of softwood lumber. Its imports come from Canada and the FSU. As a result of the U.S. policy, Canada augments its exports to JAP (114.09%) and displaces FSU's exports, which decline by 26.30%. Because the additional exports from Canada are significantly higher than the lost imports from the FSU, prices in JAP fall by 5.71%. Consequently, Japanese supply decreases and demand increases.

MEX is an importer of softwood lumber, primarily importing from the USS under free trade because of the contiguous location. Because the U.S. tariff on Canadian imports causes the USS to divert its exports to the USN, Mexican imports from the USS are now replaced, almost one-to-one, by imports from Canada. CHI is becoming a major importer of lumber because of its continued strong economic growth. Under free trade, CHI was importing from its neighbor, the FSU, and NZA. After the U.S. tariff, CHI increases its imports from the FSU as the FSU has to reorient its exports from JAP to CHI. NZA now exports less to CHI, as they are selling to the more lucrative USW market.

Producer surplus in the importing countries (the EU, JAP, and CHI) declines and consumer surplus increases because low-priced imports from Canada are flooding their markets. These three importing countries experience net welfare gains. The net welfare changes in MEX and NZA are very small.

Summary and Conclusion

As global trade in lumber is growing and highly interconnected, U.S. and Canadian policies not only have implications for the producers and consumers in these two countries but also in other countries. Consequently, U.S. and Canadian policies cause reallocation of bilateral trade among various countries. In particular, other exporters grab the market share lost by Canada in the USN and USW, while Canada augments its exports to other importing countries. As a result, though the United States is able to protect its producers from the Canadian oversupply, it cannot fully safeguard its producers from other exporters. U.S. policies hurt its consumers the most. In spite of U.S. import restrictions, Canadian lumber producers are able to expand their lumber production because of timber subsidies. U.S. consumers will stand to gain from a permanent free-market solution, though they benefit more under the Canadian subsidy and no U.S. tariff scenario. Stated differently, U.S. tariffs hurt the consumers and, such a policy, as termed by Myneni, Dorfman, and Ames, is a "beggar thy consumer trade policy." U.S. tariffs also harm lumber wholesalers and building-supply stores, who have been opposing U.S. policy. In contrast, Canadian subsidy policy is a drain on the treasury and resource owners.

The results show that the U.S. and Canadian policies harm the lumber producers in the exporting countries—the FSU and SCA—as Canada diverts its exports from the United States to other importing countries—the EU

and JAP—and seizes the market share from the FSU and SCA. One exception to this result is that producers in SAM benefit, as SAM captures the Canadian market share loss in the USN by switching its exports from the EU to the USN. Because of the Canadian and U.S. policies, consumers in the major importing countries (the EU, JAP, and CHI) gain, as they can buy lumber at a lower price. These results are clearly borne out by the producer- and consumer-surplus measures as well.

Because Canada is the largest exporter, it has an incentive to maximize its national welfare by exercising its market power and imposing the optimal export tariff, as highlighted by Kinnucan and Zhang. Similarly, the United States, as a large importing country, can exercise its market power and maximize its welfare through optimal import tariff. Such policies have to withstand the scrutiny of the WTO. However, free-market policies will facilitate more efficient production and consumption decisions in both countries. Canada's unwillingness to phase out its subsidy and the U.S. intransigence to eliminate its tariff, even after the WTO's rulings, only prolongs the lumber litigation without any closure and continues to remain a contentious clash between the two countries. Currently, Canada has appealed to the WTO to impose sanctions against the United States for not reducing the tariff sufficiently. The WTO has established a panel to assess the U.S. compliance to its 2004 ruling that the U.S. tariff is excessive.

[Received June 2005; Accepted October 2005.]

References

Adams, D.M. "Market and Resource Impacts of a Canadian Lumber Tariff." *Journal of Forestry* 101(2003):48–52.

Adams, D.M., and R.W. Haynes. *The 1993 Timber Assessment Market Model: Structure, Projections and Policy Simulation.* U. S. Department of Agricultural Forest Service, General Technical Report PNW-GTR-368, 1996.

Bernard, J.T., L. Bouthillier, J. Catimel, and N. Gelinas. "An Integrated Model of Quebec-Ontario-U.S. Northeast Softwood Lumber Markets." *American Journal of Agricultural Economics* 79(1997):987–1000.

Boyd, R.G., K. Doroodian, and S. Abdul-Latif. "The Effects of Tariff Removals on the North American Lumber Trade." *Canadian Journal of Agricultural Economics* 41(1993):311–28.

Boyd, R.G., and K. Krutilla. "The Welfare Impacts of U.S. Trade Restrictions against the Canadian Softwood Lumber Industry: A Spatial Equilibrium Analysis." *Canadian Journal of Economics* 20(1987):17–35.

Canada Department of Foreign Affairs and International Trade. *Softwood Lumber Trade Actions: Chronology & Background.* Internet site: http://www.daift-maeci.gc.ca/. . .TradeActionsBackground-e.html (Accessed November 20, 2001).

Devadoss, S., and A. Aguiar. "Recent Developments in the U.S.–Canadian Softwood Lumber Disputes," *International Law and Trade Policy* 5(2)(2004):168–94.

Devadoss, S., A.H. Aguiar, S.R. Shook, and J. Araji. "A Spatial Equilibrium Analysis of U.S.–Canadian Disputes on the World Softwood Lumber Market." *Canadian Journal of Agricultural Economics* 53(2005):177–192.

Food and Agriculture Organization of United Nations [FAO]. *Statistics Database.* Internet site: http://apps.fao.org (Accessed October 10, 2003).

International Labor Organization. *Laborstat.* Internet site: http://laborsta.ilo.org (Accessed October 20, 2003).

International Monetary Fund. *International Finance Statistics Yearbook.* Washington, DC, 2003.

Kinnucan, H., and D. Zhang. "Incidence of the 1996 Canada-U.S. Softwood Lumber Agreement and Optimal Export Tax." *Canadian Journal of Agricultural Economics* 52(2004):73–88.

Lindsey, B., M.A. Groombridge, and P. Loungani. *Nailing the Homeowner: The Economic Impact of Trade Protection of the Softwood Lumber Industry.* Washington, DC: CATO Institute, 2000.

Myneni, G., J.H. Dorfman, and G.C.W. Ames. "Welfare Impacts of the Canada-US Softwood Lumber Trade Dispute: Beggar Thy Consumer Trade Policy." *Canadian Journal of Agricultural Economics* 42(1994):261–71.

Rahman, S., and S. Devadoss. "Economics of the U.S.–Canada Softwood Lumber Dispute: A Historical Perspective." *The Estey Centre Journal of International Law and Trade Policy* (2002): 29–45.

Random Lengths, Inc. *2003 Yearbook: Forest*

Product Market Prices and Statistics. Portland, OR: Random Lengths Publications, Inc., 2004.

Reed, L. *Two Centuries of Softwood Lumber War Between Canada and the United States.* Prepared for The Free Trade Lumber Council. Internet site: http://www.ftlc.org/index.cfm?Section=2&DownloadID=37 (Accessed March 20, 2005).

Takayama, T., and G. Judge. *Spatial and Temporal Price Allocation Models.* Amsterdam: North Holland Publishing Co., 1971.

U.S. Department of Commerce [USDOC]. Internet site: http://ia.ita.doc.gov/lumber/02-7849.txt (Accessed November 12, 2002).

U.S. Federal Register. *Certain Softwood Lumber Products from Canada.* 24159, (Final Determination). Washington, DC, May 31, 1983.

U.S. Federal Register. *Certain Softwood Lumber from Canada.* No. 51,37,453,37,458–63. Washington, DC, 1986.

U.S. International Trade Commission [USITC]. Investigations Nos. 701-TA-414 and 731-TA-928, Washington, DC, 2001.

Van Kooten, G.C. "Economic Analysis of the Canada-United States Softwood Lumber Dispute: Playing the Quota Game." *Forest Science* 48(4)(2001):712–21.

Wear, D.N., and K.J. Lee. "U.S. Policy and Canadian Lumber Effects of the 1986 Memorandum of Understanding." *Forest Science* 39(4)(1993): 799–815.

Williamson, T., G. Hauer, and M.K. Luckert. "A Restricted Leontief Profit Function Model of the Canadian Lumber and Chip Industry: Potential Impacts of US Countervail and Kyoto Ratification." *Canadian Journal of Forest Research* 34(2004):1833–44.

World Trade Organization [WTO]. *United States—Preliminary Determinations with Respect to Certain Softwood Lumber from Canada,* Panel Report, WT/DS236/R, 2002.

World Trade Organization [WTO]. *United States—Final Countervailing Duty Determinations with Respect to Certain Softwood Lumber from Canada.* DS257, 2003.

World Trade Organization [WTO]. *United States—Final Countervailing Duty Determinations with Respect to Certain Softwood Lumber from Canada.* DS257/AB/R. 2004.

Zhang, D. "Welfare Impacts of the 1996 U.S.–Canada Softwood Lumber Agreements." *Canadian Journal of Forest Research* 31(11)(2001):1958–67.

Zhang, D., and C. Sun. "U.S.–Canada Trade Disputes and Softwood Lumber Price Volatility." *Forest Products Journal* 51(4)(2001):21–27.