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COVID-19 and the Mystery of Lumber Price Movements

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Abstract: The COVID-19 pandemic led to unprecedented changes in the U.S. price of softwood lumber by more than 300% between 2020 and 2022. The increased volatility of lumber prices after the COVID-19 outbreak remains unexplained. In this paper, we examine how a calibrated random walk can induce similar price volatility through the development of a stochastic process. As a preferred approach, we employ an event model to estimate the impact of COVID-19 and other key events on the price of softwood lumber. The econometric model serves to provide evidence that the price volatility of softwood lumber is not completely random, and we can instead attribute part of the variation to recent regional and global events. We found that, while COVID-19 did result in a price jump, it was smaller than a rainfall event that restricted imports from Canada, while import duties and other trade actions had no discernible impact on U.S. lumber prices.

Keywords: lumber price volatility; stochastic processes; econometric regression

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1. Introduction

Canada is one of the world's largest softwood lumber producers, with the lumber industry accounting for 7.2% of national exports, $1.5 billion in government revenue, and contributing $25 billion to the Canadian economy (1.6% of Canadian GDP) [1]. During the COVID-19 pandemic lumber prices rose significantly, and price volatility was highly impacted. This is shown in Figure 1, where we also provide U.S. housing starts. Surprisingly, housing starts fell dramatically beginning in 2005, but the impact on prices was insignificant compared to the impact of the pandemic.

This study aims to provide information about the potential factors that have contributed to significant changes in softwood lumber prices over the past several decades, including in particular the impact of COVID-19. We do this by first examining whether price movements were simply random—a stochastic process affected by many unexplained variables. We then employ event analysis to determine whether certain events, including the pandemic, could explain erratic prices. Outside of this research, several factors have been identified as potential reasons explaining why COVID-19 resulted in price volatility. One line of research considered the increase in demand for lumber used in repairs and remodeling during the pandemic [2], while another focused on the role of inelastic supply [3]. However, none have explored whether volatility was simply random or explained by identifiable events that impacted price and could be analyzed utilizing an econometric model. Supply chain constraints on exports were not considered, but, in the current research, we discovered they could be extremely important.

The base econometric model that we use in the event analysis looks at pricing data from the Composite Framing Index over time, with significant effects partitioned as dummy variables to analyze their impact on lumber prices (the Composite Framing price Index was used as a threshold price for determining the tariff in resolving some of the softwood lumber disputes between Canada and the U.S.). To provide a more robust analysis of the effects of COVID-19 on lumber prices, we employ roughly 41 years of data. This allows for additional analysis of other significant events in the softwood lumber industry, including those with respect to the softwood lumber dispute between Canada and the U.S. Over

50% of the softwood lumber produced in Canada is exported to the United States, which highlights the importance of including the effects of the softwood lumber dispute, and subsequent Softwood Lumber Agreements (SLA), in our econometric models. For more detailed information regarding the softwood lumber disputes and subsequent agreements, see van Kooten et al. [2].

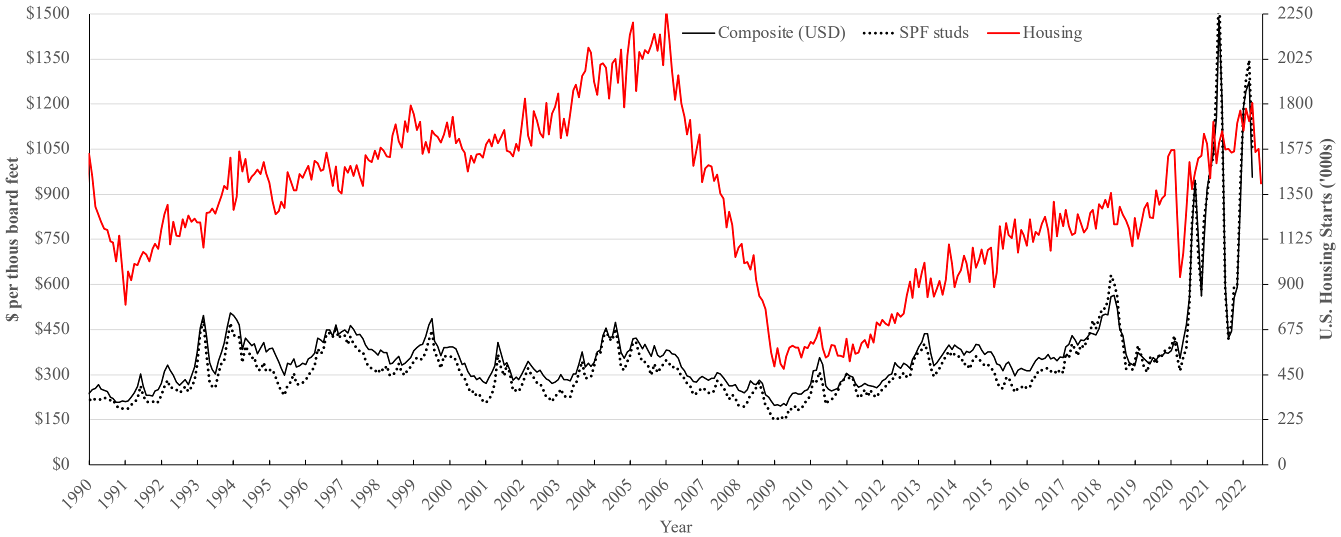

Figure 1. Monthly prices of lumber sold in the U.S. and the composite framing price index in USD, and U.S. housing starts, January 1990 through July 2022. Source: Authors' calculations using data from [4–6].

One of the main points of contention between Canada and the U.S., and the subject of a 2020 World Trade Organization (WTO) dispute panel, is the implementation of Countervailing (CVD) and Antidumping (AD) duties by the United States. CVD are placed by an importing country (in this case the U.S.) when a government feels that the exporting country is subsidizing production and depressing prices [7]. Therefore, the CVD acts as an import tax. Generally, AD duties are put in place by importing countries to prevent exporters from selling a product at a lower price than they would normally charge in domestic markets [7]. As seen in Table 1 and Figure 2, during the four decades after 1981 the United States imposed an AD duty or CVD, or both, on Canadian softwood lumber. Through data collection from various sources [8,9], we have included a variable that represents the value of both CVD and AD duties over the 41-year time period in our econometric analysis.

Table 1. Historical AD and CVD rates between Canada and the United States.

Year [a]	Average of AD or CVD (%)
1987–1991	15.00
1992	9.92
1993–1994	6.51
2001	25.60
2002	22.42
2003	13.92
2004–2005	10.81
2006	11.86
2007–2009	15.00
2010	14.09
2011	15.00
2012	11.25
2013	6.67

Table 1. *Cont.*

Year [a]	Average of AD or CVD (%)
2015	8.57
2017	22.85
2018–2020	20.23
2021	19.84
2022	17.91

[a] Years without an AD or CVD were removed. Source: Authors' calculations using data from [8,9].

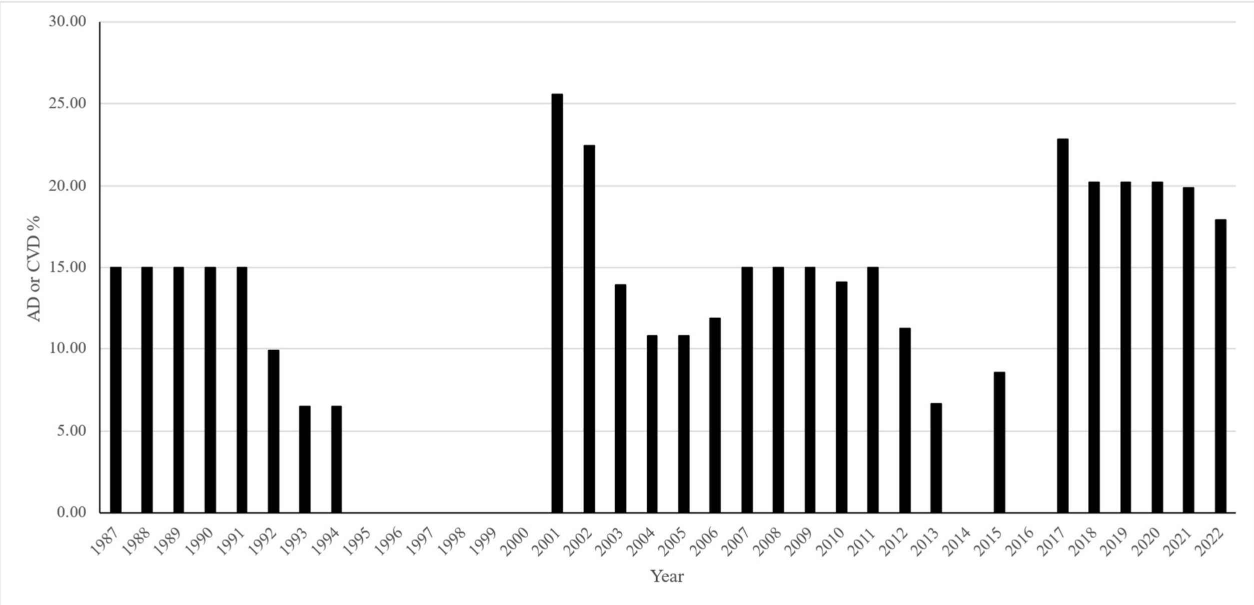

Figure 2. Historical antidumping and countervailing duties on Canadian softwood lumber by the United States. Source: Authors' calculations using data from [8,9].

An additional event of interest that we consider is a dummy variable representing the Atmospheric River event that occurred during November 2021, which was formally known as the Pacific Northwest Floods (PNF). The rainfall began as a "Pineapple Express" storm system, and the resulting floods caused an estimated $675 million in insured damage [10]. The series of atmospheric rivers began on 13 November 2021 and led to tragic loss of life, mudslides, and the flooding of homes, businesses and farms. Many aspects of public infrastructure (most importantly, major highways) were severely damaged and created a bottleneck on supply chains. This bottleneck extended into the softwood lumber industry as trains and commercial trucks were unable to bring lumber from the interior to shipping points on the coast. Based on information from the Council of Forest Industries [11], it was estimated that the impact from transportation constraints continued throughout the winter until June 2022.

We began our exploration of these and other factors affecting lumber price volatility over the past several decades by first, in the next section, considering whether lumber price movements might constitute a simple stochastic process [12]. Although we found that this might certainly be the case, we felt that it might be possible to determine drivers of volatility. To do so, we relied upon event analysis. In Section 3, we develop four econometric models to test whether the COVID-19 pandemic and other global and local events had a significant effect on the price of softwood lumber. Our results are provided in Section 3, followed by concluding comments in Section 4.

2. Materials and Methods

2.1. Modeling Price Volatility as a Stochastic Process

In this section, we assume lumber prices exhibit Brownian motion and examine whether a plausible stochastic process can potentially explain price movements following the COVID-19 pandemic. A random variable whose value changes through time according to probabilistic laws constitutes a stochastic process. Consider $\{P(t)\}$ to be a sequence of random lumber prices ordered by a discrete time variable t = 1, 2, 3, ... Assume a strictly stationary stochastic process, which implies that the joint distribution of $P(t_1)$, . . . , $P(t_n)$ is identical to the joint distribution of $P(t_1 + t)$, . . . , $P(t_n + t)$ for any t. For the stationary process, $\mu_P = E[P(t)]$ and $\sigma_P^2 = Var[P(t)]$ are independent of time and $\rho_P(k) = \frac{\text{Cov}[P(t),\, P(t+k)]}{\sigma_P^2}$. Some processes are stationary, but some are non-stationary, such as the value of an oil company's stock. The expected value of price might grow without bound, while variance grows as a function of time. We assume the price of lumber does not grow over time, thus we have a mean-reverting stochastic process, the simplest of which is known as an Ornstein-Uhlenbeck process [13].

$$dP = \eta\left(\overline{P} - P\right)dt + \sigma dz \tag{1}$$

where η is the speed of reversion and $\overline{P}$ is the 'normal' level of x, the level to which x reverts.

In discrete time, the expected value at any future time of the process in (1) is $E[P_t] = \overline{P}\left(P_0 - \overline{P}\right)e^{-\eta t}$; and the variance of $\left(P_t - \overline{P}\right)$ is $V\left[P_t - \overline{P}\right] = \frac{\sigma^2}{2\eta}\left(1 - e^{-2\eta t}\right)$. The larger the η, the less drift-away from the normal level. The discrete time version of the Ornstein-Uhlenbeck process is [13]:

$$P_t - P_{t-1} = \overline{P}\left(1 - e^{-\eta\Delta t}\right) + \left(e^{-\eta\Delta t} - 1\right)P_{t-1} + \varepsilon_t \tag{2}$$

where Δt equals 1 in our case and ε_t is normally distributed with mean zero and variance: $\sigma_\varepsilon = \frac{\sigma^2}{2\eta}\left(1 - e^{-2\eta t}\right)$.

Using the monthly data found in Figure 1 for the period of January 2016 through April 2022 of the composite price index, and for the period January 2016 through March 2022 for the U.S. price, we can estimate the regression Function (2) for each price series [14]:

$$P_t - P_{t-1} = \alpha + \beta\, P_{t-1} + \varepsilon_t \tag{3}$$

where $\alpha = \overline{P}\,\left(1 - e^{-\eta\Delta t}\right)$ and $\beta = \left(e^{-\eta\Delta t} - 1\right)$. The regression results are provided in Table 2. We have chosen to highlight this limited time frame to keep the model concise, although this process could easily be applied over the entire time period.

Table 2. Parameter Estimates for Stochastic Process Model [a].

Item	Composite Price	U.S. Price
Intercept α	57.6332 (1.851)	78.0546 (2.198)
Slope β	0.9072 (17.300)	0.8658 (14.013)
Residual standard error	123.1	142.5
Monthly σ	13.41	16.00
R^2	0.8039	0.7317
F-statistic	299.3	196.4
Number of observations	75	74

[a] t-statistics provided in parentheses.

The information provided in Table 2 informs the construction of the stochastic mean-reversion process (2). The stochastic paths over a period of 100 months, or nearly a decade, are provided in Figure 3 for the composite and U.S. prices. These indicate that lumber prices are highly volatile over the period 2016 to 2022, and that volatile prices would continue based on recent past behavior. However, if the volatility is related to the COVID-19 pandemic, an examination of trends does not provide an adequate explanation for such volatility. That is, we cannot rule out that lumber price movements are completely random and not related to various events, although this is not a very satisfying explanation. Rather, we employ an event model to explain why the pandemic might have led to volatile lumber prices.

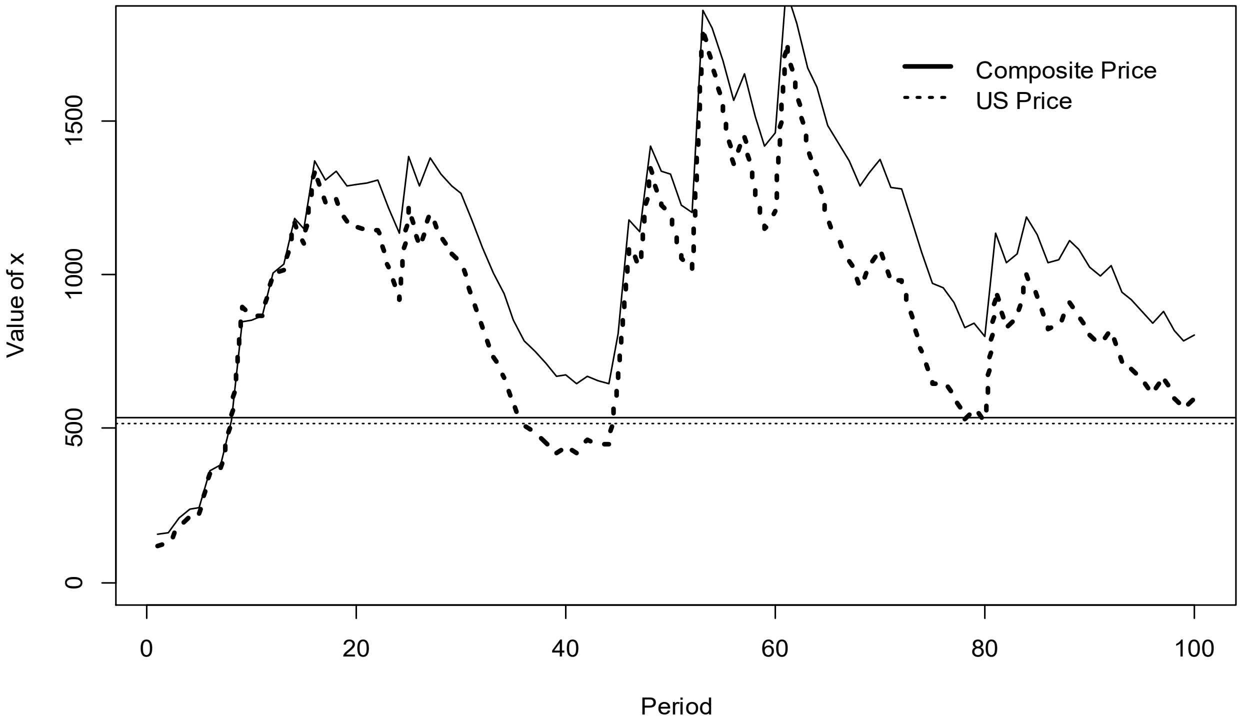

Figure 3. Potential paths of composite and U.S. lumber prices based on Ornstein–Uhlenbeck Stochastic Mean-Reversion processes with means indicated by straight lines.

2.2. Price Impact Model Specification

In this section, we explore the design and variable specification of our price impact model. Similar to Zhang [15,16], we employ four highly aggregated reduced-form econometric price models that include factors influencing lumber supply, the Canada-US exchange rate, as well as various policy variables. Our first two models include monthly data for the period between January 1, 1981, and October 31, 2022. The first model is specified as:

$$P_t = \alpha_0 + \alpha_1 Covid_t + \alpha_2 PNF_t + \sum_{i=3}^{n} \alpha_i X_{it} + \varepsilon_t,\ \varepsilon_t \ \sim \ n.i.d.\left(0,\ \sigma^2\right) \quad (4)$$

where P_t indicates the monthly price of the composite softwood lumber index [5]; $Covid_t$ and PNF_t were used to represent the COVID-19 pandemic, and the PNF respectively; and X_{it} represent the subsequent control variables described in Table 3.

Table 3. 1981–2022 variables, their descriptions, and sources.

Variable	Description	Unit	Source	Model 1	Model 2	Model 3	Model 4
P_t	Composite Lumber Price	$CAD	Random Lengths	X	X	X	X
$Exch_t$	$CAD to $USD Exchange Rate	C$/US$	FRED Economic Data	X	X	X	X
HS_t	New Privately Owned Housing Units Started in the United States	1000s	FRED Economic Data	X	X	X	X
$ADCVD_t$ [a]	Anti-Dumping and Countervailing Duty Rates by the USA on Canadian Softwood Lumber	%	Various sources		X		X
W_t	Average Hourly Wage of Canadian's Employed in Forestry and Logging	$CAD	Statistics Canada			X	X
PRE_t	Pre—Softwood Lumber Agreements	0 or 1	January 1981–December 1986	X	X		
MOU_t	Memorandum of Understanding	0 or 1	January 1987–September 1991	X	X		
$L2_t$	Period in between MOU and TRQ	0 or 1	January 1992–December 1993	X	X		
TRQ_t	Tariff Rate Quota Periods	0 or 1	April 1996–March 2005	X	X	X [b]	X [b]
$SLA06_t$	Softwood Lumber Agreement of 2006	0 or 1	October 2006–December 2015	X	X	X	X
$POST_t$	Post Softwood Lumber Agreement of 2006	0 or 1	January 2017–July 2022	X	X	X	X
FC_t	Great Financial Crisis	0 or 1	December 2007–June 2009	X	X	X	X
$Covid_t$	COVID-19 Pandemic	0 or 1	January 2020–January 2022	X	X	X	X
PNF_t	Pacific Northwest Floods	0 or 1	November 2022–June 2022	X	X	X	X

[a] The $ADCVD_t$ has been created by the authors using data from [8,9] which was only included in the second regression. [b] In Models 3 and 4, the period for TRQ_t was limited to January 2001–March 2005.

Our second model is identical to the first apart from $ADCVD_t$, a variable constructed to represent the actual value of the AD plus CVD placed on Canadian softwood lumber by the United States. The implementation of AD and CVD policies is a point of contention between Canada and the U.S., as noted in the previous section. Our rationale for including regressions run with and without $ADCVD_t$ is motivated by the lack of clear and consistent data on the monthly rates of AD and CVD tariffs over time. The data we collected and report for this variable have been collected from a variety of sources, as no single source has kept track of this information over time. Additionally, four major companies—Canfor Corporation, Resolute Forest Products, West Fraser Mills, and J.D. Irving—had varying rates of CVD and AD imposed on them because of their size and influence within the softwood lumber industry. In addition, a single rate was set for all other companies, which is a function (often a weighted average) of the rates imposed on the large companies and is used for the construction of this variable. Because of the innate uncertainty and variation due to the nature the of AD and CVD rates, we chose to present the regression output for both time periods with and without this variable. The second model is given below:

$$P_t = \beta_0 + \beta_1 Covid_t + \beta_2 PNF_t + \beta_3 ADCVD_t + \sum_{i=4}^{n} \beta_i X_{it} + \varepsilon_t,\ \varepsilon_t\ \sim\ n.i.d.\left(0,\ \sigma^2\right) \quad (5)$$

Our second pair of models includes the addition of Average Hourly Wages from those employed in the Forestry and Lumber Industries as defined by Statistics Canada [17]. These data are only available from Statistics Canada for the months of January 2001 to October 2022, and therefore we have included this data in separate regressions. Therefore, aside from the condensed time period the third and fourth regressions are identical to Equations (3) and (4) respectively with the addition of W_t contained in X_{it}. A detailed description of the variables included in each of the four models can be found in Table 3.

Our main variable of interest is $Covid_t$ as we expect that the COVID-19 pandemic caused lumber prices to rise significantly [2]. Based on our initial data exploration (and seen below in Figure 4), there is a sharp increase in both the raw lumber price and the variation of price following the COVID-19 pandemic. By incorporating the event regressors, we expect to be able to attribute more of this variation in price to the pandemic, and not simply just a random walk. Although our variable of interest is the COVID-19 pandemic, we also expect positive coefficients on the other event variables in the model. Similar to the results found by Zhang [9] for example, we expect HS_t and W_t to have positive coefficients, as increases in the number of housing starts can be attributed to an increase in demand, and an increase in wage rates can reduce supply and thus increase price. Additionally, we expect the coefficients on $Exch_t$ to be negative as demonstrated by Adams et al. [18], and Zhang [15], and we expect the coefficients on PNF_t to be positive as an interruption in the supply chain amounts to a suppression of supply which then drives up prices.

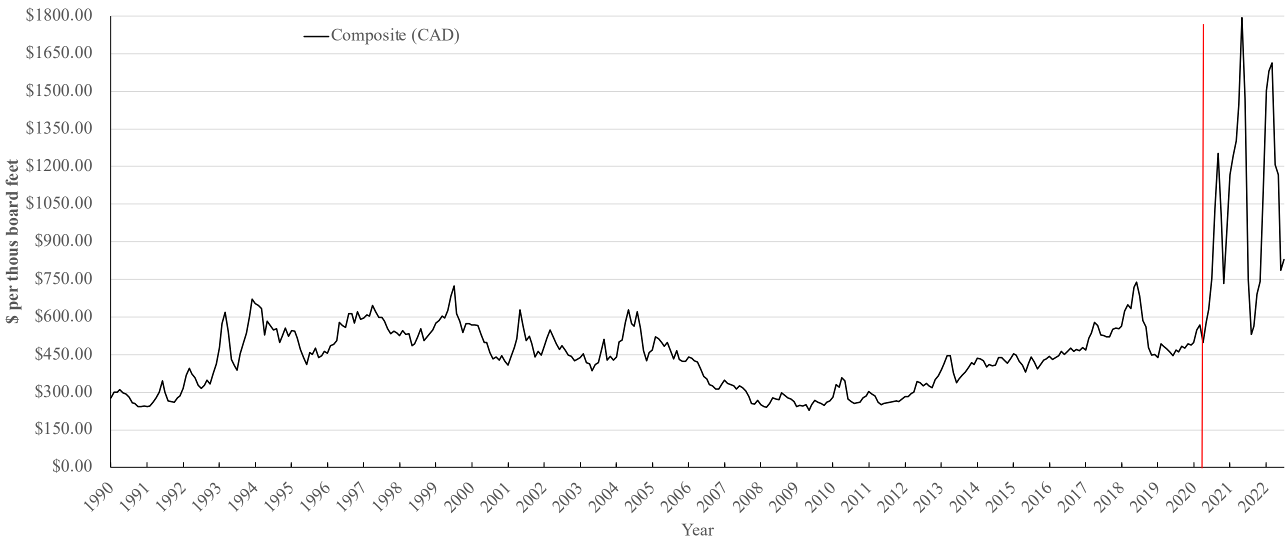

Figure 4. Composite framing price index in CAD January 1980 through July 2022 Source: Statista (2022) and Random Lengths (various issues).

3. Results

The estimation results are provided in Table 4 for the CFP Index, results for the Spruce Pine Fir (SPF) Index can be found in Appendix A. The first and third columns of the table provide results for models without the $ADCVD_t$ variable, while the second and fourth the results when it is included. As seen in the table, the majority of the events that we identified are positive and highly statistically significance; most importantly, the central variable of interest in the study, $Covid_t$, is statistically significant in all regressions—the COVID-19 pandemic had a positive impact on softwood lumber prices. When the entire dataset from

1981–2022 was employed in the regression, the price of softwood lumber increased by 42.1% at the 1% significance level during the pandemic months. With the addition of the ADCVD variable, the significance of $Covid_t$ does not change, although there is a slight reduction in the price impact (38.5%). Additionally, when using the condensed dataset (from 2001–2022), the significance of $Covid_t$ remains, but its impact is reduced somewhat further (32.7% at the $p < 0.01$ significance level). Now with the addition of the $ADCVD_t$ variable, the coefficient estimate is slightly higher at 33.1%.

Table 4. Explaining North American lumber price movements: dependent variable logarithm of composite price index.

Regressor	(1981)	(1981)	(2001)	(2001)
$Exch_t$	0.647 ***	0.486 ***	0.438 ***	0.435 ***
	(0.079)	(0.066)	(0.095)	(0.087)
HS_t	0.0002 ***	0.0002 ***	0.0003 ***	0.0002 ***
	(0.00003)	(0.00002)	(0.00004)	(0.00004)
$ADCVD_t$		−0.013 ***		−0.008 ***
		(0.001)		(0.002)
	(0.030)	(0.025)		
MOU_t	−0.349 ***	−0.223 ***		
	(0.032)	(0.028)		
$L2_t$	−0.014	0.040		
	(0.041)	(0.034)		
W_t			0.028 ***	0.018 ***
			(0.004)	(0.005)
TRQ_t	0.003	0.066 ***	0.081	0.108 **
	(0.030)	(0.025)	(0.051)	(0.046)
$SLA06_t$	−0.031	−0.002	0.045	0.010
	(0.035)	(0.029)	(0.063)	(0.058)
$POST_t$	0.216 ***	0.436 ***	0.201 ***	0.324 ***
	(0.035)	(0.033)	(0.065)	(0.064)
FC_t	−0.263 ***	−0.170 ***	−0.146 ***	−0.133 ***
	(0.040)	(0.033)	(0.043)	(0.039)
$Covid_t$	0.351 ***	0.326 ***	0.283 ***	0.286 ***
	(0.041)	(0.033)	(0.040)	(0.036)
PNF_t	0.626 ***	0.594 ***	0.443 ***	0.472 ***
	(0.061)	(0.050)	(0.065)	(0.059)
Constant	4.983 ***	5.220 ***	4.345 ***	4.755 ***
	(0.107)	(0.089)	(0.154)	(0.164)
Observations	501	501	255	255

Note: ** $p < 0.01$, *** $p < 0.01$.

The significant effect that the COVID-19 pandemic had on lumber prices is not a surprise, but the extent of the price impact relative to the effect that other past events had on price, it presents an interesting contrast. Considering our full regression model without $ADCVD_t$ (col 1 in Table 4), the COVID-19 pandemic price impact was 12 percentage points higher than that of the Great Financial Crisis of 2008 (42.1% vs. 30.1%). With the inclusion of $ADCVD_t$ (col 2), the impact is even more pronounced at 20 percentage points (38.5% vs. 18.5%). Across all four regressions $Covid_t$ remains extremely significant, with estimated price impacts ranging from 32% to 42%. Clearly, the pandemic had a sizeable impact on the softwood lumber industry.

Although our main variable of interest was COVID-19, we also identified a surprising and interesting significant event—the supply chain disruption caused by the November 2021 Atmospheric River (Pacific Northwest Floods). We found that the PNF had a large and statistically significant impact on softwood lumber prices. Looking first at our extended dataset from 1981–2022, the PNF had an 87.0% impact on price (holding all else constant); when the $ADCVD_t$ variable is included as a regressor, the positive impact is only slightly reduced to 81.1%. In the model where only the data from 2001–2022 are employed in the regression, the PNF event remains statistically significant ($p < 0.01$), with its impact respectively ranging from 60.3% to 55.7% depending on whether or not the $ADCVD_t$ variable is included. The severity of this natural disaster on the softwood lumber prices was roughly 2.5 times higher than the impact of COVID-19 pandemic, even though the PNF event lasted only about one-third as long as the pandemic. Both events indicate that disruptions to the lumber supply chain can lead to significant impacts on industry prices.

Finally, differences between models representing the two distinct time periods can be partially understood by looking at the overall variance in price between the two time frames. As indicated in Figures 3 and 4, the variation in price during the COVID-19 pandemic and the subsequent PNF is more pronounced visually when we view the data as part of a longer time frame. Upon comparing the price data of the shorter time frame (2001–2022), the change in variation, although still obvious, is less than when using the longer time frame (1981–2022). This is not surprising given the greater number of events after 2001 (five) compared to before 2001 (three), with one event common to both time frames (see Table 3).

4. Discussion

An explanation for why the price of lumber rose as a result of the November 2021 flooding event is simple—there was a disruption in the supply chain that shifted the supply curve inwards while demand remained unchanged. The reason why the COVID-19 pandemic resulted in an increase in lumber prices requires a much more nuanced explanation as the underlying factors are unclear. Although an inward shift of the supply function and/or an outward shift in the demand are involved, it is not clear why this would be the case. An inward shift in supply could be the result of a pandemic-induced reduction is labour; but demand might have declined as it did in many retail sectors. Identification of such effects would be necessary for economists to determine the welfare impacts of the pandemic. Previous research by van Kooten and Schmitz [1] postulated that there was actually an increase in the demand for lumber; with more people working from home and desiring more space, there was an increase in demand for lumber by the repair and remodelling, and the housing, sectors. On the supply side of lumber, van Kooten et al. [3] argued that lumber producers already faced rail transport and sawmill capacity constraints. These constraints were then exacerbated by the COVID-19 pandemic leading to a substantial increase in price. In both cases, the price increases had significant on producer and consumer surpluses, and the distribution of welfare.

In this study, we employed two modelling approaches to examine the potential factors impacting the large variation of softwood lumber prices resulting from the COVID-19 pandemic—a method that employed a calibrated stochastic process, which demonstrated the inherent instability in lumber prices but could not explain its root cause, and an economic model that could account for price variability. Overall, we found that the COVID-19 pandemic had a large statistically significant impact on softwood lumber prices, as witnessed over the period since March 2020. Additionally, we found that the Pacific Northwest Floods had an even greater statistically significant impact (although likely shorter lived) on softwood lumber prices following the pandemic, which offers an explanation as to the lack of a return to pre-pandemic prices in the periods following the end of the pandemic. Our research is limited by data availability—if more data had been available on individual factors affect softwood lumber our regression results could be more precise. However, the pandemic is a recent event and future research may be able to present panel data to compare the pandemic effects across countries, or more detailed regressors to partial out price effects further. Additionally, we have uncovered the importance of an intact supply chain on the softwood lumber industry. The PNF led to significant damages to the lumber routes to the coast, and additional research is needed on the effect of supply chain issues on lumber exports.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Explaining North American Lumber Price Movements: Dependent Variable Logarithm of Spruce-Pine-Fir (SPF) Price Index.

Regressor	(1981)	(1981)	(2001)	(2001)
$Exch_t$	0.444 ***	0.246 ***	0.131	0.133
	(0.093)	(0.080)	(0.119)	(0.113)
HS_t	0.0002 ***	0.0002 ***	0.0003 ***	0.0003 ***
	(0.00003)	(0.00003)	(0.0001)	(0.0001)
$ADCVD_t$		−0.014 ***		−0.007 ***
		(0.001)		(0.002)
PRE_t	−0.478 ***	−0.546 ***		
	(0.035)	(0.030)		
MOU_t	−0.327 ***	−0.191 ***		
	(0.037)	(0.034)		
$L2_t$	0.007	0.055		
	(0.048)	(0.041)		
W_t			0.033 ***	0.024 ***
			(0.006)	(0.006)
TRQ_t	0.086 **	0.152 ***	0.173 ***	0.195 ***
	(0.035)	(0.030)	(0.063)	(0.061)
$SLA06_t$	−0.016	0.011	0.043	0.010
	(0.041)	(0.035)	(0.079)	(0.076)
$POST_t$	0.380 ***	0.622 ***	0.352 ***	0.457 ***
	(0.041)	(0.039)	(0.081)	(0.084)
FC_t	−0.335 ***	−0.233 ***	−0.192 ***	−0.182 ***
	(0.046)	(0.040)	(0.054)	(0.051)
$Covid_t$	0.345 ***	0.321 ***	0.267 ***	0.268 ***
	(0.048)	(0.040)	(0.050)	(0.048)
PNF_t	0.659 ***	0.614 ***	0.427 ***	0.463 ***
	(0.071)	(0.060)	(0.080)	(0.077)
Constant	5.059 ***	5.343 ***	4.403 ***	4.770 ***
	(0.125)	(0.108)	(0.192)	(0.214)
Observations	501	501	255	255

Note: ** $p < 0.05$, *** $p < 0.01$.

References

1. Van Kooten, G.C.; Nelson, H.; Mokhtarzadeh, F. *Canada-U.S. Softwood Lumber Dispute: Background. Chapter 2 in International Trade in Forest Products: Lumber Trade Disputes, Models and Examples*; van Kooten, G.C., Voss, L., Eds.; CAB International: Wallingford, UK, 2021; pp. 10–26.
2. Van Kooten, G.C.; Schmitz, A. COVID-19 Impacts on U.S. Lumber Markets. *For. Policy Econ.* **2022**, *135*, 102665. [CrossRef]
3. Van Kooten, G.C.; Zanello, R.; Schmitz, A. Explaining Post-Pandemic Lumber Price Volatility and its Welfare Effects. *J. Agric. Food Ind. Organ.* **2022**, 18. [CrossRef]
4. Statista. Monthly Price of Lumber in the United States from January 2019 to March 2022. 2022. Available online: https://www.statista.com/statistics/1239728/monthly-lumber-price-usa/ (accessed on 25 November 2022).

5. Anderson, J.; West, N.; Fitzgerald, A.; Guzman, D. *Random Lengths. Various Issues. Forest Product Market Prices and Statistics Yearbook*; Random Lengths Publications Ltd.: Eugene, OR, USA, 2021.
6. Federal Reserve Bank of St. Louis (FRED). U.S. Census Bureau and U.S. Department of Housing and Urban Development, New Privately-Owned Housing Units Started: Total Units [HOUST]. 2022. Available online: https://fred.stlouisfed.org/series/HOUST (accessed on 29 November 2022).
7. World Trade Organization (WTO). (n.d.). Anti-Dumping, Subsidies, Safeguards: Contingenties, etc. Available online: https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm8_e.htm (accessed on 25 November 2022).
8. Global Affairs Canada. Softwood Lumber. 2022. Available online: https://www.international.gc.ca/controls-controles/softwood-bois_oeuvre/index.aspx?lang=eng (accessed on 25 November 2022).
9. Zhang, D. *The Softwood Lumber War: Politics, Economics, and the Long U.S.-Canadian Trade Dispute*, 1st ed.; Routledge: London, UK, 2007.
10. Insurance Bureau of Canada (IBC). Insured Losses of 2021 Floods Now $675 Million. 2022. Available online: http://www.ibc.ca/bc/resources/media-centre/media-releases/insured-losses-from-2021-floods-in-bc-now-675-million (accessed on 11 November 2022).
11. COFI; BC Council of Forest Industries, Vancouver, BC, Canada. Personal Communication, 20 September 2022.
12. Lawler, G.F. *Introduction to Stochastic Processes*, 2nd ed.; Taylor & Francis Group: Boca Raton, FL, USA, 2006.
13. Dixit, R.K.; Pindyck, R.S. *Investment under Uncertainty*; Princeton University Press: Princeton, NJ, USA, 1994; p. 74.
14. Dias, M.A.G. Stochastic Processes with Focus in Petroleum Applications. April 2008. Available online: http://marcoagd.usuarios.rdc.puc-rio.br/stochast.html (accessed on 20 May 2022).
15. Zhang, D. Welfare impacts of the 1996 United States—Canada Softwood Lumber (trade) Agreement. *Can. J. For. Res.* **2001**, *31*, 1958–1967. [CrossRef]
16. Zhang, D. Welfare impacts of the 1996 United States—Canada softwood lumber agreement: An update. *Can. J. For. Res.* **2006**, *36*, 255–261. [CrossRef]
17. Statistics Canada. Table 14100306: Average Hourly Earnings for Employees Paid by the Hour, by Industry. Monthly, Unadjusted for Seasonality. 2022. Available online: http://dc.chass.utoronto.ca.ezproxy.library.uvic.ca/cansimdim/English/ (accessed on 25 November 2022).
18. Adams, D.M.; McCarl, B.A.; Homayounfarrokh, L. The role of exchange rates in Canadian—United States lumber trade. *For. Sci.* **1986**, *32*, 973–988.