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Do exporters of Canadian forest products price to market?

Kurt Niquidet, [a,b*] Kyle Sia-Chan, [b] Jonathan Kan, [b] Lili Sun, [c] Craig Johnston[d]

a: University of British Columbia, Faculty of Forestry, Vancouver, BC, Canada.
b: BC Council of Forest Industries, Vancouver, BC, Canada.
c: Natural Resources Canada, Pacific Forestry Centre, Victoria, Canada.
d: Bank of Canada, Ottawa, Ontario, Canada.
**Corresponding author: E-mail: niquidet@cofi.org*

ABSTRACT

Forest products in Canada contribute significantly to the Canadian trade balance. Canadian producers depend heavily on export markets raising the question: how do exchange rate fluctuations impact Canada's competitiveness in foreign markets? The paper applies a fixed-effects model with individual slopes to investigate this question. Twenty years of monthly data are employed to study the pricing-to-market (PTM) behaviour of Canadian softwood log, lumber and pulp exports as the exchange rate changes. We find a great degree of incomplete exchange rate pass-through, with PTM being apparent for Canadian exporters, particularly in major markets. The export price adjustment tends to mitigate the effect of exchange rate fluctuations on foreign currency prices of Canadian products in most cases. This pricing behaviour reflects exporters' desire to stabilize their share of the destination market.

Keywords

forestry, imperfect competition, international trade, pricing-to-market

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INTRODUCTION

The effect of exchange rate variations on pricing decisions is known as the exchange rate pass-through (ERPT). A better understanding of how the ERPT affects the Canadian forest industry is important as forestry-related commodities represent a significant share of Canadian merchandise exports. Firms in forest product industries compete globally, and exchange rate changes could impact competitiveness in foreign markets. If exchange rate pass-through is incomplete and changes to the exchange rate have a limited impact on prices in the destination country, these changes may improve firms' profitability but will not have a significant effect on exports.

The Canadian forest products industry provides a case study for examining exchange rate pass-through because forest products are one of Canada's top export categories. Further, exports play a significant role in many of Canada's regional economies, and Canada has a floating exchange rate. Some studies have examined the effect of exchange rates on the broader global forest products trade (Bolkesjø and Buongiorno 2006), but they fail to disentangle the exchange rate pass-through from the effects of other macroeconomic variables on the demand and supply of forest products. Accordingly, the results are mixed: some studies find the effect of the exchange rate on trade flows to be insignificant, while others find it significant (e.g., Bolkesjø and Buongiorno 2006; Jee and Yu 2001; Wisdom and Granskog 2003).

An incomplete pass-through could be in line with at least two fundamentally different models. First, in a perfectly competitive market with floating exchange rates where the law of one price holds, free-on-board export prices for homogeneous products will be equalized across markets in the exporter's currency, but changes in exchange rates will not affect bilateral export prices. In other words, import prices in the foreign market will fluctuate in proportion to changes in the exchange rate. This is generally called complete exchange rate pass-through. Second, incomplete pass-through happens in an imperfect market where an exporter can adjust markup over marginal costs of exports because of some degree of market power. This latter case is better known as pricing to market. Other reasons for imperfect pass-through include imperfect arbitrage, long-term contracting, invoice currency decisions by exporters, high transaction costs, and the influence of government policy or product differentiation.

Pricing to market can explain some of the empirical findings of the insensitivity of international trade flows to exchange rate changes in forest products (e.g., Buongiorno et al. 1988; Jennings et al. 1991). Few studies, however, specifically examine the exchange rate pass-through in forest products (e.g., Uusivuori and Buongiorno 1991; Hänninen and Toppinen 1999). Fewer still examine this issue with a Canadian focus. Despite the potential importance of the pass-through relationship in explaining the performance of Canadian forest product exports, empirical research on this issue remains sparse. Alavalapati et al. (1997) are the exception, where they examine the effects of the Canada–US exchange rate on Canadian wood pulp prices using a cointegration analysis. They find evidence of incomplete exchange rate pass-through and conclude that Canadian pulp producers may not have the market power to increase their pulp prices. Still, they focus exclusively on an aggregated Canada-U.S. pulp market. At the same time, questions remain about whether similar findings hold in lumber and log markets, as well as whether ERPT is found with trading partners outside North America.

It is important to recognize that the softwood lumber dispute between Canada and the U.S. could significantly impact trade dynamics between the two countries (see Zhang and Sun 2001; van Kooten, 2002; Yin and Baek, 2005; Zhang and Parajuli 2016; Johnston and Parajuli 2017). Research on the Canada-U.S. softwood lumber market has largely focused on the effects of protectionist policies on cross-border trade, often neglecting the implications for market integration (e.g., Parajuli et al. 2015) or analyzing price transmission under the assumption of stable bilateral trade agreements (e.g., Sun and Zhuo 2014). The benefits of trade liberalization, such as improved price transmission between domestic and foreign markets due to reduced tariffs and trade costs, are well acknowledged. For instance, Guo and Johnston (2021) point out that duty-free treatment for Canadian softwood lumber notably reduces transaction costs between the two countries, thereby facilitating quicker price transmission from Canada to the U.S. However, their study does not explore how exchange rate fluctuations affect the transmission of price changes between these markets.

The objective of this study is therefore to better understand the degree of exchange rate pass-through for Canadian forest products. The main question this study tries to answer is whether exporters of Canadian forest products differentiate between destination markets, adjusting prices to smooth the effect on prices in important destination markets when the Canadian dollar appreciates (or depreciates). We investigate pricing-to-market behaviour for 12 Canadian forest products using panel data.

MODEL

The model's origins can be attributed to Krugman (1986), which was expanded upon by Knetter (1989). The theoretical underpinning is based on a producer's profit maximization problem, assuming imperfect competition. The first-order conditions of the maximization problem are given by:

$$\mathrm{P}_{it} = \mathrm{c_t} \frac{\epsilon_{it}}{\epsilon_{it} - 1}, i = 1, \dots, \mathrm{N} \text{ and } t = 1, \dots, \mathrm{T}, \quad (1)$$

here $i = 1, \dots, \mathrm{N}$ represents foreign destinations; P_{it} is the export price to the destination i in period t measured in the exporter's currency; c_t is the marginal cost of production in period t, and ϵ_{it} is the elasticity of demand considering the local currency price in the destination market i in period t.

Equation (1) states that the price in the exporter's currency is a markup over marginal cost, and the markup is determined by the elasticity of demand in the various destination markets. It shows that profit maximization occurs when the price is equal to the marginal cost in a perfect competitive market. In this case, the elasticity of demand is sufficiently large, no markup is charged and the firm chooses the level of output at which marginal cost is equal to the world price. The law of one price applies in all markets. Fluctuations in the exchange rate do not affect prices measured in the exporter's currency, and there is a complete exchange rate pass-through to the destination countries.

In a market with imperfect competition, producers can add a markup above marginal cost. Pricing to market assumes an exporter discriminates between markets according to the different demand elasticities it faces. Such a phenomenon may be present in forest products, as indicated in empirical work by Niquidet and Tang (2013), which shows differing import demand elasticities for Canadian lumber between China and Japan. There could still be a complete exchange rate pass-through if the elasticity of demand in the importing destination is constant. For example, the producer will charge a fixed markup over marginal cost, but the markup can vary across destinations. In this case, variations in the exchange rate will not affect the price in terms of the exporting country's currency. However, the markup is variable when the demand elasticity in the destination market is not constant. The price in this case is affected by fluctuations in the exchange rate and this leads to incomplete exchange rate pass-through.

Furthermore, when demand is less convex than the constant elasticity demand, the absolute value of the demand elasticity increases with increases in the price and decreases when the price decreases. The markup falls when the importing destination's currency depreciates and rises when it appreciates. Thus, fluctuations in the exchange rate are stabilized by the changes in prices. However, if demand is more convex than the constant elasticity of demand, the opposite occurs, and fluctuations in the exchange rate are exaggerated by the changes in prices (Knetter 1989).

To test if exporters modify prices with fluctuations in the exchange rate, we use the following empirical fixed-effects regression model:

$$ln\, p_{it} = \alpha + \theta_t + \tau_i + \beta_i \; ln\, s_{it} + \varepsilon_{it}, \tag{2}$$

where p_{it} is the export unit value measured in the currency of export origin (Canadian dollars per cubic metre of logs and lumber, and Canadian dollars per tonne of pulp), θ_t is a time effect, τ_i is a country effect, s_{it} is the exchange rate (adjusted for inflation in the destination market) measured in terms of the destination market's currency (destination country's currency per Canadian dollar) and ε_{it} is a disturbance term.

The model allows us to distinguish between the three cases described previously. First, perfect competition would imply that τ and β are equal to zero because the free-on-board export price is equal to the marginal cost, and thus the prices are equal across destinations. The change in marginal cost across time is captured by θ. Second, imperfect competition with constant demand elasticity implies that the markup over marginal cost is fixed but varies across destinations. Thus β remains equal to zero because the changes in exchange rates do not affect the export prices in the exporter's currency and are completely reflected in local currency prices, while τ is not equal to zero. Third, under imperfect competition with changing demand elasticities because of fluctuating local currency prices, export prices are affected by fluctuations in exchange rates and the markup is not fixed. Thus β and τ are not equal to zero. A negative estimated beta coefficient implies that the changes in export prices stabilize the fluctuations in exchange rates while a positive estimate indicates a destabilizing effect.

One of the common criticisms of many studies on pricing to market is that unit values are used as export prices. It has been argued that changes in unit values could be triggered as a response to fluctuations in exchange rates by other factors besides pricing to market (e.g., Glauben and Loy 2002; Lavoie and Liu 2007). For example, it could be that product quality changes across different markets and time periods (Gil-Pareja 2002). However, the impact of product differentiation has been minimized in this study by choosing products at the most disaggregate level possible (HS 8-digit level) and by focusing on forest product exports from one specific region (British Columbia). See the next chapter for a description of the data. Furthermore, as Knetter (1989) argues, systematic differences in product quality across markets and time can be captured by country and time effects, as done in this study. Consequently, we feel this study adequately tests for effects of pricing to market for forest product exports from British Columbia.

DATA

We use monthly data for Canadian forest products, including different species of logs, lumber and pulp. Nominal export prices were calculated by dividing the export values in Canadian dollars (free on board) by the quantity exported, taken from the Statistics Canada HS-8 classification for each major trading partner. Depending on the availability of data for major markets, the time frame varies across different products from 2004 to 2023. Missing price values were replaced by the average of previous and subsequent observations if available.

Monthly nominal exchange rates are adjusted by consumer price indexes (CPIs) in the destination market.[1] Exchange rates and CPIs are obtained from various sources, including the FRED, Federal Reserve Bank of St. Louis and the International Monetary Fund (IMF)'s International Financial Statistics as well as each country's bureau of statistics.

[1] Following the pricing to market literature (e.g., Knetter 1995; Carew 2000) this adjustment is made because optimal export prices should not be influenced by changes in the nominal exchange rate that corresponds to inflation in the destination market.

The export price statistics and the average share in Canadian exports are further reported in the Appendix, in Table A1, Table A2 and Table A3. The softwood log products considered are hemlock (HS 44032061, 44032560, 44032660), Douglas fir (HS 44032080, 44032580, 44032680), spruce (HS 44032040, 44032390, 44032490), and cedar (HS 44032070, 44032570, 44032670). In 2023, 6.8 percent of the 40.2 million cubic metres of British Columbia’s harvested logs were exported. Most of the exported logs were from coastal areas, where hemlock and Douglas fir made up around three-quarters of the log harvest. In the British Columbia Interior, the main species were lodgepole pine and spruce. China has the largest share of British Columbia log exports (47.2 percent), followed by Japan (28.1 percent), the United States (19.1 percent) and South Korea (5.1 percent). Although China purchased the largest share of British Columbia’s log exports, Table A1 shows that Japan has the largest share of British Columbia’s exports of Douglas fir (48.1 percent). China has the largest share of spruce and hemlock exports (50.7 percent and 64.9 percent, respectively), and the United States has the largest share of cedar exports (54.6 percent).

Lumber products included in the analysis are western red cedar (HS 44071071, 44071941, 44091091), hemlock and Amabilis fir (Hem-Fir, HS 44071033, 44071490, 44071932), hemlock (HS 44071061, 44071992), and spruce, pine and fir (S-P-F, HS44071031, 44071390). In 2023, 74 percent of British Columbia’s softwood lumber production volume was spruce, pine or fir (SPF), and 26 percent was from other species, such as cedar, Douglas fir and hemlock. Over the past decade, BC lumber exporters relied heavily on the United States, although the emergence of China as a significant export destination has eroded the share of exports destined for the US. On aggregate, the top three export markets for BC lumber products are the United States, China and Japan with 77 percent, 11 percent and 6 percent of shares in 2023, respectively. Even within different species, the United States has the dominant share in the total amount of BC lumber exports (Table A2).

For BC wood pulp, the products considered are wood pulp obtained by a combination of mechanical and chemical pulping processes (BCTMP) (HS 47050000), bleached soda or sulphate (Kraft) coniferous pulp (HS 47032120), unbleached soda or sulphate coniferous pulp (HS 47031100) and dissolving pulp (HS 47020000). Bleached pulp represented 83.5 percent of BC pulp exports followed by wood pulp obtained by a combination of mechanical and chemical pulping processes (10.5 percent), unbleached sulphate (3.6 percent), and dissolving pulp (2.4 percent). China, the United States and Japan are the top three markets for BC pulp exports. China represented 74 percent of British Columbia's export share in 2023, while the United States and Japan represented 20 percent and 6 percent shares, respectively. Much of China's pulp supply comes from imported recycled fibres, where a significant percentage is sourced from large pulp mills recently built in the Southern Hemisphere, which use low-cost plantation short-fibred hardwoods. Long-fibred pulps from British Columbia are essential as "make-up" pulps to provide desired papermaking characteristics such as strength and bulk. The United States and Japan use pulp imported from British Columbia to produce newsprint and manufactured paper products. Prices and average shares of BC pulp exports exhibit significant variation across countries (see Table A3).

RESULTS

We apply Fisher-type (Choi 2001) unit root tests for panel datasets to the natural logarithm (ln) export prices and ln real exchange rates before the regressions. The null hypothesis is all panels contain unit roots and the alternative hypothesis is at least one panel is stationary. The results rejected the null hypothesis in all cases indicating at least one panel is stationary. We further conducted Levin-Lin-Chu unit root tests to ln export prices and ln real exchange rates. The tests rejected that ln export prices have unit roots in all cases we researched but cannot reject that ln real exchange rates have unit roots. We decided to proceed without further adjusting the data for several reasons: First, whether real exchange rates are unit root or stationary has been controversial. There is a large amount of literature in this area. Some research (Assaf 2006, Liew et. al. 2004) showed that real exchange rate series can be nonlinear trend stationary, and therefore, cannot be captured by most of the unit root tests. Kanas (2009) found that the real exchange rate is stochastic, and regime-dependent i.e. there is a stationary regime and a non-stationary regime. In addition, it is known that real exchange rates can be fractionally integrated, exhibiting long memory (Cheung 1993). Hence, taking the first difference over the real exchange rate might over-adjust the data. To take into account the dynamics of the model, we included lagged ln export prices as an additional explanatory variable as current export prices could also depend on past export prices.

The results of the model estimates are summarized in Table 1, Table 2 and Table 3. We estimate 12 forest product panel models with monthly data. The sample period varies depending on the availability of data. The regression models all contain a constant, a set of time effects and country effects. We chose a single-country effect as a reference country. These benchmarks must be dropped off to avoid singularity. Hence, the fixed effects are to be interpreted as differentials from those implicit in the regression.

For each product, the tables report the estimates of the country effects (τ) and the coefficient on the exchange rate (β). The majority of the country-specific coefficients are highly significant, confirming the price discrimination and market segmentation by BC exporters, who set different fixed markups for different markets. For products that are believed to be homogeneous, this is strong evidence against the competitive market model in which commodity arbitrage leads to the law of one price. A negative coefficient suggests fixed markups lower than that of the United States (the reference country), a positive coefficient indicates fixed markups higher than the reference country's, and an insignificant coefficient indicates an insignificantly different markup from that of the reference country. Most of the coefficients are positive, particularly for lumber and logs.

The results further suggest that many cases violate the complete pass-through implied by the constant-elasticity model. Canadian exporters generally differentiate between destination markets and adjust their pricing behaviour accordingly. Pricing to market was applied in almost half of the cases, and Canadian exporters adjusted their markups in response to Canadian dollar appreciation or depreciation. It appears that exporters try to keep the price levels in local currency stable in most of the markets while allowing for complete pass-through or amplifying the fluctuation in a few cases.

For BC log exports (Table 1), we found that all species except Douglas fir have consistently positive country effects coefficients which means the fixed markups for China, Japan and Korea are higher than the reference country (the U.S.) for all species except for Douglas fir.

Table 1. The impact of real exchange rate and country effects on BC log export prices.

Product	Destination	Country effects(τ)	Exchange rates (β)
Hemlock	China	5.08 (0.46) ***	0.05 (0.05)
	Japan	4.97 (0.58) ***	0.08 (0.16)
	Korea	5.27 (0.83) ***	-0.16 (0.13)
	U.S.		-0.99 (0.12) ***
Number of observations = 908; R^2=0.57			
Douglas fir	China	-2.25 (0.44) ***	-0.23 (0.13) *
	Japan	-1.43 (0.70) **	0.11 (0.17)
	Korea	-1.51 (1.07)	0.08 (0.19)
	U.S.		0.33 (0.14) **
Number of observations = 904; R^2=0.63			
Cedar	China	2.31 (0.84) ***	-0.00 (0.07)
	Japan	2.29 (0.93) **	-0.08 (0.22)
	Korea	3.70 (1.38) ***	-0.58 (0.22) ***
	U.S.		-0.47 (0.19) **
Number of observations = 580; R^2=0.31			
Spruce	China	3.47 (0.46) ***	0.23 (0.05) ***
	Japan	2.97 (0.52) ***	0.18 (0.24)
	Korea	3.82 (0.67) ***	-0.53 (0.08) ***
	U.S.		-0.66 (0.12) ***
Number of observations = 804; R^2=0.51			

*Note: Numbers in the brackets are the standard errors. ***Indicates statistical significance at the 1% level or better; **Indicates significance at 5% level or better; *Indicates significance at 10% level or better.*

Significant pricing-to-market coefficients (βs) were found for half of the species and destination countries. The eight exceptions include hemlock to China, Japan and Korea, Douglas fir to Japan and Korea, cedar to China and Japan, and spruce to Japan. Among the eight significant pricing-to-market coefficients, destination currency price stabilization was found in all exports except spruce to China. In that case, BC exporters adjust prices in a way that amplifies the effect of exchange rate fluctuations on the destination currency price. This is optimizing behaviour only if exporters perceive demand curves to be more convex than a constant elasticity demand curve (Knetter 1989).

For BC lumber exports (Table 2), country effects coefficients were all positive indicating higher fixed markups for all countries than the reference country the U.S. except cedar to France, South Korea and Taiwan, hem-fir to Taiwan and hemlock to all countries.

Table 2. The impact of real exchange rate and country effects on BC lumber export prices.

Product	Destination	Country effects(τ)	Exchange rates (β)
Cedar	China	0.21 (0.20)	0.14 (0.06) **
	France	-0.66 (0.88)	-0.12 (0.17)
	Japan	-0.26 (0.05) ***	-0.33 (0.06) ***
	South Korea	-1.24 (0.23) ***	0.35 (0.10) ***
	Taiwan	-0.60 (0.16) ***	0.02 (0.10)
	UK	0.68 (0.76)	0.14 (0.14)
	US		0.11 (0.01) ***
Number of observations = 2,034; R^2=0.85			
Hem-fir	China	0.08 (0.35)	-0.11 (0.10)
	Italy	1.54 (0.64) **	0.06 (0.24)
	Japan	0.79 (0.63)	-0.42 (0.15) ***
	South Korea	1.17 (0.91)	-0.26 (0.14) *
	Taiwan	-0.10 (0.43)	-0.35 (0.15) **
	UK	1.44 (0.60) **	0.04 (0.18)
	US		-0.10 (0.13)
Number of observations = 1,470; R^2=0.92			
Hemlock	China	-0.74 (0.21) ***	0.00 (0.08)
	Italy	-1.30 (0.85)	-0.24 (0.17)
	Japan	-0.40 (0.08) ***	-0.21 (0.09) **
	South Korea	-0.03 (0.32)	-0.30 (0.12) ***
	Taiwan	-1.04 (0.17) ***	-0.16 (0.11)
	UK	-1.70 (0.95) *	-0.30 (0.18) *
	US		0.14 (0.03) ***
Number of observations = 1,808; R^2=0.91			
S-P-F	China	1.19 (0.34) ***	-0.00 (0.04)
	Japan	1.50 (0.47) ***	0.17 (0.07) **
	South Korea	1.98 (0.62) ***	-0.29 (0.09) ***
	Taiwan	0.96 (0.30) ***	-0.17 (0.09) *
	UK	1.33 (0.55) **	0.00 (0.10)
	US		-0.25 (0.09) ***
Number of observations = 930; R^2=0.73			

*Note: Numbers in the brackets are the standard errors. ***Indicates statistical significance at the 1% level or better; **Indicates significance at 5% level or better; *Indicates significance at 10% level or better.*

The regression indicates that 15 out of 27 export markets violate the invariance of export prices to exchange rates implied by the constant-elasticity model. Among them, all cases have negative coefficients except S-P-F to Japan, hemlock to the U.S., and cedar to China, South Korea and the U.S. This indicates that exporters are capable of price discrimination to offset relative price changes in the destination currency induced by exchange rate fluctuations in most cases. Price stabilization was consistently found in the SPF lumber markets, which is the dominant type of lumber produced in the BC interior. The price stabilization serves to keep prices paid by importers in their currency relatively stable and hence ensure competitiveness and protect the market shares of Canadian exporters in these markets. Statistically significant and negative pricing-to-market coefficients were also found in hem-fir to the U.S. market. The United States is a large market, and Canadian exporters may be more concerned with maintaining their market share than stabilizing profits in Canadian-dollar terms. Table 3 reports the results of pulp exports.

Table 3. The impact of real exchange rate and country effects on BC pulp export prices.

Product	Destination	Country effects(τ)	Exchange rates (β)
BCTMP	China	0.49 (0.12) ***	0.03 (0.02)
	India	0.33 (0.13) ***	-0.09 (0.03) ***
	Japan	0.51 (0.17) ***	-0.00 (0.04)
	Korea	0.33 (0.25)	0.08 (0.04) **
	US		-0.10 (0.04) ***
Number of observations = 1,135; R^2=0.68			
Bleached Pulp	China	-0.55 (0.24) **	0.04 (0.06)
	France	-1.93 (0.29) ***	-0.26 (0.07) ***
	Indonesia	-0.71 (0.75)	0.01 (0.08)
	Japan	-0.66 (0.41)	0.13 (0.10)
	Korea	-0.73 (0.59)	0.03 (0.09)
	Taiwan	-0.46 (0.26) *	0.14 (0.10)
	US		0.13 (0.08)
Number of observations = 1,589; R^2=0.85			
Unbleached Pulp	China	-1.05 (0.27) ***	-0.02 (0.05)
	India	-1.15 (0.30) ***	-0.11 (0.07)
	Japan	-0.99 (0.35) ***	-0.05 (0.05)
	Korea	-0.68 (0.51)	-0.16 (0.10) *
	US		0.20 (0.24) ***
Number of observations = 1,130; R^2=0.66			
Dissolving	China	2.91 (0.63) ***	0.20 (0.10) **
	Taiwan	2.55 (0.68) ***	0.15 (0.18)
	US		-0.49 (0.19) ***
Number of observations = 282; R^2=0.69			

*Note: Numbers in the brackets are the standard errors. ***Indicates statistical significance at the 1% level or better; **Indicates significance at 5% level or better; *Indicates significance at 10% level or better.*

For BCTMP and dissolving pulp, countries consistently have higher fixed markups than the reference country the U.S.; for bleached and unbleached pulp, the markups are mostly lower than the U.S. Eight out of 20 export markets violate the invariance of export prices to exchange rates implied by the constant-elasticity model with five negative coefficients dominating. Interestingly, the price stabilization strategy for BC dissolving pulp exports is only found in the US market. One explanation is that Canadian firms face a high level of competition in the US compared with other destination markets. In Chinese markets, Canadian exporters try to amplify the fluctuation of exchange rate for all types of pulp which means the elasticity of demand in China is more convex than a constant elasticity demand curve.

CONCLUSIONS

In about half of the forest product markets we study, Canadian export prices are sensitive to fluctuations in exchange rates. For cases in which the complete pass-through is rejected, negative coefficients occur much more frequently than positive coefficients. This suggests that price adjustments in the local currency of the destination market tend to be stabilizing. Canadian exporters may be more concerned with maintaining their market share than stabilizing profits in Canadian-dollar terms. Price stabilization is especially true for exports to developed markets such as the United States, where negative pricing to market is found in most cases. This provides evidence that price setting is an important instrument of strategic behaviour for Canadian firms because the markup adjustment is used to smooth fluctuations in the destination country's prices and thus protect the market share of Canadian exporters in the foreign market. Alternatively, Canadian exporters tend to completely pass through or amplify the fluctuation of the exchange rate in some emerging markets such as China.

These results state that weaker exchange rates may not improve Canadian exporters' competitiveness in foreign markets. Exchange rate pass-through is incomplete and changes to the exchange rate have a limited impact on prices in the destination country. While these changes may improve firms' profitability, results indicate they will not have a significant effect on exports.

These findings also draw into question the methodology behind some forest sector models. While models of the forest product trade have been dominated by numerical methods, the most common approach is to assume exchange rates are perfectly passed through to prices (see Kallio et al. 1987; Perez-Garcia 1996; Solberg et al. 2003; Buongiorno et al. 2003). The results of this study suggest an incomplete pass-through of exchange rates to foreign prices, which suggests improvements could be made to existing forest-sector models. More broadly, many of the assumptions behind existing models may not hold empirically, including the assumption of constant elasticities of demand and market integration. Future research in the forest products trade needs to further explore market segmentation and the potential relevancy of "New Trade Theory" and "New-New Trade Theory" which incorporates imperfect competition and firm-specific data.

CONFLICTS OF INTEREST

The authors confirm there are no conflicts of interest.

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APPENDIX

Table A1. Average nominal export prices (CAD/cubic metre) and export market shares of BC logs.

Product	Destination	Mean		Average export shares (%)
Hemlock	United States	$	71.2	6.5%
	China	$	119.7	64.9%
	Japan	$	111.1	7.5%
	South Korea	$	115.2	20.6%
Douglas fir	United States	$	103.4	26.9%
	China	$	127.8	21.0%
	Japan	$	142.6	48.1%
	South Korea	$	151.9	3.7%
Cedar	United States	$	156.0	54.6%
	China	$	156.7	4.4%
	Japan	$	170.7	21.5%
	South Korea	$	209.5	14.3%
Spruce	United States	$	211.1	3.2%
	China	$	125.1	50.7%
	Japan	$	162.3	17.1%
	South Korea	$	126.7	27.1%
True fir	United States	$	89.0	19%
	China	$	119.8	18.1%
	Japan	$	114.9	43.1%
	South Korea	$	113.4	19.7%

Table A2. Average nominal export prices (CAD/cubic metre) and export market shares of BC lumber.

Product	Destination	Mean		Average export shares (%)
Cedar	Taiwan	$	338.8	0.4%
	France	$	1,100.7	1.1%
	Japan	$	710.5	1.8%
	China	$	456.8	3.4%
	South Korea	$	458.5	0.2%
	United Kingdom	$	1,183.6	2.3%
	United States	$	527.3	82.8%
Hem-fir	Taiwan	$	222.9	5.3%
	Italy	$	730.7	0.6%
	Japan	$	365.3	21.7%
	China	$	206.5	31.7%
	South Korea	$	262.6	1.3%
	United Kingdom	$	684.7	0.1%
	United States	$	211.4	32.8%
Hemlock	Taiwan	$	752.2	8.2%
	United States	$	237.0	36.5%
	United Kingdom	$	237.0	1.0%
	South Korea	$	238.4	0.9%
	China	$	239.2	21.6%
	Japan	$	247.7	20.2%
	Italy	$	372.1	1.0%
Spruce-Pine-Fir	Taiwan	$	154.7	0.9%
	Japan	$	259.7	8.0%
	China	$	155.2	16.2%
	South Korea	$	220.2	0.9%
	United Kingdom	$	184.9	0.1%
	United States	$	165.9	71.5%

Table A3. Average nominal export prices (CAD/tonne) and export market shares of BC pulp

Product	Destination	Mean		Average export shares (%)
BCTMP	China	$	568.0	62.8%
	South Korea	$	644.1	17.9%
	United States	$	574.8	3.2%
	India	$	622.2	9.1%
	Japan	$	658.0	1.3%
Bleached Kraft	United States	$	786.9	17.2%
	China	$	791.7	54.2%
	Japan	$	761.6	8.8%
	South Korea	$	778.3	4.0%
	Taiwan	$	751.4	2.1%
	Indonesia	$	863.0	5.6%
	France	$	670.8	0.4%
Unbleached Kraft	United States	$	676.8	34.7%
	China	$	788.9	51.5%
	Japan	$	742.1	4.0%
	India	$	568.3	4.0%
	South Korea	$	663.6	5.8%
Dissolving	China	$	1,225.1	73.7%
	United States	$	1,348.5	16.6%
	Taiwan	$	1,253.0	8.9%

Note: BCTMP refers to BC wood pulp obtained by a combination of mechanical and chemical pulping processes (BCTMP) (HS 47050000).