

**THE FISCAL YEAR 2021 VIRGINIA  
ECONOMIC IMPACTS  
OF THE  
PORT OF VIRGINIA**

**January 18, 2022**



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# THE FISCAL YEAR 2021 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA

Prepared for  
**The Virginia Port Authority**

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## EXECUTIVE SUMMARY

### THE ECONOMIC IMPACTS OF THE PORT OF VIRGINIA ON THE COMMONWEALTH'S ECONOMY IN FY 2021

*Despite worldwide COVID effects and supply chain concerns, the Port of Virginia (POV) has offered stabilizing economic leadership (The Virginian-Pilot 12/21/21). Their robust capabilities, proactive technology implementation, and resilience planning have allowed them to manage an enviable flow through the port. The overall economic impacts are demonstrated through job and pay growth with imports being the major driver. Specifically, the Virginia economic impacts of the Port of Virginia in fiscal year 2021 include:*

- **\$100.1 BILLION IN OUTPUT SALES;**
- **\$47.4 BILLION IN VIRGINIA GROSS STATE PRODUCT;**
- **\$27.2 BILLION IN VIRGINIA LABOR INCOME;**
- **436,667 FULL- AND PART-TIME JOBS; AND**
- **\$2.7 BILLION IN STATE AND LOCAL TAXES AND FEES.**

The Port of Virginia is the global maritime gateway for the Commonwealth's import and export of freight. Three sources of impacts are exhibited:

- flow from moving freight;
- exporting Virginia-made goods; and
- importing goods to be finished, assembled and delivered to users inside Virginia and beyond.

Eighty-five percent of the fiscal year 2021 Virginia output, 85 percent of Gross State Product (value-added), 84 percent of labor income, and 83 percent of employment impacts flowed from businesses in Virginia using imports as intermediate inputs in providing consumers here and elsewhere with finished goods.

*Comparing POV fiscal year 2021 levels to FY 2018 estimates:*

- **FY 2021 CARGO TONNAGE WAS UP 6.0 PERCENT;**
- **FY 2021 OUTPUT SALES WERE UP 8.7 PERCENT;**
- **FY 2021 VIRGINIA GROSS STATE PRODUCT WAS UP 20.6 PERCENT;**
- **FY 2021 VIRGINIA LABOR INCOME WAS UP 17.8 PERCENT;**
- **FY 2021 FULL- AND PART-TIME JOBS WERE UP 10.0 PERCENT; AND**
- **FY 2021 STATE AND LOCAL TAXES AND FEES WERE UP 28.6 PERCENT.**

In fact, every dollar of POV-related impact on Virginia GSP creates on average 5.8 cents of state and local revenue – again, producing \$2.7 billion.

# THE FISCAL YEAR 2021 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA

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# THE FISCAL YEAR 2021 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA

## INTRODUCTION

**“Supply-Chain Mess Threatens Holiday Sales, From Hot Sauce to Board Games  
Manufacturers face backlogged ports, scarce materials and components, worker shortages”**  
(Wall Street Journal Dec. 19, 2021)

**This is not a problem in Virginia.** The Port of Virginia (POV) from 2018 to 2021 has been a positive, stabilizing influence in Virginia (The Virginian-Pilot & Daily Press Editorial Board 12-21-2021). The numbers offered in this report strongly support the POV’s economic leadership despite upheavals in the global landscape. The value of Virginia-made exports are up seven percent while the value of Virginia-used imports increased 12 percent during the last three years. Virginia has benefited greatly through jobs and pay growth led by the POV economic impacts. This was despite COVID-19’s negative effect on Virginia employment. Supply chain fears for the holidays (The Hill Dec. 21, 2021) and poor performance especially of West Coast ports, did not materialize at the POV – in fact, the traffic fluidity was admirable. As a result, direct export-related jobs were up 28 percent and direct import-related jobs were up 9 percent. Every dollar of POV-related impact on Virginia GSP creates on average 5.8 cents of state and local revenue – the equivalent of \$2.7 billion.

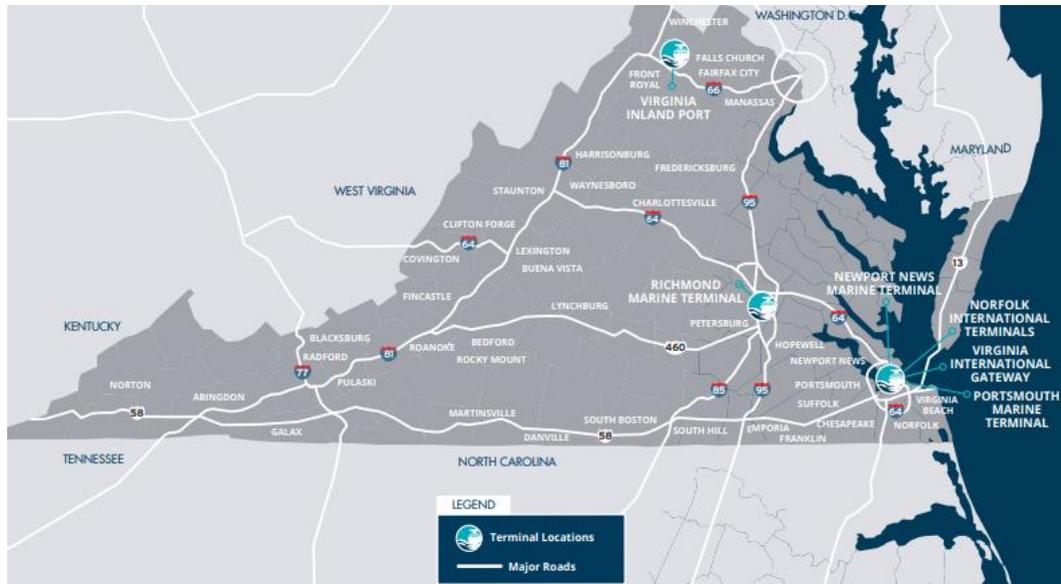
The Virginia Port Authority, a division of the Commonwealth of Virginia, commissioned the Raymond A. Mason School of Business to assess the Fiscal Year (FY) 2021 economic and fiscal impacts of the Port of Virginia (POV) operations at its owned and leased terminals in Virginia.<sup>1</sup> The Port of Virginia owns and operates: the Norfolk International Terminals (NIT), the Portsmouth Marine Terminal (PMT), the Newport News Marine Terminal (NNMT), and the Virginia Inland Port (VIP) — an intermodal facility in Front Royal, Virginia with rail connection to NIT. The POV operates the Virginia International Gateway Terminal (VIG) in Portsmouth along with the Richmond Marine Terminal (RMT) serviced by barge.

These terminals are Virginia’s gateway to the world for deep-sea transport, with 99.8 percent of the tonnage shipped in containers and only two-tenths of one percent in breakbulk. The POV does not transport bulk cargo such as coal. POV operations are a major driver of the Virginia economy through three major channels:

- 1) moving exports and imports within Virginia,
- 2) exporting goods made in Virginia, and
- 3) Virginia businesses using imported goods as inputs.

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<sup>1</sup> In the two previous studies that the Raymond A. Mason School of Business conducted of the economic and fiscal impacts of the Port of Virginia's (POV) operations for FY 2018 and FY 2013, the empirical portion of the analysis was produced by Roy Pearson, Chancellor Professor of Business, Emeritus. After a long and distinguished career as a member of the William and Mary faculty that began in 1971, Dr. Pearson sadly passed away in August of 2020. As a result, for this analysis of the FY 2021 economic and fiscal impacts of POV operations the Raymond A. Mason School of Business partnered with Mangum Economics, a Glen Allen, Virginia based firm to provide the empirical analysis. The method used to perform that analysis faithfully follows the study design created by Dr. Pearson for the FY 2013 and FY 2018 analyses, which facilitates temporal comparisons across the three studies.



The Virginia impacts of this POV-based value chain are reported in Table 1. The FY 2021 amounts and percent distributions of the total impacts for the three impact types show the Virginia users of POV imports create over 83 percent of the POV Virginia economic impacts. In the following sections we will be describing in detail each of the three components of the value chain.

<i>Table 1</i> <b>POV-based Virginia Impacts</b> (\$ in millions)	<b>Output Purchases</b>	<b>Value -added Income (GSP)</b>	<b>Labor</b>	<b>Employ- ment</b>
<b>POV Cargo- moving Impacts</b>	<b>\$5,385.7</b>	<b>\$2,905.1</b>	<b>\$2,061.1</b>	<b>32,424</b>
<b>Percent of Total Virginia-made</b>	<b>5.4%</b>	<b>6.1%</b>	<b>7.6%</b>	<b>7.4%</b>
<b>Exports Impacts</b>	<b>\$10,112.8</b>	<b>\$4,023.8</b>	<b>\$2,173.7</b>	<b>41,071</b>
<b>Percent of Total Virginia-used</b>	<b>10.1%</b>	<b>8.4%</b>	<b>8.0%</b>	<b>9.4%</b>
<b>Imports Impacts</b>	<b>\$84,613.6</b>	<b>\$40,473.7</b>	<b>\$22,915.6</b>	<b>363,172</b>
<b>Percent of Total</b>	<b>84.5%</b>	<b>85.4%</b>	<b>84.4%</b>	<b>83.2%</b>
	<b>\$100,112.1</b>	<b>\$47,402.6</b>	<b>\$27,150.4</b>	<b>436,667</b>

Moving the exports and imports centers on the POV loading and unloading deep-sea vessels at its Norfolk Harbor terminals, loading exports delivered to the terminals from all 50 states, D.C. and Canada and unloading imports from around the world destined for all 50 states and D.C. This is facilitated by semi-automated stacking cranes, two Class I railroads operating on dock (34% of cargo arrives and departs the port by rail provide double-stack rail to the Midwest; an impressive interstate network supported with an inland port; barge service to Richmond; and access to 75% of the U.S. population within a two-day drive.

Exports made in Virginia have a separate, additional Virginia economic impact. Overseas demand for these goods drives this production. However, the availability of an exceptional deep-water port (50' channel and dredging to a unique 55-foot channel depth by 2024), able to handle a variety of container exports through 30 international shipping line services direct to more than 45+ foreign ports, provides global market access for Virginia businesses with 2.5 hours to open sea. While the production of Virginia-made exports is a major economic contribution facilitated by Port of Virginia operations, imports of materials, components, parts, and end-products are the dominant value-added source.

Over 40 percent of the imports that move through the Port of Virginia are used as inputs by Virginia businesses - inputs to produce goods for sale in Virginia and across the nation. These imports are inputs into 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 in production by Virginia businesses, the margins earned in the supply chain here, are income, creating Virginia payroll, taxes, and jobs. This economic impact generated by the port operations needs recognition as a major source of Virginia output of goods and services.

Impacts are reported here by four measures: output (or sales of goods and services); value added (the regional production of goods and services – the Virginia Gross State Product, equivalent to the national Gross Domestic Product); labor income (including benefits and proprietors' income) and employment. These measures are displayed in tables throughout this report and interpretation is discussed.

Output is the dollar demand for current output of the goods or services, a broad measure of business activity and taxable flows. However, the dollar sales include not only the seller's internal costs and profit but also cover the seller's purchase of intermediate inputs from other businesses, such as electricity, fuel, and insurance, double counting that output of others.

Value-added internally by the selling enterprise, omitting the value of intermediate inputs purchased from other companies, is the seller's direct contribution to Virginia's Gross State Product and the direct source for local income and jobs. Summing Value Added to obtain unique national measures of current output of goods and services is the method used worldwide to calculate Gross Domestic Product: the POV-related value-added.

Labor income consists of wages and salaries, benefits, and sole proprietors' income. Labor income is the largest component of Virginia's Gross State Product.

Employment uses the Bureau of Labor Statistics definition of full-time and part-time employees and self-employed persons, so is consistent with the labor income series.

## PORT OPERATIONS

The Port of Virginia (POV) operations here include the Virginia Port Authority, and its private operating unit, Virginia International Terminals. The POV terminals included when referring to the port operations are the deep-water Norfolk International Terminals, Newport News Marine Terminal, the Virginia International Gateway Terminal, and Portsmouth Marine Terminal, plus the two satellite terminals, the Richmond Marine Terminal (RMT) and the Virginia Inland Port (VIP), an intermodal facility in Front Royal.

Port of Virginia first priority was physically transferring freight between the 1,538 container and breakbulk deep-sea vessels and the terminal docks. We report here on the tons moved and the containers handled, measured in TEUs (Twenty-foot Equivalent Units). TEUs are the standard unit for describing containers handled by the port, although the predominant container size is 40 feet in length. The port generally gets paid by container and not the value enclosed within the container.

The port moves containers in response to shippers' needs, whether the containers are loaded or empty. However, the weight of empty TEUs is not included in the container tons moved.

The POV terminals also handle breakbulk cargo which is included in the total tonnage, but the FY 2021 breakbulk tons were only 0.2 percent of the total tons moved. Breakbulk can be assumed to be in the total impact results without expressly identifying it in the text or tables.

The tonnage and TEU movement are given in Table 2. Moving 23.4 million tons is 46,800,000,000 pounds or, stated differently, moving 2,564,384 fifty-pound bags per day, or 106,849 bags per hour...

around the clock. Of course, this is only feasible with stevedores using the port's cargo handling equipment, automation abilities, and computer technology.

Note that the POV loaded export and import container tonnage were roughly equal: 50 percent of the loaded total each. Therefore, export and import cargo transportation impacts within Virginia's borders were roughly equal. The differences in overall export and import economic impacts arise from how much of the export production in the loaded containers is made in Virginia versus how much of the imported goods value is used as intermediate inputs by Virginia companies.

All of the POV tonnage and TEUs passed through the POV deep-water terminals. However, a portion of the container import cargo was shipped onto the Richmond Marine Terminal by rail, truck, and barge, and an even larger portion was sent by rail and truck to the Virginia Inland Port. The Richmond Marine Terminal 560,947 tonnage was only 2.3 percent of the total POV tonnage but served a valuable function in moving exports from and imports to Richmond area international trade customers. The tonnage and TEU volume

<b>Table 2</b>			
<b>Port of Virginia Freight Moved, Tons and TEUs</b>		<b>Tons</b>	<b>TEUs</b>
<b>Containers</b>			
<b>Loaded</b>			
	<b>Exports</b>	<b>11,378,862</b>	<b>1,016,040</b>
	<b>Imports</b>	<b><u>12,009,707</u></b>	<b><u>1,520,647</u></b>
	<b>Total Loaded</b>	<b><u>23,388,569</u></b>	<b><u>2,536,687</u></b>
<b>Empty</b>			
	<b>Exports</b>		<b>663,474</b>
	<b>Imports</b>		<b><u>20,840</u></b>
	<b>Total Empties</b>		<b><u>684,314</u></b>
	<b>Total</b>	<b><u>23,388,569</u></b>	<b><u>3,221,001</u></b>
<b>Breakbulk</b>			
	<b>Exports</b>	<b>10,949</b>	
	<b>Imports</b>	<b><u>43,794</u></b>	
	<b>Total Breakbulk</b>	<b><u>54,743</u></b>	
<b>FY 2021 Tonnage Moved</b>		<b>23,443,312</b>	

moved to and from the Virginia Inland Port not only has been a valuable service for the growing number of Virginia international trade customers in Northwest Virginia but also created Virginia distribution centers (DCs) sending goods to other states, especially in the Midwest and Mid-Atlantic...by some estimates up to 90% of trucks leaving these DCs are bound for out-of-state destinations.

<b>Table 3</b>				
<b>Port of Virginia Containers Moved to Satellite Ports</b>	<b>Richmond Marine Terminal</b>		<b>Virginia Inland Port</b>	
	<b>Tons</b>	<b>TEUs</b>	<b>Tons</b>	<b>TEUs</b>
<b>Loaded</b>				
<b>Exports</b>	<b>216,103</b>	<b>16,165</b>	<b>61,452</b>	<b>5,265</b>
<b>Imports</b>	<b>344,844</b>	<b>41,518</b>	<b>180,560</b>	<b>31,178</b>
<b>Total Loaded</b>	<b>560,947</b>	<b>57,683</b>	<b>242,012</b>	<b>36,443</b>
<b>Empty</b>				
<b>Exports</b>		<b>25,881</b>		<b>25,750</b>
<b>Imports</b>		<b>53</b>		<b>121</b>
<b>Total</b>		<b>25,934</b>		<b>25,871</b>
<b>Empties</b>				
<b>Total Moved</b>	<b>560,947</b>	<b>83,617</b>	<b>242,012</b>	<b>62,314</b>

The POV port operations involve more than personnel running terminals and stevedores loading and unloading the cargo. It includes the pilots and tugboat services bringing the ships into port and docking them, companies providing ship services, maintenance, and repair, along with warehousing and storage companies consolidating and storing cargo before moving it to ships or inland. These **port and harbor operations** created a direct \$1,080.8 million demand for output of goods and services, as shown in Table 4. **Freight arrangement and other transportation support** includes a broad and diverse range of services, such as freight forwarders who arrange the transportation and warehousing, customs house brokers who assure freight is properly categorized, along with a variety of enterprises providing other support services (e.g., insurance, inspection, and security) and delivering \$466.4 million in output of goods and services.

The largest private-enterprise port-related services were an estimated \$1,234.4 million for **land and barge transportation** of the exports and imports within the borders of Virginia. Gross State Product is output and income produced within a state's borders, so transportation services moving POV exports and imports in other states would be counted as output and income in these other states, even if provided by Virginia companies. The land and barge transportation of Port of Virginia cargo in FY 2021 was 63 percent by truck, 33 percent by rail, and 4 percent by barge, at an estimated direct cost of \$1,234.4 million, as reported in Table 4.

<b>Table 4</b> <b>POV-related Port Direct</b> <b>Impacts (\$ in millions)</b>	<b>Output</b> <b>Purchases</b>	<b>Value</b> <b>Added</b> <b>(GSP)</b>	<b>Labor</b> <b>Income</b>	<b>Employ-</b> <b>ment</b>
<b>Ship &amp; harbor operations,</b> <b>vessel (un)loading</b>	<b>\$1,080.8</b>	<b>\$575.1</b>	<b>\$494.2</b>	<b>6,694</b>
<b>Freight arrangement &amp; other</b> <b>transportation support</b>	<b>\$466.4</b>	<b>\$234.1</b>	<b>\$213.1</b>	<b>2,991</b>
<b>Land &amp; barge transportation</b>	<b>\$1,234.4</b>	<b>\$601.3</b>	<b>\$474.0</b>	<b>7,179</b>
<b>Total Direct Impacts</b>	<b>\$2,781.6</b>	<b>\$1,410.5</b>	<b>\$1,181.3</b>	<b>16,864</b>

The direct output, value added, and employment impacts of Port of Virginia operations in Table 4 give rise to two other streams: the indirect and induced impacts, and the total impacts are the sum of the direct, indirect, and induced impacts as reported in Table 5. Indirect impacts are the business-to-business (B2B) flows created by direct output demand, value-added, compensation, and jobs.

<b>Table 5</b> <b>POV Cargo-Moving</b> <b>Virginia Impacts</b> <b>(\$ millions)</b>	<b>Output</b> <b>Purchases</b>	<b>Value</b> <b>Added</b> <b>(GSP)</b>	<b>Labor</b> <b>Income</b>	<b>Employ-</b> <b>ment</b>
<b>Direct Impact</b>	<b>\$2,781.6</b>	<b>\$1,410.4</b>	<b>\$1,181.2</b>	<b>16,863</b>
<b>Indirect Impact</b>	<b>\$1,377.8</b>	<b>\$766.0</b>	<b>\$506.0</b>	<b>8,179</b>
<b>Induced Impact</b>	<b>\$1,226.2</b>	<b>\$728.6</b>	<b>\$373.9</b>	<b>7,381</b>
<b>Total Impacts</b>	<b>\$5,385.6</b>	<b>\$2,905.0</b>	<b>\$2,061.1</b>	<b>32,423</b>

The output shown as a Virginia indirect impact in Table 5 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 cleaning, accounting, legal, and medical services. The output, labor income, and employment created by this B2B spending are an indirect impact, caused by and dependent upon the initial Port of Virginia operations-related demand for goods and services (i.e., the direct impact).

There also is a third impact stream that is labelled an induced impact. This is created as the income earned by households and businesses is spent in the process of meeting the direct and indirect demands, primarily for household consumption along with taxes paid to state and local governments being spent to provide public services and infrastructure. The induced impact is very real and predictable. Households spend most of their income, similar to the way state and local governments spend the taxes they receive.

Despite the negative effects of COVID-19 on the economy and employment, the total port-related spending to handle and move POV exports and imports in Virginia in FY 2021 was \$5,385.7 million, creating Virginia Gross State Product (GSP) of \$2,905.1 million, of which \$2,061.1 million went for labor income for 32,424 workers.

## EXPORTS MADE IN VIRGINIA

The Virginia economic impacts of transporting exports arriving at ports and on their way 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 Port of Virginia shipment data, interviews, and U.S. Census Bureau international trade state and port monthly export data by commodity, we estimate that Virginia businesses produced \$6,864.7 million in containerized exports in FY 2021, as reported in Table 6.

In our previous impact study, *THE FISCAL YEAR 2018 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA*, released in November 2019, we concluded that FY 2018 POV exports included \$6,419.3 million in Virginia-made goods. Our FY 2021 estimate is that POV exports included \$6,864.6 million in Virginia-made goods – a 6.9 percent increase over FY 2018. The FY 2021 and FY 2018 totals are directly comparable because we use the same estimation methodology in both studies. For the exports (and imports), we only used the foreign trade value and tons data reported by months on USA Trade Online (at <https://usatrade.census.gov/index.php>), a dynamic database subject to updates and revisions over time, in addition to POV data and user interviews.

<b>Table 6</b>	<b>FY 2021</b>	<b>FY 2018</b>
<b>Virginia-Made Exports, Value by Major Sectors</b>	<b>Dollar Value (\$ mill.)</b>	<b>Dollar Value (\$ mill.)</b>
<b>11 Agric., forestry, &amp; fishing products</b>	<b>\$825.4</b>	<b>\$619.4</b>
<b>21 Nonmetallic mining products</b>	<b>\$624.4</b>	<b>\$341.0</b>
<b>31 Food, bev., textiles, &amp; apparel mfg.</b>	<b>\$1,379.1</b>	<b>\$973.8</b>
<b>32 Wood, paper, chem., plastics mfg.</b>	<b>\$2,113.3</b>	<b>\$2,442.6</b>
<b>33 Metal, machin., electronics, transpt. &amp; furniture mfg.</b>	<b>\$1,655.8</b>	<b>\$1,732.2</b>
<b>90s Waste, scrap, used/spec classif. goods</b>	<b>\$266.6</b>	<b>\$310.4</b>
<b>Total Exports</b>	<b>\$6,864.6</b>	<b>\$6,419.4</b>

The fiscal year comparisons in Table 6 do serve to illustrate the shifts over time in the mix of export products grown, processed, or manufactured by businesses here in the Commonwealth. The types of Virginia export goods are reported by NAICS two-digit codes. NAICS Group 11 is the production of crops and animals, along with the harvest of timber and seafood, including aquaculture. Group 21 includes coal and petroleum products as well as ores and minerals. Processed foods, including canned, dried, packaged and frozen, are in the NAICS Code 31 manufacturing group. Processed wood and paper products and chemicals are in NAICS manufacturing Group 32. Group 33, with machinery, transportation equipment and electronics, has a high percentage of finished durable goods products.

The \$6.5 billion in international export products sold in FY 2021 by Virginia businesses was a direct economic output impact. These exporting businesses buy inputs and supplies from other Virginia businesses, thus creating a very large FY 2021 indirect output impact of \$2.4 billion. The employees of exporting businesses and their suppliers live in Virginia, spending most of their earnings here, yielding an additional \$1.3 billion induced impact. The direct export sales of \$6.5 billion generated a cumulative total of \$10.1 billion in business purchases being spent in Virginia, as shown in Table 7. The sum of the direct, indirect, and induced Virginia value-added, or GSP, is \$4.0 billion. This Virginia value-added included \$2.2 billion in Virginia labor income for 41,071 employees.

	Output Added (GSP)	Value Income	Labor Purchases	Employ- ment
<b>Direct Impact</b>	<b>\$6,451.4</b>	<b>\$2,051.7</b>	<b>\$1,057.6</b>	<b>20,465</b>
<b>Indirect Impact</b>	<b>\$2,377.4</b>	<b>\$1,208.9</b>	<b>\$737.3</b>	<b>12,884</b>
<b>Induced Impact</b>	<b>\$1,284.0</b>	<b>\$763.1</b>	<b>\$378.8</b>	<b>7,722</b>
<b>Total Impacts</b>	<b>\$10,112.8</b>	<b>\$4,023.8</b>	<b>\$2,173.7</b>	<b>41,071</b>

## **IMPORTS USED AS INPUTS IN VIRGINIA**

The Port of Virginia handled 12 million tons of containerized imports worth an estimated \$52 billion. Nearly 60 percent of these imports, by tonnage and value, went to destinations outside of Virginia. As with exports, the Virginia economic impacts of getting these goods unloaded and across Virginia are included as part of the \$5.4 billion port operations impacts already discussed.

Our focus here is the FY 2021 separate, additional impacts of Virginians' use and purchase of over 42 percent of these imports, \$21.7 billion worth in Table 8. That amount is not Virginia production, an expense not income. Importantly, as it moves through the supply chain to Virginia businesses and households, value is added by the manufacturers, wholesalers, warehousing companies, and retailers in the chain who use these imports as

inputs in producing their products and services. The final sales prices to customers in Virginia or in other states average about 2.6 times the import input costs.

The POV operations do not create these final demands; they instead serve as the means to satisfy them efficiently, at a profit for Virginia businesses.

The types of Virginia-used import goods are reported in Table 8 by NAICS two-digit codes, with our FY 2021 estimates and the FY 2018 values for comparison. The largest sector by value in both years is NAICS Code Group 33: Machinery, Electronics, and Furniture, with FY 2021 imports valued at \$10.9 billion and nearly \$10.1 billion in FY 2018. All NAICS groups, except the 90s (containing waste, scrap, and used materials), experienced high growth rates over the three-year period, with an overall growth in value of 11.9 percent.

With Virginia exports, the dollar value is the final price of Virginia output. The use of Virginia imports is quite different from export production. The Virginia imports are inputs for different types of durable goods manufacturers (e.g., Stihl), nondurable goods producers

(e.g., International Paper, WestRock), wholesalers (e.g., BJs, Costco), and retailers (e.g., Family Dollar, Home Depot, Kohl, Lenox, Lowes, Target, Walmart).

With imports, the \$21.7 billion in businesses' cost of FY 2021 imports used in the Commonwealth is Virginia inputs, further processing by Virginia's manufacturers, wholesalers, and retailers. The impact in Virginia is the value-added by Virginia businesses, equal to the final price minus the import input purchases.

Therefore, to identify the Virginia economic impacts, we had to estimate the final sales value of the imports in the products sold to the ultimate consumers. 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 final output in current dollars, consisting of the value-added within each industry and the dollar amount of intermediate inputs they purchased from other businesses. From the industry information, intermediate inputs as a percent of industry GDP are calculated. Then, dividing that percent into the dollar value of inputs yields the value of the industry's output.

<b>Table 8</b>	<b>FY 2021</b>	<b>FY 2018</b>
<b>Virginia-used</b>	<b>Dollar Value</b>	<b>Dollar Value</b>
<b>Imports, Value by</b>	<b>(\$ mill.)</b>	<b>(\$ mill.)</b>
<b>Major Sectors</b>		
<b>11 Agric., forestry &amp; fishing products</b>	<b>\$1,143.7</b>	<b>\$1,414.7</b>
<b>21 Nonmetallic mining products</b>	<b>\$17.1</b>	<b>\$11.5</b>
<b>31 Food, bev., textiles, &amp; apparel mfg.</b>	<b>\$4,101.5</b>	<b>\$2,965.1</b>
<b>32 Wood, paper, chem., plastics mfg.</b>	<b>\$5,418.2</b>	<b>\$4,757.7</b>
<b>33 Metal, machinery, electronics, transport &amp; furniture mfg.</b>	<b>\$10,902.8</b>	<b>\$10,090.5</b>
<b>90s Waste, scrap, used/spec classification goods</b>	<b>\$147.5</b>	<b>\$156.3</b>
<b>Total Imports</b>	<b>\$21,730.8</b>	<b>\$19,395.8</b>

Viewing Virginia imports as part of the intermediate inputs used by Virginia businesses, a conservative estimate is they average less than 40 percent of the final Virginia output value. What this means is the total import-based output price is at least 2.5 times the value of the imported inputs (2.5X multiplier), with additional spending inside Virginia at least equal to 60 percent of total sales. With a 2.5X multiplier, the \$21.5 billion of imported inputs in FY 2021 yields an estimated final import-based sales value of \$53.6 billion. We report this \$53.6 billion in Table 9 as the FY 2021 *direct* Virginia spending flow from Virginia use of the imports.

<b>Table 9 Virginia-Used Imports (\$ in millions)</b>	<b>Output Purchases</b>	<b>Value Added (GSP)</b>	<b>Labor Income</b>	<b>Employ- ment</b>
<b>Direct Impact</b>	<b>\$53,622.5</b>	<b>\$23,221.3</b>	<b>\$13,378.0</b>	<b>198,901</b>
<b>Indirect Impact</b>	<b>\$17,418.5</b>	<b>\$9,187.1</b>	<b>\$5,399.9</b>	<b>82,579</b>
<b>Induced Impact</b>	<b>\$13,572.6</b>	<b>\$8,065.3</b>	<b>\$4,137.7</b>	<b>81,692</b>
<b>Total Impacts</b>	<b>\$84,613.6</b>	<b>\$40,473.7</b>	<b>\$22,915.6</b>	<b>363,172</b>

Virginia manufacturers, producers, wholesalers, and retailers creating those sales generated Virginia value-added of \$23.2 billion (58 percent of which went for labor income) and made purchases from other Virginia businesses, an indirect output demand of \$17.4 billion. The full FY 2018 economic impacts are reported on the bottom line in Table 9. The \$84.6 billion in output purchases, creating \$40.5 billion in Virginia Gross State Product, with \$22.9 billion in labor income earned by 363,172 Virginia workers is a very large and often underappreciated economic impact related to the POV operations.

There are no online data for estimating how much of the \$53.6 billion in direct import-generated Virginia sales in FY 2021 were to Virginia consumers. However, comparing data for national imports of goods (excluding services) with the use of goods reported by type in the Gross Domestic Product accounts gives us a rough estimate that between 45 and 60 percent of the \$53.6 billion in output was bought by Virginia consumers, or \$24 billion to \$32 billion. If so, then Virginia output not consumed here is \$22 billion to \$30 billion sold by Virginia manufacturers, distribution centers, and retailers to customers in other states. This Virginia output is Commonwealth domestic exports, creating POV import-related income and jobs in Virginia.

## **EXPORTS/IMPORTS DEEP DIVE and TRENDS**

There are changes across the last three years that reveal interesting stories. On one hand, while direct export-related jobs were up 27.7 percent, there was a decline in Pay & Benefits per direct export job. In 2018, the average pay and benefits was \$56,610 but dropped to \$51,678 in 2021. Further, Direct Output per Direct Job (a measure of productivity) related to exporting went from \$400,480 in 2018 to \$315,241 in 2021. If the industry mix was the same across time, this would be more concerning. But in examining the underlying commodities, pay and productivity are aligned within each industry. These three years saw a major shift in the mix of industries exporting: raw materials industries (with relatively lower margins, pay, and productivity) were up and value-added manufacturing and assembly were down.

On the other hand, direct import-related jobs were up 8.9 percent – but with a much larger base. The direct Pay & Benefits per direct job is significantly up from \$59,215 in 2018 to \$67,260 in 2021. Further, Direct Output per Direct Job related to importing has increased slightly from \$265,548 in 2018 to \$269,594 in 2021. With both import-related pay/job and productivity increases in the past three years, we see very minor shifts in the commodity mix. This offers evidence that those positive outcomes are real within industry trends over time.

Both Richmond and Front Royal numbers are down from the 2018 study. While a small volume compared to the total port activity, it is an important service to their increasing number of customers. The Winchester area that includes Front Royal is one of the fastest growing in Virginia. Subsequently, this volume is likely to be temporary because it is being driven by short-term paucity of containers in Asia along with concomitant demand. This has both raised the price of containers as well as the price of shipping – as much as 10 times previous rates. Speed-to-export (even empties) is a distorting effect on the market so containers can be sent to Asia and returned as imports (raising profits for shipping companies). This is driving behavior by the shipping companies to emphasize the returns of containers directly to the port of debarkation instead of returning them through the more customer convenient ports in Richmond (RMT) and the Virginia Inland Port at Front Royal (VIP).

## **PORT OF VIRGINIA IMPACT RECAP**

The total FY 2021 Virginia impacts attributable to the Port of Virginia were reported by type and category in Table 1, summing to \$100.1 billion in output, creating \$47.4 billion in Gross State Product within Virginia's borders, of which \$27.2 billion was labor income earned by 436,667 employees and proprietors. These total impacts are repeated as the first row of Table 10. It should be emphasized that any commodities included here have moved in containers (bulk commodities are not included).

To further unpack these total impacts, we report the tons moved to and from Norfolk Harbor to the two POV satellite ports, the Richmond Marine Terminal (RMT) and the Virginia Inland Port (VIP). The economic value of these two ports goes far beyond just moving containers. At each port, Virginia businesses produce export goods loaded into outgoing containers and receive and use imported goods as inputs in processing, making, and distributing value-added products to their final users. The total (i.e., direct, indirect, and induced) economic impacts of exports made and imports used by RMT users and VIP users

are included in the POV all-ports impacts in Table 10. However, we can estimate separately each port’s contribution to the all-ports totals.

For the Richmond Marine Terminal, our analysis indicates a contribution of \$2.6 billion in output purchases, of which \$1.2 billion was Virginia value-added, funding \$700 million in labor income for over 11,000 workers. This contribution accounts for nearly 3 percent of the total POV Virginia impacts, as shown in Table 10. The RMT impact contribution is predominantly created by RMT customers using imported goods as inputs in processing, making, and distributing their products: import use accounted for 93 percent of the RMT value added, labor income, and employment impact contributions.

<b>POV Total Impacts and Satellite Ports Contributions (\$ in millions)</b>	<b>Output</b>	<b>Value- added Purchases (GSP)</b>	<b>Labor Income</b>	<b>Employ- ment</b>
<b>POV All-ports Impacts</b>	<b>\$100,112.1</b>	<b>\$47,402.6</b>	<b>\$27,150.4</b>	<b>436,667</b>
Percent of Total	100.0%	100.0%	100.0%	100.0%
<b>Richmond Marine Terminal Impacts Contribution</b>	<b>\$2,584.3</b>	<b>\$1,222.1</b>	<b>\$692.1</b>	<b>11,092</b>
Percent of Total	2.6%	2.6%	2.5%	2.5%
<b>Virginia Inland Port Impacts Contribution</b>	<b>\$1,341.4</b>	<b>\$639.0</b>	<b>\$361.7</b>	<b>5,742</b>
Percent of Total	1.3%	1.3%	1.3%	1.3%

Our estimate of the Virginia Inland Port FY 2021 economic impact contribution is \$1.3 billion in output, over \$600 million in Virginia value-added (GSP), with over \$360 million in labor income earned by almost 6,000 workers, accounting for about 1.3 percent of the total POV impacts. VIP is almost exclusively an import-use center, generating 95 percent of its value added, labor income, and employment contribution. VIP exports are largely produced outside of Virginia, so the made-in-Virginia export contribution is small compared to its import-use impacts. For example, Nature’s Touch Frozen Foods announced in November 2021 that it plans to invest over \$40 million across the street from VIP. It plans to create 67 new jobs and move up to 45 million pounds of fruit through the terminals. As discussed earlier, the distorting effect of shipping companies’ requirement for their containers to be returned faster, even empty, to the ships is clearly seen in the relative emphasis of imports versus exports.

## **STATE AND LOCAL GOVERNMENT REVENUE IMPACTS**

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.

<b>Table 11</b>				
<b>POV-based Virginia Government Revenue Impacts</b>	<b>Port Operations</b>	<b>Exports Made in Virginia</b>	<b>Imports Used as Inputs in Virginia</b>	<b>Total Virginia State &amp; Local Government Revenue</b>
<b>(Revenue in Millions)</b>	<b>\$192.4</b>	<b>\$323.5</b>	<b>\$2,228.5</b>	<b>\$2,744.4</b>
<b>Value Added (GSP) Created in Millions</b>	<b>\$2,905.1</b>	<b>\$4,002.1</b>	<b>\$40,473.7</b>	<b>\$47,380.3</b>
<b>Revenue Percent of Value-added</b>	<b>6.6%</b>	<b>8.1%</b>	<b>5.5%</b>	<b>5.8%</b>

We have estimated revenue for the specific industries directly impacted by POV-related activities. Our final Virginia state and local government estimated revenues produced by the total (direct, indirect, and induced) POV-related FY 2021 economic impacts are **\$2.7 billion** as shown in Table 11.

The **\$2.7 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 \$2.4 billion, or 88.9 percent of the total \$2.7 billion.

The largest state and local government revenue amounts by source, \$2.2 billion, flow from Virginia businesses using the imports as inputs in producing their final goods and services.

We included POV-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 POV-related impact on Virginia GSP creates on average 5.8 cents of state and local revenue.

## **POV'S STABILIZING INFLUENCE ON VIRGINIA'S ECONOMY**

In assessing POV's economic and fiscal impact on Virginia in FY 2021, it is important to keep in mind the situation within the larger economy during that time. Just as in the rest of the country, economic conditions in Virginia changed dramatically with the governor's lockdown on economic activity was imposed in early 2020 in response to the pandemic. Figure 1 depicts the trend in total nonfarm employment in Virginia between January 2011 and June 2021. As these data illustrate, between March and April of 2020, 428,000 jobs were lost in Virginia a single month (or approximately one out of every nine jobs in the state). That job loss effectively wiped out more than nine years of accumulated employment growth in Virginia in a single month. Although Virginia has since recouped many of those jobs, as of June 2021 statewide employment was still down 116,600 jobs from where it was in March of 2020 before the lockdown was implemented.

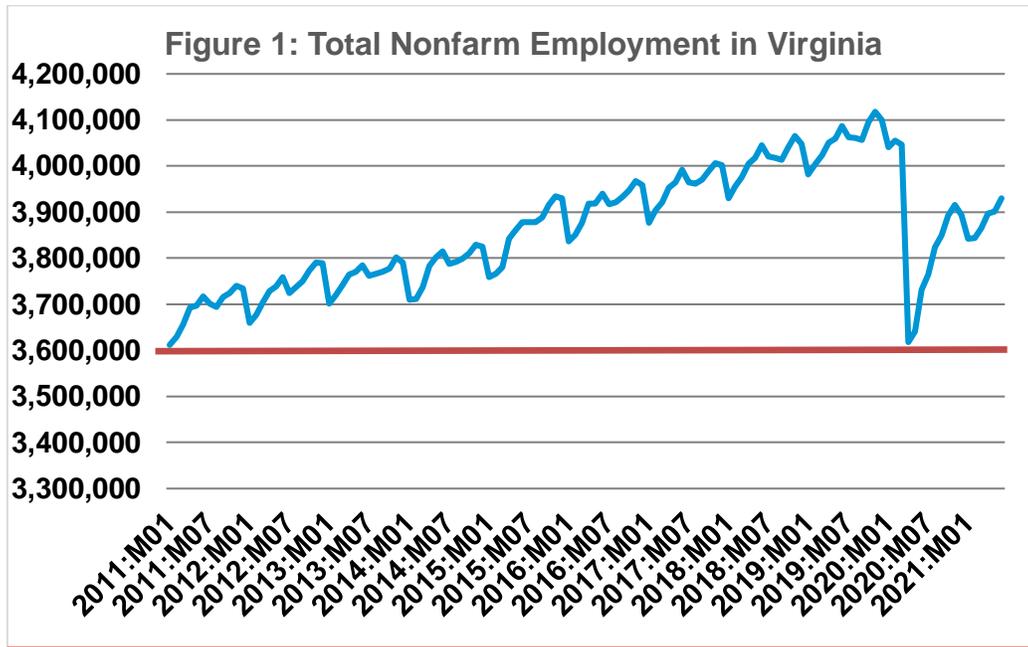
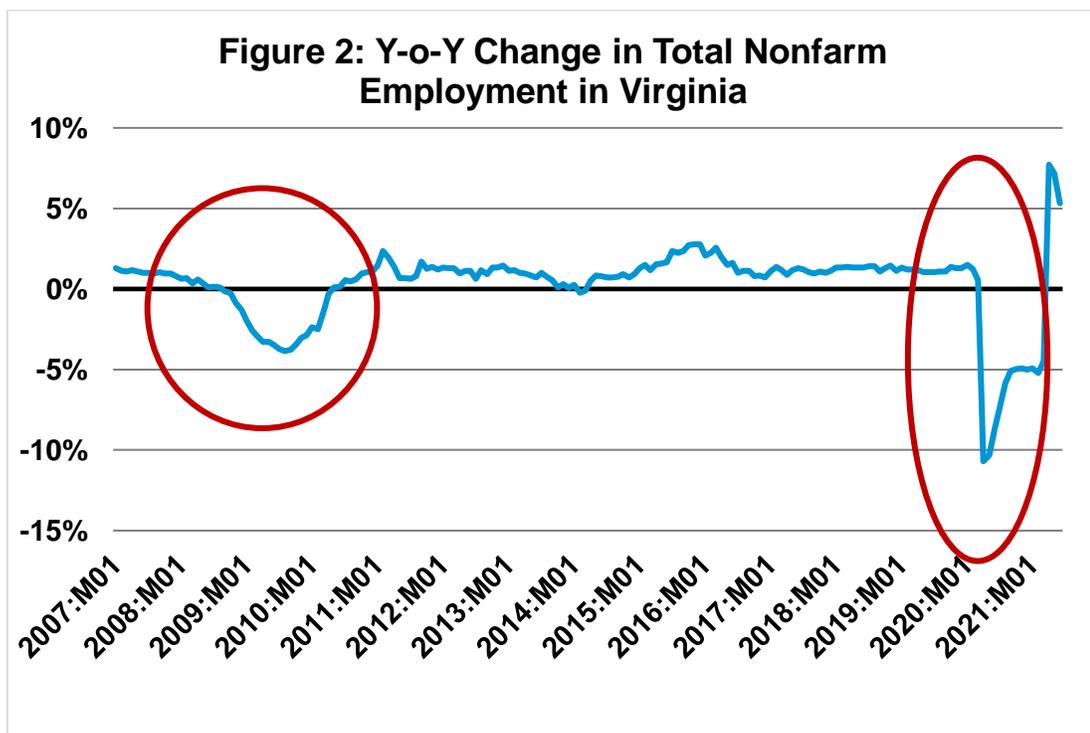


Figure 2 provides additional context for these numbers by comparing the year-over-year change in total nonfarm employment in Virginia over this period compared to what the state experienced during the “Great Recession” of 2007. As these data show, in April of 2020 Virginia experienced a year-over-year jobs loss of 10.7 percent. By way of comparison, at the bottom of the Great Recession, the worst recession to hit the country since the Great Depression, Virginia’s year-over-year job loss was only 3.8 percent.



It is important to realize that even in this historically challenging economic environment, in FY 2021, POV's economic and fiscal impact still grew by 6.0 percent in cargo tonnage, 8.7 percent in output sales, 20.6 percent in Virginia Gross State Product, 18.8 percent in Virginia labor income, 10.0 percent increase in full- and part-time jobs, and 28.6 percent in state and local taxes and fees compared to FY 2018. This clearly demonstrates the stabilizing influence that POV had on the economy of Virginia and especially Hampton Roads during what was one of the worse, if not the worse, economic downturns the country has ever experienced.

## LOOKING FORWARD

What can be learned and applied to the future of the POV? We answer with a cautionary tale of where Virginia could have been without the leadership at the Virginia Port Authority and state government. This is followed by three broad lessons learned: it takes vision, an investment in infrastructure, and concern for business especially small business, to achieve the stable, economic growth engine that is the Port of Virginia.

A cautionary tale in the Wall Street Journal (12/7/21)

“In late August, a small container ship called the A Kinka left Hong Kong loaded with, among other things, 50-inch Roku TVs, aluminum cookware and Fender guitars, as well as about 26,000 backgammon and chess sets destined for a small toy company in California. The A Kinka and everything on it was stuck in a global supply-chain tangle that has vexed companies and consumers, exacerbated inflation, and delayed the delivery of hot tubs, pickup trucks and clothing.

More than 100 companies needed cargo on the 574-foot-long ship, including giants like Amazon.com Inc. But for smaller businesses that were waiting for just one or two containers, the delays have taken a heavy toll, leaving some with disgruntled customers and significant financial pain. One small firm had Halloween boots that missed Halloween. Another couldn't get paid for \$250,000 worth of lighting fixtures it had sold until they were delivered.

“The mom-and-pop stores are going to bear the brunt of it,” said John Hansen III, president of the 16-person company. “A lot of the big guys knew this was coming—and secured goods as early as they could.”

The games on the A Kinka should have reached retailers by September. Hansen paid about \$27,000 to ship each container, about 10 times the price a year earlier, he said.

“Instead of the normal 30 days, it will be at least five months or six months from the date the container was loaded in China,” said Mr. Kirstein. “Delays in shipments are forcing us to look for credit lines because we can't continue like this”.

**We see the difficulties that were avoided but what can be learned from Virginia's experience?**

First, this success requires vision, “Ports in California, without robotics and automated machines, have faced major logistical problems that contribute to backups. The ports in

Hampton Roads, meanwhile, have been able to adjust nimbly to unpredictable schedules and labor shortages” (The Virginian-Pilot 12/21/21). The Virginia Port Authority (VPA) proactively assessed the needs and put the pieces together to allow the operations to be robust to many unknowns and be not only a stabilizing force but a rising influence on the economy. While these operations should be lauded, Asian and European large ports (e.g., the Port of Singapore and the Chinese ports of Yantian, Ningbo and Shanghai as well as Rotterdam, Antwerp and Hamburg) are much more automated. Virginia cannot rest on its success, “For years, domestic supply chains have negotiated our port system with amazing efficiency. In the U.S., a combination of thoughtful planning, supply-chain coordination, new technologies and routing and scheduling optimization make possible the standout performance” (The Hill 12/22/21). What will be required in the future to compete?

Second, VPA with the support of the Commonwealth have invested early in the necessary infrastructure. Over one million total additional container capacity was recently added at Virginia International Gateway (VIG) and Norfolk International Terminal (NIT) with a \$325 million investment. Three Ultra Large Carrier Vessels (ULCVs) can be served simultaneously. Rail capacity expansion with the central rail yard at NIT will be completed in 2023. The widening and deepening to 55-foot deep channels will follow a year later.

Further, there is the ability for one entity to manage across facilities and modes of transportation. “One of the major differences is the streamlined operating structure of the Port of Virginia. Unlike the Los Angeles area, where the two ports have separate management, the terminals in Hampton Roads are run by one entity — the Virginia Port Authority. That makes it easier for those in charge to, for example, divert a ship to another terminal if one is becoming congested. In Los Angeles, once cargo is offloaded, it is handled by three distinct trucking providers that operate separately from the terminals” (The Virginian-Pilot 12/21/21). In Virginia, the VPA can adjust quickly. The future will require additional coordination within the supply chain, balance across inbound and outbound volumes, synchronization across modes of transportation, and communication among shippers, carriers, and customers. More investment will be needed in tracking technology, artificial intelligence (AI), the internet of things (IoT), blockchain, robotics, and automation (The Hill 12/22/21).

Again, other states offer a glimpse of the road paved by low preparedness, “...(T)here is a limit to how much our private sector can cope with outdated infrastructure in handling increased demand and unprecedented disruptions. We cannot delay the expansion and construction of our ports anymore. Specifically, they need railway connections, greater channel width, bigger cranes and higher bridges, both to accommodate large vessels and to encourage competition with one another.” (The Hill 12/22/21). Continued funding is critical to maintain POV’s advantages and attract companies’ utilization of their services.

Third, the economic engine of growth is small business. Unfortunately, an inability to acquire the raw materials, parts, components, and products falls disproportionately on small businesses. They do not have the volume, and thus the leverage, to get the attention of suppliers. When ports are unable to perform their duties, businesses and their employees suffer...but large firms can often find alternative ways of meeting their needs. For instance, Target was able to charter its own cargo ship to clear supply chain jams and deliver containers of product for their stores (Minneapolis / St. Paul Business Journal 10/6/21) – small firms have no such ability. The POV has grown relative to East Coast options because of their ability to maintain the flow through the ports for all businesses.

Finally, with leadership that offers vision, implemented infrastructure projects, and concern for business interests, Virginian consumers see economic success: jobs, increased

income, tax support for better public services. “The smooth operation of the port has been a strong stabilizing force amid the economic disruptions of COVID. Leaders who look to the future and make provisions for it top the list of reasons Virginia’s ports are doing well while others are struggling. From local Hampton Roads communities to the port authority and to the state capital in Richmond, leaders have wisely made the Port of Virginia a priority and acted to make its position strong even in unexpected tough times” (The Virginian-Pilot 12/21/21).

What is Amazon doing? They are a bellwether of the future by constantly innovating approaches and their business model. They are building their own 53-foot containers allowing flexibility of when to return them to the port - when it is best for Amazon. They are employing more air cargo transportation. They are chartering ships and even own retrofitted small ships that are calling on smaller ports to increase their ability to be robust to the environment. In fact, Amazon is an ocean vendor that ranks in the top five in transpacific operations with over 10,000 containers transported per month.

In an Amazon world, what is the future going to look like? Energy prices rising, more need for flexibility with higher cost logistics, drive for sustainability with pressure to buy local - all point to the reduction of transportation in response to the increasing costs. Economics often drives behavior and, with these trends, we are likely to see a drop in imports where ocean transportation costs become significant despite the increasing added value they play in Virginia. Alternatively, for high value-added products, air transportation becomes more flexibly viable. This offers us a challenging scenario - since answering the question, “Where to grow?” is likely to increasingly require taking business from other ports’ slice of the pie. The Port of Virginia has successfully identified the challenges of the future and prepared themselves. This new future is likely to need all their skills, continued innovation, and proactive government partners.

In summary, the Port of Virginia’s success requires a continuing process of preparation. It requires visionary leadership, proactive investment in technology and infrastructure, as well as a healthy, economic environment for citizens through businesses that create the jobs. The forward-looking approach that positioned the terminals so well to deal with the challenges within these pandemic years deserves support as additional initiatives are required. Virginia’s ports are vital for the economy in the Commonwealth and the nation (The Virginian-Pilot 12/21/21). In the Age of Amazon, the ability to get high quality, low cost materials, parts, and products where they are needed and when they are needed has become the greatest competitive advantage. This is the power of logistics; this is the power facilitated by the port. These conveyed inputs, predominantly imports in Virginia, are then converted into value-added goods that produce 2.5 times their purchase value which in turn drives additional taxes, job opportunities, and income.

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## BIOGRAPHICAL SKETCH

### **K. Scott Swan, Ph.D.**

K. Scott Swan, Ph.D. is the David L. Peebles Professor of Business Chair and serves as Head of the Marketing & Innovation Area at The College of William & Mary, Raymond A. Mason School of Business. He is on the Advisory Board for the Alan B. Miller Entrepreneurship Center. He was awarded a Senior Fulbright Chair: the 2015-2016 Hall Chair for Entrepreneurship in Central Europe at WU (Vienna, Austria) and The University of Bratislava, Slovakia - one of two in business worldwide. He has led the development of an Innovation & Entrepreneurship minor to serve undergraduate students as well as an Online Masters' of Science in Marketing Innovation. Prof. Swan recently published *Global Marketing* (5th) Routledge: New York and London (with Kate Gillespie). He serves on the board of two journals related to product development, management, and design: *The Design Journal* and the *Journal of Product Innovation Management* along with authoring of three books on these subjects. One book, *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), has experienced over 70,000 chapter downloads.

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. He has accomplished three economic impact studies for the Virginia Port Authority and four for Norfolk Redevelopment and Housing Authority, along with others including Union Mission, Virginia Maritime Association, Governor's Report for Virginia's Housing Policy Advisory Board, and Jefferson Labs. Dr. Swan has presented at conferences across most of Europe, Asia, and S. America. He has lectured internationally at University of Applied Science Upper Austria (Wels), Corvinus University in Budapest, MCI in Innsbruck, Tsinghua University in Beijing, Aoyama Gakuin University in Tokyo, WHU in Koblenz, Germany, The University of Bratislava in Slovakia, and the Vienna Business School (WU) in Austria.

### **Mangum Economics**

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