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Impact of inefficient quota allocation under the Canada-U.S. softwood lumber dispute: A calibrated mixed complementarity approach

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ABSTRACT

In this paper, a spatial price equilibrium model developed to shed new light on the economic impact of restrictive trade sanctions adopted in the Canada-U.S. softwood lumber dispute. Mixed complementarity programming is used to solve a 21-region, global trade model that is calibrated to 2011 observed bilateral trade flows using positive mathematical programming. In addition, the model employs a mechanism for analyzing the effects of the tariff rate quota used in the 2006 Softwood Lumber Agreement (SLA). It is estimated that the SLA created an annual deadweight loss of $28 million, paid by U.S. consumers. The quota constrained Alberta lumber producers while BC producers had excess quota. The lack of a proper mechanism for capturing quota rent, such as a tradable quota scheme or quota auction resulted in the survival of high-cost firms, perhaps to the detriment of lower-cost firms in Alberta. In the absence of SLA, it is estimated that Alberta would supply an additional 9% of Canadian softwood lumber to the U.S., eroding the supply share of all other regions while improving aggregate welfare.

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1. Introduction

The softwood lumber dispute between Canada and the U.S. has a long history. The current Softwood Lumber Agreement (SLA) was struck in September 2006 and then extended to October 2015, followed by a one-year grace period during which U.S. lumber producers could not initiate action against Canada.[1] The SLA employed region-specific, tariff-rate quotas (TRQs) on softwood lumber imports from Canada, but exempted the provinces of Atlantic Canada. In 2006, two border measures were made available to non-exempt regions (with British Columbia divided into Coast and Interior regions); provinces chose their preferred option knowing that they could switch options every three years, although none has chosen to do so. The two options are described in Table 1.

Option A employs an export charge that varies with the prevailing *Random Lengths*' monthly composite softwood lumber price, which is calculated from the monthly prices of various lumber products as prescribed in the SLA. A region's threshold base quota depends on expected monthly U.S. consumption, which is a 12-month moving average of U.S. consumption ending three months prior to the month in question. The export charge is applied to exports from a region up to 1.01 times that region's share (the over quota trigger is referred to as the 'surge mechanism'),[2] after which all exports in that month are subject to a retroactive additional export charge equal to 50% of that month's export charge rate (Table 1). Under Option B, the export charge is lower than under Option A and still varies with the composite price, but the volume quota also varies with price. Alberta and BC chose Option A, while Saskatchewan, Manitoba, Ontario and Quebec chose Option B.

Under the SLA, the allocation of TRQs among provinces is troubling because there are times when one or more regions have excess quota, while another region exceeds its quota limit. This has been a particular problem for Alberta which has often exported softwood lumber in excess of its surge trigger (as shown in Fig. 1), even to the point where it incurred penalties. Although the World Trade Organization (WTO)

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[1] Details can be found at the softwood lumber website of Global Affairs Canada, http://www.international.gc.ca/controls-controles/softwood-bois_oeuvre/index.aspx?lang=eng [accessed July 4, 2016].

[2] In Article VIII of the SLA, the surge mechanism sets the threshold at 1% over the regional share, but the daily SLA export reports set the surge trigger at 110% of the regional share. However, in a month following a surge, the surge amount must be covered by below quota sales. Thus, we focus only on the quota without considering the surge aspect.

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Table 1
Calculation of the triggers under the U.S.-Canada Softwood Lumber Agreement.
Source: Softwood Lumber Agreement, Article VI, Paragraph 2. http://www.treaty-accord.gc.ca/text-texte.aspx?id=105072&lang=eng [accessed July 4, 2016].

Random Lengths framing lumber composite price	Option A: Export charge	Option B: Export charge + quota
Over US$355/mbf	0%	0% + no quota
US$336 to US$355/mbf	5%	2.5% + regional share of 34% of U.S. consumption
US$316 to US$335/mbf	10%	3.0% + regional share of 32% of U.S. consumption
US$315 or under	15%	5.0% + regional share of 30% of U.S. consumption

prefers TRQs to outright bans and hard quotas, a TRQ may still elicit quota rents that promote wasteful rent-seeking activities (Hranaiova and de Gorter, 2003), and adversely affect trade patterns and the distribution of wealth. As Canada supplied more than US$5 billion worth of lumber to the U.S. in 2014 alone, the rents and income distributional impacts associated with government intervention in lumber could be substantial.

The softwood lumber trade dispute is motivated by many factors, including the creation and distribution of rents, and not just by economic efficiency considerations (van Kooten, 2002). The rents may be sizeable and come solely at the expense of U.S. consumers (Lindsey et al., 2000). Given that the scarcity rents are created by government policy, various studies over the past 15 years have investigated the income distributional aspects of alternative policies (intervention mechanisms) employed in the Canada-U.S. lumber dispute.[3] Baek (2011) used an econometric model to argue that Canada-U.S. trade in softwood lumber is driven more by macroeconomic variables, such as housing starts and disposable income, than market variables, and that the welfare effects of the current SLA are modest. In a similar vein, Nagubadi and Zhang (2013) used a cointegration framework to find that macroeconomic variables are the main driver of North American lumber trade. However, they conclude that U.S. imports of softwood lumber were 11.2% to 12.8% lower as a result of the SLA, but provide no measure of the welfare impacts.

Parajuli et al. (2015) estimated a system of equations that integrated the SLA's export taxes explicitly, concluding that the 2006 SLA had little influence on Canada-U.S. trade; rather, the trade between the two countries was driven largely by the magnitude of Canadian overseas exports. Later, Parajuli and Zhang (2016) adopted a partial equilibrium framework of U.S. import demand for Canadian softwood lumber to find that the SLA reduced U.S. imports of Canadian lumber by 7.8%, although they did not control for Canadian overseas exports. Parajuli et al. (2016) then developed a two-country, two-stage game theoretic model to estimate an optimal export tax associated with the 2006 SLA, concluding that the monthly optimal export tax tracked the actual export tax quite closely, with the monthly difference ranging from −4% to 19%. However, the authors do not control for the effects of the provincial surge triggers..

In contrast, van Kooten and Johnston (2014) employed a 20-region, spatial price equilibrium (SPE) trade model to measure the welfare impacts of the SLA. They found that, if the SLA's export tax on Canadian lumber was removed, Canada would gain $91.8 million, but welfare gains to the U.S. would be modest. The effects of exporting above the TRQ amount were not considered, however.

In the past, SPE models did not explicitly model a tariff-rate quota when examining the Canada-U.S. softwood lumber dispute, perhaps because of the challenge the TRQ posed for modelers. Thus, it remains to be seen how an ability to redistribute quota among Canadian regions would affect the creation and distribution of rents. To investigate this, it is useful to employ an SPE model that assumes differences in prices between regions are due to shipping and handling costs (Takayama and Judge, 1971). There remains one problem to overcome: When ad valorem tariffs and TRQs are used, SPE models cannot be directly solved as the tariff depends on the endogenously determined supply price (Nicholson et al., 1994).

The purpose of the current study is to redefine the SPE modeling framework previously used in studying the Canada-U.S. softwood lumber trade dispute to shed light on the economic impact of the restrictive trade sanctions adopted under SLA. In particular, we examine the effect of differences in how the quota is applied in various Canadian regions and the implication this has for arbitrage opportunities. Rationing pushes the price above the marginal cost of production, leading to an arbitrage opportunity for the exporting region. Auctioning of quota will lead to greater efficiency and eliminate opportunities for arbitrage. Further, we propose a method of calibrating the trade model using positive mathematical programming in the context of mixed complementarity programming where price and quantity need to be determined simultaneously to obtain optimal quota levels.

To address these objectives, we begin in the next section by examining how quota rents are created under TRQs. This is followed by the formulation of a nonlinear optimization problem of global softwood lumber trade, including a detailed description of how to incorporate TRQs explicitly into the modeling framework. We then consider how to calibrate our model by integrating PMP into the MCP procedure for solving trade models. This is followed by our empirical results and the potential benefits of arbitrage of TRQs within Canada. We conclude by arguing that the provisions of the 2006 SLA can lead to greater all-around benefits if provinces collaborate to set up a market for trading quota. Finally, we consider how the current SLA might need to be modified to incorporate quota trading, and its implications with regards to the WTO.

2. Methods and data

2.1. Rent generation with tariff-rate quotas

To examine the potential rent-seeking effect of TRQs consider Fig. 2. We must first identify three important components: an in-quota tariff (t_0), the quota level (denoted TRQ in the figure), and an over-quota tariff ($t_1 > t_0$). The U.S. demand function is the excess demand function or difference between U.S. demand and U.S. supply for prices below the U.S. autarkic price. The Canadian supply curve is the excess supply curve given as the difference between Canadian supply and demand for prices above the Canadian domestic autarkic price.

In panel (a), the quota is not binding as excess demand intersects the excess supply schedule at Q^1. The price charged for imports (P^1) is equal to the Canadian supply price (P^s) multiplied by $1 + t_0$, and the tariff revenue is simply equal to the light-shaded area: $t_0 \times P^s \times Q^1$. In panel (b), the quota is binding at Q^2. In this case, the U.S. domestic price must rise to P^2 to clear the market, creating a quota rent equal to the sum of the two shaded areas, or $(P^2 - P^{s\prime}) \times Q^2$. The light-shaded area in Fig. 2(b) denotes that tax revenue, which equals $t_0 \times P^{s\prime} \times Q^2$, while the dark-shaded area denotes the rent or windfall accruing to Canadian lumber producers. The in-quota export tax rate, $t_0 < t_1$, is too low to capture the entire quota rent.

Under the SLA, Canada imposes a tax on exports of softwood lumber to the U.S., while the quota in any month depends on U.S. demand in the preceding period; it is set at 28% with the quota divided across Canada's provinces on the basis of their pre-SLA share of the U.S. market. As with a TRQ system, producers pay a lower tax rate on within-quota

[3] For a review of earlier studies see Yin and Baek (2004).