The Users of Lumber and the US-Canada Softwood Lumber Agreement: An Event Study

by

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The Users of Lumber and the SLA: An Event Study

Abstract

In this paper we analyze whether the Softwood Lumber Agreement between US and Canada imposed significant economic costs on the users of Lumber in the US. To ascertain this impact we use an event study. Our event study analyzes variations in the stock prices of lumber using firms listed at the major stock markets in the US. We find that events leading to the Softwood Lumber Agreement had significant negative impacts on the stock prices of industries using softwood lumber. The average reduction of stock prices for our sample of firms was approximately 5.42% over all the events considered.

Key Words and Phrases: SLA, International Trade Disputes, Event Study
JEL Classifications. Primary: F13; Secondary: G1.
1 Introduction

Bilateral trade in softwood lumber is the subject of a long standing and ongoing dispute between Canada and the United States (US) (see Reed (2001) for a detailed chronology). The current round of this dispute started as a US countervailing duty investigation in 1982/83. The US claimed, and still claims, that fees charged for harvesting softwood on public lands by certain Canadian provincial governments are artificially low. It also claims that artificially low fees set by provincial governments constitute countervailable subsidies.

In May 1996, Canada and the US signed the Softwood Lumber Agreement (SLA). Using a tariff rate quota the SLA voluntarily restricted US bound exports of Canadian lumber from four provinces, Alberta, British Columbia, Ontario, and Quebec. The first 14.7 Billion Board Feet (BBF) of softwood lumber exported from these provinces could be shipped duty free. The next 650 million board feet exported was subject to a tax of $50 per thousand board feet. All further exports, were subject to a tax of $100 per thousand board feet.

The main objective of this paper is to investigate the impact of the SLA on US industries that use lumber as an input. All else being equal, restrictions on Canadian lumber exports raise lumber prices in the United States.\(^3\) This raises profits for US lumber producers, but also makes those who use lumber worse off. Lindsey et. al.

\(^3\)Zhang (2001) estimates that the anticipated increase in lumber price in the US due to the SLA was 16% for its first four years.
(2000) estimate that the SLA raises the cost of lumber in an average new US home by 800 - 1300 Dollars. More dramatically, they also estimate that for every $50 increase in the price of 1,000 board feet of framing lumber, 300,000 potential homeowners are priced out of the housing market. However, homeowners are not the only group affected by an increase in lumber prices. When customers can no longer afford to buy homes, home builders lose business. Further, as the cost of softwood lumber rises, remodeling costs rise, and subsequently, remodelling orders fall. In addition to the final consumers, a trade restriction on lumber adversely affects other industries which use lumber as a raw material. Examples of such industries are home builders, manufactured-home builders, lumber dealers etc.4

Most previous studies of the softwood lumber dispute focus on the obvious gainers or losers. These are the US producers, the Canadian producers, and the US consumers (see, for example, Zhang, and Hussain (2004), Zhang (2001), Van Kooten (2002), and Begley et al. (1998)). The industrial users of lumber are usually ignored. This is a potentially serious omission for two reasons. The first is the lack of an inclusive welfare analysis. Given that lumber is primarily used as a raw material, any analysis of welfare that ignores the raw material using industry cannot calculate the true costs of the trade restriction. The second reason is political economy. While consumers usually do not form special interest groups, intermediate input using industries are likely to lobby against harmful trade restrictions. In the case of lumber,

4In 1993, 83 percent of the US consumption of softwood lumber was in Construction (USITC (1995)). This included new residential, repair and remodelling, and nonresidential construction.
one such counter-lobby is the American Consumers for Affordable Homes (ACAH, see http://www.acah.org). This special interest group is largely a collection of industrial lumber users. Ignoring the industrial users of lumber would imply ignoring an important US counter-lobby in the softwood lumber dispute.

In this paper we wish to redress this imbalance. Our aim is not to present an inclusive welfare analysis, or an inclusive political economy analysis. Our aim is solely to point out that the impact of SLA on the industrial users of lumber is important and significant enough. We wish to use the results from this paper to persuade researchers and policy makers to include the industrial users of lumber in future analyses of this dispute.

To investigate the impact of the SLA we use an ‘event study’. An event study is an empirical study of prices of an asset just before and after some event, like an announcement, merger, or dividend. A key assumption is that the capital market is efficient, and can evaluate the impact of new information on a firm’s expected future profits. This implies that ‘abnormal’ changes in a firm’s stock price can be interpreted as the present discounted value of future gains or losses expected due to the event.\(^5\)

\(^5\)To calculate ‘abnormal’ returns we first calculate the relationship between the firm’s stock price and the stock market in the absence of the event under consideration (in this case the Softwood Lumber Agreement). This relationship generates predicted returns in the absence of the agreement. These predicted returns are then compared with the actual returns on the event dates (dates specific to the agreement) giving us abnormal returns.
We consider three events leading to the Softwood Lumber Agreement. The first event date is February 2, 1996. Seeing that negotiations between US and Canadian governments had made little headway, on February 2, 1996 the Council for Fair Lumber Imports (CFLI - a coalition representing US lumber interests) announced its own deadline. It announced its intention to file a petition for a countervailing duty if an agreement between US and Canada was not reached by February 15th, 1996. The second event date is February 15, 1996, this day an agreement between the two countries was reached in principle. The final event date we consider is April 3, 1996, this day Canada finalized the agreement and announced its details.

Our results indicate that the events leading to the Softwood Lumber Agreement had significant negative impacts on the stock prices of industries using softwood lumber. The average reduction of stock prices for our sample of firms was approximately 1.5% for each of the first two events. For the final event (Canada finalizing the agreement) the average reduction in stock prices was significantly higher at approximately 2.5%. Cumulating the losses over all three events, we find that the average reduction in stock prices for the firms in our sample was 5.42%. Given these results, it seems fairly clear, that the Softwood Lumber Agreement imposed significant economic costs on the users of lumber. We also disaggregate this impact amongst the users of lumber. Using four digit Standard Industrial Classification (SIC) codes we find that retailers and wholesalers of lumber and other building materials (SIC 5211) had the largest depreciation in their market value at 12.99% over all the events. Single-family
housing construction firms (SIC 1521) were next. Their loss in market value was 6.19%. Operative builders (SIC 1531) lost 4.22% of their market value, and Mobile Homes and Prefabricated Wood Buildings (SICs 2451 and 2452) lost 1.88% of their market value due to the SLA.

The main contribution of this paper is to draw attention to the industrial users of lumber as important players in the softwood lumber dispute. No other study has carefully considered this group in their analysis of the Canada US softwood lumber dispute. We believe that this is an important omission from the literature as softwood lumber is an intermediate good. The group we consider bears a large portion of the cost of this long standing dispute and thus its omission could have important implications. The second contribution of this paper is to illustrate the use of stock price data to study the impact of trade restrictions. While event studies have been used earlier in the literature studying the Canada US softwood lumber dispute they are not commonly used. In fact there have probably been only a handful of studies in the economic literature analyzing the stock market impacts of trade restrictions.\footnote{For the same reason this paper is also a contribution to the broader empirical literature studying trade restrictions. Most papers in this literature evaluate the industry directly affected by the policy. As far as we know, our paper is the first empirical analysis of a trade restriction on the industrial users of the restricted good.}

\footnote{Begley et al. (1998) used an event study to assess the impact of export taxes during the Memorandum of Understanding (MOU) on the producers of Canadian Lumber. More recently, Zhang and Hussain (2004) have used an event study to assess the impact of events related to the MOU, the SLA, and the recent countervailing duty by US authorities in 2001. Their analysis only focuses}
We structure this paper as follows. In Section 2 we provide a brief history of the US-Canadian softwood lumber dispute. In Section 3 we describe our event study. In Section 4 we discuss the data and its sources. We present our results in Section 5, and conclude in Section 6.

2 The US-Canada Softwood Lumber Dispute: A Brief History till the Softwood Lumber Agreement

In Table 1 we list the main countervailing duty investigations involving softwood lumber and their outcomes in the current round of the dispute. The first countervailing investigation is commonly termed Softwood Lumber I. Concern over rising Canadian lumber imports resulted in a petition for a Countervailing Duty (CVD) in October 1982. The petition alleged that Canadian Provincial and Federal governments were subsidizing softwood lumber production by selling the right to cut timber on public lands at artificially low prices. In the ensuing investigation the International Trade Administration (ITA), a dispute settlement body in the US Department of Commerce, ruled that Canada’s policies regarding allocation and pricing of softwood on the producers of lumber. Other examples are Lenway et al. (1996) who examine the returns to the steel industry from the trigger price mechanism of 1977 and 1980, and the voluntary export restrictions of 1982 and 1984, and Ries (1993) who examines the effect of voluntary export restraint agreements in 1981 on profits in the Japanese automobile industry.

8 For a more comprehensive description of the US-Canada lumber dispute please see Braudo and Trebilcock (2002), and Reed (2001).
lumber did not constitute a countervailable subsidy to its softwood lumber industry.\(^9\)

The dispute was revived in May 1986 by US interests grouped under the Coalition for Fair Lumber Imports (CFLI). The Coalition requested US authorities to impose a countervailing duty on Canada’s softwood lumber exports to the US. In this new phase (called Softwood Lumber II), the facts of the case as well as the applicable law had not materially changed from the first phase in 1982/83. However, the Canadian share of the US softwood lumber market had risen from 28.5 percent in 1983 to 31.6 percent in 1985 (see Gagné (1999)). This time the International Trade Administration reversed its prior decision. It found Canadian stumpage rates to be countervailable, and imposed a 15 percent provisional duty.\(^10\) In December 1986, US and Canada agreed to a Memorandum of Understanding (MOU) under which Canada imposed a 15 percent tax on its exports to the US.

In Canada there was resentment against the MOU. Further, during this period British Columbia (the single largest exporter of softwood lumber) replaced its export charge by permanently increased stumpage rates. In October 1991, Canada unilaterally terminated the Memorandum of Understanding. This was met almost immediately by interim duties on Canadian lumber. A third countervailing duty investigation (Softwood Lumber III) was initiated. In May 1992, the ITA issued a fi-

\(^9\)The ‘specificity test’ of an export subsidy was not met. This was because this stumpage rate was valid for all producers and did not target exporters specifically.

\(^10\)The difference between stumpage revenues received by provincial governments and applicable government costs was used to determine whether subsidy existed.
nal determination which set the countervailing duty at 6.51 percent.\textsuperscript{11} Subsequently, Canada appealed the ruling at the dispute settlement body of the Canada US Trade Agreement (CUSTA).

A prolonged period of litigation under the CUSTA followed.\textsuperscript{12} The duty imposed was disallowed by CUSTA, and finally revoked by the US government in 1994. Following this revocation a period of mostly free trade followed. This was a phase of euphoria in bilateral relations between US and Canada. When President Clinton visited Ottawa (February 1995) after the North American Free Trade Agreement both US and Canadian governments viewed trade disputes such as Softwood Lumber as minor irritants in a phase of increasing integration (as reported by Leo Ryan in a news report for the Journal of Commerce on February 23rd 1995).

Nevertheless, in late 1995 there was renewed pressure on the US government to limit softwood imports. Given that the Canadian softwood lumber industry had incurred large litigation costs to win Softwood Lumber III they were willing to look for a negotiated bilateral solution. Despite ongoing negotiations, on February 2, 1996 the US coalition for fair lumber imports announced its intentions to petition if no pact was reached by February 15th. Under this pressure, the five year SLA,

\textsuperscript{11}The methodology used to determine the counterviable duty differed from the one used in the Softwood Lumber II. This time round the finding of subsidy was based on the difference between stumpage rates under the small business program in Canada and rates of major licenses.

\textsuperscript{12}The panels overturned ITA’s and ITC’s findings. The US went on to challenge the panel’s decision. After a further investigation the panel upheld its previous decision.
(from April 1, 1996 to March, 31, 2001), was accepted by both the sides. Even these five years of SLA were marred by further disputes. The US customs, on at least three occasions, reclassified products from tariff codes outside the SLA into codes covered by the agreement. Also, during this period British Columbia’s stumpage reduction was challenged by the US under the dispute settlement provisions of the agreement.

Since the end of the SLA on April 1st 2001 the softwood lumber dispute has been in the news once again. Another countervailing duty was imposed by US authorities (August 2001). But since then another bilateral agreement has been agreed in principle, and more recently WTO, and NAFTA rulings have been announced on the dispute.

3 An Event Study

3.1 The Market Model

This event study is based on the market model, relating the return of an individual firm’s stock to the return of a market index and a firm-specific constant.

\[ R_{it} = a_i + B_i R_{mt} + e_{it}, \]  

where \( R_{it} \) is firm i’s return at date t; \( R_{mt} \) is the return of the value weighted NYSE/AMEX/NASDAQ index at date t; \( a_i \) and \( B_i \) are the parameters to be estimated; and \( e_{it} \) is a serially uncorrelated error term with mean 0 and constant variance \( \sigma_i^2 \) for stock i.
The above traditional market model equation can be expanded to include separate
dummy variables for each event date. Thus, an event window of N observations
requires N dummy variables. The estimated equation is of the following form:

\begin{equation}
R_{it} = a_i + B_i R_{mt} + \sum_{n=i+1}^{T+N} EW_{nt} A_{in} + e_{it} \\
(t = 1, T, T + 1, ..., T + N); (i = 1, 2, ..., I),
\end{equation}

where \( EW_{nt} \) is a dummy variable that takes the value 1 for the \( n^{th} \) day of the event
window and 0 otherwise, and the \( A_{in} \) are additional parameters to be estimated.
Equation (2) is estimated using ordinary least squares.

The coefficient of the dummy variable (\( EW \)) is the abnormal return (\( A \)).

\[ \hat{A}_{it} = R_{it} - (\hat{a}_i + \hat{B}_i R_{mt}) \quad t = T + 1, ..., T + N. \]

There are \( I \) set of equations, one for each firm, with \((T + N)\) observations for each
\( i \). In the above model, the estimation period for the slope and the intercept is
\((t = 1, ..., T)\). These T observations without the dummy variables determine the
estimated slope and the intercept as well as the estimated variance \( s_i^2 \). The estimation
period for the market model is 365 days, beginning 396 days prior to the event \( t_0 \) and
ending 30 days before the event, as shown in Figure 1. The remaining N observations
\((t = T+1, ..., T+N)\) include the event dummies and do not affect the estimated slope,
since the observations in the event window are “dummied out”. There are \( N \) days in
the event window. The \( A_{in} \) coefficients for these N observations are nothing but the
prediction errors or the abnormal returns.\(^{13} \) See Appendix A for further discussion.

\(^{13}\) Also, the variance \( s_i^2 \) is estimated with the first T observations, since the regression residuals for
The above regression provides an unbiased estimate of \( \sigma_i^2 \)\(^{14}\)

\[
    s_i^2 = \frac{\sum_{t=1}^{T} \hat{\epsilon}_{it}}{T - 2}; \ t = 1, 2, 3, \ldots, T.
\]

The dummy variables can be aggregated to obtain cumulative daily abnormal returns (\( CA \)). Over an interval of two or more trading days beginning with day \( T + 1 \) and ending with day \( T + N \), the average cumulative abnormal return across the I firms is

\[
    ACA = \frac{1}{I} \sum_{i=1}^{I} CA_i
\]

where the cumulative abnormal return over the event window (\( N \)) for firm \( i \) is defined as

\[
    CA_i = \sum_{t=T+1}^{T+N} \hat{A}_{it}
\]

### 3.2 Hypothesis Testing

Abnormal returns by design exhibit sampling error. The abnormal return, \( \hat{A}_i \), has an expected mean of zero and covariance matrix given by\(^{15}\)

\[
    V(\hat{A}_i) = \sigma_i^2 [I_N + X_N(X_T'X_T)^{-1}X_N'];
\]

\[
    T = \text{Estimation Period}; \ N = \text{Event Window}
\]

where \( X_T \) is a matrix of explanatory variables over the estimation period and \( X_N \) a matrix of explanatory variables over the event window. The covariance matrix, the event window, the last \( N \) observations, are zero.

\(^{14}\) Please refer to the appendix for greater detail on the variance and covariance of abnormal returns.

\(^{15}\) Please see the Appendix for greater detail.
The first term in the covariance matrix is the variance due to random disturbances and the second term is the additional variance due to the sampling error in \((\hat{a}, \hat{B})\) (prediction outside the estimation period). Testing for the statistical significance of CA (aggregated abnormal returns over the event window) requires us to account for this sampling error, which further leads to serial correlation of the abnormal returns.\(^{16}\) Abnormal returns are serially correlated despite the fact that the true disturbances, \(e_{it}\), are independent across time.

Furthermore, it is reasonable to believe that there exists cross-sectional contemporaneous correlation between the returns of firms belonging to the same industry; this is referred to as industry clustering. The cross-sectional correlation of shocks within an industry cannot be eliminated by controlling for the market return, since the correlation within the same industry is generally over and above that of the market.

A test statistic introduced by Boehmer, Musumeci and Poulsen (1991) is used to test for statistical significance of cumulated abnormal returns\(^{17}\). This test statistic is an extension of the standardized abnormal return test (also known as the Patell test) and corrects for both serial correlation and contemporaneous correlation. Boehmer et al. (1991) report that this test is well specified and quite powerful.

\(^{16}\)For a firm, all the abnormal returns estimate use the same intercept and slope parameters.

\(^{17}\)Please see the appendix for more detail on the test statistic used.
4 Data

4.1 Consumers of Softwood Lumber

Our sample of lumber using industry (also referred to as downstream industry) draws from the membership of the American Consumers for Affordable Homes (ACAH). The ACAH claims that it represents approximately 95 percent of softwood lumber use in the US.\(^{18}\) However, not all members of this associations are direct consumers or users of softwood lumber. In the US, softwood lumber is largely used for constructing new homes and remodeling existing structures. It is also used for building manufactured homes. Accordingly, we short list firms from the ACAH that belong to the following four digit Standard Industrial Classification (SIC). These are: SIC 1521 (Single-Family Housing Construction), SIC 1531 (Operative Builders), 2451 (Mobile Homes), and 2452 (Prefabricated Wood Buildings). Besides the direct users, we also include suppliers, in other words, the wholesale lumber dealers, their relevant SIC

code is 5211 (Lumber and other Building Materials).\textsuperscript{19}

Depending on the availability of stock price data we shortened the list further. Our data for stock price data comes from the Centre for Research on Security Prices (CRSP) database. We use firms that were listed either on the American Stock exchange (AMEX) or the New York Stock Exchange (NYSE). We also require the availability of stock price data during the entire time period relevant for the SLA. The relevant time period begins a year before the first news report regarding possible export restrictions in 1995 and ends 40 days after the last news report regarding the SLA. This process of elimination leaves us with data for 37 firms.

In Table 5 we list all the firms used in this analysis. The last two columns include their ranking in terms of revenue in the domestic industry.\textsuperscript{20} A few large firms can be classified into both Single Family Housing and Operative Builders. We sorted these firms into a single classification depending on their ranking and their primary SIC listing in the Compustat Database.\textsuperscript{21} However, as most of the industry leaders are being considered, the sample does represent a significant share of the market.\textsuperscript{22}

The Single-Family Housing Construction industry is highly fragmented and dis-

\textsuperscript{19}We further checked the websites of these firms to confirm that they either used softwood lumber as an input or were softwood lumber dealers.

\textsuperscript{20} The revenue share data is drawn from Gale Group (2001a, b, and c).

\textsuperscript{21} For example, Centex Corporation (refer to Table 5), which ranked 1 under SIC 1531 and 2 in SIC 1521, was placed under SIC 1521. In case the ranking was not available we placed them under their primary SIC, as specified in the Compustat Database.

\textsuperscript{22} The revenue share data is drawn from Gale Group (2001a, b, and c).
The industry consists of contractors that are primarily engaged in building, remodeling, and repairing houses. Some large contractors in the industry are also listed as operative builders. However, around 75 percent of the establishments engage solely in the construction of single-family housing. In 1997, the five largest contractors accounted for 14 percent of the revenue share in the industry, their total revenue being $11.3 billion. The industry revenue leader, Pulte Corporation, accounted for 2.3 percent of the housing starts. Other large single-family home contractors include Centex Corporation, Kaufman & Broad Home Corporation, D. R Horton and Lennar Corporation.

Operative Builders account for a smaller percentage of construction. Their also undertake site development, real estate management activities, land acquisition, land sales and other miscellaneous operations. Unlike general contractors, operative builders own the structures they erect and act as their own general contractors. The largest operative builder, in 1999, with sales of $5.2 billion was Centex Corporation followed by Pulte Corporation, Ryland Group, Toll Brothers and Beazer homes.

Lindsey et. al. (2000) provide the information that in 1997, 23.8 percent of single-family housing starts, and 30.5 percent of new single-family homes sold were Manufactured Homes. In other words, this too is also an important industry for

\[\text{\footnotesize \cite{23}}\]

\[\text{\footnotesize Much of the descriptive information below regarding each industry is drawn from Gale Group (2001a, 2001b, and 2001c).}\]

\[\text{\footnotesize According to Lindsey et. al. (2000), this figure was calculated at the request of the National Association of Home Builders by the Bureau of the Census. The calculation was based on Census}\]
our analysis. This industry is relatively more concentrated. There are only 88 manufactured home corporations in the US, and in 1998, the top 10 manufactured home producers accounted for 78 percent of total industry shipments. The industry leader was Champion Enterprises, followed by Fleetwood Enterprises, Oakwood Home Corporation, Clayton Homes, and Cavalier Homes.

Several types of establishments fall into the Retail Lumber and Building Materials category. The largest categories, by far, are Lumber Yards, Home Centers and Warehouse Home Centers. The industry leaders are Home Depot, Lowes, Menard Incorporated (a private firm not listed on any stock exchange), and The 84 Lumber Company (also a private firm).

4.2 Event Dates

To find the dates for public media announcements related to the SLA, we use two databases. These are the Lexis Nexis Academic Database and the Business and Company Resource Center of Gale Group Database. In Table 2 we list what we consider to be the three important announcements or events related to the SLA. The second column of the table contains the headline for the news report and the third column lists the news source in which the report was published.

The first event date considered is February 2, 1996. On this date the Council for Fair Lumber Imports (CFLI - a coalition representing US lumber interests) announced

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its intent to file a petition for a countervailing duty if an agreement between US and Canada was not reached by February 15th, 1996. This announcement was probably prompted by the lack of progress made in the negotiations between US and Canadian governments. The second event date considered is February 15, 1996. On this day, under pressure from the CFLI announcement, an agreement between US and Canada was reached and announced in principle. The final event date we consider is April 3, 1996. On this day Canada finalized the Softwood Lumber Agreement and announced its details.

5 Results

We expect the Softwood Lumber Agreement to have a negative impact on the users of lumber. We also find results consistent with that hypothesis. Protection for the domestic lumber industry in the form of the Softwood Lumber Industry had a significantly negative impact on the market value of firms that use lumber as an input. In Table 3 we report the stock price response for the users of lumber to the three events listed above. The Average Cumulative Abnormal returns (ACA) for the event window (-1,+1) (cumulating the average return of firms from one day before the news release to one day after the news release) is reported in the table. The ACA is significantly negative for all events.

For the first event, that is the warning by the CFLI (or US producers), the ACA is significantly negative at the 5 percent level. The second event, the day the agreement
was announced in principle, had a relatively smaller, but still statistically significant, effect on the stock prices. There are two possible reasons for this smaller impact. The first being that the market anticipated this announcement. If the threat by CFLI was seen as credible, the market would have anticipated the announcement of the agreement on the second event date (the earlier threat included this event date as a deadline). The second reason could be that the market did not consider the agreement announced as being credible. Till a few hours before the agreement was announced several Canadian provincial representatives disagreed over the details of the SLA. The disagreement between Provinces was widely known and is likely to have reduced the market’s expectation about whether the SLA would be finalized or not. Consistent with the second possible reason above, the final signing of the SLA greatly caused significant depreciation in the market value of our sample of lumber using firms. We find a negative 2.38% abnormal return during this event, significant at the 1 percent level. In the sixth column of Table 3 we report the number of firms with positive and negative average abnormal returns for the event window.

For all three events, firms with negative returns outnumber the firms with positive returns. For the final event, when Canada finalized the agreement, the number of firms that lost market value are more than three times those that gained value. In the last column of Table 3 we report the test statistic for the generalized sign test. This tests whether the fraction of positive returns for the event window is the same as in

\[25\] There are some details regarding this disagreement in the newsreport regarding the announcement of this agreement.
those during the estimation period. For each of the events the null hypothesis that the number of positive returns is the same as those during the event window is rejected. In other words, the decrease in the number of firms losing value during each event is statistically significant. For the final event, when Canada finalized the agreement, 28 of the 37 firms reported negative abnormal returns, and this is significantly different from similar ratios during the estimation period at the 1 percent level.

We add the cumulative abnormal returns for all three events to obtain the Total Cumulative Abnormal Return (TACA). In Table 4 we present the TACA for each of the 4 digit SIC industry considered (1521, 1531, 2451 & 2452, 5211 and others). The results suggest that the response to SLA varied across industries. Firms belonging to SIC 5211 (Lumber and Other Building Materials) had the largest depreciation in their market value. Their TACA was -12.99% and is significant at the 1 percent level. The next largest impact occurred in Single-Family Housing Construction. Their TACA was -6.19% and was significant at the 1 percent level. Though TACA for SICs 1531, 2451 and 2452 are negative, they are not statistically significant. This is probably because the consumption of softwood lumber in Mobile Homes and Prefabricated Wood Buildings is relatively small. Also, firms belonging to Operative Builders (SIC 1531) are involved in many other activities like site development work, real estate management activities, land acquisition, and land sales. The impact on these firms is thus likely to be less than for firms belonging to Single-Family Housing Construction, where 75 percent of establishments engage in the same single activity.
In the last row of Table 4 we present results cumulated for all three events, for all firms in our sample. We find that the market value of all firms in our sample depreciated by 5.42 percent, and this is significant at the 5 percent level.

5.1 Robustness/Sensitivity to the Event Window

We test the sensitivity of these results to the definition of the event window by expanding our event window. In Table 6, we report TACA for various event windows. Irrespective of the definition of an event window the TACA is negative and significant at the 5 percent level, and point estimates are similar across windows. We report the results for an event window of 5 days, (-2,+2) in Tables 7 and 8. As with the 3 day event window, the last event (Canada’s finalizing of the agreement) had the biggest impact, and again this is significant at the 1 percent level. The other events also reduced market value but the reduction is not statistically significant for the first event. Even at the industry level results do not vary much across event windows.

6 Conclusion

In this paper we evaluate whether the Softwood Lumber Agreement had a significant economic impact on the industrial users of lumber. To ascertain the impact of the SLA on users of lumber we study stock price variations of lumber using firms. We find that events leading to the Softwood Lumber Agreement brought about large and statistically significant reductions in the stock values of the firms in our sample. If
we assume that the stock market processes information efficiently this reduction in stock value can be interpreted as the economic loss expected from the SLA.

This analysis illustrates the importance of studying the industrial users of a restricted intermediate good in the analysis of a trade restriction. In the case of softwood lumber, industrial use makes up a majority of the first wave of US consumption of lumber. Thus the costs of the any trade restriction on lumber is going to be shared by these industrial users, and final consumers. Through this paper, we present an estimate of the cost borne by the industrial users of lumber from the SLA.

Nevertheless, a few caveats are due. We only include firms listed in the major stock exchanges in the US. While we believe that our sample covers a significant share of the relevant industries, it is important to remember that the sample is not comprehensive. If we could include all firms that used softwood lumber this negative effect is likely to be larger still.

References


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A Appendix

Methodology

For each firm the equation is:

\[ R = XZ + e \]

where \( R \) is a \([(T+N) \times 1]\) vector; \( X \) is \([(T+N) \times (2+N)]\) matrix; \( Z \) is a \([(2+N) \times 1]\) vector of coefficients; and \( e \) is a \([(T+N) \times 1]\) vector.

The partitioned \( X \) matrix can be written as:

\[
X = \begin{bmatrix}
X_T & 0 \\
X_N & I
\end{bmatrix}
\]

Where \( X_T \) is a \([T \times 2]\) matrix and \( X_N \) is a \([N \times 2]\) matrix. The upper right hand corner is a \([T \times N]\) matrix of zeros, and the lower right hand corner is a \([N \times N]\)
identity matrix. The estimated coefficient matrix is:

$$\hat{Z} = [X'X]^{-1}[X'Y]$$

Inverting the above X matrix and solving for \(\hat{Z}\)

$$[X'X]^{-1} = \begin{bmatrix}
(X'_TX)^{-1} & -(X'_TX)^{-1}X'_N \\
-X_N(X'_TX)^{-1} & I + X_N(X'_TX)^{-1}X'_N
\end{bmatrix}$$

$$[X'X]^{-1}X'R = \begin{bmatrix}
(X'_TX)^{-1}X'_T R_T \\
-X_N(X'_TX)^{-1}(X'_T R_T) + RN
\end{bmatrix} = \begin{bmatrix}
\hat{Z}_T \\
\hat{Z}_N
\end{bmatrix}$$

Since there is a dummy variable for each day in the event window that takes the value 1 on the nth day and 0 otherwise. Only the first T observations without the dummies are used to estimate the slope and the parameters \(\hat{Z}'_T = \hat{a}_i, \hat{B}\), as is in the traditional market model. \(\hat{A}\) are the abnormal returns which are estimated using the estimates of \(\hat{a}_i, \hat{B}\) from the first T observations and is reduced to \(R_N - X_N\hat{Z}_T\).

**Covariance**

In order to design a statistic to test the significance of ACA, characteristics of abnormal returns needs to be studied in a little more detail. Abnormal return by design exhibit sampling error. Abnormal return, \(\hat{A}_i\), has an expected mean of zero and the covariance matrix is given by

$$V_i = \sigma_i^2[I + X_N(X'_TX)^{-1}X'_N];$$

\(T = \text{Estimation Period}; N = \text{Event Window}\)
where \( X_T \) is the matrix of explanatory variables over the estimation period and \( X_N \) is the matrix of explanatory variables over the event window. The covariance matrix, \( V(\bar{A}_i) \), has two parts. The first term in the covariance matrix is the variance due to random disturbances and the second term is the additional variance due to the sampling error.\(^{26}\) The maximum likelihood estimate of the variance \( \text{cov}(A_{ip}, A_{is}) \), for \( p = s \) is (the variance of the abnormal return)

\[
S^2(\bar{A}_i) = s^2_i \left[ 1 + \frac{1}{T} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{t=1}^{T} (R_{mt} - \bar{R}_m)^2} \right]
\]

where, \( \bar{R}_m = \frac{1}{T} \sum_{t=1}^{T} R_{mt} \).

Testing for the statistical significance of CA (aggregated abnormal returns over the event window) is complicated by serial correlation of the abnormal returns.\(^{27}\) Abnormal returns are serially correlated despite the fact that the true disturbances, \( e_{it} \), are independent through time. The variance of the cumulative abnormal return, given serial correlation in the series of abnormal return, is equal to the sum of the variances of the individual abnormal returns plus twice the sum of their covariances.

\[
V(CA_i) = \sigma^2_i \left[ I + X_N'(X_T'X_T)^{-1}X_T' \right] i
\]

where \( i \) is a \((N \times 1)\) unit vector. In other words for an event window that extends from \( t=1 \) to \( t=N \) the estimate of covariance is

\(^{26}\) Due to prediction outside the estimation period.

\(^{27}\) For a firm, all the abnormal returns estimates use the same intercept and slope parameters.
\[ S^2(CA_i) = (N + 1)\sigma_i^2 \left[ 1 + \frac{N + 1}{T} + \frac{\sum_{t=p}^s (R_{mt} - 2\bar{R}_m)^2}{\sum_{t=1}^T (R_{mt} - \bar{R}_m)^2} \right] \]

**Test Statistic**

The standardized cumulative abnormal return for firm i is

\[ Z(CA_i) = \frac{CA_i}{S^2(CA_i)} \]

The following Z statistics is used to test for the statistical significance of cumulated average abnormal return for an event

\[ Z(ACA) = \frac{\sum_{i=1}^I Z(CA_i)}{I^{1/2} \left[ \frac{1}{I} \sum_{i=1}^I \left( Z(CA_i) - \frac{1}{I} \sum_{i=1}^I Z(CA_i) \right) \right]} \]

The following Z statistic is used to test for the statistical significance of the total cumulated average abnormal return for all the events considered.

\[ Z(TACA) = \frac{\sum_{e=1}^E \sum ACA_e / [V(ACA_e)]^{1/2}}{N^{1/2}} \]

The market response for each event should be independent of the others, since each event releases different information to the market.
Figure 1: The Estimation Period

Estimation Period  (365 days)  Event Window  (-1,+1)
### Table 1: History of the Softwood Lumber Agreement

<table>
<thead>
<tr>
<th>Countervailing Duty Investigations</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Softwood Lumber I: 1982</td>
<td>US authorities decided no subsidy</td>
</tr>
<tr>
<td>Softwood Lumber II: 1986</td>
<td>15% provisional duty.</td>
</tr>
<tr>
<td></td>
<td>Replaced by 15% export tax in MOU</td>
</tr>
<tr>
<td>Softwood Lumber III: 1991</td>
<td>After Canada unilaterally terminates MOU</td>
</tr>
<tr>
<td></td>
<td>Countervailing case filed: Interim bonding requirement</td>
</tr>
<tr>
<td></td>
<td>Canada wins appeal against countervailing duty in CUSTA (1993 and 1994)</td>
</tr>
<tr>
<td></td>
<td>US revokes duties against Canadian lumber (Aug 1994)</td>
</tr>
<tr>
<td></td>
<td>Bilateral consultation process for softwood established</td>
</tr>
<tr>
<td>Threat of a Countervailing Duty Investigation: 1996</td>
<td>Softwood Lumber Agreement is signed:</td>
</tr>
<tr>
<td></td>
<td>The first 650 million board feet over 14.7 BBF was subject to a tax of $50 per thousand board feet, and any further exports were subject to a tax of $100 per thousand board feet.</td>
</tr>
</tbody>
</table>
## Table 2: Chronology of Events

<table>
<thead>
<tr>
<th>Important Events</th>
<th>Headlines</th>
<th>Article</th>
</tr>
</thead>
</table>

Search Engine: LexisNexis Academic
Table 3: Stock Price Response to SLA; Event Window (-1,+1)

<table>
<thead>
<tr>
<th>EVENT</th>
<th>News</th>
<th>No. of firms</th>
<th>ACA</th>
<th>Z STAT</th>
<th>Positive: Negative</th>
<th>Z Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>event 1</td>
<td>Warning by US Producers</td>
<td>37</td>
<td>-1.50%</td>
<td>-2.61**</td>
<td>13:24</td>
<td>-1.42*</td>
</tr>
<tr>
<td>event 2</td>
<td>Agreement Reached in Principle</td>
<td>37</td>
<td>-1.45%</td>
<td>-2.63**</td>
<td>11:26</td>
<td>-2.08**</td>
</tr>
<tr>
<td>event 3</td>
<td>Canada Finalizes the Agreement</td>
<td>37</td>
<td>-2.47%</td>
<td>-3.18***</td>
<td>9:28</td>
<td>-2.74***</td>
</tr>
</tbody>
</table>

* significant at 10% confidence interval level; ** significant at 5% confidence interval level; *** significant at 1% confidence interval level

Table 4: Stock Price Response, Cumulated over all events\(^a\), by 4-Digit SIC, Event Window (-1, +1)

<table>
<thead>
<tr>
<th>SIC 3-digit</th>
<th>Industries</th>
<th>Event Window</th>
<th>No. of firms</th>
<th>TACA</th>
<th>Z STAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1521</td>
<td>Single-family Housing Construction &amp; Residential Construction, Nec</td>
<td>(-1,+1)</td>
<td>9</td>
<td>-6.19%</td>
<td>-2.90***</td>
</tr>
<tr>
<td>1531</td>
<td>Operative Builders</td>
<td>(-1,+1)</td>
<td>11</td>
<td>-4.22%</td>
<td>-0.88</td>
</tr>
<tr>
<td>2451 &amp; 2452</td>
<td>Mobile Homes &amp; Prefabricated Wood Buildings</td>
<td>(-1,+1)</td>
<td>11</td>
<td>-1.88%</td>
<td>0.04</td>
</tr>
<tr>
<td>5211</td>
<td>Lumber and Other Building Materials</td>
<td>(-1,+1)</td>
<td>6</td>
<td>-12.99%</td>
<td>-2.08**</td>
</tr>
<tr>
<td>ALL</td>
<td>ALL</td>
<td>(-1,+1)</td>
<td>37</td>
<td>-5.42%</td>
<td>-1.84**</td>
</tr>
</tbody>
</table>

* significant at 10% confidence interval level; ** significant at 5% confidence interval level; *** significant at 1% confidence interval level

This table includes TACA for all three events, event 1: US producers warn they will petition if no pact by Feb 15th; event 2: Agreement in principle reached; event 3: Canada finalizes the SLA agreement

\(^a\) Others consists of 4-digit SICs: 2515-Mattresses and Bed Springs; 5031-Lumber, Plywood, and Millwork; 5271-Mobile Home Dealers
Table 5: Names of Firms Used in the Analysis and their Classifications

<table>
<thead>
<tr>
<th>Names</th>
<th>4-Digit SIC</th>
<th>Ranking* For 1521</th>
<th>Ranking* for 1531</th>
</tr>
</thead>
<tbody>
<tr>
<td>B M C WEST CORP</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEAZER HOMES USA</td>
<td>1531</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>CALPROP CORP</td>
<td>1521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAPITAL PACIFIC H</td>
<td>1521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAVALIER HOMES IN</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CENTEX CORP</td>
<td>1531</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CHAMPION ENTERPRISE</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CLAYTON HOMES INC</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D R HORTON INC</td>
<td>1521</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>DYNAMIC HOMES INC</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENGLE HOMES INC</td>
<td>1531</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>FLEETWOOD ENTERPRISE</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GROSSMANS INC</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOME DEPOT INC</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HOVNANIAN ENTERPRISE</td>
<td>1531</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>KAUFMAN &amp; BROAD H</td>
<td>1521</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>LENNAR CORP</td>
<td>1531</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>LIBERTY HOMES I B</td>
<td>2452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOWES COMPANIES I</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M D C HOLDINGS IN</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M I SCHOTTENSTEIN</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MANUFACTURED HOME</td>
<td>1521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N V R INC</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NOBILITY HOMES IN</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OAKWOOD HOMES COR</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PULTE CORP</td>
<td>1521</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>RYLAND GROUP INC</td>
<td>1531</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>SKYLINE CORP</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SOUTHERN ENERGY H</td>
<td>2452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STANDARD PACIFIC</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STARRETT HOUSING</td>
<td>1521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOLL BROTHERS INC</td>
<td>1531</td>
<td></td>
<td></td>
</tr>
<tr>
<td>U S HOME CORP</td>
<td>1521</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>UNITED MOBILE HOM</td>
<td>2451</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WEITZER HOMEBUI A</td>
<td>1521</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WICKES LUMBER CO</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WOLOHAN LUMBER CO</td>
<td>5211</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* This ranks firms in terms of revenues earned in the industry sub-group.
Table 6: Stock Price Response for all the events\(^a\); Various Event Windows

<table>
<thead>
<tr>
<th>Event Window</th>
<th>No. of firms</th>
<th>TACA</th>
<th>Z STAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>(-1,+1)</td>
<td>37</td>
<td>-5.42%</td>
<td>-1.84*</td>
</tr>
<tr>
<td>(-2,+2)</td>
<td>37</td>
<td>-5.11%</td>
<td>-2.03*</td>
</tr>
<tr>
<td>(-3,+3)</td>
<td>37</td>
<td>-3.55%</td>
<td>-2.27*</td>
</tr>
<tr>
<td>(-5,+5)</td>
<td>37</td>
<td>-5.10%</td>
<td>-2.19*</td>
</tr>
</tbody>
</table>

* significant at 10% confidence interval level; ** significant at 5% confidence interval level; *** significant at 1% confidence interval level

\(^a\)event 1: US producers warn they will petition if no pact by Feb15th; event 2: Agreement in principle reached; event 3: Canada finalizes the SLA agreement

---

Table 7: Stock Price Response to SLA; Event Window (-2, +2)

<table>
<thead>
<tr>
<th>EVENT</th>
<th>News</th>
<th>No. of firms</th>
<th>ACA</th>
<th>Z STAT</th>
<th>Positive: Negative</th>
<th>Z Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>event 1</td>
<td>Warning by US Producers</td>
<td>37</td>
<td>-1.14%</td>
<td>-1.94*</td>
<td>14:23</td>
<td>-1.09</td>
</tr>
<tr>
<td>event 2</td>
<td>Agreement Reached in Principle</td>
<td>37</td>
<td>-1.01%</td>
<td>-2.13*</td>
<td>10:27</td>
<td>-2.41***</td>
</tr>
<tr>
<td>event 3</td>
<td>Canada Finalizes the Agreement</td>
<td>37</td>
<td>-2.96%</td>
<td>-3.52***</td>
<td>12:25</td>
<td>-1.75**</td>
</tr>
</tbody>
</table>

* significant at 10% confidence interval level; ** significant at 5% confidence interval level; *** significant at 1% confidence interval level
Table 8: Stock Price Response for the all the events\textsuperscript{a} at 4-Digit SIC; Event Window (-2, +2)

<table>
<thead>
<tr>
<th>SIC 4-digit</th>
<th>Industries</th>
<th>Event Window</th>
<th>No. of firms</th>
<th>TACA</th>
<th>Z STAT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1521</td>
<td>Single-family Housing Construction &amp; Residential Construction, Nec</td>
<td>(-2,+2)</td>
<td>9</td>
<td>-5.98%</td>
<td>-2.74***</td>
</tr>
<tr>
<td>1531</td>
<td>Operative Builders</td>
<td>(-2,+2)</td>
<td>11</td>
<td>-7.20%</td>
<td>-0.92</td>
</tr>
<tr>
<td>2451 &amp; 2452</td>
<td>Mobile Homes &amp; Prefabricated Wood Buildings</td>
<td>(-2,+2)</td>
<td>11</td>
<td>-0.84%</td>
<td>0.01</td>
</tr>
<tr>
<td>5211</td>
<td>Lumber and Other Building Materials</td>
<td>(-2,+2)</td>
<td>6</td>
<td>-7.79%</td>
<td>-1.76**</td>
</tr>
<tr>
<td>ALL</td>
<td>ALL</td>
<td>(-2,+2)</td>
<td>37</td>
<td>-5.11%</td>
<td>-2.03**</td>
</tr>
</tbody>
</table>

* significant at 10% confidence interval level; ** significant at 5% confidence interval level; *** significant at 1% confidence interval level.

\textsuperscript{a}Event 1: US producers warn they will petition if no pact by Feb15th; event 2: Agreement in principle reached; event 3: Canada finalizes the SLA agreement.

\textsuperscript{b}Others consists of 4-digit SICs: 2515-Mattresses and Bedsprings; 5031-Lumber, Plywood, and Millwork; 5271-Mobile Home Dealers.