

# EMU AND FOREST PRODUCTS PRICING IN EUROPE

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## Abstract

In previous literature, the degree of exchange rate pass-through to importing country's currency has often been found to be incomplete, which supports the idea of imperfect competition in the forest products markets. In this study, exchange rate pass-through is examined by employing a mark-up model for the UK and German pulp and newsprint markets for 1986–97. Two specifications are compared, one where exchange rates in importing countries are employed and the other that attributes for the fact that US dollar is largely used in pricing for forest industry products in Europe. In contrast to previous studies, our estimates indicate very low degrees of pass-through, which is consistent with competitive European markets for pulp and paper. Consequently, depreciations of exchange rates are found to be mainly transmitted to variable mark-ups over wood prices rather than to prices in importer's currency. Furthermore, the use of the US dollar nominated pricing is found to have practically no effect at all on this result.

**Keywords:** exchange rate, pass-through, pricing currency, pulp, newsprint, stumpage prices, cointegration

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## Introduction

When the third phase of European economic and monetary union (EMU) initiated in January 1999, a common currency, euro, was realized between its 11 member countries. During the 1999-2001, before their disappearance in the beginning of 2002, the national currencies of participating countries are irrevocably tied to the euro. The introduction of euro removed the uncertainty regarding exchange rate variation between its member countries, thus aiming to stabilize the European economy.

At the level of aggregate imports and exports, the question to what extent exchange rate variations are passed through to market prices (i.e. exchange rate pass-through, PT) has gained a lot of interest. The PT effect is said to be complete (PT=1), when the exporter does not adjust prices in his home currency, and exchange rate changes are fully reflected in foreign currency-expressed export prices. There is no PT effect (PT=0), when the export prices in the foreign currency remain unchanged, while prices in the home currency adjust to exchange rate fluctuations. Between these extremes is the case of incomplete PT, which means that exchange rate changes are partly reflected in foreign currency prices and partly in the exporter's home currency prices ( $0 < PT < 1$ ).

A mark-up modelling approach is commonly used in measuring the degree of exchange rate pass-through (e.g., Athukolara 1991 and Hung *et al.* 1993). In previous studies on forest product markets, this model was employed, for example, by Hänninen and Toppinen (1999). They found the newsprint pass-through elasticity in the UK to be 0.6, which would indicate that exchange rates are mostly reflected in pound sterling prices and only to a minor extent in domestic currency prices. In newsprint exports to Germany,

the elasticity of exchange rate pass-through was 0.5, that is, slightly lower than in the UK. Instead, in pulp markets the pass-through elasticity was smaller in the UK market (0.07) as compared to Germany (0.68).

Some other approaches measuring the degree of exchange rate pass-through have also been applied. In a bivariate model of Uusivuori and Buongiorno (1991), the pass-through was examined with respect to forest products exports from the USA to Europe and Japan. PT was found to be incomplete in most of the product categories. According to Alavapati et al. (1997), the PT was small in Canadian pulp export price indicating that Canadian exporters do not have significant market power in their pulp exports to the US. Vesala (1992) studied the exchange rate PT for export prices of Finnish paper manufactures using quarterly data for the period 1975–1991. The PT was found to lie between 0.66 and 0.69 in exports to Europe and between 0.16 and 0.30 in exports to the US. According to Vesala, the small PT in Finnish exports to the USA is due to the larger domestic paper production in the USA than in Europe. Thus, one reason for the low coefficients for the US may be Finland's smaller market power in the US market than in Europe.

Even in European forest products markets, commodities, such as pulp and newsprint, are usually denominated, in many cases also invoiced, in US dollars. Thus, changes in the currency vis-a-vis dollar will change the exporter prices of commodities, and hence, the exchange rate effect of US dollar should also be incorporated in the pricing relation (see, e.g., Pick and Carter 1993). However, in previous studies measuring the degree of exchange rate pass-through, this important element in the forest products markets has been ignored.

Another shortcoming in the previous mark-up studies based on markup pricing relation in forest products markets is the use of production price index as a proxy for domestic costs. Production prices are not a very good cost measure in a mark-up model as they strongly correlated with output prices. Contrary to the previous studies, this paper uses stumpage prices for spruce or pine pulpwood in pulp and paper production measuring the primary input cost in the production. Therefore, the results also give more direct information about the vertical interrelationships between the foreign markets of forest industry products and the exporter's domestic roundwood markets.

### **Theoretical model**

A model for estimating PT for pulp and paper exports from a certain exporter country to the UK and Germany is based on a markup model also previously used in modeling PT (e.g. Hooper and Mann 1989, Athukolara 1991, Hung et al. 1993). In deriving the price equation, it is assumed that a representative exporter (e.g. Finland, Canada) produces exclusively for imperfectly competitive UK or German markets, employs a constant returns to scale technology and unit production cost,  $C_f$ . The representative exporter firm maximizes profit by taking the competitors' price and supply of newsprint and pulp as given, and by setting the price in domestic currency ( $P_f$ ) as a constant markup over wood prices ( $C_f$ ). With  $X_f$  denoting exports, the exporter's profit is  $V_f$  defined as

$$(1) \quad V_f = (P_f - C_f) X_f.$$

Profit maximization yields

$$(2) \quad P_f = C_f \eta / (\eta - 1),$$

where  $\eta$  is the price elasticity of demand. According to Hung et al. (1993), a more general case, in which competitors' prices affect the exporter's price, can be presented using the concept of a variable markup, defined by assuming that the coefficient  $\eta$  depends on, among other things, price competitiveness in the export market. The competitiveness can be described as the relative price  $(P_o ER)/P_f$ , where  $(P_o ER)$  is the competitors' price in the exporter's currency. Thus the price elasticity of demand is

$$(3) \quad \eta = \eta((P_o ER)/P_f).$$

Using the equations (2) and (3), the pricing behavior of a profit maximizing exporter can be described as a variable markup over the unit cost:

$$(4) \quad P_f = \phi C_f.$$

The variable markup,  $\phi$ , depends on the relative price:

$$(5) \quad \phi = \phi((P_o ER)/P_f) = \phi'((P_o ER)/P_f)^\theta,$$

where  $\theta$  is the relative price elasticity of markup and  $\theta \geq 0$ . The constant markup is obtained if  $\theta = 0$  and  $\phi' = \eta/(\eta-1)$ . The second equality in (5) derives from the log-linear approximation of the nonlinear function  $\phi$ . Substituting (5) into (4) and taking a logarithmic transformation, a relation for the price of newsprint and pulp in the export market is obtained:

$$(6) \quad p_f = \delta + (1-\gamma)(er + p_o) + \gamma c_f + u,$$

where  $\gamma = 1/(1+\theta)$ ,  $0 < \gamma \leq 1$ ,  $\delta$  is a constant and  $u$  is a disturbance term that captures all other possible factors. Symbol  $\gamma$  ( $0 < \gamma \leq 1$ ) indicates the PT coefficient ( $PT = -(\partial(p_f - er)/\partial er) = \gamma$ ). The other symbols are the same as above. Lower-case variables denote logs of corresponding upper-case variables. The export price,  $p_f$ , should be homogenous of

degree one in the exchange rate and competitors' price, and the equality restriction is imposed on the coefficients of  $p_o$  and  $er$  in the estimation.

If in the equation (6) the coefficient of wood price in export pricing,  $\gamma$ , is unity, the export prices (e.g. in Finnish markka) are determined solely by production costs. Thus, the markup is held constant when the exchange rate changes. In this case the changes in the exchange rate,  $er$  (e.g. FIM/GBP, FIM/DEM), will completely pass-through into the foreign currency export price and  $PT=1$ . If  $\gamma = 0$ , the changes in  $er$  are absorbed by the variable markup and  $PT=0$ . Therefore, the export prices in foreign currency do not change (net of any effect exchange rate changes may have on prices through variations in input costs). This indicates perfect competition and the existence of the law of one price in the market. In empirical section, we will test for the homogeneity of degree one between export price, exchange rate and cost variable by imposing the theoretical structure on cointegrating vectors, if such long-run equilibrium relationships are present in the data.

### **Data and estimation method**

Monthly Finnish pulp and newsprint export price series to Germany and the United Kingdom from October 1986 to December 1997 were used in the estimations (135 observations). The prices of Canadian pulp and newsprint were used to represent competitor's prices. This is justified especially in the pulp markets, where Canada and Finland are the two largest exporter countries in both Germany and the UK over the study period. The input costs were represented by Finnish pulpwood prices, and the exchange rates used were FIM/GBP, FIM/DEM, GBP/USD and DEM/USD.

Johansen's multivariate cointegration method was used throughout this study (Johansen 1988, 1995). Two alternative specifications were tested, one using the prices and exchange rates in importing country (Model A), and the other, using prices converted to US dollars and the US dollar exchange rate (Model B).

## **Results**

A mark-up pricing relation in the equation (6) was tested for pulp and newsprint prices in UK and Germany using two different exchange rates. Johansen's cointegration analysis indicated one cointegration relationship in data when using lags from 2 to 3 in the unrestricted VAR-model. The only case where statistically significant cointegrating vector was not found at the 5 % level was for the UK newsprint model using Canadian prices nominated in the US dollar exchange rates. Based on the theoretical model structure, we also tested for linear homogeneity and zero pass-through between newsprint price, exchange rate and wood prices in the UK market, but the results should be interpreted with some caution in this particular case.

Results for the pulp price models in the two countries are reported in Table 1 and results for newsprint price models are in Table 2. In model A for the UK pulp market, a restricted cointegrating vector with a pass-through of 0.08 was obtained when imposing the linear homogeneity restriction between variables. Even the restriction where pass-through is restricted to zero was not rejected for the UK pulp price relation. The identical result for the zero pass-through was obtained also for the model system incorporating the effect of US dollar nomination in the UK market. According to this, the use of US dollar in pulp price nomination in European markets has not affected on the market pricing.

From the market competition point of view, this indicates that exchange rate variation has in the long-run been completely transmitted to domestic wood costs. This would be consistent with the law of one price in the UK pulp market (see also Figure 1 comparing prices from the two different exporting countries).

In the German pulp market, a similar result for restriction consistent with zero pass-through could be accepted for prices expressed in German marks (Model A). However, using prices nominated in US dollars, the results were inconclusive as the linear homogeneity test between export price, US dollar exchange rate and domestic costs was rejected in the markets.

In the UK newsprint market, both models A and B produced identical results, indicating linear homogeneity and zero pass-through of exchange rate changes to importers newsprint prices. In the German newsprint market, only the relationship between export price, US dollar exchange rate and domestic wood costs in Model B fulfilled the linear homogeneity restriction. However, the coefficients of the model A with German mark exchange rates were very close to those obtained in the model B. The coefficient for exchange rate pass-through in Model B was 0.23, i.e., slightly larger than in the case of the UK newsprint market.

Compared to previous studies, our exchange rate pass-through estimates are clearly at the lower end of the range. Indeed, our results support more the idea of competitive pulp and newsprint markets in Europe as those obtained in the previous studies. The overall result reported in Tables 1 and 2, indicating very low degrees of exchange rate pass-through is, however, also supported in the variability in mark-up



relationships and relatively high conformity between prices from different countries (Figure 1).

The parameter constancy in the models was tested using the 1-step Chow test. In all models the majority of the 1-step residuals lied with the 95 per cent confidence level. This result would indicate that overall parameter constancy can be accepted in models. *Ex ante*, this was not necessarily to be expected because of the high turbulence in the European markets during the 1990's.

## **Discussion**

In this study, we examined exchange rate pass-through by employing a mark-up pricing model for the UK and Germany pulp and newsprint markets. Johansen's multivariate cointegration analysis was used for monthly data during the period 1986–97. In contrast to the previous studies for forest industry products, our estimates for pass-through were very low and consistent with the competitive European markets for both pulp and newsprint. In addition, the pricing relations were found to be fairly stable and there were no significant differences between currencies, countries and products.

At least partially, our lower pass-through estimates than in previous studies may be caused by either changes in the market environment or in the differences of the data used. First, we have used more recent information on the markets than done in the previous studies, so the results may reflect tightening competition in the European pulp and paper markets. Second, the use of genuine cost data (stumpage prices) instead of production price indices could have affected the estimation results.

The main implication of our study is that introduction of euro is not likely have any major impact on international trade flows of pulp and newsprint paper. This conclusion is mainly based upon our low pass-through estimates, which are consistent with the competitive European markets for these products. For the hypothesized effect of US dollar nominated pricing, prevailing especially for softwood market pulp, practically no evidence was found. According to this, the use of US dollar in price nomination in European markets has not interfered market pricing in the past, although this has often been a claim made by the industry. Regarding the linkages between various market levels, our results indicating that exchange rate changes are mainly passed through to variable mark-ups over domestic wood prices suggests a close relationship between the European markets of forest industry products and the markets for roundwood.

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**Table 1.** Tests for mark-up pricing relation under rank  $r=1$  in the UK and Germany pulp markets as measured A) in importer's currency and B) in US dollars, 1986:10–1997:12.

	$p_F$	$er$	$p_C$	$C_F$	$\chi^2(2/3)^1$ [probability]
<b>UK</b>					
<b>A:</b>					
Unrestricted Relation	1	-0.42	-1.00	0.02	
Linear Homogeneity	1	-0.92	-0.92	-0.08	4.82 [0.09]
Zero Pass-through	1	-1	-1	0	5.45 [0.15]
<b>B:</b>					
Unrestricted relation	1	-0.65	-1.13	0.16	
Linear Homogeneity	1	-1.00	-1.00	-0.00	5.40 [0.07]
Zero Pass-through	1	-1	-1	0	5.40 [0.15]
<b>Germany</b>					
<b>A:</b>					
Unrestricted relation	1	-0.68	-1.04	0.28	
Linear Homogeneity	1	-1.00	-1.00	0.00	4.60 [0.10]
Zero Pass-through	1	-1	-1	0	4.60 [0.20]
<b>B:</b>					
Unrestricted relation	1	-0.50	-1.03	0.41	
Linear Homogeneity	1	-1.15	-1.15	0.15	10.82** [0.01]
Zero Pass-through	1	-1	-1	0	12.31** [0.01]

<sup>1</sup>  $\chi^2$  critical value for at 5 % level is 5.99 with two degrees of freedom and 7.82 with 3 d.g.f and \*

(\*\*) denotes rejection at 5 % (1 %) level.

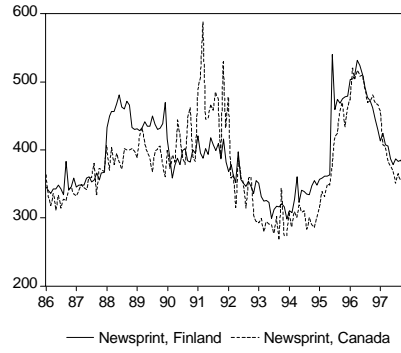
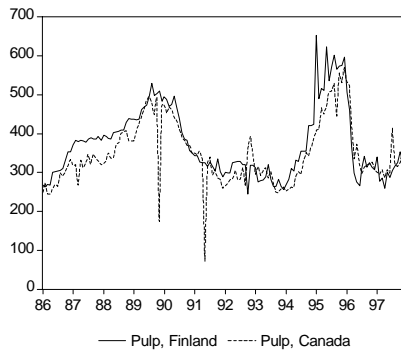
**Table 2.** Tests for mark-up pricing relation under rank  $r=1$  in the UK and Germany newsprint markets as measured A) in importer's currency and B) in US dollars, 1986:10–1997:12.

	$p_F$	$er$	$P_C$	$c_F$	$\chi^2(2/3)^1$ [probability]
<b>UK</b>					
<b>A:</b>					
Unrestricted Relation	1	-1.85	-1.57	0.28	
Linear Homogeneity	1	-1.32	-1.32	0.32	1.57 [0.46]
Zero Pass-through	1	-1	-1	0	5.34 [0.15]
<b>B:</b>					
Unrestricted Relation	1	-0.91	-1.03	0.29	
Linear Homogeneity	1	-1.31	-1.31	0.30	0.84 [0.65]
Zero Pass-through	1	-1	-1	0	2.68 [0.44]
<b>Germany</b>					
<b>A:</b>					
Unrestricted relation	1	-1.00	-0.72	-0.43	
Linear Homogeneity	1	-0.78	-0.78	-0.22	13.22** [0.00]
Zero Pass-through	1	-1	-1	0	22.93** [0.00]
<b>B:</b>					
Unrestricted relation	1	-0.95	-0.80	-0.33	
Linear Homogeneity	1	-0.77	-0.77	-0.23	2.42 [0.30]
Zero pass-through	1	-1	-1	0	11.98** [0.01]

<sup>1</sup>  $\chi^2$  critical value for at 5 % level is 5.99 with two degrees of freedom and 7.82 with 3 d.g.f and \*

(\*\*) denotes rejection at 5 % (1 %) level.

UK:



Germany:

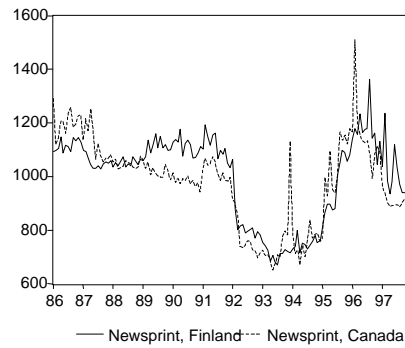
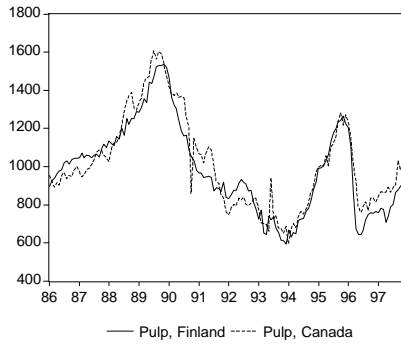


Figure 1. Pulp and newsprint prices of Finland and Canada in the UK and Germany.