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An Evaluation of Canadian and U.S. Policies of Log and Lumber Markets

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The recent lumber trade war between Canada and the United States deals with Canadian stumpage policies, Canada's log export controls, and U.S. retaliatory duty. This study determines the appropriate level of U.S. countervailing duty (CVD) by employing a vertically interrelated log–lumber model. The theoretical results show that the U.S. CVD can be greater (will be less) than the Canadian subsidy for a vertically related log–lumber market (for lumber market only). Empirical results support the theoretical findings in that the U.S. CVD for the log–lumber market (lumber market alone) is 1.55 (0.91) times the Canadian subsidy.

Key Words: countervailing duty, dispute, log, lumber, subsidy

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In recent years, countervailing measures undertaken by many countries to protect domestic producers against unfair production subsidy practices in exporting countries have alarmingly burgeoned because the WTO's Agreement on Subsidies and Countervailing Measures (ASCM) allows for such trade retaliation. For instance, from 1996 to 2005, the number of countervailing duty (CVD) cases filed with the WTO increased from 6 to 81 (WTO 2005). However, many countries go overboard and abuse the ASCM, which further escalates the complexity of litigations, adding undue burdens on the WTO Dispute Settlement Body (Miranda).[1] The crux of the issues involved in the vast majority of the CVD cases is this—what is the correct level of CVD that will offset the adverse effect of exporters' production subsidies without overly penalizing the exporting country?

The U.S.–Canadian softwood lumber (hereafter termed only as lumber) trade dispute is one such case filled with numerous and contentious disagreements over the magnitude of Canadian subsidies and U.S. countervailing duties, and it is a fertile ground for informative economic analysis. The underlying cause for this ongoing trade litigation is that the U.S. lumber producers contend that Canada with its vast endowment of government-owned forest land charges only nominal fees for stumpage (timber) sold to Canadian lumber producers. The U.S. lumber producers argue that selling timber at low prices amounts to an input subsidy because auctioning the timber in the open market will fetch much higher prices. In addition, the U.S. producers claim that Canadian log export restrictions amount to an implicit subsidy to Canadian lumber producers because U.S. lumber companies cannot avail the benefits of purchasing low-priced timber, and thus, log export

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[1] The Byrd amendment in the United States is one such case that not only imposed CVD but also distributed the proceeds from the CVD to the affected domestic industry. In doing so, this amendment provided double protection to U.S. producers: first, in the form of CVD, and second, subsidizing the U.S. domestic industry with the CVD revenues (Harris and Devadoss).

controls help to keep costs down only for the Canadian companies. In 2001, a coalition of U.S. lumber producers submitted a petition to the International Trade Administration of the U.S. Department of Commerce (USDOC) and the U.S. International Trade Commission to investigate Canadian timber sales and trade policies (USDOC 2001a and 2001b). These agencies extensively studied Canadian lumber policies and found that Canada does subsidize its lumber companies with low-priced timber. On the basis of these findings, the U.S. government imputed that the Canadian government provides its lumber companies a production subsidy of 19.34% and retaliated by levying a countervailing duty of 18.8% in May 2002 (U.S. Federal Register) to protect its lumber producers from adverse effects of the Canadian subsidy.[2] Canada vehemently refuted the level of U.S. computed subsidies and tariffs.

The objective of this study is to determine the appropriate level of U.S. countervailing duties on Canadian lumber produced from subsidized timber by employing a vertically interrelated log–lumber model. If the subsidy and CVD are for a single and not vertically integrated commodity, then the CVD will be necessarily less than the subsidy, as we show in the theoretical and empirical analyses. However, in a vertically integrated market, the value of CVD relative to production subsidy depends on several factors such as whether the subsidy is for production of output, input, or both and whether both output and input are traded or one of them is nontraded. We find that if input is nontraded and subsidy is for production of output, then it is plausible for the CVD to be greater than the subsidy. While this study aims to find the appropriate level of CVD, it does not prescribe protective policy measures.

The next section summarizes the domestic and trade policies surrounding the U.S.–Canadian lumber dispute and the existing literature. The theoretical analysis section develops a trade model to derive the level of CVD that will revert the U.S. lumber price to a level that existed before Canadian subsidy and log export control policies. This section also undertakes a comparative static analysis to obtain the plausible range of CVD. The empirical section utilizes log and lumber supply and demand elasticities to compute the CVD coefficient (i.e., ratio of CVD to subsidy) to ascertain the appropriate level of CVD. The article concludes with the policy implications of the findings to resolve this long-lasting trade litigation.

U.S.–Canadian Lumber Policies

The U.S.–Canadian dispute in lumber trade is the single most important and an extremely contentious trade disagreement between the two countries, which has festered for more than two centuries since the colonial period (Rahman and Devadoss; Reed). This trade crisis literally drove both countries to the brink of war in the early 1800s, and more recently, to strong rhetoric, intense debate, several rounds of prolonged negotiations, and a call for an outright trade war (Devadoss and Aguiar; Reed). A brief history of the most recent dispute, known in the literature as Lumber IV, with emphasis on current developments and past studies that examined these controversial issues are discussed below. Zhang (2007) provides a detailed and up to date discussion of the long history of this dispute.

Following the expiration of the 1996 Softwood Lumber Agreement[3] 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 (DFAIT 2001). Canada

[2] The USDOC also determined that the Canadian companies dump lumber in the United States (i.e., sell at below cost of production) by 12.58%. In May 2002, along with 18.8% CVD, the U.S. government imposed an antidumping tariff of 8.4%, totaling a 27.2% tariff on imports of Canadian lumber.

[3] This agreement formulated a export tax-cum-quota policy of lumber exports from Canada to the United States for five years beginning on April 1, 1996.

refutes the U.S. allegations by purporting that public timber is sold at lower prices because the Canadian companies render several valuable forest maintenance services (e.g., reforestation, road-building, protection against fire, disease, and insects) aimed toward promoting sustainable forestry, and these services should be taken into account in computing the stumpage fees (DFAIT 2001 and WTO 2003). Canada also claims that it has a natural competitive advantage in its forest industries because of its vast endowment of forest lands, and thus its lumber prices are inherently lower than U.S. lumber prices.

Based on its investigation, which began in April 2001 right after receiving the U.S. lumber producers' petition, the U.S. Department of Commerce (USDOC) estimated a single countrywide subsidy rate of 19.34% for the timber the Canadian lumber companies harvest at a reduced fee from the government-owned forest land (USDOC 2002). Meanwhile, the U.S. International Trade Commission (USITC) also determined that Canadian companies sell their lumber in the United States at below cost of production and estimated that such dumping reduces U.S. lumber prices by 12.58%. Despite Canada's objection that its forest programs are not countervailable, the United States imposed 18.8% CVD and 8.4% antidumping tariff, adding to a total of 27.2% import tariff on lumber imports. These CVD and tariffs are lower than their respective preliminary determinations. In spite of several attempts to amicably solve this trade litigation through negotiations, no durable solution was reached, and both countries turned to WTO and NAFTA panels to resolve the dispute. Canada filed three petitions 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 investigating Petition I, the WTO's subsidy determination panel followed the rule that a subsidy exists if there is a financial contribution that confers a benefit. On this basis, the WTO panel found that Canadian stumpage programs are financial contributions and adequate cause exists for the United States to countervail. But the WTO 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). The rationale for the WTO ruling is that because of supply and demand differences in both countries, Canadian lumber prices could be significantly lower than the U.S. price even under unfettered market conditions, and computing the subsidy as U.S. price minus stumpage fee will exaggerate the true value of subsidy. Based on its rule of subsidy determination, the WTO panel ruled that log export controls are not explicit financial contributions and thus not countervailable (DFAIT 2005). This ruling totally contradicts the U.S. contention that log export restraints are indeed subsidies because only Canadian lumber companies have access to low-priced logs.

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 as it used a zeroing method, which excludes the Canadian lumber sold at above-market prices and thus exaggerates the dumping quantity, leading to a high antidumping tariff. From the investigation of Petition III, the WTO ruled that imports from Canada did not inflict serious injuries on the U.S. lumber industry as the U.S. demand for lumber increased, which led to more imports from other countries. In summary, the WTO ruled that the Canadian stumpage policy is a financial contribution and countervailable, and U.S. tariffs are excessive. In response to the WTO rulings, in December 2004 the United States reduced its CVD from 18.8% to 16.7%.[4] Canada, not satisfied by these reductions, appealed to the WTO compliance panel. But the WTO panel

[4] The U.S. government also lowered the antidumping tariff from 8.4% to 4.5%, and thus the combined new import tariff is 21.2% (16.7% of CVD and 4.5% antidumping duty).

ruled in favor of the United States by stating that U.S. reduction of import duties is in conformity with its obligations. The WTO rulings were inferred by the public press and academic studies that Canadian stumpage programs are subsidies (Devadoss and Aguiar). Zhang (2007) interpreted the WTO ruling that stumpage policies could be considered subsidy to the Canadian lumber companies.

As if the WTO rulings were not murky enough, a NAFTA panel that investigated this dispute has ruled mostly in favor of Canada. In particular, the NAFTA panel found that the U.S. CVD and antidumping tariffs are excessive. Canada has claimed that since the NAFTA process is enforceable under U.S. domestic law, the NAFTA panel's findings should trump the WTO rulings. In November 2005, the USDOC based on its administrative reviews reduced the punitive duties (CVD) from 16.7% to about 9% and kept its antidumping tariff at 4.5%. Upon further intense negotiations, both countries reached a trade agreement in September 2006. Two major components of this agreement are: 1) Canada will limit its lumber exports to less than 34% of U.S. demand and impose an export tax ranging from 0% to 5%, or 2) Canada will impose an export tax that could be up to 15% depending on U.S. lumber prices. These trade policy measures aim to keep the U.S. lumber price at a higher level than the free trade price.

Because of the long history of this lumber trade war, a "truckload" of studies have investigated the impacts of various trade agreements since 1980 on both countries' lumber markets. Earlier studies analyzed the implications of the 1986 Memorandum of Understanding, which allowed Canada to impose export taxes on lumber exports. Adams and Haynes (1980) used an econometric projection model to analyze a 15% ad valorem tariff on imports from Canada. They concluded that as a result of this tariff, the U.S. lumber price would increase by 9%, U.S. production would increase by 12%, U.S. consumption would fall by 5%, and imports from Canada would decline by 41%. Boyd and Krutilla developed a spatial equilibrium model to study the impacts of U.S. tariffs and voluntary export quotas by Canada. They found that the 1986 U.S. tariffs reduced Canadian export profits by 9%, but export quota increased these profits by 40%. Kalt estimated an optimal tariff of 50%, which would result in a U.S. net gain of $458.7 million. Wear and Lee found that Canadian export tax benefits U.S. lumber producers and hurts U.S. lumber consumers and Canadian producers. But, export tax revenues more than offset producers' losses and result in a significant net gain to Canada.

Boyd, Doroodian, and Abdul-Latif examined the effects of NAFTA on lumber markets using a spatial equilibrium model. They predicted that the NAFTA will increase the trade flow among the three countries, but the welfare gain will not improve appreciably. Chen, Ames, and Hammett utilized a four-equation simultaneous system to study the impacts of U.S. tariff and Canadian export tax. They concluded that these policies will not have significant impact on U.S. lumber consumption (because of highly inelastic demand), but will lead to higher prices for U.S. producers and consumers. Myneni, Dorfman, and Ames also studied the effects of Canadian export tax (15%) versus the U.S. import tariff (6.51%). They found that the Canadian export tax will lead to a net loss to the United States as consumers' losses are more than producers' gains, but Canada will gain as export tax revenues are more than Canadian surplus losses. However, the U.S. tariff results in a net positive gain to the United States as producers' gain and tariff revenues exceed consumers' loss, but Canada will incur a large loss.

The next three studies analyzed the impacts of the 1996 Softwood Lumber Agreement (SLA). Zhang (2001) examined the effects of this agreement on prices, quantities, and welfare. He found that the U.S. lumber price will increase by $59.1/mbf, and Canadian exports to the United States will decline by 11.3/bbf. Zhang computed that U.S. producers will gain by $7.74 billion, U.S. consumers will lose by $12.48 billion, and the U.S. net loss will be $4.74 billion. But, Canadian producers will gain by $2.86 billion, and the net Canadian gain including the export fee will be $3.08 billion. Van Kooten compared the effects of SLA, Canadian export tax, and U.S. import tariff. He found that Canada would gain more under the SLA than under export tax or import tariff. His second best alternative is export tax as Canada gets to keep the tax revenues. Kinnucan and Zhang utilized a three-region model consisting of the United States, Canada, and the rest of the world to analyze the incidence of the SLA. The welfare impacts show that U.S. consumers share 37% of the export tax burden, and for the period 1996–2000, the Canadian gain from this tax-shifting burden is $3.64 billion. This gain more than offsets the inefficiency of $0.37 billion and results in a net Canadian gain of $3.26 billion, which is distributed among consumers ($2.59 billion), producers ($0.45 billion), and the treasury ($0.23 billion).

More recent studies have investigated the economic impacts of the Lumber IV dispute on the lumber market. Adams specifically analyzed the effects of the 27.2% U.S. tariff using a simplified model of U.S. demand and supply, Canadian export supply, and non-Canadian export supply to the United States. His results showed that the U.S. supply increases by 3.2%, imports from non-Canadian supply rise by 5.8%, U.S. consumption decreases by 0.6%, and imports from Canada decline by 7%. Devadoss et al. developed a spatial equilibrium model consisting of six exporting and six importing regions to study the impacts of a 27.2% U.S. tariff. They found that the U.S. import tariff impacts prices, supply, use, and bilateral trade flows not only in the United States and Canada, but also in other countries. Their welfare analysis shows that the United States incurs welfare loss because U.S. consumers' loss is more than U.S. producers' gain and tariff revenues. The reason for this finding is that their analysis is for 27.2% U.S. tariff and not for an optimal tariff. Moreover, since their study includes several importing and exporting regions, which allow for bilateral trade reallocations, U.S. market power in the international lumber market is lessened. Williamson, Hauer, and Luckert analyzed the effects of the U.S. tariff of 27% on the Canadian lumber supply and found that lumber supply declines more in British Columbia than in Ontario and Quebec. Devadoss considered the joint effects of a Canadian subsidy and a U.S. tariff on the world lumber market using a spatial equilibrium model of several importing and exporting regions. He found that the United States cannot fully protect its producers through import restrictions from Canada as other countries augment their exports to the United States. His results indicate that the United States shows a modest gain, but Canada incurs a significant loss.

The United States is the largest importer of Canadian lumber, which accounts for one third of U.S. domestic use. From the optimal tariff theory, when a country has international market power, it has the potential to maximize its welfare (Bhagwati; Irwin). As a large lumber importer, the United States can gain by imposing an optimal tariff as shown by Kalt and Kinnucan and Zhang. Conversely, since Canada exports about 60% of its lumber production to the United States, it can exercise market power as highlighted by Kinnucan and Zhang. Specifically, they showed that an optimal export tax of 0.77 by Canada will result in maximum welfare gain as opposed to an export tax of 0.35 imposed by Canada under the 1996 SLA. However, such policies are move away from free trade solutions.

The current study differs from the other studies in that it deals with the question of what the U.S. CVD ought to be—that is, the appropriate level of CVD that the United States can impose in retaliating against the Canadian subsidy policies by considering the vertical linkage in the log–lumber markets, rather than examining the impacts of U.S. and Canadian policies as earlier studies have done. Moschini and Meilke study such a CVD determination for hog–pork markets by considering output subsidies for hog and also for pork production.

Theoretical Analysis

We formulate a model of two countries (Canada and the United States) trading two commodities (logs and lumber) that are vertically integrated. The two-country model is appropriate for the analysis because Canada and the United States are the most important trading partners. Lumber trade between the two countries is valued at seven billion dollars annually and Canada exports about 60% of its lumber production to the United States (Random Lengths). The United States is the largest producer, importer, and thus, user of lumber. Canada is the second largest producer but not a major lumber user, and hence, a leading exporter to the United States due to the contiguous location.

Because of Canada's log export restrictions, timber is sold only to Canadian lumber companies, which process domestic logs and sell the lumber either in the domestic market or export market. The U.S. lumber companies process domestic logs and compete with Canadian lumber in the U.S. market. The model captures these interrelationships in a vertically interrelated log–lumber market. The specifications of log and lumber supply and demand functions in Canada and United States are

$$(1)\quad S_G^i = S_G^i\,(P_G^i, Z_G^i),$$

$$(2)\quad D_G^i = D_G^i\,(P_G^i, P_L^i, X_G^i),$$

$$(3)\quad S_L^i = S_L^i\,(P_G^i, P_L^i, s^i, Z_L^i),$$

and

$$(4)\quad D_L^i = D_L^i\,(P_L^i, X_L^i)\,,$$

where S is supply, D is demand, P is price, s is stumpage subsidy, Z is a vector of supply shifters, X is a vector of demand shifters, subscripts G and L denote logs and lumber, respectively, and superscript i refers to the country, the Untied States (U) and Canada (C).

The equilibrium condition for this model requires spatial arbitrage for lumber as given by the price linkage equation

$$(5)\quad P_L^C = P_L^U - T - t\,,$$

which states that the price in Canada is equal to price in the United States minus transfer costs comprising of transportation cost (T) and countervailing duties (t) imposed by the Untied States on lumber imports from Canada. A spatial arbitrage condition for logs is not needed because of the Canadian policy of not allowing any log exports. Consequently, log markets operate in both countries in an autarky mode, and lumber trade, Canadian domestic policies, and U.S. trade policies impact the log market only through the vertical link in the log–lumber markets.

The market equilibrium entails that the Canadian excess supply should be equal to the U.S. excess demand in the lumber market and the autarky prevails in the log markets in both countries. These equilibrium conditions can be written, after substituting the price linkage equation, as

$$(6)\quad \begin{aligned} &S_G^C\,(P_G^C, Z_G^C) \\ &- D_G^C\,(P_G^C, P_L^U - T - t, X_G^C) = 0\,, \end{aligned}$$

$$(7)\quad \begin{aligned} &S_G^U\,(P_G^U, Z_G^U) \\ &- D_G^U\,(P_G^U, P_L^U, X_G^U) = 0\,, \end{aligned}$$

and

$$(8)\quad \begin{aligned} &S_L^C\,(P_G^C - s^C, P_L^U - T - t, Z_L^C) \\ &- D_L^C\,(P_L^U - T - t, X_L^C) \\ &+ S_L^U\,(P_G^U, P_L^U, Z_L^U) \\ &- D_L^U\,(P_L^U, X_L^U) = 0. \end{aligned}$$

If we know the specific functional forms for the behavioral equations, we can solve Equations (5) through (8) to obtain equilibrium prices $(\tilde{P}_G^C, \tilde{P}_G^U, \tilde{P}_L^C, \tilde{P}_L^U)$, which can be substituted into the behavioral Equations (1) through (4) to find the equilibrium quantity of supply and demand $(\tilde{S}_G^C, \tilde{D}_G^C, \tilde{S}_L^C, \tilde{D}_L^C, \tilde{S}_G^U, \tilde{D}_G^U, \tilde{S}_L^U, \tilde{D}_L^U)$. Then lumber trade flows between the two countries can be obtained as $\tilde{X}_L = \tilde{S}_L^C - \tilde{D}_L^C = \tilde{D}_L^U - \tilde{S}_L^U$, which is consistent with the price linkage equation that Canada exports lumber to the United States. Once we solve for the endogenous variables under distortion and free trade, we can find the CVD that will revert the U.S. lumber price back to the pre-Canadian subsidy level.

However, for general functional forms of demand and supply, we cannot solve explicitly Equations (5) through (8) for endogenous variables; rather, we need to differentiate the model to find the CVD. The equilibrium log and lumber prices depend upon the exogenous policy parameters: $\tilde{P}_G = P_G(\bullet; t, s)$ and $\tilde{P}_L = P_L(\bullet; t, s)$. If the U.S. goal is to protect its lumber producers by maintaining the U.S. lumber price at the presubsidy level, then CVD (i.e., t) must be such that $\tilde{P}_L^U(\bullet; t, s) = \bar{P}_L^U$, the lumber free trade price. Thus, the problem is to find t for a given level of subsidy s such that the U.S. lumber price after the subsidy and tariff is the same as the free trade lumber price.[5] First order Taylor's series approximation of $P_L^U(\bullet; t, s)$ around the free market policies ($t = s = 0$) and use of $P_L^U(\bullet; 0, 0) = \bar{P}_L^U$ yields

$$\frac{\partial P_L^U}{\partial t} t + \frac{\partial P_L^U}{\partial s} s = 0 . \tag{9}$$

The above equation can be solved to express U.S. CVD as a proportion of the Canadian subsidy:

$$t = -\frac{\dfrac{\partial P_L^U}{\partial s}}{\dfrac{\partial P_L^U}{\partial t}} s = \theta s , \tag{10}$$

where $\theta = -(\partial P_L^U/\partial s)/(\partial P_L^U/\partial t)$ is the CVD coefficient (i.e., the ratio of CVD to subsidy). We can interpret θ as an ad valorem CVD corresponding to one unit of ad valorem production subsidy s/P_L^C. Alternatively, θ is the magnitude of the specific CVD resulting from one unit of production subsidy.

We can solve for θ by conducting comparative static analysis of Equations (6), (7), and (8) and finding $\partial P_L^U/\partial s$ and $\partial P_L^U/\partial t$, or we can solve for $d P_L^U$ to find $\partial P_L^U/\partial s$ and $\partial P_L^U/\partial t$ (since $dP_L^U = (\partial P_L^U/\partial s)ds + (\partial P_L^U/\partial t)dt$) and then compute θ. We follow the second approach and totally differentiate Equations (6) through (8) to obtain:

$$\begin{bmatrix} \left(\dfrac{\partial S_G^C}{\partial P_G^C} - \dfrac{\partial D_G^C}{\partial P_G^C}\right) & 0 & -\dfrac{\partial D_G^C}{\partial P_L^C} \\ 0 & \left(\dfrac{\partial S_G^U}{\partial P_G^U} - \dfrac{\partial D_G^U}{\partial P_G^U}\right) & -\dfrac{\partial D_G^U}{\partial P_L^U} \\ \dfrac{\partial S_L^C}{\partial P_G^C} & \dfrac{\partial S_L^U}{\partial P_G^U} & \left(\dfrac{\partial S_L^C}{\partial P_L^C} - \dfrac{\partial D_L^C}{\partial P_L^C} + \dfrac{\partial S_L^U}{\partial P_L^U} - \dfrac{\partial D_L^U}{\partial P_L^U}\right) \end{bmatrix}$$

$$\times \begin{bmatrix} dP_G^C \\ dP_G^U \\ dP_L^U \end{bmatrix} = \begin{bmatrix} -\dfrac{\partial D_G^C}{\partial P_L^C} dt \\ 0 \\ \left(\dfrac{\partial S_L^C}{\partial P_L^C} - \dfrac{\partial D_L^C}{\partial P_L^C}\right) dt + \dfrac{\partial S_L^C}{\partial P_G^C} ds \end{bmatrix}$$

Using Cramer's rule we can solve for dP_G^C, dP_G^U, and dP_L^U. But for our purpose, we need to solve only for dP_L^U:

$$\begin{aligned} dP_L^U = {} & \frac{1}{|A|}\left[\left(\frac{\partial S_G^U}{\partial P_G^U} - \frac{\partial D_G^U}{\partial P_G^U}\right) \times \left(\frac{\partial S_G^C}{\partial P_G^C} - \frac{\partial D_G^C}{\partial P_G^C}\right) \times \left(\frac{\partial S_L^C}{\partial P_G^C}\right)\right] ds \\ & + \frac{1}{|A|}\left(\frac{\partial S_G^U}{\partial P_G^U} - \frac{\partial D_G^U}{\partial P_G^U}\right) \times \left[\left(-\frac{\partial S_L^C}{\partial P_G^C}\right)\left(-\frac{\partial D_G^C}{\partial P_L^C}\right) + \left(\frac{\partial S_G^C}{\partial P_G^C} - \frac{\partial D_G^C}{\partial P_G^C}\right) \times \left(\frac{\partial S_L^C}{\partial P_L^C} - \frac{\partial D_L^C}{\partial P_L^C}\right)\right] dt \end{aligned} \tag{11}$$

where |A| is the determinant of the coefficient matrix.

Since $dP_L^U = (\partial P_L^U/\partial t)dt + (\partial P_L^U/\partial s)ds$,

$$\begin{aligned} \theta &= -\frac{\dfrac{\partial P_L^U}{\partial s}}{\dfrac{\partial P_L^U}{\partial t}} \\ &= \left[-\left(\frac{\partial S_G^U}{\partial P_G^U} - \frac{\partial D_G^U}{\partial P_G^U}\right) \times \left(\frac{\partial S_G^C}{\partial P_G^C} - \frac{\partial D_G^C}{\partial P_G^C}\right)\left(\frac{\partial S_L^C}{\partial P_G^C}\right)\right] \end{aligned} \tag{12}$$

[5] See Moschini and Meilke for appropriate CVD determinations under output subsidies in the hog–pork markets but not input subsidies and export restrictions.

$$(12) \qquad \div\left\{-\left(\frac{\partial S_G^U}{\partial P_G^U}-\frac{\partial D_G^U}{\partial P_G^U}\right)\times\left[\left(\frac{\partial S_L^C}{\partial P_G^C}\right)\left(-\frac{\partial D_G^C}{\partial P_L^C}\right)-\left(\frac{\partial S_G^C}{\partial P_G^C}-\frac{\partial D_G^C}{\partial P_G^C}\right)\times\left(\frac{\partial S_L^C}{\partial P_L^C}-\frac{\partial D_L^C}{\partial P_L^C}\right)\right]\right\}$$

To express the previous equation into elasticity forms for ease of interpretation, we consider the Leontief-cum-general function for lumber production technology. Williamson, Hauer, and Luckert consider a similar production technology in their analysis of lumber supply and input demand responses. Specifically, lumber (Q_L) is produced using logs (Q_G) in a fixed proportion and a vector of other inputs (**M**) such as labor and electricity. These other inputs are substitutable for one another but not for logs. This technology is represented by the production function $Q_L = f(Q_G, \mathbf{M}) = \min[Q_G, h(\mathbf{M})]$. For simplicity, we assume one unit of log is used to produce one unit of lumber. The cost function arising from this technology is $C(Q_L, P_G, \mathbf{W}) = P_G Q_L + c(Q_L, \mathbf{W})$. Following Shephard's lemma, we can derive the log demand from the cost function, which is perfectly inelastic. Furthermore, the profit-maximizing supply function for lumber is the same as the demand function for logs. In addition, this production technology entails that lumber supply and log demand are functions of the difference between lumber and log prices (the processing margin): $S_L^i\left(P_L^i - P_G^i, Z_L^i\right) = D_G^i\left(P_L^i - P_G^i, X_G^i\right)$.

Consider the following elasticity definitions: η_{LL}^i is lumber demand elasticity at the retail level, η_{GG}^i is log demand elasticity, η_{GL}^i is elasticity of log demand with respect to lumber price, ε_{LL}^i is lumber supply elasticity at the processing level, ε_{LG}^i is lumber supply elasticity with respect to log price, and ε_{GG}^i is log supply elasticity. Since log demand and lumber supply are identical, $\varepsilon_{LL}^i = \eta_{GL}^i$, $\varepsilon_{LG}^i = \eta_{GG}^i$, and $\eta_{GG}^i = -\varepsilon_{LL}^i\left(P_G^i/P_L^i\right)$. With these elasticity definitions and observing $S_G^C = D_G^C$ (i.e., autarky log market in Canada), we can express the CVD coefficient in Equation (12) as[6]

$$(13)\ \theta = \frac{\varepsilon_{LL}^C S_L^C}{\varepsilon_{LL}^C S_L^C \dfrac{\varepsilon_{GG}^C}{\varepsilon_{GG}^C - \eta_{GG}^C} - \eta_{LL}^C D_L^C}$$

From Equation (13), it is not readily obvious the range of values that θ could take. However, we can ascertain the possible lower and upper bounds for θ by considering different elasticity values of ε_{LL}^C, η_{LL}^C, ε_{GG}^C, and η_{GG}^C:[7]

$$\varepsilon_{LL}^C \to 0, \quad \theta \to 0$$
$$\varepsilon_{LL}^C \to \infty, \quad \theta \to 1$$
$$\eta_{LL}^C \to \infty, \quad \theta \to 0$$
$$\eta_{LL}^C \to 0 \text{ and } \eta_{GG}^C \to 0, \quad \theta \to 1$$
$$\varepsilon_{GG}^C \to \infty, \quad \theta \to \frac{\varepsilon_{LL}^C S_L^C}{\varepsilon_{LL}^C S_L^C - \eta_{LL}^C D_L^C}$$
$$\eta_{GG}^C \to \infty, \quad \theta \to \frac{\varepsilon_{LL}^C S_L^C}{-\eta_{LL}^C D_L^C}$$

From the above results, we can garner the following five possibilities for the magnitude of θ:

a) U.S. CVD can be set equal to the Canadian subsidy level only when the lumber supply is perfectly elastic or lumber and log demands are perfectly inelastic.[8] The economic intuitions are as follows: a perfectly elastic lumber supply (infinite amount of lumber supply) in Canada means that demand responses are totally mitigated and lumber price decline due to subsidy is fully trans-

[6] In deriving θ, we make use of the identity $\partial S_L/\partial P_L = -\partial S_L/\partial P_G$ arising from the supply function $S_L = S_L(P_L - P_G, Z_L)$.

[7] Another approach in ascertaining the influence of various elasticities on the CVD coefficient is to conduct a comparative static analysis by differentiating θ with respect to elasticities: $\partial\theta / \partial \varepsilon_{LL}^C > 0$, the more elastic the lumber supply, the larger the CVD; $\partial\theta / \partial \eta_{LL}^C > 0$ (note that η_{LL}^C is negative), the more inelastic the lumber demand, the larger the CVD; $\partial\theta / \partial \varepsilon_{GG}^C < 0$ the more inelastic the log supply, the larger the CVD; and $\partial\theta / \partial \eta_{GG}^C < 0$ (note that η_{GG}^C is negative), the more elastic the log demand, the larger the CVD.

[8] It should be noted that as lumber demand becomes inelastic, log demand will also become inelastic because of the fixed proportion relationship of log use in lumber production.

mitted to the United States. Hence, to restore the U.S. price to the presubsidy level, the United States has to levy a CVD equal to the subsidy. Also, when lumber and log demands are perfectly inelastic, Canadian lumber price declines are fully transmitted to the Untied States and only a CVD equal to the subsidy will neutralize this price decline.

b) No CVD is permissible when lumber supply is totally inelastic or lumber demand is infinitely elastic because the subsidy does not result in production and trade distortion.

c) If log supply is perfectly elastic, which implies that the lumber market is disconnected from the log market, then θ is a positive fraction and is equal to that generated from the lumber market alone under consideration. This can be seen by examining only the lumber market without the vertically related log market (i.e., only Equation (8) with log price as exogenous) and deriving $\theta = \varepsilon_{LL}^{C} S_{L}^{C} / (\varepsilon_{LL}^{C} S_{L}^{C} - \eta_{LL}^{C} D_{L}^{C}) \leq 1$. Thus, in this case, the U.S. CVD has to be less than the Canadian subsidy.

d) If log demand elasticity approaches perfectly elastic value, then θ approaches $\varepsilon_{LL}^{C} S_{L}^{C} / -\eta_{LL}^{C} D_{L}^{C}$, which could be greater than one because $S_{L}^{C} \geq D_{L}^{C}$ (i.e., Canada is a lumber exporter).

e) For all other cases of reasonable elasticity values corresponding to positively sloped supply and negatively sloped demand, θ could be less than or greater than one. This result arises because of the vertical link between lumber and logs as aptly modeled in this study, which can be seen from the denominator of Equation (13).

Finally, observe that θ is not a function of U.S. log and lumber supply and demand elasticities. The reason for this result is that θ is set to restore the U.S. lumber price, and thus U.S. lumber supply and demand, to the presubsidy levels by simply moving up the supply and demand curves, and their price responsiveness does not play any role. Since logs are not traded between the two countries, once the U.S. lumber price reverts to the presubsidy level, the U.S. log price also reverts to its presubsidy level, and U.S. log supply and demand price responsiveness is also not relevant.

Empirical Analysis

Estimation of the CVD coefficient θ in Equation (13) depends upon Canadian lumber and log supply and demand elasticities and lumber supply and demand quantities. The elasticities were derived from prior studies (Table 1).[9] In obtaining these elasticities, we extensively searched the literature (both in agricultural economics and forestry) relevant to Canadian markets, and where we could not find the Canadian elasticity estimates we supplemented the literature survey with studies for the U.S. market to obtain comparable elasticities. The elasticities in Table 1 provide a reasonable range of lumber and log supply and demand elasticities. Variations in elasticity values from various studies are due to differences in time periods, theoretical production functions, empirical specifications, estimation methods, regional disaggregations, end uses, and product disaggregations. Since there are some variations in these elasticity estimates, we computed weighted average elasticity values to determine the countervailing duty coefficient.[10] The quantity data are obtained from Random Lengths. Since the lumber dispute began in 2001 and the U.S. computation of Canadian subsidies was based on data around this time period, we used the average lumber production and consumption data for 2000 and 2001, which are respectively 29.106 and 8.393 billion board feet.

We found eight studies that estimated lumber supply response for Canada. Comparison of these studies reveals that supply elasticities range from an inelastic value of 0.24 to an elastic value of 2.41 with five studies reporting inelastic values and three studies presenting elastic values. The weighted average elasticity of lumber supply is 0.758. We found only one study that estimated the lumber demand elasticity for Canada but we came across numerous studies that estimated lumber demand elasticities for the United

[9] Due to lack of data on timber harvests, stumpage fees, and input uses by lumber companies, we rely on previous studies for elasticity estimates.

[10] The weights are based on regional quantities.

Table 1. Lumber and Log Supply and Demand Elasticities[a]

Studies	Region	Lumber Supply Elasticity (ε^C_{LL})	Lumber Demand Elasticity (η^C_{LL})	Log Supply Elasticity (ε^C_{GG})	Log Demand Elasticity (η^C_{GG})
Adams and Haynes (1980)[b]	Canada U.S.	0.47		0.06 to 0.99	
McKillop, Stuart, Geissler	U.S.		−0.17		
Spelter[c]	U.S.		−0.11, −0.13, −0.16, −0.29		
Chen, Ames, and Hammett	U.S.		−0.03		
Constantino and Haley	BCC	1.11			−1.43
Adams and Haynes (1989)	PNWW				−0.10
Baker (1989)	Canada	0.63			−2.01
Baker (1990)	Quebec	1.90			
Adams, Boyd, and Angle[c]	U.S.		−0.08 to −0.24		
Lewandrowski, Wohlgenant, and Grennes[d]	U.S.		−0.14, −0.15, −0.67, −0.82		
Myneni, Dorfman, and Ames	U.S.		−0.10		
Adams and Haynes (1996)[e]	BCC	0.94			
	INT	0.45			
	EAST	0.49			
	U.S.			0.15 to 0.78	
Bernard et al.[f]	Quebec	1.02, 1.03	−0.35		
	Ontario	2.12, 2.41	−10.83		
Latta and Adams	BCC	0.84			−0.55
	INT	0.38			−0.12
	EAST	0.65			−0.42
Zhang (2001)	U.S.		−0.17		
Williamson, Hauer, and Luckert	BCC	0.59			−0.70
	Ontario	0.24			−0.16
	Quebec	0.37			−0.61

[a] BCC is British Columbia Coast; INT is British Columbia Interior and Alberta; EAST is the rest of Canada; PNWW is Pacific Northwest West.
[b] Adams and Haynes (1980) reported supply response ranging from 0.06 to 0.99 for U.S. forest industry and private stumpage for eight regions.
[c] The lumber demand elasticities in these studies are for different time periods.
[d] Lumber demand elasticities in this study are for southern pine, Douglas fir, western pine, and Canadian lumber imports.
[e] Adams and Haynes (1996) estimated the private stumpage supply elasticity for nine U.S. regions, ranging from 0.15 to 0.78.
[f] The differences in the elasticities in this study are due to two types of end products (kiln-dried and air-dried).

Table 2. Estimates of Countervailing Duty Coefficient

Lumber Supply Elasticity (ε_{LL}^{C})	Lumber Demand Elasticity (η_{LL}^{C})	Log Supply Elasticity (ε_{GG}^{C})	Log Demand Elasticity (η_{GG}^{C})	θ for Log–Lumber Market	θ for Lumber Market Only
0.758	−0.265	0.620	−0.520	1.552	0.909

States. One of the reasons for the abundant number of studies for the United States is due to large market for lumber and important role of lumber in housing construction. In the interest of brevity, we report in Table 1 elasticities from only those studies that have been done since 1980. Based on these lumber demand elasticities, we obtained an average elasticity of −0.265 for our use.

Stumpage supply response studies were very scarce in the literature. After an extensive search of the literature, we could not find any academic study that examined the stumpage supply response for Canada. One reason for the lack of such studies could be due to the forest system management in Canada. Since 94% of the forest land is owned by the government, the stumpage is not sold in open market and lumber companies provide forest maintenance services in exchange for low stumpage fees, it is difficult to quantify the true price of stumpage paid by lumber companies to the Canadian government, which is a huge limitation for any studies aiming to estimate supply response. We present two studies (Adams and Haynes 1980, 1996) that estimated the supply elasticity for the U.S. forest industry and private stumpage supply for several U.S. regions, which ranged from very inelastic to unitary value. Based on these elasticity estimates, we obtain a weighted average elasticity of 0.62 for our analysis. It is also worth observing that in Equation (13) the stumpage supply elasticity appears in the numerator and denominator of the divisor, and consequently, its effect on θ is minimal, particularly if the log demand elasticity approaches zero. We present log demand elasticities from five studies; of these, two studies report elastic values and the other three studies report inelastic values. From these values, we compute an average log demand elasticity of −0.52 for use in our study.

All the four elasticities for lumber and log supply and demand are in the inelastic range (Table 2). Substitution of these elasticities along with lumber supply and demand quantities in Equation (13) yields the CVD coefficient of 1.55 for the log–lumber market model. This result illustrates that the CVD coefficient required to protect U.S. lumber producers from the effects of Canadian lumber production subsidy is greater than one. In particular, this result shows that the United States can undertake a trade policy to restrict lumber imports by levying a CVD 1.55 times the Canadian subsidy to counteract the adverse effects of Canadian policies. Therefore, a U.S. policy of setting a CVD equivalent to the production subsidy leads to less protection than required. In 2001, the U.S. government estimated the Canadian domestic subsidy for lumber companies at 19.34%. Obviously Canada vehemently objects to this subsidy rate by claiming that the United States overly exaggerates Canadian lumber policy. Without knowing the stumpage fee and cost of the services rendered by Canadian companies to maintain a sustainable forest ecosystem, it is not possible to compute the true value of subsidy. What our results show is that the United States could impose a CVD of 155% of the *true* Canadian subsidy, not the subsidy U.S. producers perceive to be.

We also compute the CVD coefficient by considering the lumber market in isolation (the last column in Table 2), which clearly indicates that the CVD coefficient is not only less than its counterpart computed for log–lumber vertical markets, but also less than one as our theoretical results espoused. Therein lies the fallacy of policy determinations based solely on the lumber market without taking into account the vertical link between the log and lumber markets. Since the log–lumber CVD is greater than the lumber-only CVD, it is misleading to consider only the lumber market without log export restrictions in determining the appropriate level of CVD to counteract the Canadian subsidy. In particular, the WTO panel's conclusion based on a narrow definition that only financial contribution amounts to a subsidy ignores the undue remuneration the Canadian lumber companies avail from the exclusive access to logs whose prices are kept artificially low because of the log export restrictions. Thus, Canadian policies favor the lumber producers in two ways: a) low stumpage fee, and b) exclusive access to the timber. Any policy determination without taking into account both of these factors is erroneous.

Summary

Numerous studies have examined the effects of policies emanating from U.S.–Canadian lumber disputes on both countries' lumber markets. This study tackles the issue of what is the appropriate level of CVD that the U.S. can impose in retaliating to the Canadian subsidy. This inquiry is very relevant and useful since the WTO has ruled that the Canadian stumpage policy is a financial contribution to its lumber companies and the initial CVD (18.8%) imposed by the United States is excessive. In this study, we describe the domestic and trade policy issues surrounding the U.S.–Canadian lumber trade litigations, formulate an analytical framework involving a vertically integrated log–lumber market for the United States and Canada, and theoretically derive the formula for the CVD coefficient. This formula provides general guidelines concerning the reasonable values for U.S. CVD to offset the adverse effects of the Canadian subsidy. We also derive the theoretical CVD coefficient by considering only the lumber market and show that it is less than one. We illustrate that it is important to consider the log–lumber market vertical link in any trade policy determination of the appropriate CVD and it will be erroneous to consider only the lumber market because the CVD for the former can be greater than the domestic subsidy, whereas the CVD for the latter will be always less than the domestic subsidy.

The empirical analysis employs the CVD formula and lumber and log supply and demand elasticity values to obtain the appropriate CVD coefficient that will neutralize the Canadian production subsidy. Our empirical findings support the theoretical results in that the CVD coefficient for the log–lumber related market is greater than one and larger than that for the lumber market, which is less than one. Thus, consideration of the lumber market by itself will lead to misleading policy recommendations. The rationale for this result is that Canada favors its lumber companies through two policies: lower stumpage price and log export restriction. To understand how these are double remunerations to Canadian lumber companies, suppose there exists no low-priced stumpage but only log export restriction. Since this export control lowers the input price only to Canadian lumber companies, it is a benefit conferred only to these companies. The second remuneration is the added lower fee for the stumpage. The estimated CVD coefficient suggests that the U.S. CVD should be 155% of the Canadian production subsidy. This study does not advocate protective policy measures by the United States, but rather it answers the question, given the U.S. goal of insulating its lumber producers from the Canadian stumpage policies, what is the appropriate level of CVD?

Given the finding of this study, a durable solution to this trade war is possible only if both countries move toward free market policies. The current agreement to this dispute calls for the Canadian lumber share of U.S. consumption not to exceed 34% and export taxes ranging from 0–5% or Canadian export taxes that could range 0–15% to keep the U.S. lumber price from falling. If the past experience of various agreements is of any indication, this agreement is not a permanent solution. Furthermore, this agreement is a move away from free trade as it does not address the Canadian subsidy and log export quota and further restricts trade by a market-share limit and an export tax. Moreover, this agreement safeguards only U.S. lumber producers at the expense of U.S. consumers.

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References

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

Adams, D.M., R. Boyd, and J. Angle. "Evaluating the Stability of Softwood Lumber Demand Elasticity by End-use Sector: a Stochastic Parameter Approach." *Forest Science* 36(1992): 825–41.

Adams, D.M., and R.W. Haynes. "The 1980 Softwood Timber Assessment Market Model: Structure, Projections, and Policy Simulations." *Forest Science Monographs* 26(3):22.

———. "A Model of National Forest Timber Supply and Stumpage Markets in the Western United States." *Forest Science* 35(1989):401–24.

———. *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.

Baker, B. "The Impact of the Corporate Tax Reform on the Sawmill Planning Mill, and Shingle Mill Products Industries: an Update." Economics Branch Note, Quebec: Forestry Canada: Economics Branch, 1989.

———. "Regional Output Supply and Input Demand in the Canadian Lumber Industry." Research Note, Ottawa, Ontario: Forestry Canada, Forest Sector Analysis Division, Economics and Statistics Directorate, 1990.

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.

Bhagwati, J. "The Generalized Theory of Distortions and Welfare." *Trade, Balance of Payment and Growth*, J. Bhagwati, R. Mundell, R. Jones and J. Vanek eds. Amsterdam: North Holland, 1971.

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.

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.

Chen, N.J., G.C.W. Ames, and A.L. Hammett. "Implications of a Tariff on Imported Canadian Softwood Lumber." *Canadian Journal of Agricultural Economics* 36(1988):69–81.

Constantino, L.F., and D. Haley. "Wood Quantity and the Input and Output Choices of Sawmilling Producers for the British Columbia Coast and United States Pacific Northwest, West Side." *Canadian Journal of Forest Research* 18(1988):202–08.

Devadoss, S. "Is There an End to U.S.–Canadian Softwood Lumber Disputes?" *Journal of Agricultural and Applied Economics* 38(2006):137–53.

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):177–92.

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

———. "Softwood Lumber, Canada's Legal Actions." Internet site: www.dfait-macci.gc.ca/trade/eicb/softwood/wto_challenges-en.asp (Accessed May 5, 2005).

Harris, B., and S. Devadoss. "Why Did the Byrd Amendment Not Fly with the WTO?" *Journal of International Law and Trade Policy* 6(2005): 226–50.

Irwin, D.A. "The Optimal Export Tax on Antebellum US Cotton Exports." *Journal of International Economics* 60(2003):275–91.

Kalt, J. "The Political Economy of Protectionism: Tariffs and Retaliation in the Timber Industry." *Trade Policy Issues and Empirical Analysis*, R.E. Baldwin ed. Chicago: University of Chicago Press, 1988.

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

Latta, G.S., and D.M. Adams. "An Econometric Analysis of Output Supply and Input Demand in the Canadian Softwood Lumber Industry." *Canadian Journal Forest Research* 30(2000): 1419–28.

Lewandrowski, J.K., M.K. Wohlgenant, and T.J. Grennes. "Finished Product Inventories and Price Expectation in the Softwood Lumber Industry." *American Journal Agricultural Economics* 76(1994):83–93.

McKillop, W., T.W. Stuart, and P.J. Geissler. "Competition Between Wood Products and Substitute Structural Products: An Econometric Analysis." *Forest Science* 26(1980):134–48.

Miranda, J. "On the Use and Abuse of Trade Remedies by Developing Countries." Paper presented at the Dartmouth-Tuck Forum on International Trade and Business, Managing Global Trade: The WTO-Trade Remedies and Dispute Settlement, Washington, DC, December 16–17, 2003.

Moschini, G., and K.D. Meilke. "Production Subsidy and Countervailing Duties in Vertically Related Markets: The Hog–Pork Case Between Canada and the United States." *American Journal of Agricultural Economics* 74(1992): 952–61.

Myneni, G., J.H. Dorfman, and G.C.W. Ames. "Welfare Impacts of the Canada–U.S. 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. *2001 Yearbook: Forest Product Market Prices and Statistics*. Portland, OR: Random Lengths Publication, 2001.

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

Spelter, H. "A Product Diffusion Approach to Modeling Softwood Lumber Demand." *Forest Science* 31(1985):685–700.

U.S. Federal Register, Washington DC, April 2001: 21328–21332.

USDOC, International Trade Administration and U.S. International Trade Commission, 2001a. "Petition for the Imposition of Antidumping Duties Pursuant to the Section 731 of the Tariff Act of 1930, Investigation A 122–838." Internet site: www.dbtrade.com/casework/softwood/AD%20Volume.pdf (Accessed July 16, 2002).

USDOC, International Trade Administration, 2001b. "Notice of Initiation of Countervailing Duties: Cetrain Softwood Lumber Products from Canada, Investigation C 122–839." Internet site: http://ia.ita.doc.gov/frn/0104frn/01-10687.txt (Accessed August 2, 2002).

———. 2002. "Notice of Final Affirmative Countervailing Duty Determination and Final Negative Critical Circumstances Determination: Certain Softwood Lumber Products from Canada, Investigation C 122–839." Internet site: http://ia.ita.doc.gov/lumber/02-7849.txt (Accessed November 12, 2002).

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.

WTO (World Trade Organization). *United States–Final Countervailing Duty Determinations with Respect to Certain Softwood Lumber from Canada*. DS257, 2003.

———. *United States–Final Countervailing Duty Determinations with Respect to Certain Softwood Lumber from Canada*. DS257/AB/R, 2004.

———. "Index of disputes issues." Internet site: www.wto.org/english/tratop_e/dispu_e/dispu_subjects_index_e.htm (Accessed January 4, 2007).

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

———.*The Political Economy of the U.S.–Canada Softwood Lumber Dispute*. Washington DC: Resources for the Future, 2007.