US Imports for Canadian Softwood Lumber in the Context of Trade Dispute: A Cointegration Approach

Rao V. Nagubadi and Daowei Zhang

Abstract: In this paper, we examine US imports of softwood lumber from Canadian provinces that are covered under various trade restriction measures between the two countries, and from the rest of the world, including other Canadian provinces that are not subject to the trade restriction measures and other countries. Using the cointegration framework, we find that in the long run, housing/construction activity and the US domestic lumber prices have a positive impact, while imported Canadian lumber prices had a negative impact on the quantity of US lumber imports from the covered provinces. In the short run, the last two lumber trade restriction measures, high Countervailing Duty and Anti-dumping Duty from August 2001 to September 2006, and the latest Softwood Lumber Agreement of 2006 from October 2006 to March 2012 (the latest data available), reduced the US imports of softwood lumber from the covered provinces by −12.8% and −11.2%, respectively. FOR. SCI. 59(5): 517–523.

Keywords: Canadian softwood lumber imports, softwood lumber war, softwood lumber agreement, cointegration, imperfect substitute

THE UNITED STATES IS THE LARGEST importer of softwood lumber from Canada. US imports of Canadian softwood lumber increased from 9.55 billion board feet (bbf) in 1980 to a peak of 21.37 bbf in 2005 before plummeting to 8.79 bbf in 2011, while Canadian share of US markets increased from 28% in 1980 to 36% in 1996 before declining to 29% in 2011 (Statistics Canada 2012, USITC 2012). In addition to market factors, these results had a lot to do with various trade restriction measures being put on Canadian lumber during various stages of the "Softwood Lumber War" between the two countries in the last 30 years (Zhang 2007). The latest trade restriction measure is the Softwood Lumber Agreement of 2006, which has recently been extended to 2015.

Several studies have examined the trends and the underlying factors of US demand for Canadian lumber (e.g., Buongiorno et al. 1979, McCarl and Haynes 1985, Adams et al. 1986, Buongiorno et al. 1988, Chen et al. 1988, Hseu and Buongiorno 1993, Sarker 1993, 1996, Nagubadi et al. 2009, Baek 2012, Song et al. 2011). These studies used different periods of data, different intervals of periods (monthly, quarterly, and annual) of analysis, and different methods. A few earlier studies (Buongiorno et al. 1979, McCarl and Haynes 1985, Adams et al. 1986, Buongiorno et al. 1988, Chen et al. 1988, Hseu and Buongiorno 1993) used the Ordinary Least Squares (OLS) regression method that has since been proven to be inappropriate for time-series data. Other studies (Sarker 1993, 1996, Nagubadi et al. 2009, Baek 2012, Song et al. 2011) failed to differentiate US demand from Canadian provinces that are covered under various trade-restricting measures from other provinces and ignored US imports from other countries. The latter (imports from other countries) has become important, increasing from a mere 0.19 bbf or 0.11% of total US softwood lumber imports in 1980 to 3.11 million board feet or 4.85% in 2005 before declining to 0.36 million board feet or 1.47% in 2011.

The results of these studies differ greatly although they show that housing/construction activity and lumber price in the US influence softwood lumber imports from Canada. Further, the role of mortgage rate (M), an influential variable in US housing/construction activity, has scarcely been examined except by Jennings et al. (1991) and Myneni et al. (1994). Yet, Painter and Redfearn (2002) show that housing starts are sensitive to changes in interest rates. Finally, not distinguishing the Canadian provinces subject to trade restriction measures (hereafter referred to as SLA Provinces) and other provinces (hereafter referred to as nonSLA Provinces) and ignoring the imports from other countries might call into question the accuracy of estimates of the impacts of various trade restriction measures.

The purpose of this paper is to further investigate the determinants of US softwood lumber imports from Canada and examine the impacts of various trade restriction measures. We also look into the relationship between imports from SLA Provinces and from the rest of the world (R) that consists of nonSLA provinces and other countries. In the process, we use the hypothesis proposed by Buongiorno et al. (1979) and confirmed by Nagubadi et al. (2004) that, because of difference in species composition, imported lumber is an imperfect substitute for domestically produced lumber. The main conclusions of this paper are that all trade

Manuscript received February 13, 2012; accepted September 21, 2012; published online December 6, 2012; http://dx.doi.org/10.5849/forsci.12-013.

Rao V. Nagubadi (nagubadi2001@hotmail.com), Auburn University. Daowei Zhang (zhangdw@auburn.edu), Auburn University, School of Forestry and Wildlife Sciences, Auburn, AL.

Acknowledgments: This project was funded in part by USDA Agriculture and Food Research Institute (AFRI) Competitive Grant 2011-67023-30051. The authors thank Xiao Han, Fiona Yang, and Bin Zheng for assistance in data collection, two anonymous reviewers, and an associate editor of this journal for their comments on an early version of this article.

restriction measures have had a significant negative impact on US imports from SLA Provinces and a positive impact on imports from the rest of the world. The next section presents a brief history of the trade dispute between the two countries, followed by methodology and data. The remaining sections present empirical results and conclusions.

Background: Softwood Lumber Dispute

The modern version of the softwood lumber dispute between the United States and Canada started in 1982 and has gone through several distinct phases. As described in Zhang (2007), free trade existed between 1972 and 1986, even though there was a failed effort made by a group of US lumber producers to restrict Canadian lumber in 1982–1983, which is often labeled as Lumber I. Since Dec. 30, 1986 and with the exception of two short free-trade periods between 1994 and 1996 and in 2001, various trade restriction measures have been put on softwood lumber imports from four major Canadian lumber producing provinces—Alberta, British Columbia, Ontario, and Quebec—that collectively accounted from more than 95% of Canadian lumber exports to the United States in the 1980s and 1990s and some 90% afterwards. These measures include a Memorandum of Understanding (MOU), two Softwood Lumber Agreement (SLA), countervailing duty (CVD), and anti-dumping duty (AD). Zhang (2007) and Random Lengths (2010) show that these four phases of trade restriction are most distinguishable:

MOU 1987:01 – 1991:10 Canadian export tax or increase in stumpage fee.

SLA96 1996:04 – 2001:03 Tariff (export tax) rate quotas.

CVD&AD 2001:08 – 2006:09 High countervailing duty and anti-dumping duty.

SLA06 2006:10 – 2012:03 Price-adjusted tariff (export tax) rate quotas.

These four phases correspond with the last three investigations by the United States Department of Commerce of alleged government subsidies to Canadian lumber producers. Lumber II began with a new petition by the Coalition for Fair Lumber Imports, a US industry group, in the summer of 1986. After a positive finding in the preliminary investigation by the Commerce Department, an interim CVD was imposed in October 1986. Subsequent negotiations resulted in the MOU with the CVD transformed to an equivalent Canadian export tax or increase in stumpage fees designed to increase the costs of lumber from the four affected Canadian provinces (Wear and Lee 1993).

Lumber II ended when Canada withdrew from the MOU in October 1991, which led to Lumber III. The United States Department of Commerce self-initiated a new CVD investigation and a CVD of 6.5% was imposed in July 1992. But the duties collected were later returned to Canada in 1994 after Canada had won the case under the US-Canada Free Trade Agreement dispute settlement mechanism. Two years later, the first Softwood Lumber Agreement of 1996 (SLA96) was implemented. SLA96 had the effect of a tariff rate quota system although (American) tariff was replaced by a Canadian export tax. It stipulated an annual duty-free quota of 14.7 bbf of lumber from the four covered provinces with an increasingly prohibitive rate of export tax for quantities above it. SLA96 lasted until March 2001, and then Lumber IV began.

In August and October 2001, the United States imposed an interim CVD and interim AD, respectively, on lumber imports from the four provinces. The combined interim CVD and AD amounted to 27%, but 20% were applied after a final determination in May 2002. This rate was further reduced to 11% in 2003, which lasted until September 2006. Although nearly 80% of the duties collected were returned to Canadian producers in 2006 as the result of implementation of the second Softwood Lumber Agreement (SLA06), the impact of the combined CVD and AD was significant. Because the combined CVD and AD rates were much higher than the interim duty of 6.5% in 1992–1994, and some of the duties collected had not been returned to Canadian producers, we treat this period as CVD&AD.

On Sept. 12, 2006, Canada and the United States signed SLA06. SLA06 is a price-adjusted tariff (export tax) rate quota system: when US lumber prices are more than $355 per thousand board feet, no export tariff is applied, and when they are less than $315 per thousand board feet, an export tax ranging up to 15% with no volume control or an export tax up to 5% with volume control (i.e., a regional share of US consumption at 30% or less) is applied. In between these two price levels, there are two more tiers of export tax and corresponding quota. SLA06 entered into force on Oct. 12, 2006 and were set for 7–9 years.

Methods and Data

Model Specification

Following Buongiorno et al. (1979) and Nagubadi et al. (2004), US demand for Canadian softwood lumber imports can be expressed in this function

$$Q = f(Y, P_D, P_C, W, R, M, D) \quad (1)$$

where Q is quantity of softwood lumber imports from SLA Provinces in Canada, Y is the housing starts in the United States, P_D is US domestic price as represented by the US softwood lumber price index, P_C is the price of imported Canadian softwood lumber, W is the overall US price level as represented by US producers price index, R is US softwood lumber imports from the rest of the world including the nonSLA Canadian Provinces and other countries, M is the 30-year mortgage rate, and D is a series of dummy variables representing various trade restriction periods and each month. The intercept also captures the effect of the January month. In this model specification, we have added a few additional variables (R, M, and D) to the model of Buongiorno et al. (1979). Equation 1 shows that the US excess demand for softwood lumber imports from SLA provinces is a function of housing activity, import and domestic prices of softwood lumber, overall price level, imports from the rest of the world (including nonSLA provinces of Canada), interest rate, seasonal factors, and policy dummy variables representing various dispute phases.

The expected signs are positive for Y and P_D, and negative for P_C, W, and M. We expect the effect of housing activity (Y) to be positive on the softwood lumber imports as lumber is one of the primary materials used in housing construction. Similarly, we expect a positive sign for the domestic lumber price (P_D) and a negative sign for import price from Canada (P_C) (Buongiorno et al. 1979). An increase in the general price level (W) and mortgage rate (M) is expected to dampen the demand for softwood lumber via decreased housing activity, and the effect of these two variables are expected to be negative. On the other hand, the effect of imports from the rest of world (R) may be positive or negative, depending on whether it complements or competes with the softwood lumber imports from affected Canadian provinces. Finally, we expect the coefficients for variables represent the four phases of trade restriction to be negative.

Estimation

Because we have time-series data, we used the cointegration framework in our analysis. Augmented Dickey-Fuller (ADF) test for unit roots was used to determine the stationarity of various variables (Enders 1995), and Granger (1969) causality tests were used to choose variables and their order to be included in the multivariate cointegration tests. Granger causality test is a test for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, usually through a series of F-tests on lagged values of X (and with lagged values of Y also known) that those X values, provides statistically significant information about future values of Y.

Multivariate cointegration tests were then used to explore whether the series have common stochastic trends (Johansen 1988, 1995), and trace and maximum eigenvalue test statistics were used to find the cointegration rank. Cointegrated variables may contain some linear combination that is stationary, indicating a stochastic trend. If variables are cointegrated, vector error correction model (ECM) is estimated to allow for long-run and short-run adjustments. If variables are not cointegrated, a vector autoregression (VAR) method is used. Engle and Granger (1987), Dickey et al. (1991), Enders (1995), and Nagubadi et al. (2001) describe in detailed and easy-to-understand fashion of the cointegration procedure applied in this paper. Since all variables, (except the dummy variables), are in logarithmic form, the coefficients in the equations can be interpreted as elasticities.

Data

This study covers more than 32 years from January 1980 to March 2012. Monthly data on softwood lumber imports from Canada (Q) separately for SLA Provinces and nonSLA Provinces were collected from Statistics Canada (Statistics Canada, various years, 2012, USITC 2012). Data on the imports from other countries were from United States International Trade Commission's Interactive Tariff and Trade DataWeb (USITC 2012). Monthly housing starts (Y), and 30-year mortgage rates (M), were from the website of the St. Louis Federal Reserve Bank (FRED 2012).

For the US domestic softwood lumber price (P_D), we used the US softwood lumber price index (WPU0811, base 1982 = 100), and for the overall US price level (W) we used the US producers' price index for all commodities (WPU0000000, base 1982 = 100), from the Bureau of Labor (USDOL 2011). Canadian softwood lumber prices (P_C) were derived by dividing the total value of the imports by quantity of imported softwood lumber from Canada and converted into US dollars using the US-Canada exchange rates from the website of the St. Louis Federal Reserve Bank (FRED 2012).

The US softwood lumber index and the all commodities producers price index were re-indexed to 1982–1984 = 100. The 30-year mortgage rates were converted into real mortgage rates using Irving Fisher approximate real interest rate formula (Fisher 1977, Barro 1997), *Real Mortgage Rate = Nominal Mortgage Rate − Inflation rate*. In estimating the inflation rate, we used consumer price index (CPI) for all urban consumers with base 1982–1984 = 100. The Canadian softwood lumber prices were converted into real prices using Canadian CPI for all commodities (2005 = 100), which was re-indexed with base, 1982–84 = 100.

Results and Discussion

We first checked the nonstationary nature of variables and then examined the movement of many variables in a dynamic and synchronizing manner in the long run and short run.

Granger Causality Test Results

Table 1 presents the results of Granger causality tests between the variable Q (which is the dependent variable being examined), and the other variables Y, P_C, P_D, W, R, and M. These results show that there were strong two-way causal interrelationships between Q and four of the six variables. The null hypothesis of no Granger Causality was rejected between Q and Y, P_C, P_D, and M.

Table 1. Pair-wise Granger Causality relationships of important variables with softwood lumber imports quantity, Q, with 12 lags, for the monthly data: 1980:01–2012:03.

Null hypothesis	Obs	F-statistic	Prob.
Y does not Granger Cause Q	375	5.746[c]	< 0.0001
Q does not Granger Cause Y		3.038[c]	0.0004
P_C does not Granger Cause Q	375	2.237[c]	0.0099
Q does not Granger Cause P_C		2.140[b]	0.0142
P_D does not Granger Cause Q	375	2.017[b]	0.0221
Q does not Granger Cause P_D		2.288[c]	0.0082
W does not Granger Cause Q	375	1.536	0.1093
Q does not Granger Cause W		1.186	0.2917
R does not Granger Cause Q	375	1.293	0.2205
Q does not Granger Cause R		1.338	0.1949
M does not Granger Cause Q	375	2.222[b]	0.0105
Q does not Granger Cause M		2.158[b]	0.0133

[a] Indicates significance levels at the 10% level of probability.
[b] Indicates significance levels at the 5% level of probability.
[c] Indicates significance levels at the 1% level of probability.

Table 2. ADF Test Results for individual variables, monthly data: 1980:01–2012:03.

	Level						First-differentiated					
	Intercept			Intercept and linear trend			Intercept			Intercept and linear trend		
Variable	Lags	ADF	DW	Lags	ADF	DW	Lags	ADF	DW	Lags	ADF	DW
Q	13	−1.42	2.01	13	−0.86	2.01	12	−5.91[c]	2.01	12	−6.32[c]	2.01
Y	13	−2.42	2.00	13	−2.65	2.00	12	−3.71[c]	1.99	12	−3.75[b]	1.99
P_C	1	−3.87[c]	1.96	1	−4.05[c]	1.97	0	−15.39[c]	1.95	0	−15.37[c]	1.95
P_D	1	−2.00	1.93	1	−2.54	1.94	0	−13.69[c]	1.93	0	−13.68[c]	1.93
W	1	0.14	2.07	1	−1.82	2.08	0	−13.45[c]	2.07	0	−13.45[c]	2.07
R	3	−2.60[a]	1.97	3	−3.22[a]	1.97	2	−11.19[c]	1.97	2	−11.19[c]	1.97
M	3	−0.48	1.97	0	−5.13	1.91	2	−15.05[c]	1.97	2	−15.09[c]	1.97

Q = Canadian Imports from SLA Provinces; Y = Housing Starts; P_C = Canadian Price; P_D = Domestic Price; W = US Price Level; R = Imports from the Rest of World including nonSLA Canadian Provinces; M = 30 Year Mortgage Rates.
[a] Indicates significance levels at the 10% level of probability.
[b] Indicates significance levels at the 5% level of probability.
[c] Indicates significance levels at the 1% level of probability.

Unit Root Tests

ADF unit root tests were conducted for equations involving intercepts only, and intercept and linear trend, for the variables in levels and first-differenced form. Maximum lag length was automatically selected by EVIEWS software program based on Schwarz Information Criterion (SIC). The results, presented in Table 2, show that all variables in levels, except P_C and R, were nonstationary in nature due to the presence of unit roots. The first-differenced variables were of stationary nature as indicated by the rejection of the null hypothesis of unit roots for all variables.

Cointegration Results

A summary of Johansen's cointegration test results based on various assumptions provided in Table 3 reveal that there were one to two long-run cointegration relationships among the variables according to the trace test, and maximum eigenvalue test at 5% critical values provided by MacKinnon-Haug-Michelis (1999). We considered at least one long-run relationship based intercept and no trend according to both tests (i.e., case 3 in Table 3). This means that there are one stationary linear combination and five stochastic trends in the system of data.

Under the assumption that there was at least one long-run equilibrium trend within the data, we estimated error correction model (ECM) that included one long-run cointegration equation. Table 4 presents the results of the one long-run cointegration equation, while Table 5 provides the results of vector ECM.

The long-run cointegration relationship translates to

$$Q_{t-1} = 2.61 + 0.68Y_{t-1}^{***} - 0.81P_{Ct-1}^{***} + 1.04P_{Dt-1}^{***} + 0.13W_{t-1} + 0.01R_{t-1} + 0.07M_{t-1} \quad (2)$$

This means that, as expected, the lagged variables of housing starts (Y), and domestic price (P_D) had a significant positive impact, while import prices (P_C) had a significant negative impact on the lagged quantity of softwood lumber imports from Canada. Equation 2 is a US excess demand function of softwood lumber from affected Canadian provinces where prices in domestic and foreign (Canadian) markets (P_D, P_C) and the activity (Y) in the main economic sector that uses softwood lumber play a dominant role. Thus, the economic reasoning behind this cointegration relationship is apparent.

The results of ECM in Table 5 show that, in the short run, out of the six endogenous variables, only one variable (first difference in the lagged quantity of SLA imports − $D(Q_{t-1})$) influenced the difference in the quantity of the softwood lumber imports from SLA Provinces in Canada, D(Q). The effects of the other variables, such as, Y, P_C, P_D, were captured within the long-run relationship equations, but not in the short-run equation.

The ECM results show that the last two phases (CVD&AD and SLA06) of trade restrictive measures had a significant negative impact on the difference in the quantity of the softwood lumber imports from SLA Provinces, D(Q).

Table 3. Summary of Johansen's cointegration ranks in monthly data, 1980:01–2012:03.

Assumptions	Trace test	Max-Eigen value test
Assuming no deterministic trend in data:		
(1) No intercept or trend in CE or test VAR	1	1
(2) Intercept (no trend) in CE, no intercept in VAR	2	2
Allowing for linear deterministic trend in data:		
(3) Intercept (no trend) in CE and test VAR	1	1
(4) Intercept and trend in CE, no intercept in VAR	2	1
Allowing for quadratic deterministic trend in data:		
(5) Intercept and trend in CE, intercept in VAR	2	1

Table 4. Long-run cointegration relationships for monthly data, 1980:01–2012:03.

Variables	CointEq1	S.E.
Q_{t-1}	1	
Y_{t-1}	−0.678[a]	0.052
P_{Ct-1}	0.806[a]	0.118
P_{Dt-1}	−1.040[a]	0.138
W_{t-1}	−0.013	0.187
R_{t-1}	−0.010	0.026
M_{t-1}	−0.068	0.080
Constant	−2.611	

[a] Indicates significance level at the 1% level of probability.

Table 5. Vector ECM of softwood lumber imports from Canada for monthly data, 1980:01–2012:03. (Recession and great-recession variables were also included initially as exogenous variables, but they did not show any influence in these equations, hence removed from the final equations.)

	Dep. var. = D(Q)	
Variable	Coefficient	S.E.
CointEq1*	−0.478[c]	0.054
$D(Q_{t-1})$	−0.120[b]	0.053
$D(Y_{t-1})$	−0.088	0.060
$D(P_{C\,t-1})$	0.236	0.150
$D(P_{D\,t-1})$	−0.333	0.249
$D(W_{t-1})$	−0.210	0.552
$D(R_{t-1})$	0.004	0.020
$D(M_{t-1})$	−0.136	0.089
MOU	0.013	0.015
SLA96	−0.018	0.014
CVD&AD	−0.128[c]	0.019
SLA06	−0.112[c]	0.018
Constant	0.040[b]	0.020
Feb.	0.072[c]	0.026
Mar.	0.169[c]	0.026
Apr.	0.072[b]	0.032
May	0.025	0.028
Jun.	−0.013	0.026
Jul.	−0.047[a]	0.025
Aug.	−0.059[b]	0.025
Sep.	−0.025	0.025
Oct.	0.001	0.025
Nov.	−0.080[c]	0.026
Dec.	−0.101[c]	0.024
R-squared	0.42	
Adj. R-squared	0.38	

* The cointegration equation or the long-run relationships are as provided in Table 4.
[a] Indicates significance levels at the 10% level of probability.
[b] Indicates significance levels at the 5% level of probability.
[c] Indicates significance levels at the 1% level of probability.

In particular, the impact of CVD&AD was −12.8%, larger than that of SLA06 at −11.2%. This result is not surprising: as lumber prices in the United States have been below the $315 per thousand dollars threshold in much of the SLA06 phase, producers from SLA provinces have been paying the maximum of 15% export taxes on their exports to the United States or have been subjected to a maximum of 5% export tax with a volume control of 30% regional market share.

We tried to examine the influence of economic recession by adding a dummy variable for the period from December 2007 to June 2009 in the cointegration analysis. As the coefficient of this variable was not significant, we removed it from the equation. Apparently the impact of these variables was picked up by the housing/construction activity and other variables that were impacted by the recession. Interestingly, the coefficients of dummy variables representing MOU and SLA96 were insignificant, and that for MOU even had the wrong sign. By plotting Q over time we noticed that Q and the drop in Q in the MOU period were small compared to those in the latter periods. It is quite possible that the small variations in the early period of a long time-series data were simply overwhelmed by the larger variations in latter periods. When we ran the model just up to the end of the MOU period and the end of SLA96, we found that both MOU and SLA96 had a negative impact. Thus, one should look only up to the end of the period when a restrictive measure is applied, not thereafter, in analyzing the impact of the restrictive measure.

Comparison

For comparison purpose, we also ran three OLS regressions similar to Buongiorno et al. (1979) and have reported our results in Table 6. Here, also all variables (except the dummy variables) were in logarithmic form so that the coefficients could be interpreted as the respective elasticities.

Model 1 shows the results obtained for the same model as Buongiorno el al. (1979) with our data period (from January 1980 to March 2012). The adjusted R^2 improves considerably from 0.78 to 0.91, and the signs of the coefficients are the same and significant as in Buongiorno et al. (1979). The elasticities for the variables changed a bit (0.28 versus 0.39 for the housing/construction activity, *Y*), (−0.23 versus −0.31 for Canada's lumber price, P_C), (0.43 versus 0.85 for US domestic lumber price, P_D), (−0.17 versus −0.34 for overall price level, *W*) and (0.53 versus 0.21 for lagged imports Q_{t-1}).

In Model 2, we added two more variables often left out of various previous analyses (R and M), but we found these two variables did not show any significant impact, while the other variables had more or less the same impacts on Q as in the Model 1. The effect of various phases of softwood lumber restrictions was examined by including them as dummy variables in Model 3. The signs of all the significant variables remained the same as in Model 1 or 2, except for overall price level, W, which had no impact on Q. US imports from the rest of the world (R) were found to be complementary to US imports from SLA Provinces. With respect to the softwood dispute phases, the SLA96 (−4.1%), CVD&AD (−14.5%), and SLA06 (−14.4%) had significant negative impacts on the softwood lumber imports from the covered provinces while MOU had a positive impact, contrary to our expectations. Thus, the ECMs had captured less negative impacts of the trade restrictive phases than the OLS model in the short run, as evidenced by the insignificant impact of the SLA96 phase and lesser negative impacts of CVD&AD and SLA06 phases in the cointegration model versus in the OLS.

Table 6. OLS regression results of Buongiorno et al (1979) model with current monthly data, 1980:01 to 2012:03. (Although, the model included monthly dummy variables, the related coefficients were not presented [n.a] in Buongiorno et al. [1979].)

	Base model		Model 1		Model 2		Model 3	
Variable[d]	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
Intercept	1.33	—	1.912[c]	0.389	1.987[c]	0.472	1.533[c]	0.505
Y	0.39[c]	0.08	0.279[c]	0.030	0.280[c]	0.034	0.329[c]	0.036
P_C	−0.31[c]	0.11	−0.233[c]	0.049	−0.224[c]	0.055	−0.323[ca]	0.064
P_D	0.85[c]	0.18	0.427[c]	0.058	0.414[c]	0.070	0.489[c]	0.081
W	−0.34[b]	0.18	−0.168[c]	0.060	−0.176[b]	0.069	0.006	0.098
Q_{t-1}	0.21[c]	0.08	0.530[c]	0.040	0.530[c]	0.040	0.436[c]	0.042
R	—	—	—	—	0.0002	0.012	0.035[b]	0.013
M	—	—	—	—	−0.014	0.040	0.001	0.040
Feb.	n.a	n.a	0.042[a]	0.023	0.042[a]	0.023	0.045[b]	0.022
Mar.	n.a	n.a	0.049[b]	0.024	0.049[b]	0.025	0.044[a]	0.024
Apr.	n.a	n.a	−0.020	0.025	−0.020	0.025	−0.022	0.025
May	n.a	n.a	−0.023	0.025	−0.022	0.026	−0.029	0.025
Jun.	n.a	n.a	−0.040	0.025	−0.040	0.026	−0.046[a]	0.025
Jul.	n.a	n.a	−0.051[b]	0.025	−0.051[b]	0.026	−0.055[b]	0.025
Aug.	n.a	n.a	−0.065[c]	0.025	−0.065[b]	0.025	−0.064[c]	0.025
Sep.	n.a	n.a	−0.024	0.024	−0.024	0.025	−0.027	0.024
Oct.	n.a	n.a	−0.016	0.025	−0.016	0.025	−0.022	0.024
Nov.	n.a	n.a	−0.053[b]	0.024	−0.052[b]	0.024	−0.048[b]	0.023
Dec.	n.a	n.a	−0.062[c]	0.024	−0.061[b]	0.024	−0.051[b]	0.023
MOU							0.029[a]	0.016
SLA96							−0.041[b]	0.020
CVD&AD							−0.145[c]	0.029
SLA06							−0.144[c]	0.046
Adj R-Sq	0.78		0.91		0.91		0.92	
Obs	152		387		387		387	
R-MSE			0.094		0.094		0.090	
DW-D			2.152		2.155		2.099	
rho			−0.084		−0.085		−0.062	

[a] Indicates significance levels 10% level of probability.
[b] Indicates significance levels at the 5% level of probability.
[c] Indicates significance levels at the 1% level of probability.
[d] Recession and great-recession variables were also included initially in the regression equations, but they did not show any influence in these equations, hence removed from the final equations.

Conclusions

In this paper, we refined and estimated the monthly model of US imports of Canadian softwood lumber using both OLS and cointegration frameworks in the context of the various trade restrictive phases. Our results show that the trade dispute and the resulting trade restrictive phases negatively impacted the softwood lumber imports from covered Canadian provinces. In particular, the high Countervailing Duty and Anti-Dumping Duty phase, from August 2001 to September 2006, reduced US imports from the covered province by −13%, which is more than most of other trade restrictive measures imposed during the course of the Softwood Lumber War.

This result suggests that US producers are winning the war over time and have won big by imposing high Countervailing Duty and Anti-Dumping Duties in early 2000s and by securing the 2006 SLA. The 2006 SLA gives the US producers assurance and protection as the housing markets in the country collapsed shortly after it was signed. On the other hand, although few people might have predicted that the housing activities in the United States would fall sharply and that lumber prices in the United States would stay below the $315 per thousand board feet threshold for much of the SLA06 phase, the fact that these things have happened when the SLA06 is in place sealed the deal for Canadian producers in the affected provinces: they have been capped. These producers have to pay 15% export tax or face the ceiling of taking their regional market share in the United States no more than 30% plus 5% export tax. Thus, it is not a surprise that US producers want to extend the current Softwood Lumber Agreement for 2 more years. Given the facts that Canadian producers had to accept the 2006 SLA even though they had won most of the legal battles and that US consumers who pay the most under trade restrictive measures do not have a legal standing in the trade dispute and have been outmaneuvered in lobbying by the US lumber industry, free trade-in softwood lumber between the two countries won't be realized for some time.

Literature Cited

ADAMS, D.M., B.A. MCCARL, AND L. HOMAYOUNFARROKH. 1986. The role of exchange rates in Canadian-United States lumber trade. *For. Sci.* 32(4):973–988.

BAEK, J. 2012. The long-run determinants of US lumber imported from Canada revisited. *For. Pol. Econ.* 14(1):69–73.

BARRO, R. 1997. *Macroeconomics.* MIT, Cambridge. 580 p.

BUONGIORNO, J., J.J. CHOU, AND R.N. STONE. 1979. A monthly model of the United States demand for softwood lumber imports. *For. Sci.* 25(4):641–655.

BUONGIORNO, J., J.P. CHAVAS, AND J. UUSIVUORI. 1988. Exchange

rates, Canadian lumber imports, and United States prices: A time series analysis. *Can. J. For. Res.* 18:1587–1594.

BUONGIORNO, J., L. BRANNMAN, AND T. BARK. 1984. Econometric versus univariate and bivariate time-series forecasts: The case of softwood lumber imports. *For. Sci.* 30:194–208.

CHEN, N.J., G.C.W.G. AMES, AND A.L. HAMMETT. 1988. Implications of a tariff on imported Canadian softwood lumber. *Can. J. Agric. Econ.* 36:69–81.

DICKEY, D.A., W.W. JANSEN, AND D.L. THORNTON. 1991. A primer on cointegration with an application to money and income. *Review* 73(2):58–78.

ENDERS, W. 1995. *Applied Econometric Time Series.* Wiley, New York. 433 p.

ENGLE, R.F., AND C.W.J. GRANGER. 1987. Cointegration and error correction: Representation, estimation and testing. *Econometrica* 55:251–276.

FISHER, I. 1977. *The Theory of Interest.* Porcupine, Philadelphia, PA. 35 p.

FRED. 2012. Federal Reserve Economic Data-FRED-St. Louis Fed. Available online at research.stlouisfed.org/fred2/; last accessed May 20, 2012.

PAINTER, G., AND C. REDFEARN. 2002. The role of interest rates in influencing long-run homeownership rates. *J. Real Estate Finance Econ.* 3:243–267.

GRANGER, C.W.L. 1969. Investigating causal relations by econometric models and cross-spectral methods. *Econometrica* 37: 424–438.

JENNINGS, S., W. ADAMOWICZ, AND L. CONSTANTINO. 1991. The Canadian lumber industry and the macroeconomy: A vector autoregression analysis. *Can. J. For. Res.* 21(3):288–299.

JOHANSEN, S. 1988. Statistical analysis of cointegrating vectors. *J. Econ. Dyn. Control.* 12:231–254.

JOHANSEN, S. 1995. *Likelihood-Based Inference in Cointegrated Vector Auto-Regressive Models.* Oxford University Press, New York. 267 p.

MACKINNON, J.G., A. HAUG, AND L. MICHELIS. 1999. Numerical distribution functions of likelihood ratio tests for cointegration. *J. Appl. Econ.* 14:563–577.

MCCARL, B.A., AND R.W. HAYNES. 1985. Exchange rates influence softwood lumber trade. *J. For.* 1985:368–370.

MYNENI, G., J.H. DORFMAN, AND G.C.W. AMES. 1994. Welfare impacts of the Canada-US softwood lumber trade dispute: Beggar thy consumer trade policy. *Can. J. Agric. Econ.* 42:261–271.

NAGUBADI, R.V., D. ZHANG, J.P. PRESTEMON, AND D.W. WEAR. 2004. Softwood lumber products in the United States: Substitutes or complements or unrelated? *For. Sci.* 50(4):416–426.

NAGUBADI, R.V., H. THOMPSON, AND D. ZHANG. 2009. Productivity and Trade during the Softwood Lumber Dispute. *Int. Trade J.* 23(3):301–324.

NAGUBADI, V., I.A. MUNN, AND A. TAHAI. 2001. Integration of hardwood stumpage markets in the Southcentral United States. *J. For. Econ.* 7(1):69–98.

SONG, N., S.J. CHANG, AND F.X. AGUILAR. 2011. US softwood lumber demand and supply estimation using cointegration in dynamic equations. *J. For. Econ.* 17(1):19–33.

RANDOM LENGTHS. 2010. US Canada trade dispute: The US-Canada trade agreement timeline, 1995–present. Available online at www.randomlengths.com; last accessed Sept. 17, 2010.

SARKER, R. 1993. A maximum likelihood cointegration analysis of Canadian lumber exports. *Can. Agric. Econ.* 41:97–110.

SARKER, R. 1996. Canadian softwood lumber export to the United States: A cointegrated and error-corrected system. *J. For. Econ.* 2(3):205–231.

STATISTICS CANADA. 2012. Available online at www.statcan.gc.ca/; last accessed May 20, 2012.

STATISTICS CANADA. various years. *Sawmills.* Cat. No. 35-003-X, Monthly Service Bulletin. Available online at www.statcan.gc/ca/pub/35-003-x/; last accessed May 20, 2012.

UNITED STATES DEPARTMENT OF LABOR (USDOL). BUREAU OF LABOR STATISTICS. Available online at www.bls.gov/; last accessed June 1, 2012.

USITC DATAWEB. United States International Trade Commission, Interactive Tariff, and Trade DataWeb. Available online at dataweb.usitc.gov/; last accessed May 20, 2012.

ZHANG, D. 2007. *The Lumber War: Politics, Economics, and the Long Lasting US-Canada Trade Dispute.* Resources for the Future Press, Washington, DC. 320 p.