THE FISCAL YEAR 2018 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA

November 18, 2019

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EXECUTIVE SUMMARY

THE ECONOMIC IMPACTS OF THE PORT OF VIRGINIA ON THE COMMONWEALTH'S ECONOMY IN FY 2018

The Virginia economic impacts of the Port of Virginia (POV) in fiscal year 2018 include:

- **$92.1 BILLION IN OUTPUT SALES (10.8 PERCENT OF VIRGINIA'S ESTIMATED OUTPUT PURCHASES);**
- **$39.3 BILLION IN VIRGINIA GROSS STATE PRODUCT (7.5 PERCENT OF VIRGINIA'S FY 2018 TOTAL GSP);**
- **$23.0 BILLION IN VIRGINIA LABOR INCOME (7.0 PERCENT OF TOTAL EMPLOYMENT COMPENSATION);**
- **397,094 FULL- AND PART-TIME JOBS (9.5 PERCENT OF VIRGINIA'S FY 2018 RESIDENT EMPLOYMENT); AND**
- **$2.1 BILLION IN STATE AND LOCAL TAXES AND FEES (4.2 PERCENT OF TOTAL STATE AND LOCAL REVENUES).**

The Port of Virginia is the Commonwealth's global maritime gateway for import and export of freight. Port of Virginia impacts flow from moving freight; exporting Virginia-made goods; and importing goods to be finished, assembled and delivered to users inside Virginia and beyond. Over eighty percent of the fiscal year 2018 Virginia output, Gross State Product (value added), labor income, and 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 2018** levels to **FY 2013** estimates:*

- **FY 2018 CARGO TONNAGE MOVED WAS UP 22.9 PERCENT (WHILE REAL VIRGINIA GSP GREW 5.1 PERCENT).**
- **POV-RELATED LABOR INCOME ROSE 31.3 PERCENT, WHILE VIRGINIA EMPLOYEE COMPENSATION (INCLUDING SUPPLEMENTS AND PROPRIETORS' INCOME) INCREASED 15.3 PERCENT.**
- **POV GENERATED VALUE-ADDED (GSP) WAS 28.7 PERCENT HIGHER IN FY 2018 THAN IN FY 2013 (WHILE VIRGINIA NOMINAL GSP GREW 13.9 PERCENT).**

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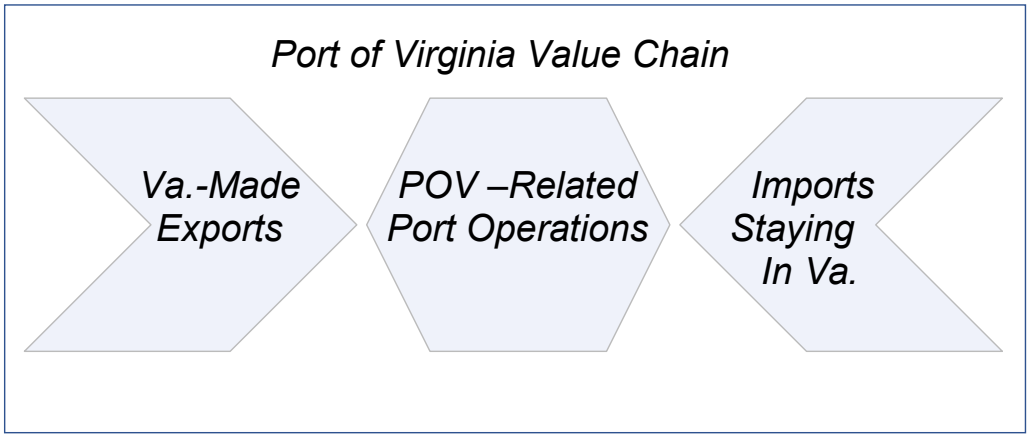
INTRODUCTION

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) 2018 economic and fiscal impacts of the Port of Virginia (POV) operations at its owned and leased terminals in Virginia. 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. The POV also has a capital lease for the Virginia International Gateway Terminal (VIG) in Portsmouth, along with an operating lease for the Richmond Marine Terminal (RMT). These terminals are Virginia's gateway to the world for deep- sea transport, with 99 percent of the tonnage shipped in containers, only 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: moving exports and imports within Virginia, exporting goods made in Virginia, and Virginia businesses using imported goods as inputs. The Virginia impacts of this POV-based value chain are reported in Table 1. The FY 2018 amounts and percent distributions of the total impacts for the three impact types show the Virginia users of POV imports create over 80 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.

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 two

Class I railroads operating on dock (35% of cargo arrives and departs the port by rail— highest in the East Coast) provide double-stack rail to the Midwest; an impressive interstate network supported with an inland port; 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 a unique deep-water port (50' channel and beginning construction in January 2020 to go to a 55-foot channel depth by 2024), able to handle a variety of container exports through nearly 30 international shipping line services direct to more than 90 foreign ports, provides global market access for Virginia businesses. Bottom line: this expands the volume they can produce and sell profitably. The production of Virginia-made exports is a major economic contribution attributable to Port of Virginia operations.

Over 40 percent of the Port of Virginia imports are Virginia business inputs, used to produce goods for sale to Virginia customers and to be shipped to other states. 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 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.

Table 1 POV-Based Virginia Impacts ($ Amounts in Mill.)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
POV Cargo-Moving Impacts	**$ 5,534.3**	**$ 3,090.5**	**$ 2,084.9**	**36,638**
Percent of Total	6.0%	7.9%	9.0%	9.2%
Virginia-Made Exports Impacts	**$ 10,792.6**	**$ 3,574.9**	**$ 2,115.1**	**37,652**
Percent of Total	11.7%	9.1%	9.2%	9.5%
Virginia-Used Imports Impacts	**$ 75,733.4**	**$ 32,636.7**	**$ 18,838.6**	**322,784**
Percent of Total	82.3%	83.0%	81.8%	81.3%
Total Impacts	**$ 92,060.4**	**$ 39,302.1**	**$ 23,038.5**	**397,074**

Impacts are reported here by four measures: output purchases (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 supplements and proprietors' income) and employment. These measures will be in tables throughout this report, so their meaning needs to be 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 methodology used worldwide to calculate Gross Domestic Product: the POV-related Value Added.

Labor income consists of wages and salaries, supplements to these, and sole proprietors' income. Labor income is the largest component of Virginia's Gross State Product, 63.2 percent in FY 2018. 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.

TONS AND TEUS MOVED

Port of Virginia first priority was physically moving freight onto or off of the 1,704 deep-sea vessels docking at the terminals. We report here on the tons moved and the containers handled, measured in TEUs, Twenty Feet Equivalent Units. TEUs are the standard unit for describing containers handled by a port or on a container ship, although the predominant container size is 40 feet in length.

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 2018 breakbulk tons were only 0.9 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 movements are given in Table 2. Moving 22.1 million tons may not seem like a massive task but stated differently it may be more apparent:
22.1 million tons is 44,213,550,858 pounds. The average person does not regularly lift objects weighing over 50-pound bags of seed, fertilizer, or pet food. The 44.2 billion pounds is the equivalent of moving 2,422,660 fifty- pound bags per day, or 100,944 per hour every 24 hours. This is not feasible with purely human cargo handling, but routine today with stevedores using the Port's cargo handling equipment and computer technology.

Table 2 *Port of Virginia Freight Moved, Tons and TEUs*	*Tons*	*TEUs*
Containers		
Loaded		
Exports	**10,980,945**	**1,002,662**
Imports	**10,930,059**	**1,303,528**
Total Loaded	**21,911,004**	**2,306,190**
Empty		
Exports		**497,035**
Imports		**24,512**
Total Empties		**521,546**
Total TEUs	**21,911,004**	**2,827,736**
Breakbulk		
Exports	**29,268**	
Imports	**166,503**	
Total Breakbulk	**195,772**	
FY 2018 Tonnage Moved	**22,106,775**	

Note that the POV loaded export and import container tonnage were nearly equal, 50 percent of the loaded total each. Therefore, export and import cargo transportation impacts within Virginia's borders were essentially 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.

DAY IN THE LIFE OF THE PORTS PART 1

The giant container ship CMA CGM J. ADAMS is greeted by the comfortably deep 50 feet of water as it enters the Norfolk Harbor. Dredging has begun in expectation of the needs of Ultra Large Container Vessels (ULCVs) for 55-foot depths and channels wide enough to accommodate two-way traffic for both Navy ships and these largest class of container vessels. Further dredging will reduce light-loading along the Southern Branch improving capacity for Supermax ships. This means that the Virginia Port Authority manages the best prepared marine terminals on the U.S. East Coast for the future. It also makes it an easy decision for freight forwarders and routers to increasingly choose Virginia's ports.

The container ship is expertly guided through the channel and alongside the Virginia International Gateway (VIG) Terminal, by tugboats, pushboats, and pilots like Ken Flowers. Safely in its berth along the 800-foot wharf, the boom of one of the largest ship to shore cranes in the Western Hemisphere, capable of reaching across 26 containers on a vessel, moves across the deck and plucks one of the over 8,000 containers that had been arranged to minimize the effort of unloading and loading.

Over the next few hours, the containers are moved via ship to shore crane from the vessel to the berth, and then from a shuttle carrier to one of the 26 container stacks that hold tens of thousands of containers. Those container stacks are constantly being "groomed" by sophisticated AI technology to ensure the container is in the closest possible location it can be for the scheduled arrival of the truck, train, or barge that will carry it on to its next destination.

There is a moment of rest and recovery for the crew onboard. Foreign crews are processed into the U.S. — some are taken to see dentists or doctors, others hit downtown Norfolk to taste the local flavors, while a few head to Virginia Beach to stretch their sea legs along the boardwalk. Water, fuel, and food are replenished onboard. Private companies like Givens (ship services), Panattoni (one million ft^2 of warehouse space near the Richmond Marine Terminal), and InterChange (transportation and storage of materials and products) are beneficiaries of these needs associated with the ports. Quick repairs are accomplished. If more extensive work is required then those services are available too in the surrounding area. In fact, thousands of specialized private services are well-established for the needs of the transports of international trade.

Once the transfer of imports and exports has been accomplished, the ship is again escorted through the harbor, a mere 18 nautical miles to open sea. This was all accomplished in less than 48 hours. The other pieces of the logistics puzzle are taking place simultaneously. The on-terminal railroad carries 35% of the cargo, produces 63% less in greenhouse gas emissions compared to trucks, allows two-day service to the Midwest, and importantly services the growing inland port at Front Royal. This "port without water" allows trucks to pick-up and drop-off containers more than a hundred miles from the coast which means that companies like Red Bull, moving hundreds of containers per month, can make 4-6 trips a day with less than 15 minute turns and get

their drivers home at night allowing them to keep happier employees as well as better managing their logistics – all the while enjoying the Virginia Highlands sunsets.

The Front Royal facility is already twice as large as planned and is set to double in size again in the near future – not coincidently situated in the fastest growing county in Virginia. Easy access to land, interstate highways, and the majority of the population within two days ride, make this an attractive spot for expansions and new companies to set-up in Virginia like Rubbermaid, Toray Plastics, Home Depot, Mercury Paper, Solaris, Agro Sevilla (olives), and Lenox to name a few. Exports from Front Royal include a number of lumber related companies such as American Hardwoods, Alleghany, and DDSP.

In the ports around Norfolk, most containers are picked up by drivers who pass through the scanners and over the scales when their appointment has arrived. RFID readers communicate with the tags on the truck and a color-coding system tells the driver what they must do. Backing their empty chassis into the bay of correct stack of the twenty-four that are available, for example, at VIG terminals, the driver exits the cab, removes pins, and enters a booth where a weight sensor signals that the truck is ready to be loaded. The railed straddle carrier brings the container over and sets it down on the chassis which allows the driver to emerge from the safety booth and check the pins to assure everything is secured. The driver pulls away and exits through another set of scanners making the trip in and out of the terminal in about 45 minutes.

Table 3
Port of Virginia Containers Moved to Satellite Ports

	Richmond Marine Terminal		Virginia Inland Port	
Loaded	**Tons**	**TEUs**	**Tons**	**TEUs**
Exports	210,266	9,142	253,667	11,029
Imports	376,727	20,929	616,658	34,259
Total Loaded	586,993	30,071	870,325	45,288
Empty				
Exports		10,619		24,213
Imports		1,188		1,206
Total Empties		11,807		25,419
Total Moved	586,993	41,878	870,325	70,707

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 586,993 tonnage was only 2.7 percent of the total POV tonnage but served a valuable function in moving exports from and imports to Richmond area international trade customers. The larger tonnage

and TEU volume 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.

DAY IN THE LIFE OF THE PORTS PART 2

Barges are being loaded including some refrigeration units or reefers (benefitting companies like Lidl) that then head up the James River to what was called the Port of Richmond but renamed the Richmond Marine Terminal (RMT). This newest port has grown from a gravel lot with one old classic red Manitowoc crawler crane handling 149 containers in its first year to almost 40,000 containers and sporting a new blue Liebherr crane.

The RMT encompasses about 121 acres of paved container storage and staging areas with a few historical buildings on the James River. This operation is going through its own major expansion and upgrades that has attracted a growing list of companies like Brother International and Bissel who both moved close to the facility and appreciate its personal service, growing capacity, innovative flexibility, and up to six turns a day for trucks. An Amazon facility is going in next door – coincidence? Interestingly, logjams in the New York port brought down additional barge traffic to Norfolk along with traditional movement of grains from the Midwest to Baltimore and barged down by Perdue Agribusiness to their own terminal. Who knew that barges are a growth business?

MOVING CARGO IN VIRGINIA

The POV port operations involve far more than the personnel running the terminals and the stevedores loading and unloading the cargo. It includes the pilots and tugboat services who bring the ships into port and dock them, companies that provide ship services and maintenance and repair, and warehousing and storage companies that consolidate and store the cargo before moving to ships or inland. These **port and harbor operations** created a direct $1,288.7 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 brokers who assure freight is properly categorized, along with a variety of enterprises providing other support services such as insurance, inspection, and security, delivering $534.8 million in output of goods and services.

Table 4 POV-Related Port Direct Impacts ($ Amounts in mill)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
Ship & harbor operations, vessel (un)loading	**$ 1,288.7**	**$ 666.2**	**$ 499.9**	**7,410**
Freight arrangement & other transportation support	**$ 534.8**	**$ 247.3**	**$ 167.4**	**2,822**
Land & barge transportation	**$ 1,164.5**	**$ 661.2**	**$ 502.1**	**9,657**
Total Direct Impacts	**$ 2,988.0**	**$ 1,574.7**	**$ 1,169.5**	**19,888**

The largest private-enterprise port-related services were an estimated $1,164.5 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 2018 was 62 percent by truck, 35 percent by rail, and 3 percent by barge, at an estimated direct cost of $1,164.5 million, as reported in Table 4.

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

Table 5 POV Cargo-Moving Virginia Impacts ($ Amounts in Mill.)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
Direct Impact	**$ 2,988.0**	**$1,574.7**	**$1,169.5**	**19,888**
Indirect Impact	**$ 1,262.7**	**$ 745.0**	**$ 505.0**	**7,946**
Induced Impact	**$ 1,283.6**	**$ 770.7**	**$ 410.4**	**8,804**
Total Impacts	**$ 5,534.3**	**$3,090.5**	**$2,084.9**	**36,638**

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. 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.

The total port-related spending to handle and move POV exports and imports in Virginia in FY 2018 was $5,534.3 million, creating Virginia Gross State Product (GSP) of $3,090.5 million, of which $2,084.9 million went for labor income for 36,638 workers.

EXPORTS MADE IN VIRGINIA

The Virginia economic impacts of transporting exports getting to 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 *made in Virginia*. Total Port shipments are reported in detail, but information on the origin and destination of the contents and 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 $6,419.3 million in containerized exports in FY 2018, as reported in Table 6. In our previous impact study, ***THE FISCAL YEAR 2013 VIRGINIA ECONOMIC IMPACTS OF THE PORT OF VIRGINIA,*** released in December 2014, we concluded that FY 2013 POV exports included $10,856.8 million in Virginia-made goods, considerably more than in FY 2018. However, the FY 2018 and FY 2013 totals are not directly comparable because we used different estimation methodology for the fiscal year 2013 study. For example, in addition to POV data and port user interviews, we mainly used U.S. Army Corps of Engineers Waterborne Commerce Statistics Center state-to-state and foreign trade data, the only

source for domestic tonnage by port by product as well as foreign tonnage. For the FY 2018 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), a dynamic database subject to updates and revisions over time, in addition to POV data and user interviews.

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. All of these exports are in containers: bulk shipments from the coal terminals are not included. 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.

Table 6 Virginia-Made Exports, Value by Major Sectors	*FY 2018 Dollar Value ($ mill.)*	*FY 2013 Dollar Value ($ mill.)*
11 Agric., forestry & fishing products	$ 619.4	$ 1,711.2
21 Nonmetallic mining products	$ 341.0	$ 17.2
31 Food, bev., textiles, & apparel mfg.	$ 973.8	$ 1,396.8
32 Wood, paper, chem., plastics mfg.	$ 2,442.6	$ 4,457.2
33 Metal, machinery, electronics, transport & furniture mfg.	$ 1,732.2	$ 2,794.0
90s Waste, scrap, used/spec classification goods	$ 310.4	$ 480.5
Total Exports	$ 6,419.3	$ 10,856.8

In looking at exports, an extraordinary example is one refrigerated container worth $12 million. While one might guess electronic parts, it is from life-saving products related to the pharmaceutical industry. Wyeth and Merck are two companies that have invested heavily in Virginia and are significant users of the port. Wyeth has three sites encompassing 1.73 million square feet on 348 acres near Richmond. Their products include such staples as ChapStick that is manufactured and packaged here along with Denorex, Preparation H, Robitussin, Dimetapp, and Children's Advil. Further north, Merck is planning a

$1 billion expansion to its manufacturing facility adding 120,000 square feet to its existing 1.1 million-square-foot operation to increase production of one of its vaccines. Merck also is forming a partnership with Blue Ridge Community College and James Madison University to address employment needs related to biotechnology engineering, computer science, and other life sciences.

Among the companies exporting thousands of TEUs and tens of thousands of tons were well-known Virginia names: MeadWestvaco, Dupont de Nemours, International Paper, Perdue, Pilgrim's Pride, Smithfield Packing, Honeywell International, Philip Morris International, and Stihl.

Like other companies, Stihl chose its location because of proximity to the Virginia ports and a look toward future growth. That growth has resulted in Stihl offering over 80 models into 80 countries and counting. Exports are part of the story but imports open up new markets – they make Stihl more competitive. The timeliness, predictability, and reliability of their imported parts and materials lower their costs and improve cashflow. Stihl's plants all over the world even compete against each other so every advantage is pursued to improve efficiency including the use of the Foreign Trade Zone (FTZ) to reduce paperwork and costs associated with re-exportation. Liebherr themselves had a $45 million expansion and continues the use of the FTZ as do other companies such as Sumitomo, Volvo, and Usui International.

The $6.4 billion in international export products sold in FY 2018 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 2018 indirect output impact of $2.8 billion. The employees of exporting businesses and their suppliers live in Virginia, spending most of their earnings here, yielding an additional $1.5 billion induced impact. The direct export sales of $6.4 billion generated a cumulative total of $10.8 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 $3.6 billion. This Virginia value-added included $2.1 billion in Virginia labor income for 37,652 employees.

Table 7 Virginia-Made Exports Impacts ($ Amounts in Mill.)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
Direct Impact	**$ 6,419.3**	**$ 1,532.2**	**$ 907.4**	**16,029**
Indirect Impact	**$ 2,828.5**	**$ 1,254.0**	**$ 787.7**	**12,622**
Induced Impact	**$ 1,544.8**	**$ 788.7**	**$ 420.0**	**9,001**
Total Impacts	**$ 10,792.6**	**$ 3,574.9**	**$ 2,115.1**	**37,652**

IMPORTS USED AS INPUTS IN VIRGINIA

The Port of Virginia handled 10.9 million tons of containerized imports worth an estimated $46 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 $5.5 billion Port operations impacts already discussed. Our focus here is the FY 2018 separate, additional impacts of Virginians' use and purchase of over 42 percent of these imports, $19.4 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 2018 estimates and the FY 2013 values from our 2014 impact study for comparison. The largest sector by value in both years is NAICS Code Group 33: Machinery, Electronics, and Furniture, with FY 2018 imports valued at $10.1 billion and nearly $6.0 billion in FY 2013. All NAICS groups except 21, containing petroleum, ores and minerals, experienced high growth rates over the five year period, with an overall growth in value of 86.2 percent.

The Virginia import use is quite different from the export production. With the Virginia exports, the dollar value was the final price of Virginia output. With imports, the $19.4 billion in businesses' cost of FY 2018 imports used in the Commonwealth is Virginia inputs, intermediate goods for 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.

Table 8 Virginia-Used Imports, Value by Major Sectors	*FY 2018 Dollar Value ($ mill.)*	*FY 2013 Dollar Value ($ mill.)*
11 Agric., forestry & fishing products	$ 1,414.7	$ 914.9
21 Nonmetallic mining products	$ 11.5	$ 12.9
31 Food, bev., textiles, & apparel mfg.	$ 2,965.1	$ 1,247.7
32 Wood, paper, chem., plastics mfg.	$ 4,757.7	$ 2,265.4
33 Metal, machinery, electronics, transport & furniture mfg.	$ 10,090.5	$ 5,954.8
90s Waste, scrap, used/spec classification goods	$ 156.3	$ 23.1
Total Imports	$ 19,395.8	$ 10,418.7

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.

The Virginia imports are inputs for different types of durable goods manufacturers (e.g., Newell Rubbermaid, Stihl), nondurable goods producers (e.g., International Paper, MeadWestvaco), wholesalers (e.g., BJs, Costco), and retailers (e.g., Family Dollar, Home Depot, Kohl, Lenox, Target, Walmart).

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 $19.4 billion of imported inputs in FY 2018 yields an estimated final import-based sales value of $48.5 billion. We report this $48.5 billion in Table 9 as the FY 2018 *direct* Virginia spending flow from Virginia use of the imports.

Table 9 Virginia-Used Imports ($ Amounts in Mill.)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
Direct Impact	**$ 48,489.4**	**$ 16,378.6**	**$ 10,815.7**	**182,650**
Indirect Impact	**$ 12,651.6**	**$ 7,488.2**	**$ 4,286.7**	**60,726**
Induced Impact	**$ 14,592.4**	**$ 8,769.9**	**$ 3,736.2**	**79,408**
Total Impacts	**$ 75,733.4**	**$ 32,636.7**	**$ 18,838.6**	**322,784**

Virginia manufacturers, producers, wholesalers, and retailers creating those sales generated Virginia value-added of $16.4 billion (two thirds of which went for labor income) and made purchases from other Virginia businesses, an indirect output demand of $12.7 billion. The full FY 2018 economic impacts are reported on the bottom line in Table 9. The $75.7 billion in output purchases, creating $32.6 billion in Virginia Gross State Product, with $181.8 billion in labor income earned by 322,784 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 $48.5 billion in direct import-generated Virginia sales in FY 2018 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 $48.5 billion in output was bought by Virginia consumers, or $22 billion to $29 billion. If so, then Virginia output not consumed here of $19 billion to $26 billion was 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.

PORT OF VIRGINIA PORTS IMPACT RECAP

The total FY 2018 Virginia impacts attributable to the Port of Virginia were reported by type and category in Table 1, summing to $92.1 billion in output, creating $39.3 billion in Gross State Product within Virginia's borders, of which $23 billion was labor income earned by 397 thousand employees and proprietors. These total impacts are repeated as the first row of Table 10.

In describing tons moved, we reported 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 (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 $4.3 billion in output purchases, of which $1.8 billion was Virginia value added, funding $1.1 billion in labor income for over 18,000 workers. This contribution accounted for nearly 5 percent of the total POV Virginia impacts, as shown in Table 10. The RMT impact contribution was predominantly created by RMT customers using imported goods as inputs in processing, making, and distributing their products: Import use accounted for 92 percent of the RMT value added, labor income, and employment impact contributions.

Table 10 POV Total Impacts and Satellite Ports Contributions ($ in Mill.)	*Output Purchases*	*Value Added (GSP)*	*Labor Income*	*Employ-ment*
POV All-Ports Impacts	**$ 92,060.4**	**$39,302.1**	**$23,038.5**	**397,074**
Percent of Total	100.0%	100.0%	100.0%	100.0%
Richmond Marine Terminal Impacts Contribution	**$ 4,315.8**	**$ 1,828.9**	**$ 1,058.0**	**18,189**
Percent of Total	4.7%	4.7%	4.6%	4.6%
Virginia Inland Port Impacts Contribution	**$ 6,904.9**	**$ 2,984.6**	**$ 1,724.7**	**29,604**
Percent of Total	7.5%	7.6%	7.5%	7.5%

Our estimate of the Virginia Inland Port FY 2018 economic impact contribution is $6.9 billion in output, nearly $3.0 billion in Virginia value added (GSP), with $1.7 billion in labor income earned by nearly 30 thousand workers, accounting for about 7.5 percent of the total POV impacts. VIP is almost exclusively an import-use center, generating 97 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.

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.

The IMPLAN model total state and local revenue estimates are industry and place specific by type, but not by category by specific industry. Therefore, IMPLAN recommends "constructing your own estimates of [*industry*] direct taxes whenever possible and using the *[IMPLAN*] model estimates for indirect and induced tax impacts." We have done our own estimates 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 2018 economic impacts are **$2.1 billion** as shown in Table 11. That total was equal to 4.2 percent of FY 2018 Virginia total state and local revenues of $49.9 billion (excluding federal trust fund transfers).

Table 11 POV-Based Virginia Government Revenue Impacts	*Port Operations*	*Exports Made in Virginia*	*Imports Used as Inputs in Virginia*	*Total Virginia State & Local Government Revenue*
Revenue in Millions	**$ 152.2**	**$ 316.4**	**$ 1,631.5**	**$ 2,100.0**
Value Added (GSP) Created in Millions	**$ 3,090.5**	**$3,574.9**	**$ 32,636.7**	**$ 39,302.1**
Revenue Percent of Value Added	**4.9%**	**8.8%**	**5.0%**	**5.3%**

The **$2.1 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 $1.82 billion, or 88.2 percent of the total $2.1 billion.

The largest state and local government revenue amounts by source, $1.6 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 5.3 cents of state and local revenue.

LOOKING FORWARD

In the Executive Summary, we noted that FY 2018 cargo tonnage moved through the Port of Virginia was up 22.9 percent compared to FY 2013, which is a 4.2 percent compound annual rate (CAR) of growth. Having the capacity to handle that physical growth and be able to meet future increases requires continual investment in port infrastructure, equipment and technology. The FY 2018 output expenditures of $1.3 billion in Table 4 for Ship and Harbor Operations included $358.2 million in Port of Virginia investment. Thirty-nine percent of that amount, $139.3 million, was public funds spent for the Norfolk International Terminal south expansion, as part of the $350 million approved by the Virginia legislature for this ongoing project.

The other 61 percent of the $358.2 million spent by Port of Virginia in FY 2018 was $218.8 million of private funds for the Virginia International Gateway Terminal expansion and upgrades (this $321 million project was completed in July 2019). The investment was split about equally for infrastructure, such as larger berths, and equipment and information technology. There is a steady increase in the size of container ships, in length, width, and container capacity, from under 10,000 Twenty Equivalent Units (TEUs) to over 15,000 TEUs, with 11 ships on order by Mediterranean Shipping Company (MSC) with 23,350 TEU capacity. Larger ship size means more containers to move per ship, requiring not just more cranes and shuttle carriers, but ones with more reach and mobility, and sophisticated information systems to coordinate the ship docking, container loading and unloading, and rapid movement of the containers in and out of the port gates.

In addition to the Port of Virginia's Norfolk Harbor projects, major investments in infrastructure and upgraded equipment are occurring at both the Richmond Marine Terminal and Front Royal's Virginia Inland Port – both of which will have the headroom to literally double in volume. While still relatively small, this commitment to innovation and customer needs is a critical factor in future

growth. The future requires flexibility, adaptability and robustness to deal with uncertainty and environmental change.

Relationships still matter but brands are less important and word-of-mouth, often in the form of ratings, have taken precedence. A greater number of retail shutterings occurred in 2017 than in 2008s "Great Recession". Many of the top brands are shrinking or dying by more than a hundred stores, e.g., Payless, Sears and Kmart, Gymboree, The Limited, GameStop, Bebe, Wet Seal, Crocs, JCPenney, Michael Kors, Macy's (Fast Company, January 2018). This all results in many past traditional customers' imports demanded being greatly reduced. The bright side includes:

1] digital native brands who establish direct relationships with customers (and have more than doubled their gross margins (65%) versus traditional e-commerce (30%),

2] discounters and off-price retailers (e.g., Burlington, Home Goods, Marshalls/T.J.Maxx) offering "treasure hunts" that make in-person shopping fun and exciting (40-90% growth projected), and

3] innovators like Apple with $5,546 sales/ft^2 versus an industry average of $325 sales/ ft^2 and other savvy e-tailers who use digital to drive inspiration. e.g., Sephora, Ulta (Fast Company, January 2018).

Although about 80 percent of sales still go through physical stores, 50 percent of online product searches go through Amazon who is willing to spend additional billions to speed up delivery (shipping losses increased from $5 billion in 2015 to $7.2 billion in 2016 - Fast Company, January 2018). Retailers and wholesalers are driven to compete on this basis or be driven to the sidelines.

What does this new world require? Both for discounters and innovators, logistics are critical: the ability to get quality, low cost materials, parts, and products where they are needed and when they are needed – almost immediately — has become the greatest competitive advantage. These inputs are then converted into value-added goods that produce 2.5X in sales value that drives additional taxes, job opportunities, and income. This is the environment in the Age of Amazon.

The Virginia Port Authority is benefitting from an ability to assist businesses in their drive to innovate and compete with quality, with speed, and with efficiency. Further, analytics is required to understand the deep knowledge hidden within tens of thousands of transactions as well as how to pivot when things change — every day. Any investments that move the needle on quality, speed, and efficiency along with immediate availability of data and transparency in the logistics process will accelerate the growth of Port of Virginia shipments.

APPENDIX: BIOGRAPHICAL SKETCHES

ROY L. PEARSON

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A Raymond A. Mason School of Business faculty member since 1971, Roy Pearson was named the Chancellor Professor of Business in 1987 and retired to Emeritus status in 2005. He served as Director of the College's Bureau of Business Research from 1984 to 1998, doing research projects for government agencies and businesses and publishing the ***Virginia Outlook***, providing forecasts three times annually for Virginia and its six largest metropolitan areas.

Economic impact modeling is another specialty, employed in many numerous Bureau of Business research studies. In recent years, he and Scott Swan completed ***The Fiscal Year 2013 Virginia Economic Impacts of the Port of Virginia*** in December 2014, and ***The Fiscal Year 2013 Economic Impacts of Virginia Maritime Industry International and Domestic Commerce*** in February 2016. Roy and Scott did a series of four economic impacts studies for the Norfolk Redevelopment and Housing Authority during the period 2012-2014. They also produced three 2030 scenarios of ***The Future of Housing in Virginia***, in ***Addressing the Impact of Housing for Virginia's Economy, A report for Virginia's Housing Policy Advisory Council,*** November 2017. This year, they published two reports for the Southeastern Universities Research Association (SURA): ***Economic Impacts and Qualitative Drivers of the Thomas Jefferson National Accelerator Facility Fiscal Year 2018*** in January 2019, and ***Economic Impacts of a Future Electron-Ion Collider at the Thomas Jefferson National Accelerator Facility*** in February 2019.

Roy has served on the Governor's Joint Advisory Board of Economists at the pleasure of eight Virginia governors: Robb, Baliles, Wilder, Allen, Warner, Kaine, McAuliffe and Northam. He is a past President and Distinguished Fellow of the Virginia Association of Economists and past President and honorary member of the Association for University Business and Economic Research. He served on the Board of Directors of the International Institute of Forecasters (IIF), and as Associate Editor of the IIF's ***Foresight: The International Journal of Applied Forecasting***. His other professional memberships include the National Association for Business Economics. He received a B.S. in Commerce and Ph.D. in Economics from the University of Virginia.

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K. Scott Swan, Ph.D. is a Professor of International Business, Innovation, and Marketing at The College of William & Mary, Raymond A. Mason School of Business. He serves as Head of Marketing and is on the Board of Advisors to the Alan B. Miller Entrepreneurship Center. He teaches classes related to export management, international marketing, entrepreneurship, design thinking, innovation, and strategy. Prof. Swan was instrumental in the start of the Innovation and Design Studio that helped lift the Marketing Area to a #1 rating for undergraduate programs in BusinessWeek's 2013 ranking of U.S. universities. He was a co-developer of the new Innovation & Entrepreneurship minor to serve students across the W&M campus. He is leading the effort for a new Online Masters of Marketing which focuses on innovation driving customer insights, product development, and integrated communications. 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.

Prof. Swan has published widely and serves on the board of two journals related to product development, innovation 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 45,000 chapter downloads. http://www.springer.com/business+%26+management/technology+management/book/978-3-642-54375-3

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 completed 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 two for Southeastern Universities Research Association (SURA) related to Jefferson Labs – all with Prof. Roy Pearson. These studies have often required innovative tools and solutions to complex problems that have not been tackled previously. The approaches have been presented at national conferences. All of them have been applauded by the clients and received positive press coverage. The clients have reused the analysis for annual reports, adopted the recommendations for implementation, and benefited from the strategic positioning proposals.

Dr. Swan has presented at conferences across most of Europe, Asia, and South 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.