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ECONOMIC IMPACT OF TENNESSEE FOREST PRODUCT EXPORTS IN 2022

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INTRODUCTION

The U.S. is the world's largest source of industrial wood production (FAO, 2019), with the U.S. South accounting for half of total production (Howard and Liang, 2019). Most of this production is from the "pine belt," which includes states like Mississippi, Alabama, and Georgia. Unlike these pine-belt states, Tennessee is primarily a hardwood state (deciduous trees), which are relatively high value and make an important contribution to Tennessee's economy (Pelkki and Sherman, 2020). Tennessee's forestry activity tends to be in rural areas and is often smaller scale than other industries, so the economic and social importance of the wood products industry are often underappreciated. It is estimated that forestry in Tennessee provides over 85,000 jobs and has an annual economic impact of over \$21 billion (Menard, English and Jensen, 2021). Tennessee is among the top ten states in terms of the relative importance of forestry, alongside Maine, Wisconsin, and Oregon (Pelkki and Sherman, 2020).

Tennessee's forestry industry is globally connected, and many sawmills in the state are dependent on global sales. About half of the higher-grade hardwood lumber produced in Tennessee is exported (Luppold et al., 2018). Consequently, changes in global markets can have a significant impact on Tennessee's forest economy. In this report, we discuss the economic impact of Tennessee's forestry exports. We examine the export changes in 2022 (relative to 2021) across destination countries (e.g., China, European Union) and by product (e.g., oak lumber, hardwood logs, barrels), and further assess the full economic impact of export sales on income and jobs at the state level.

Forestry exports are not just important to Tennessee but to the entire country. U.S. sales of forest products to foreign countries were \$10.5 billion in 2022. In the context of agriculture and related products (as defined by the U.S. Department of Agriculture),¹ forest products are an important share of total U.S. exports, with global sales comparable to America's top agricultural exports: beef (\$11.8 billion), dairy products (\$9.5 billion), cotton (\$8.9 billion), and wheat (\$8.3 billion). Forestry exports in Tennessee (\$194 million in 2022) ranked third among agricultural and related exports behind distilled spirits and cotton (USDA, 2023).

Exports of forest products were negatively impacted by the U.S. trade war with China in 2018 and 2019 and the COVID-19 pandemic in 2020. This was the case for both the U.S. and Tennessee. The pandemic had a significant impact on global sales due to supply and demand disruptions in the global market for finished wood products (e.g., furniture) and the interrelated market for raw materials and inputs (e.g., logs and lumber) (Muhammad and Taylor, 2020). These effects were in addition to the negative impacts of China's retaliatory tariffs on U.S. timber, which are still in place (Muhammad et al., 2022).

Exports of forest products from 2019 to 2022, nationally, regionally, and for Tennessee are reported in Table 1. From 2020 to 2021, U.S. exports increased by \$2.1 billion. In 2022, exports continued to increase by \$756 million (nearly 8%) when compared to the previous year, reaching 10.5 billion. This increase was mostly in Southern states, followed by Western states. U.S. and Tennessee exports further recovered in 2022 by 8% and 4%, respectively, when compared to 2021 (USDA, 2023). The increase in exports sales in 2021 and 2022 was a welcomed turnaround given the declines experienced in previous years.

Table 1. U.S. Forest Product Exports: 2018-2022

Country/ Region/State	2019	2020	2021	2022	\$ Change 2021-2022	% Change 2021-2022
\$ million						
United States	\$8,324	\$7,662	\$9,736	\$10,492	\$756	7.8%
South	3,297	3,059	3,878	4,363	485	12.5%
West	2,139	1,922	2,582	2,758	177	6.9%
Midwest	1,276	1,243	1,577	1,660	82	5.2%
Northeast	1,295	1,154	1,386	1,427	40	2.9%
Tennessee	177	139	186	194	8	4.3%

Source: U.S. Department of Agriculture, Foreign Agricultural Service (2023)

¹See the following link for all USDA product categories: <https://apps.fas.usda.gov/gats/ProductGroup.aspx?GROUP=BICO-HS10>

OVERVIEW OF TENNESSEE FOREST PRODUCT EXPORTS

Figure 1 shows Tennessee forest product exports since 2010. In 2022, export sales were \$194 million, which was an increase of more than \$8 million when compared to the previous year. From 2017 to 2020, export sales fell from \$290 million dollars to \$139 million.



Figure 1. Tennessee Forest Product Exports: 2010-2022. Source: USDA, Foreign Agricultural Service (2023).

As previously noted, declines in 2018 and 2019 were caused by the U.S. trade war with China, which was compounded by the COVID-19 pandemic in 2020. In 2020, exports reached their lowest level in more than a decade. Sales to China were \$143 million in 2017, the highest in a decade, accounting for almost half of all of Tennessee’s forestry exports that year. Because of the trade war and pandemic, exports to China fell to a low of \$32 million 2020. In 2021 and 2022, the state returned to pre-pandemic levels. However, exports are still significantly less than before the trade war. As shown in Figure 1, this is mostly due to sales to China not recovering from the trade war.

Figure 2 shows Tennessee’s forest product exports to top destination countries (2019-2022). The importance of China to Tennessee export sales cannot be overstated. In 2018, more than \$102 million of Tennessee forest product exports went to China, which was about 40% of total exports that year. In 2019, however, the retaliatory tariffs caused Tennessee’s exports to China to decline significantly to less than \$40 million. Exports to China declined even further to about \$32 million in 2020 but rebounded to more than \$50 million in 2021. Unfortunately, exports to China fell in 2022 to \$43 million. The overall increase in Tennessee’s forest product exports in 2022 are mostly due to increased sales to countries other than China, most notably, Canada, Mexico, Ireland, and Japan. In fact, exports to Ireland have been steadily declining in recent years but increased from less than \$5 million in 2021 to \$10 million in 2022. Exports to Mexico increased from \$6 million to \$11 million from 2021 to 2022.

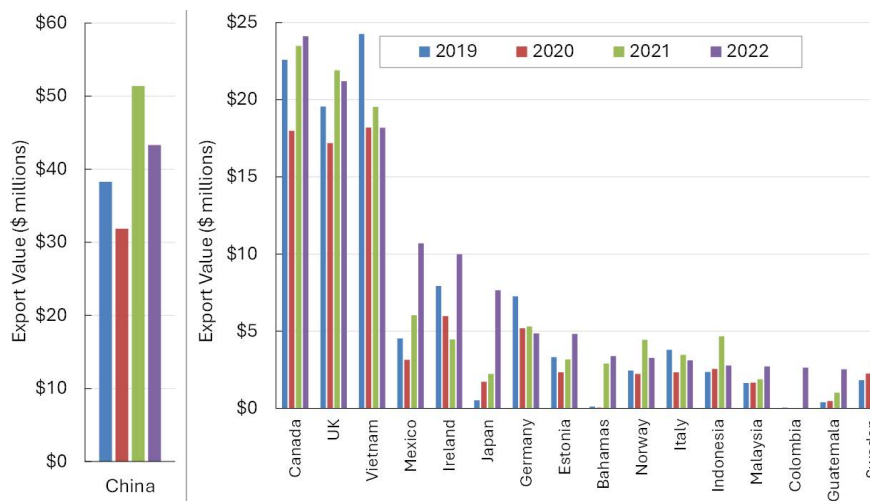


Figure 2. Countries are ordered based on 2022 export sales. Source: USDA, Foreign Agricultural Service (2023).

Figure 3 shows Tennessee's forest product exports by top categories based on value (2019-2022). Oak lumber is Tennessee's largest forest product export. In 2019, oak lumber exports were \$84 million, but decreased to \$65 million in 2020. In 2021, oak lumber exports increased to \$88 million but then slightly declined to \$81 million in 2022. Other major products significantly increased (e.g., casks and barrels, and oriented strand board) or moderately increased (e.g., other hardwood lumber and logs). Like oak lumber, some products even declined in 2022: ash lumber, oak logs, poplar and aspen lumber, and joinery and carpentry. I-beams are a new emerging category, negligible in the recent past, but exceeding \$5 million in 2022.

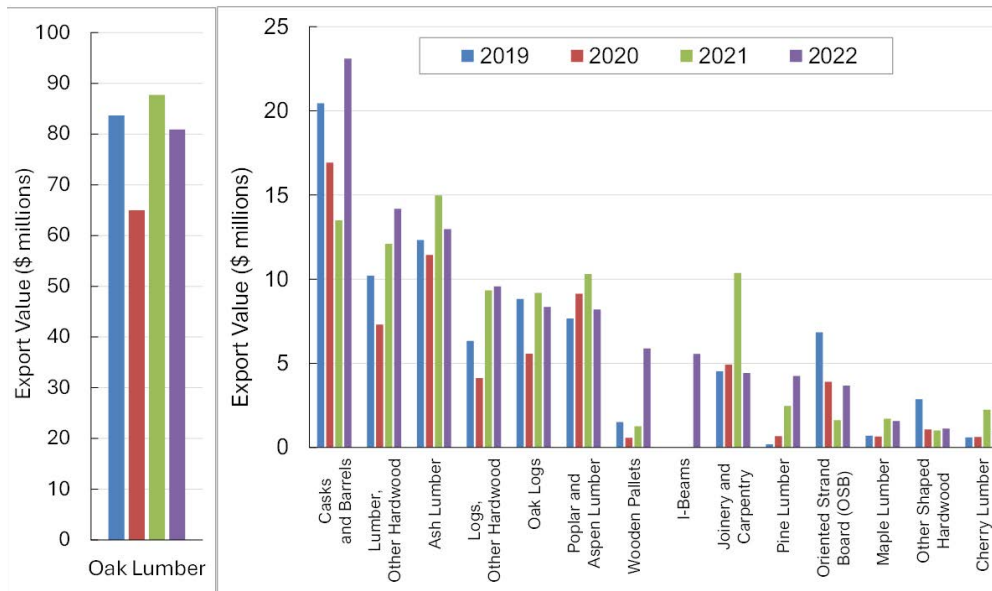


Figure 3. Product categories are ordered based on 2022 export sales. Source: USDA, Foreign Agricultural Service (2023).

Next, we consider Tennessee's forest product exports by major product category and top destination (see Table 2). Oak lumber was the leading export category in 2022 with China being the top destination (around \$23 million), followed by the EU-27 (\$14 million) and Vietnam (\$10 million). Casks and barrels are the second largest category. However, these sales are mostly to the EU-27 and UK. Note that casks and barrel exports to the EU increased by 154% in 2022 when compared to the previous year. As shown in Figure 2, I-beams are a relatively new category for Tennessee. All I-beam exports from Tennessee are going to Canada. Other than other hardwood logs and poplar logs, exports to China have mostly declined in 2022.

Table 2. Tennessee Forest Product Exports by Major Destination Country and Product Category: 2022 and Percent Change from 2021

Product Category	China	Canada	EU-27	United Kingdom	Vietnam	Mexico	Japan
Export Value in 2022 (\$ million)							
Oak Lumber	\$22.62	\$2.85	\$13.89	\$9.53	\$10.35	\$2.18	\$1.26
Other HW Logs	6.80		1.42	0.08			0.46
Other HW Lumber	4.45	0.69	1.66	0.11	1.69	2.97	0.10
Ash Lumber	4.23	0.29	3.80	1.43	0.92	0.50	0.01
Oak Logs	3.14		0.14	0.03	2.05	0.11	2.16
Cherry Lumber	0.73		0.15	0.00	0.03		
Poplar/Aspen Lumber	0.57	1.59	0.93	0.89	2.69	0.91	0.17
Maple Lumber	0.21		0.02	0.00	0.16	1.03	
Poplar/Aspen Logs	0.20		0.07	0.04	0.03	0.64	
Casks (Barrels)	0.09	0.23	8.39	8.69		0.25	0.00
Pine Lumber	0.04	2.40	0.13		0.03	1.19	0.01
Pallets		0.23	2.26			0.02	3.21
I-Beams		5.55					
Oriented Strand Board		3.67					
Joinery and Carpentry		2.57					0.00

Note: HW is hardwood. Infinity % represented growth from zero (or near zero) to a new positive value. Source: USDA, Foreign Agricultural Service (2023).

Table 2. Tennessee Forest Product Exports by Major Destination Country and Product Category: 2022 and Percent Change from 2021 (CONTINUED)

Product Category	China	Canada	EU-27	United Kingdom	Vietnam	Mexico	Japan
Percent Change in 2022 (from the previous year)							
Oak Lumber	-4.1%	-31.2%	-10.5%	-22.9%	4.7%	103.3%	379.6%
Other HW Logs	16.5%		-20.1%	Infinity %	Infinity %		-1.2%
Other HW Lumber	-23.2%	-0.8%	48.8%	-6.5%	-20.9%	327.4%	199.0%
Ash Lumber	-27.1%	13.9%	18.0%	-20.9%	-21.6%	150.7%	-55.4%
Oak Logs	-49.7%		117.5%	29.4%	48.1%	446.1%	174.8%
Cherry Lumber	-64.1%		1,171.3%	-100.0%	-41.9%		
Poplar/Aspen Lumber	-24.3%	0.6%	-39.3%	-23.9%	-25.4%	-5.7%	165.3%
Maple Lumber	-35.6%		90.8%	Infinity %	-54.7%	29.9%	
Poplar/Aspen Logs	Infinity %		182.9%	Infinity %	Infinity %	8.9%	
Casks (Barrels)	-74.0%	-49.9%	153.9%	36.6%		-48.9%	-100.0%
Pine Lumber	-36.1%	49.4%	235.0%		Infinity %	197.9%	Infinity %
Pallets	-100.0%	-32.1%	199.4%			-69.9%	Infinity %
I-Beams		Infinity %					
Oriented Strand Board		139.3%					
Joinery and Carpentry		-71.3%					-100.0%

Note: HW is hardwood. Infinity % represented growth from zero (or near zero) to a new positive value. Source: USDA, Foreign Agricultural Service (2023).

ECONOMICS IMPACTS OF FOREST PRODUCT EXPORTS ON TENNESSEE

Model Overview and Data

In this section, we estimate the economic impact of Tennessee's forestry exports for 2022. IMPLAN's® (Cloud platform Version 7.0 basic data for 2021) was used in estimating the economic impact at the state level. Using state-level export data from the Foreign Agricultural Service's Global Agricultural Trade System (GATS), the level and increases in export sales in 2022 by product category, based on the Harmonized System (HS) of classifying traded products, were linked to corresponding North American Industry Classification System (NAICS) sectors using the Commodity Translation Wizard (DataWeb, 2023). In a few instances where more than one NAICS code matched the same HS code, we used the NAICS sector that most closely aligned with the HS classification. The NAICS codes were then matched to corresponding IMPLAN codes using the IMPLAN conversion spreadsheet (IMPLAN, 2023). Sales by IMPLAN codes based on state exports are reported in Table 3.

Table 3. Direct Output and Changes in Direct Output for 2021 and 2022 by IMPLAN Sector Based on Export Sales

IMPLAN Code	Sector	2021	2022	Direct Output Change (\$)	Direct Output Change (%)
16	Commercial logging	\$19,633,672	\$19,122,856	-\$510,816	-2.6%
132	Sawmills	\$132,403,090	\$123,942,241	-\$8,460,849	-6.4%
133	Wood preservation	\$321,253	\$547,351	\$226,098	70.4%
134	Veneer and plywood manufacturing	\$2,176,986	\$1,583,001	-\$593,985	-27.3%
135	Engineered wood member and truss mfg.	\$10,369,397	\$10,502,823	\$133,426	1.3%
136	Reconstituted wood product mfg.	\$1,967,261	\$4,415,045	\$2,447,784	124.4%
137	Wood windows and door mfg.	\$429,603	\$298,521	-\$131,082	-30.5%
139	Other millwork, including flooring	\$76,519	\$151,256	\$74,737	97.7%
140	Wood container and pallet mfg.	\$15,009,006	\$29,559,328	\$14,550,322	96.9%
143	All other miscellaneous wood product mfg.	\$2,927,941	\$3,225,646	\$297,705	10.2%
163	Other basic organic chemical mfg.	\$250,365	\$213,839	-\$36,526	-14.6%
390	Burial casket manufacturing	\$0	\$36,599	\$36,599	n/a
391	All other miscellaneous mfg.	\$0	\$135,908	\$135,908	n/a
	Total Direct Output from Exports	\$185,565,093	\$193,734,414	\$8,169,321	4.4%

Note: The direct output changes are used to shock the Tennessee IMPLAN model to derive total output and employment changes. "mfg." is manufacturing. Values are not adjusted for inflation. Source: Calculations using trade data from the USDA, Foreign Agricultural Service trade data and the Commodity Translation Wizard (DataWeb, 2023) to map the trade data to NAICS sectors and IMPLAN codes.

This version of IMPLAN has the capability to model 546 industries based on their assigned NAICS sectors. IMPLAN measures the economic transactions (buying/selling relationships) among industries and households in the economy. Output from the model provides quantitative measures of the economy including total industry output (the value of all sales), employment, labor income, value-added, plus taxes at the federal and state-county level.

The state IMPLAN model provides estimates of multiplier-based impacts. The multipliers, in this instance, measure the response of the entire state economy to changes in forestry sector sales.² There are three different components of the multiplier effects in the model for every industry. First is the initial impact or direct impact due to direct sales. Second is the indirect multiplier effects, which indicates to what extent output in the primary industry will impact other industries in the region due to the input needs (goods as well as services). The last impact (induced multiplier effects) indicates to what extent the output of the regional economy increases (decreases) because of changing consumer income and the rippling effect of local purchases.

Economic Impacts of Export Sales in 2022

The total impact of export sales in 2022 is reported in Table 4. Tennessee’s forestry exports in 2022 were \$193.7 million, which led to an estimated total impact of \$358.8 million. Estimates indicate that forestry exports support a total of 1,692.3 jobs statewide. Given the composition of Tennessee’s export sales, the milling sector (sawmills) (\$237.8 million and 997 jobs), wood container and pallet manufacturing (\$51.6 million and 261 jobs), and the commercial logging sectors (\$35.2 million and 310 jobs) are the most affected sectors.

Table 5 depicts the increase in exports in 2022 (relative to 2021). The \$8.2 million increase in forestry exports in 2022 led to an estimated total impact of \$11.9 million. Estimates indicate that this increase led to an increase of 61 jobs statewide. The largest gains were in the wood container and pallet manufacturing (\$25.4 million and 129 additional jobs) and the reconstituted wood product manufacturing (\$3.5 million and 9 additional jobs) sectors. Note that the decline for certain industries, particularly sawmills, is primarily due to declines in log and lumber exports overall.

Table 4. Total Impacts of Exports in 2022 with Inclusion of Indirect and Induced Multiplier Effects and State-Wide Total Impacts (2022\$)

Rank	Industry	Total Impact		
		Output ^a (million \$)	Employment ^b (jobs)	
1	132	Sawmills	\$237.8	997.3
2	140	Wood container and pallet mfg.	\$51.6	261.1
3	16	Commercial logging	\$35.2	310.1
4	135	Engineered wood member and truss mfg.	\$17.4	63.3
5	136	Reconstituted wood product mfg.	\$6.3	16.2
6	143	All other miscellaneous wood product mfg.	\$5.5	24.9
7	134	Veneer and plywood mfg.	\$2.7	12.0
8	133	Wood preservation	\$0.9	2.4
9	137	Wood windows and door mfg.	\$0.5	2.0
10	163	Other basic organic chemical mfg.	\$0.3	0.8
11	139	Other millwork, including flooring	\$0.3	1.1
12	391	All other miscellaneous mfg.	\$0.2	0.9
13	390	Burial casket mfg.	\$0.1	0.2
		State Total Impact	\$358.8	1,692.3

^a Annual value of production by industry

^b Industry specific mix of full-time, part-time, and seasonal employment

²The foreign trade data used in this report could influence the multipliers in the model as follows: multipliers are based on the amount of local purchasing as indicated by the regional purchase coefficient (the RPC) for each commodity. The RPC must be less than or equal to the supply demand pool coefficient (SDP), which is local supply, net of foreign exports, divided by gross demand. Because we include new estimates for foreign exports, it is possible that the resulting change in the SDP coefficient for the affected forestry sectors could influence the RPC coefficients in our analysis. However, in evaluating changes in the SDP coefficients for the 13 IMPLAN forestry sectors where we estimated trade impacts, the RPC coefficients were not affected (i.e., RPC remained less than or equal to the SDP coefficient for each of the 13 sectors).

Table 5. Total Impacts of the Change in Exports in 2022 with Inclusion of Indirect and Induced Multiplier Effects and State-Wide Total Impacts (2022\$)

Rank	Industry	Total Impact		
		Output ^a (million \$)	Employment ^b (jobs)	
1	140	Wood container and pallet mfg.	\$25.4	128.5
2	136	Reconstituted wood product mfg.	\$3.5	9.0
3	143	All other miscellaneous wood product mfg.	\$0.5	2.3
4	133	Wood preservation	\$0.4	1.0
5	391	All other miscellaneous mfg.	\$0.2	0.9
6	135	Engineered wood member and truss mfg.	\$0.2	0.8
7	139	Other millwork, including flooring	\$0.1	0.5
8	390	Burial casket mfg.	\$0.1	0.2
9	163	Other basic organic chemical mfg.	-\$0.1	-0.1
10	137	Wood windows and door mfg.	-\$0.2	-0.9
11	16	Commercial logging	-\$0.9	-8.3
12	134	Veneer and plywood mfg.	-\$1.0	-4.5
13	132	Sawmills	-\$16.2	-68.1
		Total Impact	\$11.9	61.3

^a Annual value of production by industry

^b Industry specific mix of full-time, part-time, and seasonal employment

CONCLUSION

The forestry sector is important to the Tennessee economy, and, while exports are a small share of the total economic activity when considering all related activities such as furniture, flooring and paper production, global sales have a significant economic impact, primarily on the sawmill and logging sectors. Consequently, the Tennessee Department of Agriculture should continue to support efforts to increase export sales. However, the results of this report also suggest the need to decrease reliance on the Chinese market. Overall, the results of this report show that the increase in 2022 export sales relative to the previous year (+\$8.2 million) resulted in a total economic impact of +\$11.9 million and 61 additional jobs. Note that the results of this study do not include activities that facilitate export sales, such as transportation from sawmills to the port. Overall, the economic impact of the change in 2022 was smaller than 2021. That said, an overall increase is always better than a decline in the forest products industry.

REFERENCES

- Dataweb. 2023. Commodity Translation Wizard. United States International Trade Commission. <https://dataweb.usitc.gov/classification/commodity-translation>
- Food and Agriculture Organization of the United Nations (FAO). 2019. Forest Products 2017. <http://www.fao.org/3/ca5703m/ca5703m.pdf>
- Howard, J.L., and S. Liang. 2019. "U.S. Timber Production, Trade, Consumption, and Price Statistics, 1965–2017." Research Paper: FPL-RP-70. U.S. Forest Service, U.S. Department of Agriculture. https://www.fpl.fs.usda.gov/documnts/fplrp/fpl_rp701.pdf
- IMPLAN. 2023. Spreadsheet 2022 NAICS TO IMPLAN 546 INDUSTRIES. <https://implanhelp.zendesk.com/hc/en-us/articles/360034896614-546-Sector-Industries-Conversions-Bridges-Construction-2018-Data>
- Luppold, W., M. Bumgardner, K. Kottwitz, F. Maplesden, and I. Novoselov. 2018. Chapter 5: Sawn Hardwood. In: *Forest Products Annual Market Review 2017-2018*. Geneva, Switzerland: United Nations Publications.

REFERENCES (CONTINUED)

Menard, J., B. English, and K. Jensen. 2021. "Tennessee Ag & Forestry Stats 2021: Economic Contributions of Agriculture and Forestry in Tennessee." University of Tennessee Institute of Agriculture Report. https://arec.tennessee.edu/wp-content/uploads/sites/17/2021/12/TN_AgStats_2021_accessible.pdf

Muhammad, A., and A. Taylor. 2020. "Implications of COVID-19 on Tennessee Exports of Forest Products." UT Extension, W 913. tiny.utk.edu/W913

Muhammad, A., C. M. Hellwinckel, E. Anosike, and A. Taylor. 2022. "Economic Impact of the COVID-19 Pandemic on Tennessee Forest Product Exports." UT Extension, W 1064. tiny.utk.edu/W1064

Pelkki, M., and G. Sherman. 2020. "Forestry's Economic Contribution in the United States, 2016." *Forest Products Journal* 70(1): 28-38.

U.S. Department of Agriculture (USDA). 2023. Global Agricultural Trade System (GATS). Foreign Agricultural Service. <https://apps.fas.usda.gov/GATS/default.aspx>



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