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An Analysis
of European Demand for Oak Lumber

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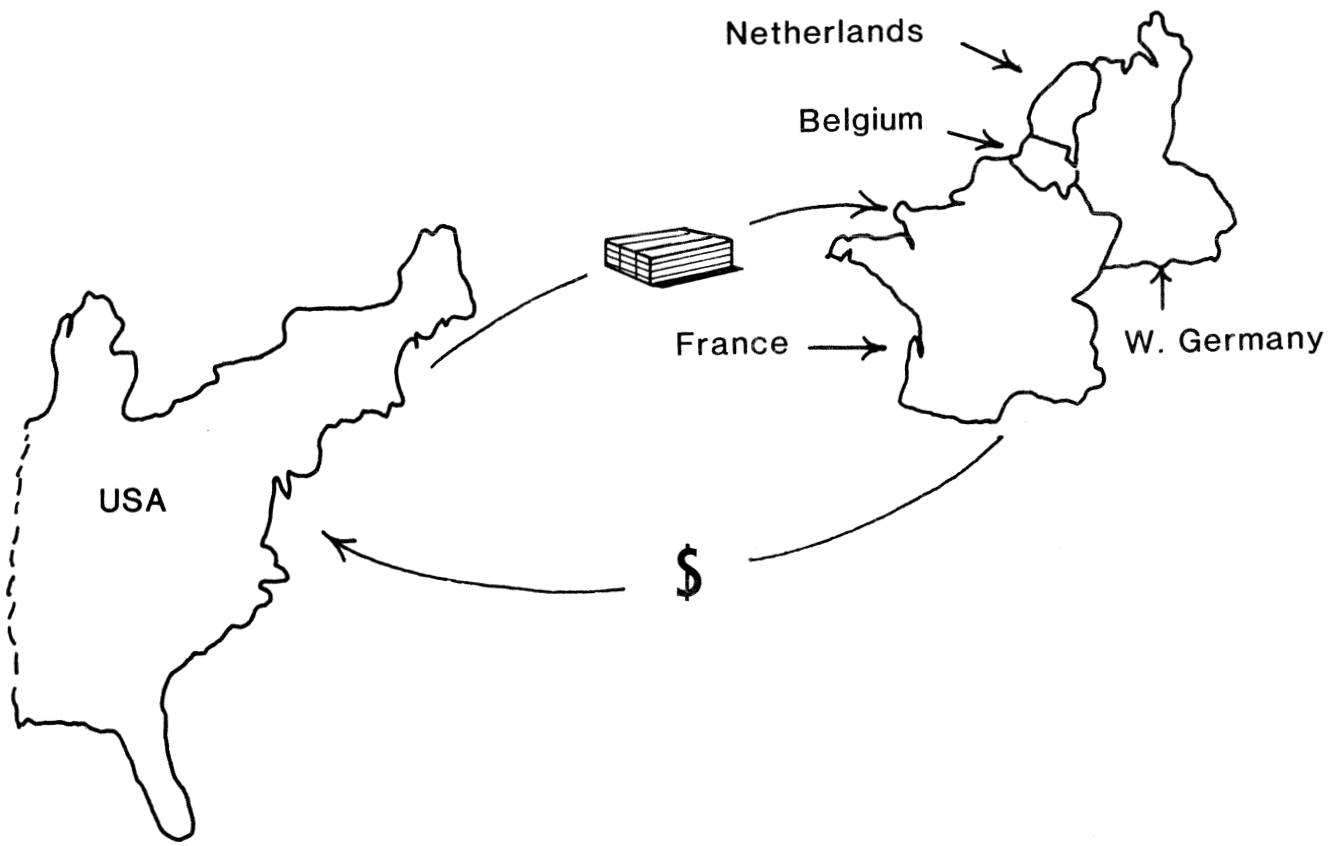

The Author

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Abstract

Exports of oak lumber from the United States to the Netherlands, Belgium, Germany, and France were analyzed using ordinary least squares estimation procedures. The analyses indicated that the large increases in European demand for U.S. oak during the 1970's were caused by a combination of the dollar's depreciation against currencies of major European demanders, increases in prices of European oaks, increases in output prices in Europe, and furniture style changes.

Introduction

The surge in hardwood lumber exports during the last decade signaled an increasing foreign demand for lumber produced in the United States. In 1971, exports of hardwood lumber were only 110 million board feet, or 1.6 percent of domestic production. Of this, only 10 million were shipped to European countries. However, exports began to increase after 1971 so that by 1980 total exports reached 350 million board feet and exports to Europe increased to 157 million board feet. But by far the most significant aspect of the change in exports was that 102 million board feet, or nearly 30 percent of the total, were oak shipments to four countries—the Netherlands, Belgium, Germany, and France. Shipments to these countries increased by 1,600 to 3,000 percent in a period of just 8 years (Table 1).

The domestic effects of the dramatic increase of oak exports to Europe are somewhat mixed. European buyers have been willing to pay a premium for high-grade plain and quartered-cut oak lumber, causing the price of Firsts and Seconds (FAS) oak to increase tremendously. Many producers and wholesalers of hardwood lumber have benefited from the premium prices being paid for high-grade oak and have changed their marketing practices to accommodate European buyers. But many domestic demanders are complaining about the increases in lumber price, while other domestic demanders claim that the large profits being made by suppliers of the higher grades make domestic supplies of No. 1 and No. 2 Common lumber available at a lower price.

In order to understand why European demand for domestically produced oak has increased so dramatically and judge whether it will continue to increase in the future, the demands for oak lumber by major importing countries must be quantified. Then the factors that have caused the change can be isolated and measured. Such information can be used by domestic demanders and suppliers to anticipate changes in European demands in the future, and thus to make better production and usage decisions. Forest resource planners and other government officials also can use the information to develop export marketing programs.

Literature pertaining to international trade in forest-related commodities is available, but literature pertaining to international demands for hardwood lumber is scarce. Although Chou and Buongiorno (1984) have estimated demands for hardwood lumber by European countries and Camous (1980) has studied the effects of exports on French oak price, no study has addressed export demand for hardwood lumber of a specific species to a specific country.

Table 1.—Volumes of oak lumber exported to major European demanders and percentage changes in exports for the years 1973 through 1980, in thousand board feet (Mbf)

Country	1973	1976	1977	1978	1979	1980	Percentage change 1973–1980
Norway	2,168	1,748	2,031	1,210	1,747	2,009	– 7.3
Denmark	776	863	888	1,087	678	1,561	101.2
United Kingdom	3,744	327	680	957	1,447	2,848	– 23.9
Ireland	323	315	301	586	313	415	28.5
The Netherlands	904	7,714	12,366	27,297	23,471	26,829	2,867.8
Belgium	1,788	6,388	5,079	11,850	20,467	30,373	1,598.7
Germany	1,196	3,461	9,238	19,712	24,586	37,018	2,995.2
France	525	334	986	2,639	5,105	10,504	1,900.8
Spain	2,284	2,794	2,140	2,823	5,196	3,373	47.4
Italy	908	417	389	894	3,361	9,660	963.9

SOURCE: U.S. Department of Commerce, Bureau of the Census, *U.S. Exports Schedule B. Commodity by Country.* Report 410, Washington, DC.

Model Development and Data Base

Economic theory stipulates that the demand for a productive input is a function of the price of the input, prices of other inputs, and price of the output. Export demand relationships developed by Leamer and Stern (1970) and others follow the general form stipulated by theory except for the substitution of industrial production or economic activity level for the price of output. Since information on levels of economic activity is more easily found than output price information, the substitution of economic activity level for price of output is probably made for convenience. The current study attempts to formulate the demand relationships in the form that is stipulated by economic theory, within the bounds of data availability.

The data base used for equation estimation consists of observations made quarterly from 1973 through 1979. This period was chosen because it is representative of the current international monetary market structure, which underwent a structural change in 1973. Information on the quantities exported was obtained from *U.S. Exports Schedule B. Commodity by Country* (Report FT410), compiled by the U.S. Department of Commerce, Bureau of the Census.

The price of the input in the demand relationships for the various countries was the price of American FAS red oak lumber plus whole carlot premium as reported in the *Hardwood Market Report* (Lemsky 1970, 1980). *Hardwood Market Report* prices were used instead of unit prices derived from export statistics because unit prices are affected by merchandising costs such as sorting, drying, and stacking. These have changed over time as American exporters have learned more about their customers, making unit prices an inconsistent measure of the price being paid for the actual lumber. The price of FAS lumber was used because Europeans tend to purchase high-grade "clear" lumber. The premiums were added to the FAS price because shipments of lumber bound for export are usually composed mostly of high-grade lumber. Red oak price was used rather than a combination of red and white oak prices because the reported prices of these species were nearly the same between 1973 and 1979.

The price of French oak was included in the demand relationship to represent the price of substitute species. Although French and U.S. oaks are not perfect substitutes for one another, many European furniture and cabinetmakers can use either species after a short adjustment period. The French oak price series used was released by the French office, National des Forets, Department Commerical, in a publication by Christian Camous entitled "La Formation du Prix du Chene en France, Une Etude Econometrique" (1980).

An important consideration in the price of an imported input is the exchange rate between countries. The exchange rate can be considered a separate variable in model specification, or it can be used to adjust price from one currency to another. Theoretically, it is more sound to adjust price with exchange rate because the adjusted price is the one that foreign demanders face in the marketplace. Since countries like Belgium import oak from both France and the United States, the prices of these commodities must be based on the currency of the importing country. Exchange rates and indexes were obtained from the *Monthly Bulletin of Statistics*, published by the United Nations.

The selection of an output price variable was complicated by the facts that furniture prices in the individual countries were unobtainable and reported price indexes for general commodity groups were inconsistent across countries. Given these difficulties, the most appropriate available price indexes were selected for each country. The indexes for finished goods were used in the German and Dutch demand relationships, while the indexes for domestic goods prices were used in the Belgian and French equations. All indexes were obtained from the *Monthly Bulletin of Statistics*.

Since past levels of lumber price, interest and wage rates, and output prices were found to affect aggregate demand for hardwood lumber in the United States, (Luppold 1982), past levels of U.S. oak price, French oak price, and output price may affect current export demand. If the European demanders react like their American counterparts, a lag specification of 1 to 3 years and polynomial in form should be tested. The polynomial, or "inverse U", lag structure indicates a situation where a change in price exerts an increasing, then decreasing influence on demand over time.

One additional variable that has influenced the quantity of oak lumber exported to Europe is the change in furniture styles throughout the continent. Prior to 1975, oak lumber was used in traditional furniture, while mahogany and teak were used in fashionable furniture; but in the mid 1970's, a quick change to oak in the fashionable furniture market occurred, creating a larger demand for oak (Ascherman 1983). To account for this change, a dummy variable was included in the model with the dummy equaling 1 for dates after 1975 and zero otherwise.

Model Estimation

The estimated demand equations for the Netherlands, Belgium, Germany, and France are presented in Table 2. All the equations fitted the data well, as indicated by the "t" statistics and the R^2's. All non-intercept variables were of the expected sign and were significant at the 0.05 level or better. The Durbin-Watson (D-W) statistic for the Belgian equation indicated no autocorrelation, while the D-W values of the other equations fell in the inconclusive range.

The length and appropriate type of lag structure used in the individual price variables in each equation were empirically determined. The demand equations for the Netherlands, Belgium, and Germany had identical specifications of polynomial lagged price variables. The French equation was composed of moving averages that were 3 quarters in length.

Table 2.—Statistically estimated U.S. oak export demand relationships for the Netherlands, Belgium, Germany, and France

Country	Variable	Coefficient	t statistic	Nature of lag	
The Netherlands	Intercept	9597.6	1.56		—
	U.S. oak price	− 2.165[a]	2.91**	Polynomial t-2 through t-6	
	French oak price	.687	− 2.29*	Polynomial t-1 through t-4	
	Price finished goods	4.286	− 2.44*	Polynomial t-1 through t-4	
	1976 dummy	2670.3	3.50**		—
			R^2 = .833		
			D-W = 1.18		
Belgium	Intercept	10957.1	4.34**		—
	U.S. oak price	− 2.864	7.31**	Polynomial t-2 through t-6	
	French oak price	1.369	− 8.32**	Polynomial t-1 through t-4	
	Price domestic goods	5.585	− 4.43**	Polynomial t-1 through t-4	
	1976 dummy	780.9	1.79*		—
			R^2 = .877		
			D-W = 1.81		
Germany	Intercept	9420.6	2.29*		—
	U.S. oak price	− 2.489	5.71**	Polynomial t-2 through t-6	
	French oak price	.753	− 3.48**	Polynomial t-1 through t-4	
	Price finished goods	5.072	− 3.47**	Polynomial t-1 through t-4	
	1976 dummy	2754.4	5.33**		—
			R^2 = .922		
			D-W = 1.49		
France	Intercept	931.5	1.21		—
	U.S. oak price	− 13.58	− 4.83**	Moving average t-1, t-2, t-3[b]	
	French oak price	.696	2.97**	Moving average t-1, t-2, t-3	
	Price domestic goods	18.27	3.79**	Moving average t-1, t-2, t-3	
	1976 dummy	658.0	4.00**		—
			R^2 = .864		
			D-W = 1.47		

[a] The coefficients associated with the polynomial lags are the opposite signs of the resulting elasticities because negative weights were used in their calculation (See Maddala 1977).

[b] Moving averages representing an even lag distribution performed better than polynomial lag structures in the French equation.

** Significant at $\alpha = 0.01$.

*Significant at $\alpha = 0.05$.

Analyses

Demand elasticities for U.S. oak price, French oak price, and output price for the Netherlands, Belgium, Germany, and France are shown in Table 3. The elasticities are cumulative, or long-term, elasticities which reflect the total impact of a change in an explanatory variable after a period of up to 18 months. The elasticities presented are at 1980 prices and quantities to be most reflective of current market activity.

As should be expected, the long-term price elasticities of U.S. oak are relatively high, ranging from 3.8 for the Netherlands to 5.4 for Belgium. Such high long-term price elasticities are not unusual for a high-value, limited-use imported item. The high elasticities indicate that a change in oak price in the United States or a change in exchange rates has a rather large impact on the demand for U.S. oak. This change did not begin instantly, rather the effect was spread over 2 to 6 quarters in the Netherlands, Belgium, and Germany, and 1 to 3 quarters in France.

The dummy variable which was included to account for the style change in European furniture was statistically significant in all the demand equations. The level of the change in millions of board feet can be determined directly from the coefficient associated with the dummy variable. The style change affected German and Belgian demand to a much greater degree than it affected the demands of France and the Netherlands.

The elasticities in Table 3 show the relative influence of a 1-percent change in the various prices on quantities exported. However, in order to analyze why the quantities exported changed so dramatically during the 1970's, the percentage changes in U.S. and French oak prices (adjusted for exchange rates) and changes in output prices must be considered. These changes are shown in Table 4.

Although the price of U.S. oak increased by more than 100 percent in U.S. dollars between 1973 and 1979, the price of U.S. oak in the Netherlands, Belgium, and Germany rose only 11 to 32 percent because of the large depreciation of the U.S. dollar against European currencies during the 1970's (Table 5). The price of U.S. oak in France increased by 65 percent because the U.S. dollar did a little better against the French franc than against the Dutch guilder, the Belgian franc, or the German mark. Of course, any price increase would discourage demand for U.S. oak; but a small price increase in U.S. oak would be more easily offset by an increase in French oak price or output price.

French oak price increased by 414 percent between 1973 and 1979 (Table 4), but the increases in French oak price in the Netherlands, Belgium, and Germany were considerably less because of the weakness of the French franc. Still, price increases of 248 percent in Germany, 297 percent in Belgium, and 283 percent in the Netherlands more than offset the increase of U.S. oak price, even considering the differences in price elasticities. Ironically, the large increase in French oak price has been attributed to exports of French oak (Camous 1980). According to this theory, an increased demand for French oak caused the price of French oak to rise, which, in turn, caused the demand for and price of U.S. oak to increase. The initial increase in French oak demand was probably caused by the decreased availability of Japanese oak and the decreasing availability of tropical species from Africa and Asia.

Table 3.—Cumulative elasticities of demand for U.S. oak in the Netherlands, Belgium, Germany, and France with respect to price of U.S. oak, price of French oak, and price of output at 1980 levels

Country	Price of U.S. oak	Price of French oak	Price of output
The Netherlands	– 3.80	0.99	2.43
Belgium	– 5.41	2.13	2.98
Germany	– 4.05	1.00	2.62
France	– 4.66	1.73	3.35

Table 4.—Percentage changes in U.S. oak price, French oak price, and output price for the Netherlands, Belgium, Germany, and France, 1973-1979

Country	Price of U.S. oak[a]	Price of French oak[b]	Price of output
The Netherlands	23	283	57
Belgium	32	297	45
Germany	11	248	52
France	65	413	118

[a] Adjusted for exchange rates between the U.S. and the demanding country.
[b] Adjusted for exchange rates between France and the demanding country.

Table 5.—Percentage changes in the U.S. dollar and the French franc against the currencies of the Netherlands, Belgium, Germany, and France, 1973-1979

Against the. . .	Change in the value of the U.S. dollar	Change in the value of the French franc
Dutch guilder	– 39	– 25
Belgian franc	– 35	– 21
German mark	– 44	– 34
French franc	– 18	—

Output prices also increased in Europe during the 1970's. These increases more than offset the increase in U.S. oak price, after accounting for the differences in their relative elasticities. The root of the price increases was the rapid and stable economic growth of the European economies during the 1970's. The rather high increase in French price of output corresponds to the inflation France experienced relative to the other countries under study. This difference in inflation rates is reflected in the depreciation of the French franc against the other currencies (Table 5).

One result of the continuing high level of exports to Europe is a better organized and larger export marketing system. When the initial surge in export demand occurred, few American suppliers of hardwood lumber were used to the buying customs of European demanders. The continual export demand has forced American suppliers to understand the wants and needs of European buyers better in order to get a piece of the market. This is evident in the resorting and regrading of lumber that is now termed "export" grade. It probably means that the U.S. exports will not revert to pre-1973 levels.

The trade in any commodity between any two countries or regions is an economic phenomenon and is dependent on economic variables. The relative levels of these variables dictate the level and direction of trade. In 1982, there was a slight decrease in exports of oak to Europe, linked to the increasing strength of the dollar over European currencies and a decreasing rate of growth in European economies. The weakening of the French franc against other European currencies also curtailed increases in French oak price.

Recent developments that will contribute to better marketing of American lumber include the stationing in Europe of representatives from U.S. lumber associations, the development of a section of the Foreign Agricultural Service concerned with forest products, tax advantages for firms whose primary purpose is to export, and the proposed development of export trading companies. These are only a start.

One major obstacle to the exportation of hardwood products is the lack of concrete market information. Although lack of easily obtainable information gives market insiders an advantage, it hinders entrance into the market, which can only hurt the economic efficiency of the market and may jeopardize further growth of the American share of the European market. More accurate and timely reporting of prices and quantities on a species-by-species basis is needed. Transportation costs would also be of interest to potential and current suppliers.

The United States could be one of the biggest hardwood lumber exporters in the world. This potential can be realized by lower cost production and a marketing system sophisticated enough to operate on an international scale. Future research efforts and planning resources should be aimed at providing the needed ingredients for long-term development of our export market potential.

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Exports of oak lumber produced in the United States to major European demanders were analyzed using ordinary least squares estimation procedures.

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