An Analysis of U.S. Hardwood Log Exports from 1990 to 2021

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Abstract

In 1990, the major destinations for hardwood logs exported by the United Sates were Europe, Canada, and three East Asian markets: Japan, Taiwan, and Korea. From 1990 to 2005, the volume of hardwood logs exported to Canada increased by 402 percent. During this period, another East Asian log market developed, consisting of China, Hong Kong, and Vietnam (CHV). While increased Canadian exports were an apparent result of increased U.S. bilateral trade with Canada, the development of the CHV market was associated with increased U.S. furniture imports from that region. The volume of U.S. log exports worldwide peaked in 2005, and the value of log exports peaked in 2007. Exports to all regions declined in 2009. After 2009, exports to CHV increased and surpassed shipments to Canada in 2014. In the past decade, much of the increase in exports to CHV appears to be the result of demand within China. Recently, these exports have been affected by trade disputes and the COVID-19 pandemic. For most of the study period, the dominant log export species were white oak, red oak, maple, or cherry in terms of value. Since 2018, walnut has become the most important log export species (value basis) as a result of increased shipments to China.

Hardwood log exports have been a divisive issue in the United States since the 1960s (Luppold 1994). Most timberland owners believe that logs should be sold to the highest bidder, while many U.S. hardwood processors contend that exports increase the prices they pay for logs. Position within the hardwood supply chain also can affect perceptions of log exports; for example, many U.S. hardwood log brokers believe that increasing log exports is beneficial to business (Montague et al. 2013). Although hardwood log exports have been debated in the hardwood industry for a long time, these exports have not risen to the same extent as the volume and value of hardwood lumber exports (Bumgardner 2017).

The contentious history of hardwood log exports has prompted legislation attempting to restrict their trade. In the 1960s, debates over walnut (*Juglans nigra*) log exports caused quotas to be imposed by the U.S. Congress (Luppold 1994). These quotas were later rescinded as the General Agreement on Tariffs and Trade stipulated a concurrent conservation plan for this species to be developed by the United States. Such a plan could have limited U.S. consumption and was never implemented. In 1989, the Forest Resources and Conservation and Shortage Relief Act was passed, which prohibited exports of logs cut on eastern federal lands. However, this legislation was never implemented, as funds were not appropriated by Congress.

Debates over log exports reemerged when red oak (*Quercus* spp.) log shipments to China increased by 95 percent between 2016 and 2017 (U.S. Department of Agriculture, Foreign Agriculture Service [USDA FAS] 2022). This increase reportedly reduced log availability and increased log prices to northeastern U.S. sawmills (Meyer 2017a, 2017b) and prompted research on opinions of log exports. For example, in a survey of the hardwood industry of Pennsylvania, responses were evenly divided when asked if the export of sawlogs was good for the state (Jacobson et al. 2018). The biggest concern was the loss of jobs and that unsawn logs that usually would arrive at mills in Pennsylvania to manufacture lumber were being moved overseas at unprecedented rates. One respondent noted, ''When you export sawlogs, you are exporting the lifeblood of a lot of small mills and businesses that use these logs and

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lumber in their business. They employ a lot of people.'' However, not all comments saw Pennsylvania log exports as problematic. High prices for logs and good trade relations with foreign buyers were cited positively. One respondent noted, ''Overseas consumer demand for hardwoods is booming because those countries understand and appreciate our hardwoods. It's a good thing they want our wood and are willing to pay for it. As long as that dynamic exists, it's up to us to innovate, compete, and fill the demand as best we can, with what we have.''

The 2017 increase in log exports to China was short lived, as trade disputes between the United States and China caused tariffs to be imposed on agricultural products by China, including hardwood logs (Congressional Research Service [CRS] 2019). These disputes were associated with a 38 percent decline in hardwood log exports to China between 2017 and 2019 (USDA FAS 2022). In January 2020, a trade agreement between the United States and China was implemented (Office of the U.S. Trade Representative [USTR] 2020), and as a result of this agreement, Chinese tariffs on U.S. products were reduced. However, this agreement was implemented just as the COVID-19 pandemic began.

Policy, trade, and other issues influence log exports; however, these exports are affected primarily by economic factors, including changes in monetary exchange rate and economic growth in importing countries or regions (Luppold and Bumgardner 2013). Exports of logs and lumber to Taiwan, China, and Vietnam also have been affected by the offshoring of the U.S. furniture industry (Buehlmann and Schuler 2009). Additionally, bilateral trade between the United States and Canada was enhanced with implementation of the North American Free Trade Agreement in 1994.

The objectives of this article are to examine changes in the volume, value, and unit value (imputed price developed by dividing value by volume) of U.S. hardwood logs exported to major international markets or market regions and to discuss the impact of these exports on U.S. hardwood product markets. In this endeavor, we first examine yearly log export volumes and values and isolate important turning points in these measures between 1990 and 2021. Changes in volume and value of log exports to important regions are then explored. This analysis is followed by an examination of changes in the exports of important species, how exports of these species have been distributed among world regions, and variations in regional and species unit values. We then summarize by discussing apparent relationships between log export markets and U.S. hardwood product markets.

Methods

Data

Due to of errors in the reporting of log exports to Europe, Asia, and Canada that persisted through 1989 (Luppold 1995), 1990 was selected as the starting point for this analysis. The data used in this study were developed using the U.S. Department of Agriculture, Foreign Agricultural Service, Global Agricultural Trade System (GATS) application (USDA FAS 2022). All reported volumes are in cubic meters (m^3), usually in thousands of m^3. In terms of conversion factors, 1,000 board feet (MBF) of lumber equals 2.36 m^3, and 1 MBF of logs equals 4.53 m^3 according to the Food and Agriculture Organization (Jones 2016).

All value estimates have been inflation adjusted to 2021 dollars using the wholesale price index for all commodities (U.S. Department of Labor, Bureau of Labor Statistics [USDL BLS] 2022). Reported unit values are the inflation-adjusted values divided by the associated m^3 volumes. Export values reported in GATS are ''free alongside ship,'' that is, the value at the U.S. seaport, airport, or border port of export, based on the transaction price, including inland freight, insurance, and other charges incurred in placing the merchandise alongside the carrier at the U.S. port. It excludes the cost of loading merchandise aboard the exporting carrier and also excludes freight, insurance, and transportation costs beyond the U.S. port of exportation (USDA FAS 2022).

One of the most apparent impacts of log exports has been on log and lumber prices (Luppold 1994). The only publication that provides detail and consistent historic information on hardwood log price by quality grade and species is the Ohio Timber Price Report (Ohio Woodland Stewards Program [OWSP] 2022). Information from this publication will be used for evaluating the impact of exports on log prices. Since log exports tend to consist of higher-value logs, the prices of the highest grade of hardwood lumber (FAS) as published in the Hardwood Market Report (HMR 2021) for the Appalachian region will be used to assess the impact of exports on lumber price.

Export market regions

Since 1990, there have been three global market regions receiving high volumes of U.S. hardwood logs and lumber: North America (primarily Canada), Europe (European Union and United Kingdom), and East Asia (USDA FAS 2022). In the early 1990s, Japan, Taiwan, and South Korea (Korea) were the major East Asian importers of U.S. hardwood products. Most products imported by Japan were used within that country, while logs and lumber imported by Taiwan and Korea were used to produce furniture and other products that were exported to the United States and other developed economies.

Improved trade relations with China in the early 2000s resulted in increased exports directly to this country or through Hong Kong intermediaries. The increase in hardwood log exports to China followed increased exports of hardwood lumber. The increases in log and lumber exports were associated with the migration of the wood furniture industry from Taiwan to China (Schuler and Buehlmann 2003). A trade dispute between China and United States, which began in 2003 (U.S. International Trade Commission 2017), resulted in the bedroom portion of the Chinese furniture industry to substantially relocate to Vietnam (Luppold and Bumgardner 2011). Again, there was an associated increase in log and lumber exports to Vietnam.

Japan, Taiwan, and Korea (JTK) and China, Hong Kong, and Vietnam (CHV) are examined as two separate trading regions in this article. Hong Kong is included in the latter grouping because it was a trading intermediary for China. During the study period, the regions of Canada, Europe, JTK, and CHV accounted for at least 90 percent of annual U.S. hardwood log export volumes (USDA FAS 2022).

Species examined

The species examined in this study were selected based on their biological abundance and/or relative level of export

Figure 1.—Value and volume of U.S. hardwood log exports from 1990 to 2021 (USDA FAS 2022). Correlation coefficients: 1990 to 1996 (r = 0.58); 1997 to 2008 (r = 0.66); and 2009 to 2021 (r = 0.92).

volume. Red oak and white oak (*Quercus* spp.), hard maple and soft maple (*Acer* spp.), and yellow-poplar (*Liriodendron tulipifera*) account for 65 percent of the hardwood sawtimber volume in the eastern United States (U.S. Department of Agriculture, Forest Service 2021). Four minor (by sawtimber volume) eastern species that also have been exported at relatively high levels are ash (*Fraxinus* spp.), cherry (*Prunus serotina*), birch (*Betula* spp.), and walnut (*Juglans nigra*) (USDA FAS 2022). Three other species reported in the GATS database include beech (*Fagus* spp.), red alder (*Alnus rubra*), and paulownia (*Paulownia tomentosa*). These species and a classification of ''tropical hardwoods'' accounted for less than 5 percent of the value or volume of shipments for any given year in the study period and therefore are not analyzed in this article.

Another log classification in GATS is ''other temperate.'' Prior to 2018, this classification was solely unknown species and is still composed primarily of unidentified species (USDA FAS 2022). The volume reported for this classification varies from year to year, ranging from 4 percent of total in 2018 to 33 percent in 2009 (USDA FAS 2022). Because of this variation, all volumetric and value proportions discussed in this article are based on the proportion of identified species (total volume or value less ''other temperate'' volume or value).

Results and Discussion

Turning points in the log export market

There are several points in time when the volume or value of exports changed direction or rate of growth (Fig. 1). These turning points are the result of changes in the global economy, trade relationships, or some combination of these and other factors. The first notable turning point is 1996, after which the rate of growth in volume of exports was greater than the growth in the value of exports for a prolonged period. The peak year for export volume was 2005, while the value of exports reached an all-time high in 2007.

The volume and value of log exports declined after their respective maximums and started to trend together with subsequent turning points occurring in 2009 and 2013. Between 2013 and 2017, both value and volume trended upward at a similar rate. The value of exports started to decline in 2017, reaching a low point in 2020, and then increased in 2021. Given the above discussion of turning points in the data, these series were analyzed by examining hardwood log exports at nine points in time: 1990, 1996, 2005, 2007, 2009, 2013, 2017, 2020, and 2021.

Changes in regional log markets

In 1990, the volume of log exports was relatively evenly dispersed among three markets with shipments to Canada, JTK, and Europe accounting for 33, 31, and 28 percent of quantity exported, respectively (Fig. 2). This coincided with proportional export values of 35, 34, and 21 percent for Europe, JTK, and Canada, respectively (Fig. 3). The regional differences between proportional volumes and values were the result of higher unit values of shipments to Europe and JTK relative to Canada (Table 1).

Between 1990 and 1996, the volume of logs exported to Canada increased by 134 percent, which more than offset the declines in shipments to Europe and JTK (Fig. 2). These changes resulted in a 19 percent increase in overall quantity exported. However, the total value of log exports declined by 9 percent and remained more evenly distributed between the three regions (Fig. 3). This difference between volume and value of shipments was the result of declines in the volume of high-unit-value shipments to Europe and JTK and a 33 percent decline in the unit value of Canada shipments. The relatively low unit value of Canadian exports ($208 per m^3; Table 1) is reflective of larger quantities of sawlogs (OWSP 2022) being shipped as opposed to higher-valued veneer logs.

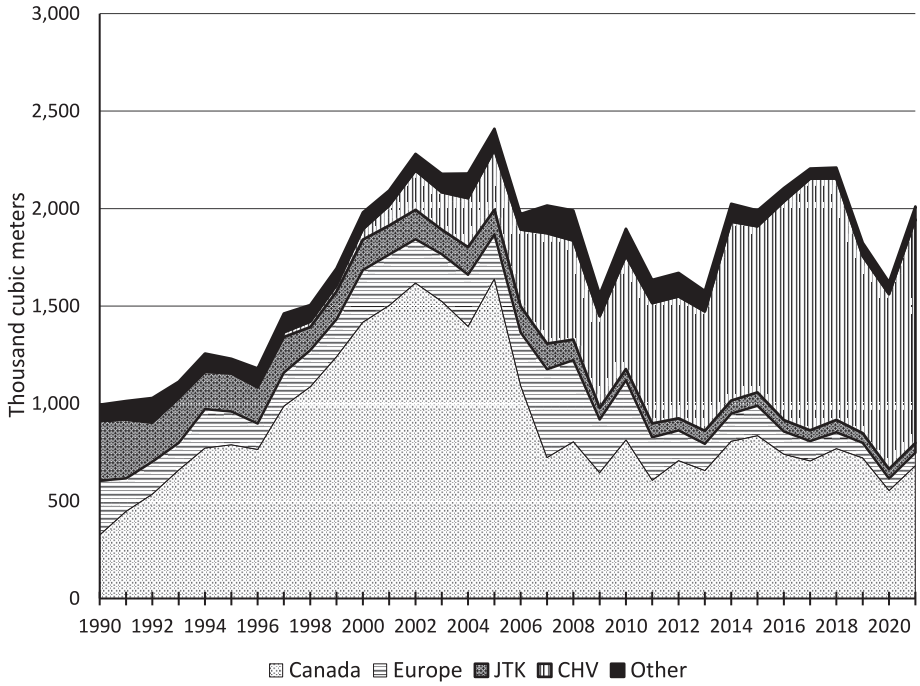

Figure 2.—Volume of U.S. hardwood log exports to Canada, Europe, JTK region (Japan, Taiwan, and Korea), CHV region (China, Hong Kong, and Vietnam), and all other regions from 1990 to 2021 (USDA FAS 2022).

The doubling of hardwood log exports between 1996 and 2005 was the result primarily of a continuation of growth in the Canadian market and the emergence of the CHV market (Figs. 2 and 3). In 2002, CHV surpassed JTK in both value and volume terms. In 2005, the volume of exports to Canada accounted for 68 percent of total (all countries) volume, and shipments to CHV rivaled the volume of logs exported to Europe.

The volume of hardwood logs exported to Canada declined by 56 percent between 2005 and 2007, but this decline was partially offset by increased shipments to Europe and CHV (Fig. 2). By contrast, the value of exports reached the all-time high in 2007 (Fig. 1). This increase in the value of logs exported was the result of greater quantities of higher-unit-value products being shipped to Europe and CHV (Table 1). The value of these shipments

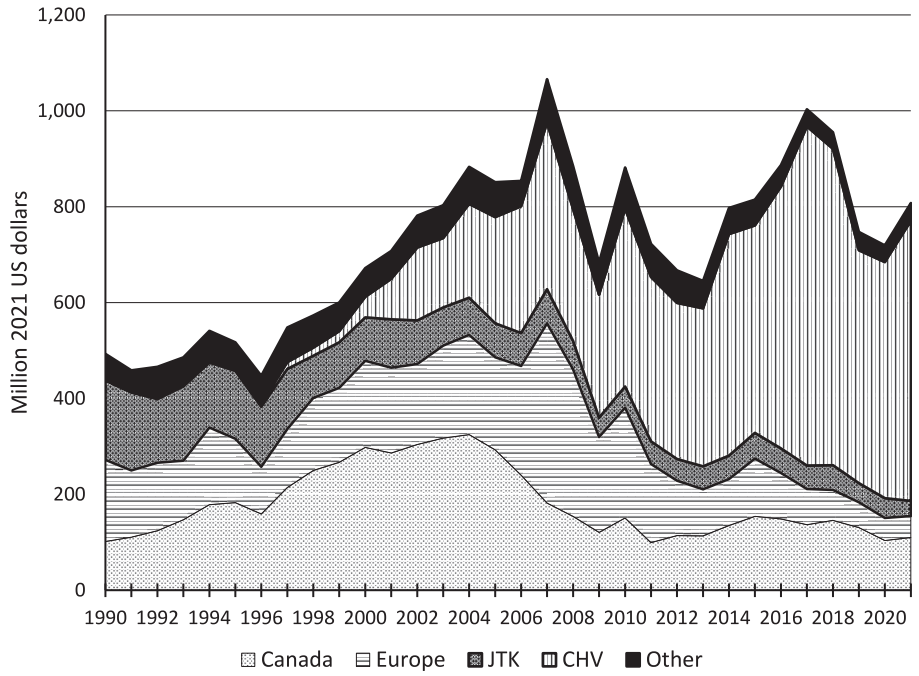

Figure 3.—Value of U.S. hardwood log exports to Canada, Europe, JTK region (Japan, Taiwan, and Korea), CHV region (China, Hong Kong, and Vietnam), and all other regions from 1990 to 2021 (USDA FAS 2022).

Table 1.—Unit value (2021 U.S. dollars per cubic meter) of U.S. hardwood log exports to Canada, Europe, and JTK and CHV regions in selected years (USDA FAS 2022).[a]

	1990	1996	2005	2007	2009	2013	2017	2020	2021
Canada	312	208	179	252	187	173	194	187	162
Europe	612	740	843	827	730	705	731	759	654
JTK	541	676	560	543	680	720	883	845	644
CHV	406	601	721	614	544	539	548	549	510
World[b]	496	379	353	529	438	409	455	443	402

[a] JTK = Japan, Taiwan, and Korea. CHV = China and Vietnam (includes Hong Kong as an intermediary for China).
[b] All export markets.

more than offset the decline in the value of products shipped to Canada. Between 2007 and 2009, the value and volume of hardwood log exports declined in all regions.

While the volume and value of exports fluctuated after 2009, CHV volumetric and value market shares increased to 39 and 51 percent, respectively, in 2013 (Figs.2 and 3). In 2014, the quantity of exports to CHV surpassed that of Canada. Log exports to CHV increased to 1.3 million m^3 in 2017 as the volume of red oak, white oak, and walnut increased by 95, 87, and 78 percent, respectively, over 2016 levels. As a result of the surge in log exports to China in 2017, CHV volumetric and value market shares were 59 and 71 percent of all hardwood logs exported, respectively; for red oak, CHV represented 75 and 79 percent of exports, respectively.

In March 2018, the United States began to place tariffs on steel and aluminum imports from all regions (CRS 2019). In April 2018, China imposed retaliatory tariffs on a variety of U.S. agricultural goods, including hardwood logs. The imposition of these retaliatory tariffs appears to be the primary cause of the 45 percent reduction in hardwood log exports to China between April and May 2018. Total volume and value of log exports to China continued at lower levels through December 2019.

In January 2020, a trade agreement between the United States and China was signed (USTR 2020), initially corresponding to increased log exports through May 2020 (USDA FAS 2022). After May 2020, there was a decline concurrent with the COVID-19 pandemic. In 2021, the value and volume of log exports to CHV began to increase at a rate greater than the other regions. By the end of 2021, the CHV market share of U.S. log exports reached its previous high levels (58 and 73 percent of volume and value of total exports, respectively).

While overall U.S. hardwood log exports increased in both volume and value between 2020 and 2021 (Fig. 1), the real unit value of these exports declined in all market regions (Table 1). This change is notable because the real price of mid- and higher-quality sawlogs reported in Ohio was 10 to 60 percent higher in real prices for every species listed (OWSP 2022). High log prices also are reflected in hardwood lumber prices, which increased at twice the rate of the overall produce price index (34 percent vs. 17 percent) during this period (USDL BLS 2022). This divergence in price movements in the export and domestic markets suggests that importers of U.S. logs purchased lower-quality products in response to increasing log prices.

Changes in species exported

Of the identified species exported in 1990, red oak, white oak, maple, and birch accounted for 23, 23, 15, and 15 percent of the volume, respectively (Table 2). Exports of these species were widely distributed between Europe, Canada, and JTK except for birch, which was shipped primarily to Canada (USDA FAS 2022). The value of exports was more concentrated, with white oak, red oak, and walnut accounting for 36, 24, and 13 percent of the market, respectively (Table 3).

Between 1990 and 1996, the export volume of maple logs increased by over 175 percent (Table 2) with over 98 percent of this increase being shipments to Canada (USDA FAS 2022). These maple shipments had a unit value of $139 per m^3 (USDA FAS 2022, USDL BLS 2022) indicating that a high proportion of the logs shipped were sawlogs (OWSP 2022). In terms of value, white oak was the top export species in 1996, and exports to Japan accounted for 52 percent of the total value of white oak shipments. The unit value of white oak exports to Japan was over $800 per m^3, indicating a high relative volume of veneer-quality logs.

The doubling of log export volume between 1996 and 2005 was the result of large increases in shipments of every species except white oak (Table 2). Two species heavily exported in the late 1990s and early 2000s were cherry and walnut (USDA FAS 2022). During this period, cherry was the most important species exported to Europe in both volume and value terms, and in 2002, cherry accounted for 50 percent of the value of identifiable species shipped to this region. Walnut was the most important species exported to CHV in value terms from 2001 to 2007. Together, cherry and walnut accounted for 15 percent of the volume and 33 percent of the value of identifiable species exported to all countries in 2005 (Tables 2 and 3).

While exports of maple logs declined sharply between 2005 and 2007, the value of white oak and walnut shipments surged, accounting for 48 percent of the value of identified species in 2007 (Tables 2 and 3). The major market for white oak in 2007 was Europe, while the value of walnut exports to CHV was slightly larger than exports to Europe (USDA FAS 2022). The decline in hardwood log exports between 2007 and 2009 occurred across all species except yellow poplar (Table 2). The largest declines in both volume and value terms were shipments of maple and red oak to Canada, white oak to Europe, walnut to Europe and CHV, and cherry to all regions.

While overall export volume and value levels in 2013 were similar to 2009 levels, there were large changes in the export of individual species (Tables 2 and 3). The largest increases in export volume and value during this period were shipments of maple to Canada and red oak and walnut to CHK (USDA FAS 2022). The largest volumetric increases in log exports between 2013 and 2017 were for red oak, ash, and walnut, respectively (Table 2). Nearly all

Table 2.—Volume (thousands of cubic meters) of U.S. hardwood log exports in selected years (USDA FAS 2022).

	1990	1996	2005	2007	2009	2013	2017	2020	2021
Red oak	179	240	404	251	166	292	609	333	480
White oak	180	160	177	314	195	183	220	179	253
Maple	113	312	603	335	182	385	428	331	400
Yellow-poplar	12	25	114	183	183	102	102	32	39
Ash	13	32	69	69	66	73	279	226	200
Cherry	18	75	169	98	35	43	44	21	32
Birch	117	76	173	110	105	177	173	130	157
Walnut	61	28	115	189	75	90	181	228	278
Other temperate[a]	219	204	561	408	519	212	145	120	154
Other[b]	82	30	25	60	35	21	26	22	19
Total	994	1,181	2,409	2,016	1,561	1,577	2,205	1,622	2,011

[a] Temperate logs not identified by species.
[b] Combined beech, red alder, tropical, and paulownia.

these increases were associated with shipments to CHV. Similarly, the decline in log exports between 2017 and 2020 was confined primarily to the CHV region with red oak log shipments realizing the largest volumetric decline. By contrast, walnut shipments to the CHV region increased in volume and value terms. As a result, in 2021, walnut was the most important export species by value and accounted for 30 percent of the value of all (identified and unidentified) U.S. hardwood logs exported worldwide.

Regional analysis and U.S. hardwood markets

The changing mix of species and volumes of U.S. hardwood log exports to the four major markets caused the relationship between total (world) export volume and value to vary. Between 1990 and 1996, these metrics were moderately correlated ($r = 0.58$), as the volume exported to Europe (high unit value) declined and the volume exported to Canada (lower unit value) increased (Fig. 1). The fluctuation in the species mix and unit values to Canada, Europe, and JTK between 1997 and 2009 resulted in a new pattern but a continuation of moderate correlation ($r = 0.66$) between the value and volume of log exports. Since 2009, CHV has become the dominant market for U.S. hardwood log exports, and although there is a wide range in the unit value for the individual species, the consistency in shipments to this region has resulted in the value and volume of log exports to be highly correlated between 2009 and 2021 ($r = 0.92$). An examination of the relationship of exports and U.S. hardwood product markets provides greater insight of the overall impact of the log export market.

Canada.—The increase in overall hardwood log export volume between 1990 and 2005 was largely the result of a 402 percent increase in shipments to Canada (Fig. 2). This increase was associated with large declines in unit value, which indicates that the logs were sawlogs rather than veneer logs. Between 1990 and 2000, log exports to Canada were similar in volumetric terms to U.S. lumber imports from that country (Fig. 4). While this may indicate that logs exported to Canada were processed into lumber that was then imported back into the United States, the correlation may be more indicative of the interconnections between these two trading partners during this time span.

The 1990s was a period of increased U.S. hardwood lumber consumption, which reached historically high levels between 1997 and 2000 (Luppold and Bumgardner 2016). During this period, Canadian lumber exports to the United States appeared to be an auxiliary supply to U.S. production, which also was at historically high levels (Luppold and Bumgardner 2017). In the 1990s, Canada also was becoming an important source of wood furniture imported by the United States, and by 1995, Canada had displaced Taiwan as the most important source of imports (Luppold and Bumgardner 2011). The near continual growth in log exports to Canada through 2005 occurred concurrently with high levels of hardwood lumber and wood furniture imports.

The 56 percent decline in log exports to Canada between 2005 and 2007 coincided with a 57 percent decline in U.S.

Table 3.—Value (millions of 2021 U.S. dollars) of U.S. hardwood log exports in selected years (USDA FAS 2022).

	1990	1996	2005	2007	2009	2013	2017	2020	2021
Red oak	99	89	135	138	92	158	289	126	153
White oak	147	108	118	270	138	125	150	116	146
Maple	38	63	159	93	48	64	86	62	68
Yellow-poplar	6	11	46	66	71	38	37	10	11
Ash	13	19	20	44	43	40	128	104	92
Cherry	16	61	133	115	36	40	36	17	22
Birch	12	12	27	17	17	19	18	13	15
Walnut	54	23	116	186	84	99	191	214	239
Other temperate[a]	79	46	89	106	137	58	61	52	59
Other[b]	28	16	10	30	19	4	7	6	4
Total	493	447	851	1,066	683	645	1,003	719	808

[a] Temperate logs not identified by species.
[b] Combined beech, red alder, tropical, and paulownia.

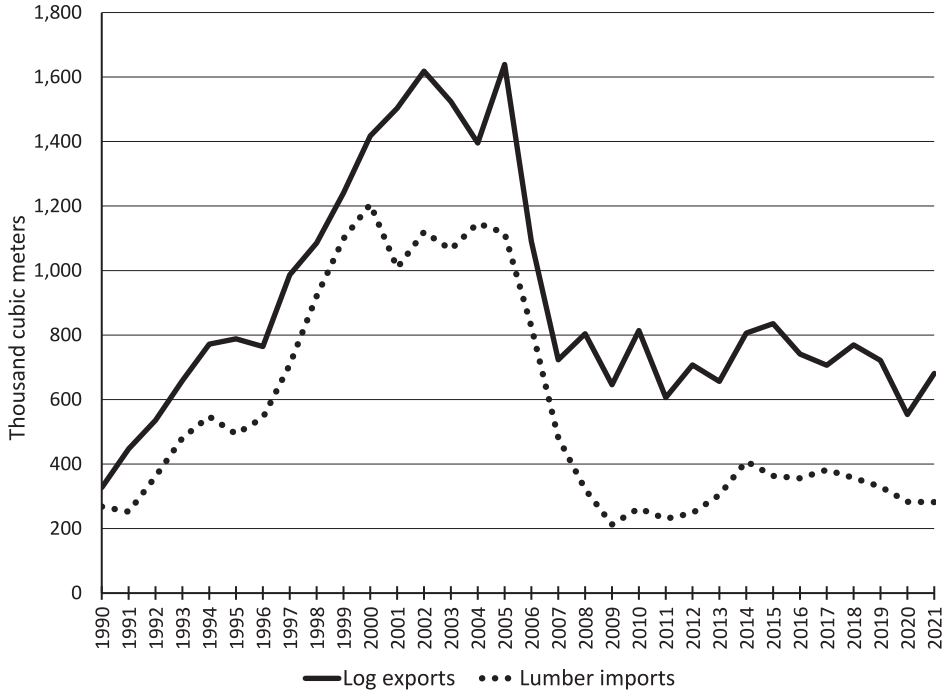

Figure 4.—Hardwood log exports from the United States to Canada versus hardwood lumber imports from Canada to the United States from 1990 to 2021 (USDA FAS 2022). Correlation coefficient r = 0.93.

hardwood lumber imports from that country (Fig. 4). Between 2005 and 2009, wood furniture imports from Canada declined by 62 percent, which also may have contributed to the decline in log exports to this country. While the decline in bilateral trade between the United States and Canada was partially the result of the Great Recession, most of the decline in log exports to Canada occurred prior to the recession (between 2005 and 2007). The relatively low level of log exports to Canada since 2009 are coincidentally associated with lower levels of hardwood lumber and wood furniture imports from Canada (U.S. International Trade Administration 2021). Overall, the interconnections between the U.S. and Canadian hardwood markets during the study period resulted in the high correlation ($r = 0.93$) between hardwood log exports and hardwood lumber imports (Fig. 4).

Europe.—The unit value of hardwood log exports to Europe was relatively high throughout the study period (Table 1), but the species mix varied over time. In 1990, white oak accounted for 35 percent of the value of exports to Europe (USDA FAS 2022). Exports of white oak to Europe declined through the 1990s but began to increase in the early 2000s and reached historically high levels in value and volume in 2007. This increase was associated with increased prices of high-quality white oak logs and lumber in the United States (HMR 2021, OWSP 2022). After 2007, white oak log exports declined and in 2021 were at the lowest levels in value terms since before 1978 (USDA FAS 2022).

Cherry and walnut are two other log species exported to Europe that have fluctuated in value and volume. In the early 1990s to the early 2000s, increased cherry log and lumber exports to Europe were associated with historically high price levels of high-quality cherry logs and lumber in the United States (HMR 2021, OWSP 2022). While walnut exports to Europe declined in 2009, they have fluctuated since then and accounted for nearly 70 percent of the value of logs exported to the region in 2021. Overall, there was no correlation ($r = –0.15$) between U.S. hardwood log exports to Europe and U.S. hardwood lumber imports from Europe over the study period, suggesting less market interconnection than what was evident with Canada. One likely reason is that beech is the primary hardwood lumber species imported by the United States from Europe, but the United States exports only small quantities of beech logs to Europe or elsewhere (USDA FAS 2022).

JTK.—The decline in log exports to JTK during the study period occurred across all markets within this region and for all species except walnut exports to Japan (USDA FAS 2022). The initial decline to this region was a reduction in log exports to Taiwan as U.S furniture imports shifted to Canada (Luppold and Bumgardner 2011). Exports to Japan also declined in the 1990s as this country faced a prolonged economic recession (Hayashi and Prescott 2002). Exports to JTK reached their lowest level in value terms in 2009 (since the early 1980s) and have remained at relatively low levels since then. Very little hardwood lumber was imported from JTK by the U.S. over the study period, so comparisons of this metric to U.S. log exports to JTK are difficult.

CHV.—The initial increase in log exports to CHV occurred as U.S. furniture imports from China started to displace imports from Canada in the early 2000s. Exports to Vietnam started to increase after antidumping rulings on bedroom furniture manufactured in China redirected investment in furniture production to Vietnam (Luppold and Bumgardner 2011). Furniture imports from China peaked in 2007, while furniture imports from Vietnam continued to increase after 2007. In 2019, wood household furniture imports from Vietnam exceeded imports from China. Still, the volume of log exports to Vietnam was just 14 percent of the volume exported to China in 2021. This

indicates that the relatively high levels of logs exported to China over the past decade appear to be used to manufacture products for consumption in China.

On a volume basis, red oak was the most important species exported to the CHV region between 2010 and 2021. In the peak year of 2017, 98 percent of the red oak log exports to this region went to China for apparent internal consumption. In 2018, walnut displaced red oak log exports to CHV in value terms, and China and Hong Kong accounted for 94 percent of walnut export value to this region. In 2021, walnut was the most important species exported worldwide, accounting for 32 percent of the value of identified species, and China accounted for nearly 75 percent of the world market for walnut (USDA FAS 2022). Overall, there was a relatively high correlation between U.S. hardwood log exports to CHV and U.S. hardwood lumber imports from CHV over the study period ($r = 0.83$), but it should be noted that relatively little hardwood lumber is imported from CHV (approximately 19,000 m^3 in 2021), which was 15 times less than from Canada and five times less than from Europe.

Summary and Conclusions

Although hardwood log exports have long been a debated topic within the hardwood products industry, they have not grown to the extent of the volume and value of hardwood lumber exports. The increased volume of logs exported during the late 1990s and early 2000s was a direct result of increased bilateral trade between the United States and Canada. The change in East Asian markets receiving U.S. logs initially was influenced by the importation of furniture by the United States from Taiwan in the 1980s and from China and Vietnam in the 1990s. While log exports to Vietnam in 2021 still appear to be influenced by the volume of furniture exported by that country, log exports to the larger Chinese market appear to be influenced more by demand within that country.

Specific instances where price can be demonstrated to be influenced directly by level of exports have been infrequent. The surge in cherry lumber prices to the highest level of any species in the mid-2000s was short lived and perhaps contributed to the decline in demand and price of this species in subsequent years. White oak prices have been influenced by fluctuations in log and lumber exports since the mid-1970s and most recently 2007. While red oak fell out of style in the U.S. market (Luppold and Bumgardner 2007), Chinese demand for this species helped maintain relatively high price levels until 2017.

Perhaps the most significant influence of log and lumber exports has been on the domestic price of walnut lumber. Historically, walnut lumber has traded at a higher price than any other commonly traded U.S. species (HMR 2021). Walnut remained the highest-priced lumber species until 1995 when international and U.S. demand for cherry resulted in that species becoming the highest-priced commonly traded U.S. species. By 2000, high-quality cherry lumber was 60 percent higher in price than walnut lumber, and hard maple and walnut lumber traded at comparable prices. After 2000, walnut log and lumber exports increased and have remained relatively high since then. In 2021, this minor species (representing around 1% of eastern U.S. sawtimber volume) accounted for 14 percent of the volume and 30 percent of the value of all logs exported in 2021. At the same time, walnut log and lumber prices are again considerably higher than any other commonly traded U.S. hardwood product.

A common theme of this assessment of U.S. hardwood log exports since 1990 has been change in terms of market destinations, unit values, and the species being demanded. Going forward, the hardwood industry should continue to be prepared to adjust as markets change, including monitoring trends in the global and regional economies and managing for species diversity. The United States likely will continue to be perceived as a reliable source of sustainably harvested hardwood logs on the global stage. Demand for U.S. log exports will remain a function of regional economic factors along with trade policies and relationships.

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