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Short- and long-run exchange rate effects on forest product trade: Evidence from panel data

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Abstract

Impacts of exchange rates on international forest products trade are widely debated, but the empirical evidence regarding this issue is still inconclusive. Here, we report findings of the impacts of the exchange rates on the main forest product imports and exports of the US, from January 1989 to November 2004. Export data consisted of monthly series of the main products exported by the US to different countries. For imports we used monthly series of the principal products imported by the US from Canada, the major source of imports. The strongest evidence was obtained by pooling the data across countries and products. In the short run, exports were very elastic with respect to the exchange rate (−2.6), while imports were moderately elastic (1.2). In the long run, the elasticity decreased but remained significant (0.5 for both exports and imports). Appreciation of the US dollar tended to matter more than depreciation, but the hypothesis that the effect of exchange rate was symmetric could not be rejected.

Keywords: Econometrics; International trade; Elasticity; Causality.
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Introduction

Forest products in the form of logs, or semi-processed and processed products are traded actively between countries (FAO, 2003). With rapid economic growth in parts of the world, and with new trade liberalization policies, the volume and value of global trade is expected to grow faster than production (Buongiorno et al., 2003). In this context, every country is attentive to policies that may affect its competitiveness and thus its share of the world market. The exchange rate in particular, i.e. the value of the domestic currency relative to that of the trading partners, has been commonly perceived as the most important macroeconomic variable affecting trade flows of forest commodities. Indeed, forest industries competing internationally have argued strongly for policies depreciating their home currencies, as this would presumably improve their competitiveness in world markets. For example, representatives of the US forest industries have called forcefully for policies that would decrease the value of the US dollar before 2001 (see e.g. AF&PA News (undated) and forest industry leaders letter to the president, dated August 17, 2001, both available from http://www.afandpa.org).

The relationship between exchanges rates and international forest products trade has been studied previously with different results. The earliest econometric studies assumed that the elasticity of import with respect to exchange rates was equal to the corresponding import price elasticity (Buongiorno et al., 1979; Adams et al., 1986). Using vector autoregressive models, Buongiorno et al. (1988) conclude that increasing exchanges rates had negligible impacts on US lumber imports from Canada between 1974 and 1985. With similar methods, Uusivuori and Buongiorno (1990) find some, but not unambiguous evidence, of short-term exchange rates effects on Swedish and Finnish forest products exports to the US. They also find that the effect disappears over time.

Other studies have focused on the role of exchange rates in Canadian exports to the US. Jennings et al. (1991) do not find a strong exchange-rate effect in the Canadian lumber sector, while Sarker (1993) finds no short-term effect, but a significant equilibrium relationship between Canadian lumber exports and the Canada–US exchange rate. Jee and Yu (2001) include exchange rates in a multivariate cointegration model of US demand for Canadian newsprint, and they find a significant long-run exchange-rate elasticity of −1.46, with monthly data from May 1988 to December 1996. Wisdom and Granskog (2003) conclude that exchange rates were an important determinant of southern pine exports from 1980 to 2000. Related papers address the issue of how exchange rate changes affect export or import prices, the so called pass-trough of exchange rates (e.g. Uusivuori and Buongiorno, 1991; Alavalapati et al., 1997; Hänninen and Toppinen, 1999). In a market economy, the existence of a pass-through of exchange rate to prices should induce a change in quantity traded. However, the effect of the exchange rate can be quite different from the pass-through effect because of its possible effects of the macroeconomy and therefore on the demand and supply of forest products. The approach used here attempts to cover all partial and global equilibrium effects of the exchange rate, including the pass-through.

The studies referred to above are all using single time-series of the trade of a particular commodity between two countries (however, Uusivuori and Buongiorno (1990) do account for possible correlations between Finnish and Swedish exports to the US). Since trade data are available by country of origin and destination, it seems natural to construct panel data sets consisting of time series of the quantity of a product traded between several countries. Pooling time series of trade into panels increases the degrees-of-freedom and widens the range of variables – and it can help bring some degree of generality to the results. Furthermore, international trade of forest products has grown rapidly in recent decades, not least due to globalization, and it is thus useful to test whether previous conclusions on exchange rate impacts still are valid.

The objective of this study was to test the short- and long-run impacts of exchange rates on the trade of various forest products. The null hypothesis was that changes in the relative value of the currencies had no long-run effect on trade. This is essentially the purchasing power parity theory (Samuelson, 1976, p. 651). The alternative hypothesis was that an increase in the relative value of an exporting country's currency reduced the country's export since the purchasing price in importing countries increased, at least in the short term (Babula et al., 1995). The hypothesis was tested with a reduced form bivariate dynamic model and monthly observations of US exports to various countries, and US imports from Canada.

Materials and methods

Data

The trade data were monthly US exports and imports from January 1989 to November 2004, compiled from the database of US Bureau of Census, Department of Commerce, Foreign Trade Statistics, for the most important commodities in terms of value (Table 1). The data are available at http://dataweb.usitc.gov/scripts/user_set.asp. In some cases, data for 1989 did not exist, or were unreliable. Then, data from 1990:1 to 2004:10 were used. The data for US exports were distinguished by country of destination, most of them to Europe, but also to Japan, the Republic of Korea, and Mexico (Table 2). For US imports, Canada is practically the single supplier, and was the only country considered here.

The exchange rate data, values of the foreign currency in US dollars, were monthly averages of daily noon buying rates in New York City, compiled from Federal Reserve Bank of St. Louis and Board of Governors of the Federal Reserve System (available from http://research.stlouisfed.org). For the European currencies that were replaced by the Euro in 2001, the Euro/US dollar exchange rate was transformed to the original currency levels with the fixed Euro conversion rates of 1999. Fig. 1 shows the historical development of the value of the US dollar relative to the currencies of some main trading partners (Canada, Italy, UK and Japan). The exchange rates varied considerably from January 1989 to November 2004, but no trend was apparent.

Table 1. Products and value of US exports and imports

	Harmonized schedule (HS) code	Value in 2003 (1000 US dollar)
Exports		
Coniferous lumber (softwood) thickness >6 mm	440710	403,608
Non Coniferous lumber thickness >6 mm	440799	733,028
Veneer sheets and sheets for plywood of nonconiferous wood	440890	407,236
Chemical woodpulp, dissolving grades	4702	263,423
Chemical woodpulp, soda or sulphate, other than dissolving	4703	2,088,239
Newsprint, in rolls or sheets	4801	323,445
Kraft paper and paperboard, uncoated in rolls or sheets	4804	1,678,736
Paper and paperboard, uncoated, in rolls or sheets, (not further worked or processed than specified in note 2 to chapter 48)	4805	190,857
Paper, paperboard, cellulose wadding and webs of cellulose fibers, coated, impregnated, covered, surface-colored, surface-decorated or printed "Other paper and paperboard"	4811	341,887
Imports		
Coniferous lumber (softwood) thickness >6 mm	440710	5,502,803
Veneer sheets and sheets for plywood of nonconiferous wood	440890	256,895
Particle board board or similar board of wood (or other ligneous material)[a]	4410	2,230,368
Chemical woodpulp, soda or sulphate, other than dissolving	4703	2,259,491
Newsprint, in rolls or sheets	4801	2,991,190
Kraft paper and paperboard, uncoated in rolls or sheets	4804	421,282

[a]Mostly waferboard and particleboard of wood.

Unit root tests

When time series are integrated (have unit roots), standard statistical methods like ordinary least squares may suggest relationships between variables that are actually independent (Granger and Newbold, 1974). To test for unit roots, augmented Dickey–Fuller (*ADF*) tests with time trend were performed for each time series, with

Table 2. Unit-root tests for exchange rate (US dollar in currency of main trading countries), January 1989 to November 2004

Country	t statistic for Dickey–Fuller test:	
	y	Δy
Belgium	−1.82	−8.90***
Canada	−1.15	−9.83***
France	−1.58	−9.09***
Germany	−1.57	−9.06***
Italy	−1.33	−9.15***
Japan	−2.11	−9.75***
Korea	−1.54	−9.77***
Mexico (90–04)	−1.15	−11.19***
Netherlands	−1.56	−9.08***
Spain	−1.26	−9.12***
United Kingdom	−2.21	−5.89***

Note: ***The hypothesis that the series had a unit root was rejected at 1% level.

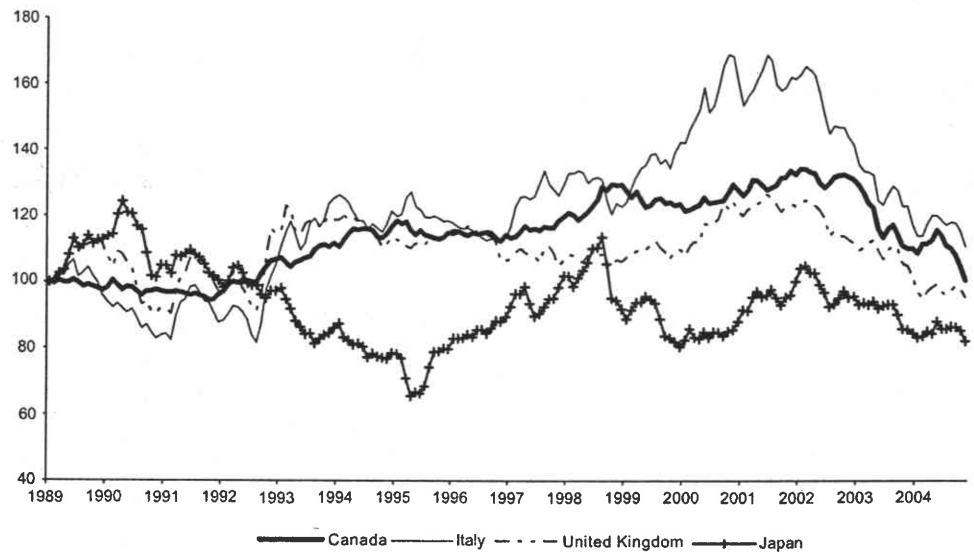

Fig. 1. Value of the US dollar relative to the currency of selected countries from January 1989 to November 2004.

the regression (Dickey and Fuller, 1979),

$$y_t - y_{t-1} = a + by_{t-1} + \sum_{r=1}^{s} c_r(y_{t-r} - y_{t-r-1}) + dt + \omega_t, \quad (1)$$

where ω_t is an error term assumed having white-noise properties. If H_0: $b = 0$ (unit root could not be rejected using data in levels) the series was first differenced and stationarity of the differenced series was tested. The number of lags, s, and the desirability of the time trend, d, were decided upon with the Akaike Information Criterion (AIC) (Akaike, 1973)

Model specification and estimation

To achieve stationarity, the relation between exports and imports were expressed in first differences of the logarithms (i.e. monthly relative changes). Therefore, the empirical model for each product group consisted of a bivariate vector autoregressive model for panel data:

$$\Delta y_{it} = \theta_i + \sum_{k=1}^{p} \alpha_k \Delta y_{i,t-k} + \sum_{k=1}^{q} \beta_k \Delta x_{i,t-k} + u_{it}, \tag{2}$$

where y_{it} was the logarithm of quantity exported or imported by the US to or from country i in month t, x_{it} was the logarithm of the value of the currency of country i relative to the US dollar, and $\Delta y_t = y_t - y_{t-1}$, $\Delta x_t = x_t - x_{t-1}$ were the relative monthly changes in exports and exchange rate, respectively. The parameter θ_i was assumed to be country specific and to remain constant over time, while the error term u_{it} varied randomly across countries and over time.

The model specification (2) rests on the observation that a system of simultaneous equations for, say, imports, exchange rate, and attendant variables, can be reduced to autoregressive models of imports and exchange rates with only these two variables and error terms (Zellner and Palm, 1974; Brorsen et al., 1985).

Model (2) is appealing in comparison to a large structural econometric model, because it requires much less information, and the results do not depend on the theory, data, and constraints chosen in building a structural model. A drawback is that one cannot recover structural information from model (2), such as the partial elasticity of exports with respect to the exchange rate, other things being held constant. But, it allows prediction of the complete dynamic effect of the exchange rate on imports and exports, taking into account the adjustment of all other relevant variables. In particular, short- and long-term multipliers, which are unique and well defined, can be interpreted as general equilibrium effects, in contrast with structural elasticities in which many other variables are assumed to be held constant.

The parameters of model (2) were estimated by product with panel data for exports and single time series for imports, and also by pooling all the products into one single panel for exports and one for imports. Estimation was by ordinary least squares, which was efficient because all the variables on the right-hand side were predetermined. Since the variables were first differences, the fixed effects θ_i represented different trends in exports between countries. The lag length was $p = q = 12$ months to account for seasonal variations in trade. Only in one case was a longer lag length needed to get white noise residuals. The white noise property was tested with the Ljung–Box's Q statistic (Ljung and Box, 1978).

Short- and long-run effects

Based on Eq. (2), the short run, or static, effect of exchange rate on traded quantity was

$$\beta = \sum_{k=1}^{q} \beta_k. \tag{3}$$

Since the variables were relative changes, β was also the short-run elasticity of exports or imports with respect to the exchange rate. In addition to the test of the significance of β, we also tested whether exchange rates caused quantity traded in Wiener–Granger's sense (Wiener, 1956; Granger, 1969), meaning that past values of exchange rate helped predict trade.

The cumulative, long-term, or dynamic effect on exports of a permanent unit change in the exchange rate was measured by the long-run multiplier (Goldberger, 1964; Hamilton, 1994). In the present case, $\beta*$ was also the long-run elasticity of exports or imports with respect to the exchange rate:

$$\mathrm{LRE}_{x\to y} = \beta* = \frac{\beta}{1-\sum_{k=1}^{p}\alpha_k}. \tag{4}$$

The variance of the long-run elasticity was estimated as

$$V(\mathrm{LRE}) = \left[\frac{\partial \mathrm{LRE}}{\partial c}\right]' V(c) \left[\frac{\partial \mathrm{LRE}}{\partial c}\right], \tag{5}$$

where $c = (\alpha_1, \ldots, \alpha_q, \beta_0, \ldots, \beta_p)$ was the vector of the coefficients in (2), and $V(c)$ was their variance–covariance matrix (Brorsen et al., 1985; Buongiorno et al., 1988).

Symmetry of the effects

Model (2) was extended to test if the effects of appreciation or depreciation of the US dollar were the same, in absolute value:

$$\Delta y_{it} = \theta_i' + \sum_{k=1}^{p} \alpha_k' \Delta y_{i,t-k} + \sum_{k=1}^{q} \beta_k' \Delta x_{i,t-k} + \sum_{k=1}^{q} \gamma_k D_{i,t-k} \Delta x_{i,t-k} + u_{it}, \tag{6}$$

where, $D_{i,t-k} = 1$ if $\Delta x_{t-k} > 0$, and $D_{i,t-k} = 0$ otherwise. The short-term exchange rate effect was symmetric if $\gamma_k = 0$ for all k. Otherwise, the short-run elasticity of trade with respect to exchange rate was $\beta^+ = \sum_{k=1}^{q} (\beta_k' + \gamma_k)$ for appreciations of the US dollar, and $\beta^- = \sum_{k=1}^{q} \beta_k'$ for depreciations of the US dollar. The corresponding long-run elasticities were calculated as in (4).

Results

All exchange rate series were $I(1)$ (Table 2), while some export and import series were $I(0)$ and some were $I(1)$ (Tables 3 and 4). All first differenced series were stationary.

Effects of exchange rate on exports

The Granger causality tests suggested that exports could be better predicted with knowledge of past exchange rates than without them for six of the ten product groups (Table 5). The Ljung–Box Q statistics confirmed that there were enough lags to remove residual autocorrelation. For all products except non-coniferious sawnwood, the short-run elasticity was negative, but it was significantly so for only six of the ten products.

The same products that had negative and significant short-run elasticities of imports with respect to exchange rate also had negative and significant long-run elasticities (Table 6). But, the long-run elasticities were much smaller in absolute value than the short-run elasticities. For example, while the short-run elasticity of all products pooled together was −2.55, the corresponding long-run elasticity was −0.52. According to our results newsprint is the most elastic product with respect to exchange rate changes (as high long-run elasticity as 1.8).

Despite apparent differences in the long-run elasticities between products, we could not reject the hypothesis that the model coefficients and therefore the elasticities were the same across products, at 5% level (Table 5). For all products pooled, the long-run elasticity was one-fifth of the short-run elasticity. A necessary condition of stability for model (1) is $\alpha = \sum_{k=1}^{q} \alpha_k < 1$, while a sufficient condition is $|\alpha| = \sum_{k=1}^{q} |\alpha_k| < 1$ (Enders, 1995). In our models, the sufficiency condition was not fulfilled. Stability was checked by verifying by simulation that after a permanent unit change in the exchange rate the change in exports converged to the LRE.

The hypothesis that an increase or decrease in exchange rate had a symmetric effect was rejected at the 5% significance level for only three of the 10 products considered (Table 7). Regardless of product there was no significant long-run effect of a depreciation, while there was a significant effect of an appreciation for five products (with one exception, the same for which the Granger-causality test supported an effect of the exchange rate). Nevertheless, when all the products were pooled, we could not reject the hypothesis that the short-term effect of the exchange rate was symmetric.

Fig. 2 shows the dynamic adjustment of exports to a 1% permanent increase in value of the US dollar, implied by the equation for all products pooled, with symmetry. The effect was a nearly 1% decrease in exports over the first 5 months, but after about 1 year exports stabilized at approximately half a percent lower than their initial level.

Table 3. Unit-root tests for US export series, January 1989 to November 2004

Product (HS code)	Destination	% of total export (2003)	*t* statistic for Dickey–Fuller test:	
			y	Δ*y*
Coniferous sawnwood (440710)	Canada	31.1	−7.18***	
	Italy	5.7	−2.97	−15.16***
	Japan	7.2	−2.40	−16.34***
	Mexico	7.0	−1.39	−13.77***
	Spain	6.7	−5.91***	
Non-coniferous sawnwood (440799)	Canada	29.1	−4.79***	
	Italy	10.0	−8.45***	
	Japan	5.1	−3.84**	
	Mexico	5.7	−3.32*	−10.92***
	Spain	3.3	−4.01***	
Veneer sheets and sheets for plywood (440890)	Canada	34.0	−5.26***	
	Italy	6.1	−9.71***	
	Mexico	3.2	−4.41***	
	Spain	9.9	−2.98	−7.77***
Chemical woodpulp, dissolving grades (4702)	Canada	5.7	−3.33**	
	France	6.6	−5.80***	
	Germany	13.7	−1.92	−11.02***
	Italy	2.0	−4.56***	
	Japan	30.9	−3.65***	
	UK	12.6	−6.83***	
Chemical woodpulp, soda or sulphate, other than dissolving (4703)	Belgium	2.7	−5.38***	
	Canada	3.5	−2.73*	−11.81***
	France	3.8	−3.17**	
	Germany	7.1	−4.12***	
	Italy	14.9	−3.36**	
	Japan	11.5	−6.34***	
	Korea	7.3	−3.68***	
	Mexico	11.9	−3.71**	
	Netherlands	5.4	−3.50***	
	Spain	2.6	−2.60	−11.42***
	UK	3.9	−2.55	−13.96***
Newsprint (4801)	Canada	10.5	−2.09	−12.38***
	Japan	45.5	−10.45***	
	Mexico	19.4	−3.14**	
Uncoated kraft paper and paperboard (4804)	Canada	15.3	−3.80**	
	Germany	1.7	−4.40***	
	Italy	5.0	−6.64***	
	Japan	5.9	−2.96**	
	Mexico	15.8	−8.34***	
	Spain	2.5	−3.64***	

Table 3. (*continued*)

Product (HS code)	Destination	% of total export (2003)	*t* statistic for Dickey–Fuller test:	
			y	Δ*y*
	UK	1.8	−2.25	−10.50***
Other uncoated paper and paperboard (4805)	Canada	45.4	−3.30*	−15.82***
	Mexico	23.7	−2.19	−11.19*
Other paper and paperboard (4811)	Canada	5.8	−4.37***	
	Japan	42.9	−5.34***	
	Korea	16.5	−6.42***	

Note: The hypothesis that the series had a unit root was rejected at: * = 10% level, ** = 5% level, *** = 1% level.

Table 4. Unit root tests for series of US imports from Canada. January 1989 to November 2004

Product (HS code)	*t* statistic for Dickey–Fuller test	
	y	Δ*y*
Sawnwood (4407)	−7.63***	
Veneer sheets and sheets for plywood (440890)	−7.20***	
Particle board (4410)	−2.61	−9.82***
Chemical pulp (4703)	−4.06***	
Newsprint (4801)	−4.83***	
Kraft paper and paperboard (4804)	−3.54**	

Note: The hypothesis that the series had a unit root was rejected at: ** = 5% level, *** = 1% level.

Effects of exchange rate on imports

Granger causality of exchange rate to imports was statistically significant only when all import series were pooled (Table 8, last row), in which case the short-run elasticity was significantly different from zero, and not different from unity (1.24).

The long-run multipliers (elasticities) were all positive and much smaller than the short-run elasticities. In fact the only LRE significantly different from zero was obtained by pooling the data for all products (0.49). (Table 9). The hypothesis of equal coefficient values across commodities, and thus common elasticities, could not be rejected at 5% level.

While appreciations of the US dollar increased imports of all products, depreciations had erratic effects, never significantly different from zero at 5% level, even when all products were pooled (Table 10).

Table 5. Short-run effects of exchanges rates on US export[a]

Product (HS code)	Observations (countries–months)	Granger-causality F statistic	Short-run effect		R^b	Q
			Elasticity	SE		
Coniferious sawnwood (440710)	5 × 179	2.04***	−3.50	1.06***	0.42	3.34
Non-coniferious sawnwood (440799)	5 × 179	1.28	−0.36	1.05	0.61	4.58
Veneer sheets and sheets for plywood (440890)	4 × 179	1.38	0.62	1.36	0.51	4.61
Chemical woodpulp, dissolving grades (4702)	6 × 191	0.46	−3.67	3.12	0.45	3.86
Chemical woodpulp, soda or sulphate, other than dissolving (4703)	11 × 179	2.57***	−1.73	0.74***	0.43	3.87
Newsprint (4801)	3 × 179	2.81***	−5.57	2.41**	0.40	4.53
Uncoated kraft paper and paperboard (4804)	7 × 179	2.24***	−0.63	0.96	0.38	2.45
Other uncoated paper and paperboard (4805)	2 × 179	2.56***	−2.49	1.09**	0.32	4.60
Other paper and paperboard (4811)	3 × 191	1.15	−2.28	1.19**	0.39	3.99
All products pooled	46 × 179	3.29***	−2.55	0.52***	0.42	14.65
F test of common coefficients across products[b]			0.53			

[a]The null hypothesis was rejected at: ** = 5% level, *** = 1% level with a one-tailed test. Q is the serial correlation test (Ljung and Box (1978)).

[b]The test statistic was: $f = \frac{ssr_c - ssr_u}{(c-1)k} / \frac{ssr_u}{\sum df}$, where ssr_c = sum of squared residuals for pooled model , ssr_u = total sum of squared residuals for separate models, c = number of products, k = number of coefficients in each model, $\sum df$ = sum of degrees-of-freedom for separate models. Critical values were from the F distribution with $(c-1)k$ and $\sum df$ degrees-of-freedom.

Table 6. Long-run elasticity of US exports with respect to exchange rate

Product category (HS code)	Long-run elasticity	SE
Coniferious sawnwood (440710)	−0.90	0.26***
Non-coniferious sawnwood (440799)	−0.04	0.13
Veneer sheets and sheets for plywood (440890)	0.12	0.26
Chemical woodpulp, dissolving grades (4702)	−0.64	0.55
Chemical woodpulp, soda or sulphate, other than dissolving grades (4703)	−0.40	0.17***
Newsprint (4801)	−1.81	0.75***
Uncoated kraft paper and paperboard (4804)	−0.14	0.21
Other uncoated paper and paperboard (4805)	−0.99	0.42**
Other paper and paperboard (4811)	−0.44	0.23**
All products	−0.52	0.11***

Note: The null hypothesis was rejected at: ** = 5% level, *** = 1% level with a one-tailed test.

Table 7. Long-run elasticity (*LRE*) on exports for appreciation or depreciation of the US Dollar

Product (HS code)	Appreciation		Depreciation		Symmetry
	LRE	SE	LRE	SE	
Coniferious sawnwood (440710)	−1.16	0.30***	−0.03	0.59	
Non-coniferious sawnwood (440799)	−0.12	0.15	−0.40	0.29	
Veneer sheets and sheets for plywood (440890)	−0.08	0.27	−0.93	0.65	**
Chemical woodpulp, dissolving grades (4702)	−1.01	0.92	0.12	1.07	
Chemical woodpulp, soda or sulphate, other than dissolving (4703)	−0.38	0.21**	0.45	0.34	
Newsprint (4801)	−2.50	0.72***	−2.06	1.56	***
Uncoated kraft paper and paperboard (4804)	−0.29	0.25	−0.35	0.45	
Other uncoated paper and paperboard (4805)	−0.84	0.40**	−1.44	1.25	**
Other paper and paperboard (4811)	−0.36	0.27	0.30	0.38	
All products	−0.70	0.12***	−0.09	0.22	

Note: **significant at 5% level, ***significant at 1% level, one tailed test for elasticities, two-tailed test for symmetry.

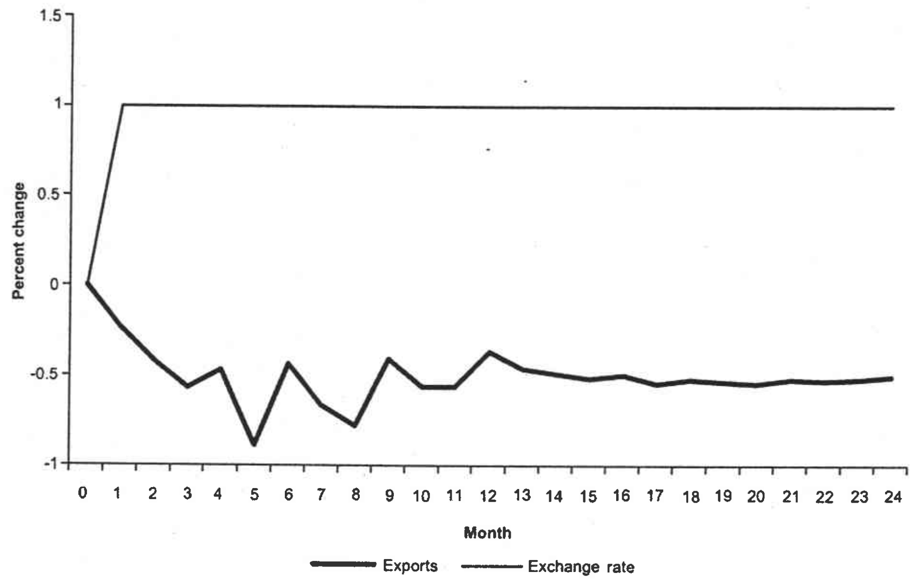

Fig. 2. Dynamic adjustment of the US forest products export to a permanent increase in the value of US dollars relative to other currencies.

Table 8. Short-run effects of exchanges rate on US imports from Canada[a]

Product (HS code)	Granger-causality F statistic	Short-run effect		R^b	Q
		Elasticity	SE		
Sawnwood (4407)	1.05	1.36	1.39	0.39	5.56
Veneer sheets (440890)	0.99	1.50	2.99	0.65	9.97
Particle board (4410)	0.81	0.95	1.79	0.32	7.65
Chemical pulp (4703)	0.57	1.17	1.26	0.35	6.83
Newsprint (4801)	1.47	0.87	0.83	0.51	8.18
Kraft paper and paperboard (4804)	0.47	1.31	1.96	0.31	6.50
All products[b]	1.66**	1.24	0.67**	0.25	2.54
F test of common coefficients across products[c]		1.17			

[a]The null hypothesis was rejected at: ** = 5% level with a one-tailed test. Q is the serial correlation test (Ljung and Box (1978)).

[b]Veneer sheets (440890) was excluded since more than 12 lags was required to remove autocorrelation form the residuals of that series.

[c]See Table 5.

The dynamic adjustment of imports in response to a permanent 1% increase in the US dollar value relative to the Canadian dollar, based on the pooled products model with symmetry, is in Fig. 3. Imports increased by more than 1% after 9 months, but then decreased progressively to stabilize at about 0.5% above the initial level.

Summary and discussion

The simplest and most general findings of the study stemmed from pooling all the data across countries and products. They implied that in the short run, exports were very elastic with respect to the exchange rate (−2.6), while imports were moderately elastic (1.2). In the long run, the elasticities of exports and imports decreased but remained significant (0.5 for both exports and imports).

Table 9. Long-run multiplier of exchange rate on US imports from Canada

Product (HS code)	Multiplier	SE
Sawnwood (4407)	0.29	0.29
Veneer sheets (440890)	0.29	0.54
Particle board (4410)	0.70	1.27
Chemical pulp (4703)	0.39	0.41
Newsprint (4801)	0.42	0.41
Kraft paper and paperboard (4804)	0.39	0.58
All products	0.49	0.26**

Note: The null hypothesis was rejected at ** 5% with a one-tailed test.

Table 10. Long-run elasticity (LRE) on imports from Canada, for appreciation or depreciation of the US Dollar

Product	Appreciation		Depreciation		Symmetry
	LRE	SE	LRE[1]	SE	
Sawnwood (4407)	0.52	0.29**	0.04	0.29	
Veneer sheets (440890)	0.59	0.47	−0.31	0.66	
Particle board (4410)	1.50	0.99	0.06	0.97	
Chemical pulp (4703)	0.49	0.45	−0.33	0.46	
Newsprint (4801)	0.30	0.44	−0.64	0.45	
Kraft paper and paperboard (4804)	1.01	0.55**	0.09	0.56	
All products	0.42	0.33	−0.27	0.49	

Note: The null hypothesis was rejected at: ** = 5%, one tailed test for elasticities, two-tailed test for symmetry.

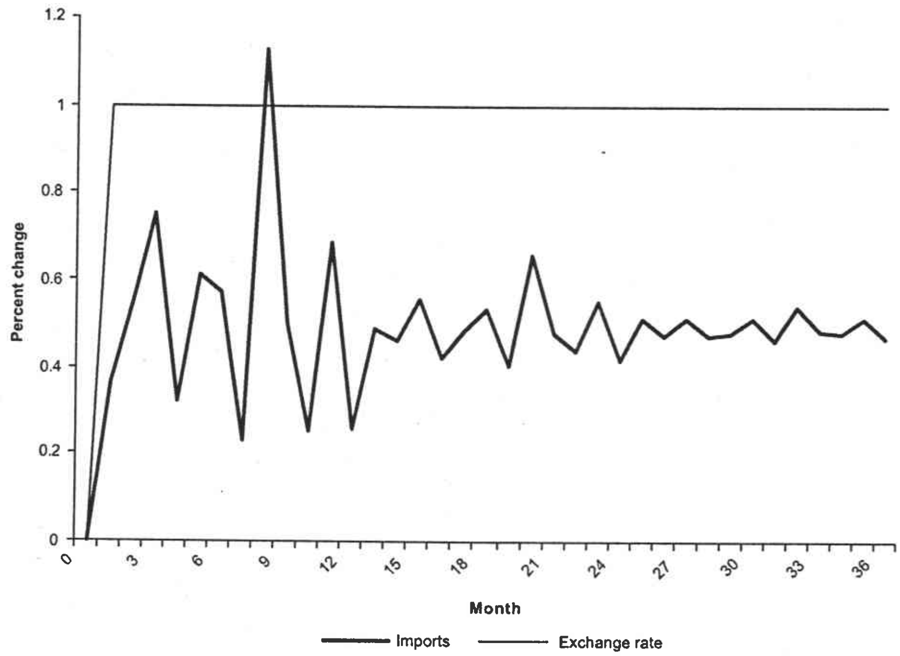

Fig. 3. Dynamic adjustment of the US forest products import to a permanent increase in the value of US dollars relative to other currencies.

These general results negate the purchasing power parity, according to which exchange rates should have no effect, at least in the long run. Instead, they support the view that exchange rates do affect competitiveness in global markets, as claimed by forest industry advocates and also found in other sectors (Babula et al., 1995). That the short-run elasticities were larger than the long-run elasticities is consistent with the view that the method captures the general equilibrium effect of the exchange rate. In the short run, the effect is just like a price shock and affects the traded quantities substantially. In the long run, the exchange rate change influences the macroeconomy of importer and exporter and thus dampens the initial price effect.

However, the detailed results were less clear. There were substantial, though not statistically significant, differences in the exchange rate elasticities between products. These differences could be due to the competitiveness, or lack thereof, in different industries, and to the use of long-term contracts in managing imports and exports. Moreover, there were differences, though only in few cases statistically significant, in the effect of US dollar appreciation and depreciation. Uusivuori and Buongiorno (1991) found that dollar appreciations tended to increase the price of US products delivered to foreign countries more than depreciations decreased them. This may explain why we found that exports tended to decrease more when the value of the dollar increased, than they increased when the value of the dollar decreased by an equal amount.

The method used here measured the full general equilibrium impact of the exchange rate on exports. Future research may be able to decompose this change in exports into a part due to price change the pass through, and other changes.

In terms of methods, this study showed the advantage of using panel data. The most accurate (low standard error) elasticities were obtained by pooling the data not only across countries of destination, but also across products. In addition, the use of monthly data gave a detailed description of the adjustment dynamics (Cunningham and Vilasuso, 1995; Chao and Buongiorno, 2002). That less accurate results could be obtained for imports may be simply due to the fact that much fewer data could be used since Canada is practically the single source of US imports.

Surprisingly few of the export and import series were non-stationary. Thus, cointegration could not be used to model the long-run relationship between forest products trade and the exchange rate. The vector autoregressive models used here instead are attractive for their simplicity and yet strong theoretical links to general dynamic structural models with many more endogenous and exogenous variables (Zellner and Palm (1974). The general equilibrium measures of the effects obtained with this method suggest that exchange rates do matter in international forest products trade, both in the short and in the long run.

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