FISCAL YEAR 2022 ECONOMIC IMPACTS OF THE VIRGINIA MARITIME INDUSTRY

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EXECUTIVE SUMMARY

The Virginia Port Authority commissioned this study to assess the economic and fiscal impacts of Virginia's non-military maritime industry. This report complements the prior study "The Fiscal Year 2022 Virginia Economic Impacts of The Port of Virginia"[1] and provides the impact of the entire Virginia maritime industry including those of containerized, breakbulk and bulk cargoes as well as the impacts of Virginia's private shipbuilding and repair industry.

The Virginia maritime industry creates high paying jobs and supports the Commonwealth's commerce worldwide. In FY 2022, the Virginia maritime industry **directly added** to Virginia's economy in four ways:

- Handling waterborne commerce: 65.6 million tons valued at **$103.5 billion,** directly involving **34,600 skilled workers**.
- The Virginia production of 12.8 million tons of waterborne exports with a value of **$14.9 billion,** directly engaging **41,000 employees**.
- Virginia use and consumption of 7.4 million tons in imports, directly generating **$33.1 billion** in net new Virginia spending for goods and services provided by **304,800 employees**.
- Virginia private shipbuilding and repair, with receipts of **$12.3 billion and 33,500 direct employment**.

The maritime-related $110.5 billion sum in direct spending for the output of goods and services employ 380,400 Virginians creating a multiplier effect throughout the state with businesses supplying the maritime industry and through its employees' spending. The total FY 2022 Virginia maritime impacts include:

- **$178.1 billion** in spending, with Virginia value-added, **Gross State Product, of $87.8 billion, equal to 14% of the estimated $649.4 billion total Virginia GSP in 2022.**
- The labor income created was **$56.9 billion, involving 729,600 Virginia employees, 20% of 3.6 million Virginia non-agricultural payroll employment in 2022.**

These impacts generated $8.1 billion of multiple types of tax and fee revenues, but the top three -- local property taxes, personal and corporate income taxes, and sales taxes -- accounted for $6.8 billion, or 84 percent of the total $8.1 billion. Every dollar of maritime-related impact on Virginia GSP creates on average 9.2 cents of state and local government revenue.

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INTRODUCTION

The maritime story is connected around the backbone of innovation, specialized services, and the tightly integrated nature of an industry dealing with a quick changing environment. The Virginia maritime industry creates high paying jobs and supports the Commonwealth's commerce worldwide. These abilities, knowledge, and resources allow the maritime industry to capture new opportunities.

This report captures all aspects of transporting, handling, storing, and processing domestically and internationally traded goods through Virginia's public and private port operations. The analysis measured containerized commodities, dry and liquid bulk shipments, and break-bulk cargos. The report also encompasses Virginia's shipbuilding and repair business activities, deep sea cruise ship operations, and other services in the maritime environment.

The Virginia Port Authority (VPA) is a political subdivision of the Commonwealth of Virginia that operates under The Port of Virginia brand name. The VPA owns and through its private operating subsidiary, Virginia International Terminals, LLC (VIT), operates four general cargo facilities Norfolk International Terminals, Portsmouth Marine Terminal, Newport News Marine Terminal and the Virginia Inland Port in Warren County. The VPA leases Virginia International Gateway and Richmond Marine Terminal. Along with the container handling facilities, Virginia maritime commerce flows through dozens of privately-owned general cargo and bulk-handling facilities located in the Norfolk Harbor and along the Elizabeth and James Rivers.

As will be shown, not only has the Virginia maritime industry been contributing jobs, pay, and resources to the state and localities but Virginia's ports have achieved significant recognition:

- Third largest container port on the U.S. East Coast. Based on TEUs handled during the 2022 calendar year.[2]
- Second largest port on the U.S. East Coast based on tonnage for all cargoes handled (CY 2022) – container, breakbulk and bulk.[3]
- Largest share of coal exports (CY 2022) in the U.S. based on total export tonnage for coal (HS2701).[4]
- Largest shipbuilding and repair industrial base in the nation.[5]

In addition, the Coastal Virginia Offshore Wind (CVOW) project being developed by Dominion Energy, assisted by the Virginia marine industry, is the largest off-shore wind project in the U.S.[6]

TONS AND VALUE MOVED THROUGH THE PORTS

Container shipments are measured in TEUs (**t**wenty-foot **e**quivalent **u**nits) and tons, while other cargo predominantly is measured in tons. We used tons as the physical unit in common. The Virginia ports moved 65.6 million tons of foreign cargo to other states and countries in FY 2022, with an estimated value of $103.5 billion.

Foreign exports and imports totaled 65.6 million tons. Table 1 gives the tonnage and value by major North American Industry Classification System (NAICS) section codes, by container and non-container. Only 39% of the tons are in containers, but these account for 94% of the dollar value. Most of the tonnage, 61%, is non-containerized but their value is only 6% of the total. These differences stem mainly from coal traffic of 32.9 million tons, out of the 39.7 million non-containerized tons categorized in Table 1 as “Nonmetallic mining products”. Other major non-containerized goods are soybeans, wheat, and corn, in NAICS Sector 11: “Agriculture, forestry, and fishing products”.

Table 1 - Virginia Maritime Exports and Imports FY 2022
Tons and Value by Major Sectors

NAICS Sectors & Description	*Container*		*Non-container*		*Total*	
	Tons (mil.)	*Dollar Value ($ bil.)*	*Tons (mil.)*	*Dollar Value ($ bil.)*	*Tons (mil.)*	*Dollar Value ($ bil.)*
11 Agric., forestry & fishing products	**1.0**	**$ 4.8**	**3.2**	**$ 1.9**	**4.2**	**$ 6.7**
21 Nonmetallic mining products	**.2**	**$ 0.2**	**32.9**	**$ 0.3**	**33.1**	**$ 0.5**
31 Food, bev., textiles, & apparel mfg.	**7.3**	**$ 17.0**	**0.2**	**$ 0.1**	**7.5**	**$ 17.1**
32 Wood, paper, petro. & chem., plastics mfg.	**11.7**	**$ 33.4**	**2.8**	**$ 1.4**	**14.5**	**$ 34.8**
33 Metal, machinery, electrical & electronics, transport eqpt. & furniture mfg.	**5.6**	**$ 41.7**	**0.5**	**$ 1.9**	**6.1**	**$ 43.6**
91-99 Waste, scrap, used/spec classification goods	**0.1**	**$ 0.6**	**0.1**	**$ 0.2**	**0.2**	**$ 0.8**
Total	**25.9**	**$ 97.7**	**39.7**	**$ 5.8**	**65.6**	**$ 103.5**
Percent of Total	**39%**	**94%**	**61%**	**6%**		

The NAICS sector components are offered here as an overview as well as described further in the sections on exports and imports. NAICS Sectors 31-33 are manufactured goods, which are higher value goods and generally move in containers.

TOTAL ECONOMIC IMPACTS OF THE VIRGINIA MARITIME INDUSTRY

The total Virginia economic impacts are reported in Table 2 to provide the background for the sections on the four components of the total: Ports Operations, Exports, Imports, and Shipbuilding and Repair. The Virginia maritime industry impacts the Virginia economy through three major channels: **handling and transporting goods** within Virginia, **exporting** goods made in Virginia, and **importing** goods used in Virginia. A fourth maritime channel is **shipbuilding and repair** (for which the ports are essential) - these building and repair services are an additional part of maritime impact.

Table 2 - Total FY 2022 Impacts of Virginia's Ports

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Income per Job*
Direct	**$ 110.5**	**$ 48.1**	**$ 33.3**	**380.4**	**$ 87,539**
Indirect	**$ 35.3**	**$ 20.3**	**$ 13.4**	**170.5**	**$ 78,592**
Induced	**$ 32.3**	**$ 19.4**	**$ 10.2**	**178.7**	**$ 57,079**
Total	**$ 178.1**	**$ 87.8**	**$ 56.9**	**729.6**	**$ 77,988**

The total ports-related Virginia sales were $178.1 billion of currently produced goods and services in FY 2022. The portion produced in Virginia, adding to our Gross State Product (GSP), was $87.8 billion, 14% of the total Virginia 2022 GSP of $649.4 billion. Out of that $87.8 billion, $56.9 billion was labor income, including payroll to an estimated 729,600 employees, equal to 20% of Virginia's 3,600,000 nonagricultural payroll employment in FY 2022.

IMPACT COMPONENTS AND MEASURES

The Virginia maritime industry handling the flow of goods through the terminals has a substantial *direct* economic impact on Virginia income and jobs. Exports

made in Virginia have a separate, additional Virginia economic impact. Producing export goods in Virginia creates income and jobs here, another *direct* economic benefit. Demand for these goods in other states and countries is the ultimate force driving this production. However, the Virginia availability of multiple deep-water ports with the ability and capacity to handle a variety of export cargoes provides global market access for Virginia businesses, expanding the volume they can produce and sell profitably. In many cases, the ports are a major reason the businesses are here in Virginia. We include the impact of Virginia-made exports to illustrate an important contribution of the ports to the state economy.

Imports remaining in Virginia for use and sale also have an additional Virginia impact. While they do not directly bring new income into the Commonwealth, these imports are inputs into production and trade in Virginia, raw materials for Virginia manufacturers, and also goods creating Virginia income and jobs as Virginia truckers, wholesalers, and retailers make them available to local consumers. These imports are the Virginia base of the supply chain meeting local demand, a supply chain of services and goods with a large impact on Virginia income and jobs. The dollar cost of the imports is an expense, not Virginia income. But the value-added, the margins earned in the supply chain here, are income, creating Virginia payroll, taxes, and jobs. This economic impact is supported by the port operations, and needs to be recognized as a direct contribution to Virginia's economy. Shipbuilding and Repair services also are a major ports-related activity, going well beyond the construction of nuclear naval ships at Newport News Shipbuilding and work on Navy vessels. In addition, the shipyards and repair businesses build, maintain, and repair hundreds of barges, tugs, and towboats.

Impacts are reported here by four measures: **Output**, the dollar sales of goods and services; **Value-added**, the portion of output produced in Virginia, our Gross State Product; **Labor Income**, the wages and salaries earned and benefits received by payroll employees plus income of sole proprietors; and the **Number of Employees**. For all four measures, the total economic impact is the sum of three types of impacts: the *direct*, *indirect*, and *induced* impacts.

The *direct* impacts give rise to the other two streams: the *indirect* and *induced* impacts. The direct output of $110.5 billion in Table 2 is the flow of payments generated initially by the demand for the goods or services. This revenue is not a measure of the sellers' contribution to Virginia's Gross Domestic Product (GSP) since the products sold include inputs purchased from other businesses, in-state and out-of-state. The *direct* contribution to Virginia Gross Domestic Product is the value-added of $48.1 billion, which is the *direct* source for local income and jobs.

The indirect impacts are the business-to-business (B2B) flows created by direct sales, value-added, labor income, and jobs. The $35.3 billion shown as indirect

output is the B2B spending for inputs and supplies from other Virginia businesses – from providers of goods and suppliers of services ranging from power and other utilities to material inputs and cleaning, accounting, legal, and medical services. The local output, value-added, labor income and jobs created by this B2B spending are indirect impacts, caused by and dependent upon the initial direct demand for goods and services (i.e., the direct impact).

There also is a third impact stream created, labeled an *induced* impact. This is created as the income earned, by households and businesses in the process of meeting the direct and indirect demands, is spent – primarily for households' consumption. The *induced* output of $32.3 billion in Table 2 is very real and predictable. Households spend most of their income. For example, if a company shuts down (a direct impact), not only does its suppliers lose sales and cut payroll and jobs (an indirect impact), but other businesses that sell to the households of the company's and suppliers' workers lose customers and cut back – an *induced* impact.

Each of the output impact flows creates value-added Gross State Product (GSP), production within Virginia's borders. We separately report labor income that is the largest component of GSP. We do not separately report estimates of other income components such as corporate profits and indirect business taxes. However, the income measures not reported here are included in estimates of the state and local government tax flows. The employment measure here is payroll jobs, excluding sole proprietors. These employment figures include part-time as well as full-time jobs, as in the U.S. Bureau of Labor Statistics and Virginia Employment Commission statistics. There is reliable information on FY 2022 payroll and jobs by type of establishment so our focus is on measures that can be estimated and verified with confidence.

The *direct* economic impacts of ports-related activities are inputs into the IMPLAN (IMpact analysis for PLANning) model used to derive the *indirect*, *induced*, and *total* economic impacts for Virginia. The IMPLAN input-output system is a widely used 546 sector model designed for estimating economic impacts, including port-related impacts. A strength of IMPLAN is that it is an open model that allows the user to modify the coefficients. Therefore, the IMPLAN model can be fine-tuned to more accurately describe the current state and local economic structure.

PORTS OPERATIONS

The ports' operations are the heart of the Virginia impacts, providing services enabling the ships and barges to call at the ports and moving cargo and cruise passengers in and out of Virginia waters. The *direct* spending for these services

was $14.4 billion, shown in the first row of Table 3, directly adding $6.2 billion to Virginia GSP, most of which was labor income with 34,600 employees directly involved. These ports' jobs are largely high-skilled ones held by experienced workers, with over $121,000 in income per job in FY 2022. The *indirect* and *induced* ripple effects through the Virginia economy brought the total output to $23.2 billion, of which $11.4 billion was GSP, 1.8% of the total production of goods and services in the Commonwealth, providing $7.7 billion in labor income supporting 84,500 jobs.

Table 3 - FY 2022 Impacts of Virginia Ports Operations

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Income per Job*
Direct	**$ 14.4**	**$ 6.2**	**$ 4.2**	**34.6**	**$ 121,387**
Indirect	**$ 5.0**	**$ 2.9**	**$ 2.2**	**28.2**	**$ 78,014**
Induced	**$ 3.8**	**$ 2.3**	**$ 1.3**	**21.7**	**$ 59,907**
Total	**$ 23.2**	**$ 11.4**	**$ 7.7**	**84.5**	**$ 91,124**

The range of these ports' operations can best be illustrated by describing income and jobs in the different types of activities involved in the *direct impacts*, summarized in Table 4. The ship and harbor operations include pilots meeting the ocean-going ships at the entrance to the Chesapeake Bay and guiding them into Hampton Roads, tugboats supervised by docking pilots docking the ships at terminals, and stevedores unloading and loading cargo. Then, tugboats and pilots participate in undocking the ships and moving them back to the mouth of the Bay. While in port, the ships can use a wide range of other services, such as launches for the crew, crew changes, ship supplies and parts, as well as maintenance. The container ships unloaded and loaded a total of 26 million tons. However, with the super-cranes used today for loading and unloading, they are only docked for a few hours.

The majority of the bulk cargo ships in FY 2022 were colliers, here to load 32.1 million tons of coal for export. Coal exports have been declining, but coal is still, by far, the largest Virginia ports tonnage export. While it is used as heating source, the critical use of coal is as the source for carbon in carbon steel. Other bulk ships were here to load nearly three million tons of oilseeds (primarily soybeans) and grain for export to other countries and states. Harbor operations go beyond moving cargo by ship. There are barge trips moving among the ports of Richmond, Hopewell, Newport News, and Norfolk Harbor. Moving these barges is a major

harbor operation for towboat companies and local businesses which may have their own towboats and barges.

Table 4 - Ports Operations Direct Labor Income and Employment

Activity	*Labor Income ($ bil.)*	*Jobs (thous.)*	*Income per Job*
Ship & harbor operations, vessel (un)loading	**$ 2.5**	**12.5**	**$ 200,000**
Freight arrangement & other transportation support	**$ 0.8**	**8.0**	**$ 100,000**
Truck, rail & barge transportation of non-Va. exports & imports	**$ 0.9**	**14.1**	**$ 63,830**
Total	**$ 4.2**	**34.6**	**$ 121,387**

Another directly-related ports operations category in Table 4 is Truck, Rail and Barge Transportation of exports and imports. The transportation expenses involved in Virginia-made exports are included in the dollar value of such exports. However, as is discussed in the next section on exports, 36.9 million tons, equal to 74% of the 49.7 million tons exported from the ports of Virginia in FY 2022, were produced in another state or country. Moving these goods across Virginia to the ports is a port-dependent activity not included elsewhere. Similarly, 8.6 million tons, or 54%, of the 16 million tons of imports were not processed or used here in Virginia, moving directly out of state by rail, truck, or barge. Moving these 45.5 million tons of goods to and from Virginia's borders directly involved an estimated 14,100 workers and generated $900 million in labor income. These non-Virginia connections of the Virginia maritime industry and Hampton Roads make Virginia a crossroads between other states and countries around the globe.

VIRGINIA-PRODUCED EXPORT IMPACTS

The Virginia economic impacts of transporting exports to the ports and activities to stow them aboard ship are included as part of the port operations impacts

discussed above. In this section we estimate the separate, additional impacts stemming from the portion of these exports that are made-in-Virginia. Total port shipments are reported in detail, but information on the origin and destination of the contents and the value of the goods inside containers is sparse, incomplete, and subject to revision. Based on U.S. Census Bureau international trade data, we estimate that Virginia businesses produced $14.9 billion in exports in FY 2022, as reported in Table 5. Table 1 reported the total maritime trade, exports and imports combined, by major product sectors through the ports of Virginia. Here we illustrate the role exports play in the Virginia economy. In Table 5, the first two columns give the tons and dollar values for Virginia maritime exports, totaling 49 million tons valued at $36 billion. The export total tonnage is 76% of overall trade, with imports only 24%. Ports' operations are based on handling and moving physical volume, tons, so these operations clearly are export dominated.

Table 5 - Virginia Maritime Exports FY 2022
Tons and Value by Major Sectors

	Total Exports		*Produced in Va*		*Va. Produced %*	*Total Exports*
NAICS Sectors & Description	***Tons (mil.)***	***Dollar Value ($ bil.)***	***Tons (mil.)***	***Dollar Value ($ bil.)***	***% Tons***	***% Dollars***
11 Agric., forestry & fishing products	**4.0**	**$ 4.2**	**2.5**	**$ 2.2**	**63**	**52**
21 Nonmetallic mining products	**32.1**	**$ 0.3**	**4.9**	**$ 0.1**	**15**	**33**
31 Food, bev., textiles, & apparel mfg.	**4.5**	**$ 5.0**	**1.8**	**$ 2.0**	**40**	**40**
32 Wood, paper, petro. & chem., plastics mfg.	**7.2**	**$ 15.2**	**2.9**	**$ 6.0**	**40**	**39**
33 Metal, machinery, electrical & electronics, transport eqpt. & furniture mfg.	**1.7**	**$ 10.6**	**0.5**	**$ 3.9**	**29**	**37**
91-99 Waste, scrap, used/spec classification goods	**0.2**	**$ 0.7**	**0.2**	**$ 0.7**	**100**	**100**
Total	**49.7**	**$ 36.0**	**12.8**	**$ 14.9**	**26**	**41**

In describing ports operations, we note that 36.9 million tons, equal to 74% of the 49.7 million tons exported by the Virginia maritime industry in FY 2022, were produced in another state or country. The Virginia direct economic impacts for these exports were the train, truck, barge, and ship transportation and handling to

move them across and out of Virginia, all of which are impacts included in ports operations, summarized in Table 4.

Overall exports clearly were primarily in NAICS 21, Nonmetallic Mining Products, with coal, brought to the Newport News coal terminals by CSX and the Norfolk terminal by Norfolk Southern. The other products in NAICS 21 include gypsum, limestone, building stone, and clay. However, most of the tonnage was not mined in Virginia. The Commonwealth's production was only 4.9 million tons, 15% of the total, with a value of roughly $100 million.

The NAICS 11 Sector, Agricultural, Forestry, and Fishing Products, contains predominantly grains (mainly wheat and corn), oilseeds (nearly all soybeans), and timber. The numbers for Virginia production may appear small. However, keep in mind that processed grains such as flour and oilseed products such as meal and oils are manufactured foods, and fresh meat and poultry are shipped frozen, all classified in the NAICS 31 manufacturing sector. Similarly, wood products and paper made here are manufactured exports in NAICS 32.

The smallest Virginia-made tonnage by sector is NAICS 33, but it has the highest dollar value per ton of all. This sector has high value per ton manufactured goods, from scientific instruments and electrical machinery to outdoor power tools and vehicles.

We estimate that Virginia private businesses produced 12.8 million tons of maritime exports worth $14.9 billion in FY 2022. The dollar values of Virginia production were modeled as the direct Virginia output impacts of maritime exports, yielding the economic impacts in Table 6.

Table 6 - FY 2022 Impacts of Virginia-Made Maritime Exports

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Income per Job*
Direct	**$ 14.9**	**$ 4.7**	**$ 3.0**	**41.0**	**$ 73,170**
Indirect	**$ 4.8**	**$ 2.6**	**$ 1.5**	**27.8**	**$ 53,957**
Induced	**$ 3.4**	**$ 2.0**	**$ 1.1**	**18.6**	**$ 38,462**
Total	**$ 23.1**	**$ 9.3**	**$ 5.6**	**87.4**	**$ 64,073**

Virginia businesses sold $14.9 billion of products to be delivered by water to other states and countries. The internal value-added within these companies was $4.7 billion, of which $3 billion was labor income. However, these exporting

companies also purchased $4.8 billion from other businesses, inputs used in production, of which $2.6 billion were made in Virginia, the *indirect* value-added in producing for export. The third Virginia impact is the households with members working in the export industries and their supporting firms spending their earnings, with $3.4 billion in direct purchases of goods and services, of which $2.0 billion was produced in Virginia. The cumulative total impact was $23.1 billion spent, with $9.3 billion produced within the borders of the Commonwealth. The total export-related labor income was $5.6 billion, supporting 87,400 jobs.

VIRGINIA-USED IMPORT IMPACTS

The tons and value of imports by NAICS sectors handled by Virginia maritime businesses were calculated from the same sources used for exports. Virginia ports received 16 million tons of imports with an estimated value of $67.6 billion. Columns 1 and 2 in Table 7 show the import tons and dollar values by the major industry sectors.

Table 7 - Virginia Maritime Imports FY 2022 Tons and Value by Major Sectors

NAICS Sectors & Description	*Total Imports*		*As Virginia Mfg. Inputs*		*% Total Imports to Va. Mfg.*	
	Tons (mil.)	*Dollar Value ($ bil.)*	*Tons (mil.)*	*Dollar Value ($ bil.)*	*% Tons*	*% Dollars*
11 Agric., forestry & fishing products	**0.3**	**$ 2.5**	**0.2**	**$ 1.5**	**67 %**	**60 %**
21 Nonmetallic mining products	**0.9**	**$ 0.2**	**0.2**	**$ 0**	**22**	**0**
31 Food, bev., textiles, & apparel mfg.	**3.0**	**$ 12.1**	**1.6**	**$ 5.6**	**43**	**40**
32 Wood, paper, petro. & chem., plastics mfg.	**7.3**	**$ 19.6**	**2.9**	**$ 7.8**	**40**	**40**
33 Metal, machinery, electrical & electronics, transport eqpt. & furniture mfg.	**4.4**	**$ 33.0**	**2.4**	**$ 18.0**	**55**	**55**
91-99 Waste, scrap, used/spec classification goods	**0.1**	**$ 0.2**	**0.1**	**$ 0.2**	**100**	**100**
Total	**16.0**	**$ 67.6**	**7.4**	**$ 33.1**	**46**	**49**

An estimated 54% of the import tons, 8.6 million tons costing $34.5 billion, pass directly through Virginia to other states. Their economic impact was included in the transportation component of ports operations. Our focus here is the separate impacts of Virginians' use in manufacturing, distribution, and consumption of 7.4 million tons, 46% of the imports, costing $33.1 billion. That $33.1 billion is not Virginia production, and does not directly create income and jobs here. However, as it moves through the supply chain to Virginia businesses, governments, and households who are final consumers, value is added by the Virginia manufacturers, wholesalers, distribution centers, and retailers in the chain. Virginia businesses profit from using these imports as inputs, creating a higher- value product for sale in Virginia and other states. Virginia consumers voluntarily pay for the value-added because it is worth it to them to satisfy their demands for these goods. Moving these imports through ports of Virginia instead of overland from other ports was a voluntary choice, demonstrating another channel through which the Virginia maritime industry is a source of economic value for Virginians.

The Virginia import use is quite different from the export production. With Virginia exports, the dollar value is the final price to the consumer. With imports, the $33.1 billion in import value is the purchase price of an input produced in other countries or states, an intermediate input for further processing by Virginia's manufacturers or a wholesale product for resale by Virginia retailers. The impact in Virginia is the value-added by Virginia businesses, equal to the final price minus intermediate input purchases from outside of Virginia such as the $33.1 billion imports costs. Therefore, to identify the Virginia economic impacts, we had to estimate the final sales value of the products in which the imports were used. The Bureau of Economic Analysis in the U.S. Department of Commerce publishes annual Gross-Domestic-Product-(GDP)-by-Industry Data for 97 industries, with 1) final output in current dollars, 2) the dollar amount of intermediate inputs such as energy, materials, and services purchased from other businesses, and 3) value-added within each industry.

From the industry information, intermediate inputs as a percent of industry GDP are calculated. Then, dividing that percentage into the dollar value of inputs yields the value of the industry's output. Viewing Virginia imports as part of the intermediate inputs used by Virginia businesses, a reasonable estimate is about 41 percent of the final Virginia output value. This means that the total import-based output price is about 2.5 times the value of the imported inputs, with additional spending inside Virginia of at least equal to 59 percent of total sales. With a 2.5 multiplier, the $33.1 billion of imported inputs in FY 2022 yields an estimated final import-based sales value of $81.2 billion. We report this $81.2 billion in Table 8 as the FY 2022 direct Virginia spending flow from Virginia use of the imports.

Table 8 - FY 2022 Impacts of Virginia-Used Maritime Imports

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Income per Job*
Direct	**$ 81.2**	**$ 37.2**	**$ 26.1**	**304.8**	**$ 85,630**
Indirect	**$ 25.5**	**$ 14.8**	**$ 9.7**	**114.5**	**$ 84,716**
Induced	**$ 25.1**	**$ 15.1**	**$ 7.8**	**138.4**	**$ 56,358**
Total	**$ 131.8**	**$ 67.1**	**$ 43.6**	**557.7**	**$ 78,178**

Virginia manufacturer, wholesaler, and retailer use of these imports directly generated Virginia Gross State Product of $37.2 billion, plus an additional $14.8 billion indirectly through B2B purchases of additional inputs from other Virginia businesses. Household spending of income earned in jobs at these businesses (*induced*) added an additional $15.1 billion in Virginia GSP. The full economic impacts are reported as the bottom line in Table 8. The $67.1 billion in Virginia Gross State Product, with $43.6 billion in labor income earned and 557,700 Virginia jobs supported, is a very large and underappreciated economic impact enabled by the Virginia maritime industry.

VIRGINIA PRIVATE SHIPBUILDING AND REPAIR IMPACTS

We use the same economic and IMPLAN methodology to produce our impact analysis of commercial shipbuilding and repair in Virginia. We chose all privately owned Virginia businesses in NAICS Sector 336611, Shipbuilding and Repairing, and the vast majority of those in NAICS Sector 488390, Other Support Activities for Water Transportation. We used a more company specific approach, one very accurate within a state but which would be very time-consuming and costly to apply to all 50 states. As state agency researchers, we can apply for and get access to Virginia employment data by months and quarters for all individual establishments in Virginia that provide data for the state unemployment insurance program, i.e., all with at least one payroll employee, with certain exceptions (such as railroads). Access requires agreement to, and application of, very detailed confidentiality terms regarding the uses of individual company data.

We acquired databases including every reporting Virginia establishment for the months and quarters in Fiscal Year 2022, from July 2021 through June 2022. We used this database and various directories and association membership lists, such as from the Virginia Maritime Association, and did a direct review of each potential company, some in person but most by telephone or review of their internet website, to select private business establishments directly engaged in the industry.

The establishments in NAICS 3366, Shipbuilding and Repair, exclude the Norfolk Naval Shipyard, a U.S. Navy facility in Portsmouth. Included is Newport News Shipbuilding, Hampton Road's largest employer, a private shipyard currently building for the U.S. Navy (but which has built large numbers of commercial ships in the past) and private companies (n=78) who actively participate in port operations and maintenance as well as ship and tug engine installation and repair that falls within NAICS Sector classification is 811310, Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance (n=84). Some companies repair ship engines not only here but even at sea, anywhere in the world. That means they are a worldwide exporter of services, as well as a provider in Virginia.

Table 9 - FY 2013 Impacts Virginia Shipbuilding & Repair

(Rounded numbers may not allow identical hand calculation of "Actual Income per Job")

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Actual Income per Job*
Direct	**$ 7.2**	**$ 3.3**	**$ 2.6**	**31.0**	**$ 82,776**
Indirect	**$ 2.5**	**$ 1.5**	**$ 1.0**	**15.5**	**$ 66,428**
Induced	**$ 2.7**	**$ 1.7**	**$ 1.0**	**21.4**	**$ 44,719**
Total	**$ 12.4**	**$ 6.5**	**$ 4.6**	**67.9**	**$ 67,073**

Table 9 repeats our Virginia direct, indirect, induced, and total FY 2013 economic impact numbers using our establishment-specific methodology and similar IMPLAN modeling. Table 10 shows our FY 2022 estimates. As with the FY 2013 estimates, our estimates still are conservative, because there certainly are some more ship repair companies we did not identify or could not verify.

Table 10 - FY 2022 Impacts Virginia Shipbuilding & Repair

(Rounded numbers may not allow identical hand calculation of "Actual Income per Job")

Impact Type	*Output ($ bil.)*	*Value Added, GSP ($ bil.)*	*Labor Income ($ bil.)*	*Employ-ment (thous.)*	*Actual Income per Job*
Direct	**$ 12.3**	**$ 5.6**	**$ 3.2**	**33.5**	**$ 96,606**
Indirect	**$ 6.0**	**$ 3.1**	**$ 1.9**	**25.5**	**$ 75,601**
Induced	**$ 3.7**	**$ 2.2**	**$ 1.1**	**20.0**	**$ 56,769**
Total	**$ 22.0**	**$ 10.9**	**$ 6.2**	**79.0**	**$ 78,498**

In sum, our shipbuilding and repair private industry impact analysis shows Virginia had at least 33,500 employees directly working in the industry, with ripple effects bringing the industry's total Virginia payroll employment impact to 79,000, with total labor income of $6.2 billion, generating $10.9 billion in Gross State Product. The labor income per direct job of $96,606 illustrates and confirms this industry is a high- paying one requiring skilled, experienced workers.

Our impact numbers, larger than estimated in the 2016 study[7] (FY 2013), also reinforce that the Virginia shipbuilding and repair industry is indeed a major industry in the state. As with the 2016 report, our impact numbers are only the impacts of annual operations, excluding the impacts of net new capital investment. This industry is a growing one, and a high fixed capital industry requiring substantial capital investment periodically to supply the growing demand. Therefore, its total economic impact is significantly more than just the operating impacts.

VIRGINIA MARITIME INDUSTRY TAX IMPACTS

The total Virginia maritime industry economic impact of $178.1 billion in spending for output generating $87.8 billion in Virginia Gross State Product, production of goods and services within Virginia's borders, produced a wide range of payments to state and local governments. The IMPLAN model used to estimate the Virginia economic impacts also captures the money flows from corporations, other enterprises, and households to Virginia state and local government. These flows are estimated based on state and local revenue data by dozens of revenue categories as reported in surveys such as the Census Bureau's Annual Survey of State and Local Government Finances. The Virginia revenue categories include general and selective sales taxes; business and personal property taxes; business and personal motor vehicle licenses; severance taxes; other state and local license taxes; non-taxes such as rents and royalties, special assessments, fines, and settlements; corporate profits taxes; personal income taxes; and institutional charges such for utilities and waste management.

We estimate that the FY 2022 Virginia maritime industry economic impacts generated $8.1 million in state and local tax revenue in Virginia from corporate and personal income tax payments, sales taxes, and property taxes. The dollar amounts in millions are reported in Table 11.

We have estimated revenue for the specific industries directly impacted by maritime-related activities. Our final Virginia state and local government estimated revenues produced by the total (direct, indirect, and induced) maritime-related FY 2022 economic impacts are $8.1 billion as shown in Table 11. The $8.1 billion is the sum of multiple types of tax and fee revenues, but the top three, local property taxes, personal and corporate income taxes, and sales taxes, accounted for $6.8

billion, or 84 percent of the total $8.1 billion. The largest state and local government revenue amounts by source, $6.2 billion, flow from Virginia businesses using the imports as inputs in producing their final goods and services.

Table 11 – Maritime-Related State and Local Taxes FY 2022

	Maritime Operations	*Exports Made in Virginia*	*Imports Used as Inputs in Virginia*	*Total Virginia State & Local Government Revenue*
(Revenue in Millions)	**$ 1,078**	**$ 813**	**$ 6,187**	**$ 8,078**
Value-added (GSP) Created in Millions	**$ 11,400**	**$ 9,300**	**$ 67,100**	**$ 87,800**
Revenue Percent of Value-added	**9.5%**	**8.8%**	**9.2%**	**9.2%**

We included maritime-generated value-added, the addition to Virginia Gross Domestic Product, to illustrate the relationship between port economic impacts and Virginia government revenue. Every dollar of maritime-related impact on Virginia GSP creates on average 9.2 cents of state and local government revenue.

VIRGINIA MARITIME INDUSTRY FROM FY 2013 TO FY 2022

While making slight adjustments in the approaches in the analysis between these periods (so comparisons are not equivalent and are not adjusted for inflation), changes in the Virginia maritime industry from FY 2013[7] to FY 2022 estimates are interesting:

- Skilled workers handling domestic & foreign cargo was up 54% with pay averaging over $121,000 for port operations workers.
- While export values were down 19% and export related jobs down even more, import values rose and produced more than 133,000 additional jobs – up 78% from 2013.
- Shipbuilding and repair billings increased by $5 billion while increasing jobs by 8%.
- Overall average income per job increased 51% from 2013 to 2022.
- Total impacts rose from $88.4 billion to $178.1 billion while revenue enhancements went from $2.7 billion. to $8.1 billion (up 200%) for state and local government.

CONCLUSION

Virginia ports tonnage and cargo values are growing because of the maritime industry's ability to see opportunity and innovate from the position of being a center of excellence. Because of this, Virginia has the potential to become a national leader in the emerging U.S. offshore wind industry. Virginia has both the natural resources, extensive ports infrastructure, robust companies, and enviable workers ready to do the job.

Concerns for the future include demand for services with reductions in the Navy fleet. There is about one-third of the number of vessels that were stationed here than the period between 1990-2000. The main channel is going to 55 feet but a lot of private terminals would like access on the branches of the Elizabeth River to be improved also. The maritime and freight transportation sectors are highly regulated, with additional regulations always under consideration, and communities often oppose actions needed to support the freight transportation and supply chains.

Finally, a sense that there are opportunities for growth permeates the industry. Further coordination among industry leaders, government officials, and the Port of Virginia along with the other Virginia maritime industry participants could continue to produce great economic benefits from investment in site development, infrastructure, warehousing, workforce strategies, and better use of our assets. The offshore wind initiative is a perfect example of building off of the region's assets which is expected to result in, "...$2 billion on direct and indirect economic impacts to the regions, and that is from the construction spent, increased in household earnings due to jobs created by the project and an increase in taxes paid."[8] The maritime industry has been a linchpin in allowing Virginia to be a successful pioneer with potential for generational economic impact.

APPENDIX A: BIOGRAPHICAL INFORMATION

K. Scott Swan, Ph.D. is a Professor of Marketing and Innovation at The College of William & Mary where he serves as Faculty Assembly President. He was a Fulbright Scholar serving as the 2015-2016 Kathryn and Craig Hall Distinguished Chair for Entrepreneurship in Central Europe. He has lectured internationally at Tsinghua University in Beijing; Aoyama Gakuin University in Tokyo; WHU in Koblenz, Germany; Corvinus University in Hungary; The Economics University in Bratislava, Hungary; the Vienna Economics University (WU); Management Center Innsbruck; and University of Applied Sciences Upper Austria in Wels. His doctorate is from the University of Texas at Austin.

He has also contributed to multiple economic impact studies for the Virginia Maritime Association, Virginia Port Authority, and Norfolk Redevelopment & Housing Authority, Union Mission, Governor's Report for Virginia's Housing Policy Advisory Board, and Jefferson Labs with the late Roy Pearson. Most recently he has worked with Mangum Economics. He is on the Editorial Review Board of *The Design Journal* and *The Journal of Product Innovation Management.* Professor Swan has worked in project management for Flour-Daniel, marketing management for Foremost Corporation of America, as well as founding several small businesses related to design.

Prof. Swan has published multiple books including *Global Marketing* (with Kate Gillespie - 5th Ed. Routledge, New York and London, 2022). *Innovation and Product Management: A Holistic and Practical Approach to Uncertainty Reduction* (with Kurt Gaubinger, Michael Rabi, and Thomas Werani - Springer Science & Business Media 2015), which has experienced over 70,000 chapter downloads.

APPENDIX B: BIBLIOGRAPHY

1. The Raymond A. Mason School of Business, College of William and Mary, "The Fiscal Year 2022 Virginia Economic Impacts of The Port of Virginia", April 26, 2023. https://www.portofvirginia.com/wp-content/uploads/2023/09/FY-2022-VIRGINIA-ECONOMIC-IMPACTS-042823-2.pdf
2. Hampton Roads Harbor Trade Overview, CY2022: https://wp.portofvirginia.com/wp-content/uploads/2023/07/2022-Trade-Overview.pdf
3. U.S. Census Bureau: https://usatrade.census.gov/.
4. Ibid.
5. The Economic Importance of the U.S. Private Shipbuilding and Repairing Industry, Maritime Administration (MARAD) March 30, 2021.
6. The Bureau of Ocean Energy Management (BOEM): https://www.boem.gov/renewable-energy/lease-and-grant-information.
7. FISCAL YEAR 2013 ECONOMIC IMPACTS OF VIRGINIA MARITIME INDUSTRY INTERNATIONAL AND DOMESTIC COMMERCE (February 9, 2016) Raymond A. Mason School of Business, William & Mary.
8. *Inside Business* (June 19, 2023, p.31) Offshore wind energy projects move forward.