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

AUGUST 18, 2022

Raymond A. Mason School of Business
WILLIAM & MARY

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Prepared for
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EXECUTIVE SUMMARY

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

Despite worldwide COVID effects, ongoing supply chain disruptions, and even dramatic changes in globalization, the Port of Virginia (POV) has offered stabilizing economic leadership. 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 growth in jobs, pay, output sales, and taxes with imports being the major driver.

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 USA-made goods; and
- importing goods to be finished, assembled, and delivered to users inside United States and beyond.

Seventy-five percent of the FY 2021 nationwide output impact supported by the Port of Virginia and 76 percent of value-added, labor income, and employment impacts flowed from businesses in the United States using imports as intermediate inputs in providing consumers with finished goods.

Specifically, the **national economic impacts of the Port of Virginia** in fiscal year (FY) 2021 include:

- **$340.5 BILLION IN OUTPUT SALES;**
- **$152.9 BILLION IN VALUE ADDED;**
- **$88.8 BILLION IN U.S. LABOR INCOME;**
- **1,294,368 FULL-TIME AND PART-TIME JOBS.**

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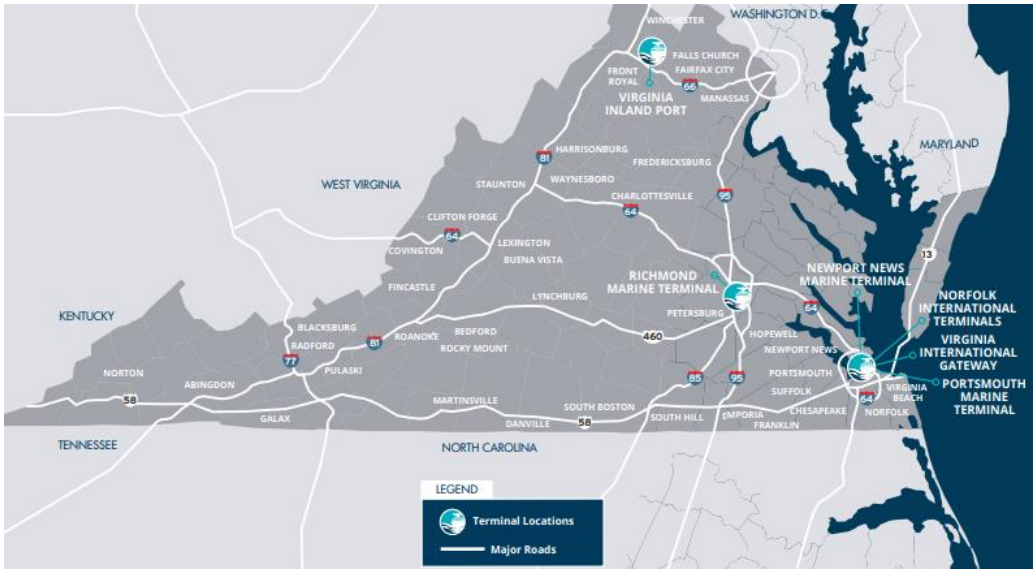
INTRODUCTION

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) 2021 **national economic impacts** of the Port of Virginia (POV) operations at its owned and leased terminals in Virginia.[1] 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 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) 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 American economy through three major channels:

1) moving exports and imports,
2) exporting goods made in the USA, and
3) American businesses using imported goods as inputs.



[1] Raymond A. Mason School of Business has partnered with Mangum Economics, a Glen Allen, Virginia-based firm to provide the empirical analysis.

The national economic 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 (i.e., direct, indirect, and induced) show that the nationwide users of POV imports generate over 74 percent of the national economic impact supported by POV while exports generate almost 23 percent. In the following sections we will describe in detail each of the three components of the value chain.

Table 1 POV-based USA Impacts ($ in millions)	*Output Sales*	*Value -added Income*	*Labor Income*	*Employ-ment*
POV Cargo-moving Impacts	**$9,034.5**	**$4,409.7**	**$3,504.7**	**52,332**
Percent of Total	**2.7%**	**2.9%**	**3.9%**	**4.0%**
USA-made Exports Impacts	**$76,763.0**	**$32,665.8**	**$17,669.9**	**258,441**
Percent of Total	**22.5%**	**21.4%**	**19.9%**	**20.0%**
USA-used Imports Impacts	**$254,740.3**	**$115,808.0**	**$67,615.9**	**983,595**
Percent of Total	**74.8%**	**75.7%**	**76.2%**	**76.0%**
Impacts	**$340,537.8**	**$152,883.5**	**$88,790.5**	**1,294,368**

Moving these exports and imports center 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 while 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 - double-stack rail to the Midwest), an impressive interstate network supported with an inland port conveniently accessible near I-81, barge service to Richmond, and access to 75% of the U.S. population within a two-day drive.

Exports made in the USA have a separate, additional American economic impact. Overseas demand for these goods drives this production. However, the availability of an exceptional deep-water port (50’ channel and dredging to the 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 American businesses with 2.5 hours to open sea. While the production of American-made exports is a major economic

contribution – all facilitated by the Port of Virginia operations importing materials, components, parts, and end-products that are the dominant value-added source.

Over 70 percent of the imports that move through the Port of Virginia are used as inputs by American businesses - inputs to produce goods for sale across the nation. These imports are inputs into a supply chain of services and goods with a large impact on American income, jobs, and taxes. The dollar cost of the imports is an expense, not national income. But the value-added in production by American businesses, the margins earned in the supply chain here, are income, supporting jobs, payroll, and taxes. This economic impact generated by port operations needs recognition as a major source of American output of goods and services.

Impacts are reported here using four measures: output (or sales of goods and services); value-added (the portion of output sales that are comprised of the value that a business adds to the commodities it used to produce that final product sold); labor income (including benefits and proprietors' income) and employment. These measures are displayed in tables throughout this report and their 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 local income and jobs

Labor income consists of wages and salaries, benefits, and sole proprietors' income. Labor income is the largest component of Gross Domestic 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) includes the Virginia Port Authority and its private operating unit, Virginia International Terminals. The POV terminals include, when referring to the port operations, the deep-water Norfolk International Terminals (NIT), Newport News Marine Terminal (NNMT), the Virginia International Gateway (VIG) Terminal, Portsmouth Marine Terminal (PMT), and two satellite terminals: the Richmond Marine Terminal (RMT) and the Virginia Inland Port (VIP), an intermodal facility in Front Royal, Virginia.

The Port of Virginia's first priority is 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 - stated differently, this is, on average, like moving 2,564,384 fifty-pound bags per day, or 106,849 bags per hour…around the clock…everyday…all year long. Of course, this is only feasible with stevedores using the port's cargo handling equipment, automation abilities, and computer technology.

Table 2
Port of Virginia Freight Moved, Tons and TEUs

	Tons	TEUs
Containers		
Loaded		
Exports	**11,378,862**	**1,016,040**
Imports	**12,009,707**	**1,520,647**
Total Loaded	**23,388,569**	**2,536,687**
Empty		
Exports		**663,474**
Imports		**20,840**
Total Empties		**684,314**
Totals	**23,388,569**	**3,221,001**
Breakbulk		
Exports	**10,949**	
Imports	**43,794**	
Total Breakbulk	**54,743**	
FY 2021 Tonnage Moved	**23,443,312**	

Note that the POV loaded export versus import container tonnage are roughly equal (50 percent of the loaded total each). Therefore, export and import cargo transportation impacts within America'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 the USA versus how much of the imported goods value is used as intermediate inputs by American 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 primarily by barge, while an even larger portion was sent primarily by rail to the Virginia Inland Port. The Richmond Marine Terminal's 560,947 tonnage was 2.3 percent of the total POV tonnage but served a valuable function in moving exports from and imports to the Richmond area's international trade customers. The tonnage and TEU volume moved to and from the Virginia Inland Port not only has been a valuable service for the growing number of international trade customers in Northwest Virginia but allowed Virginia distribution centers (DCs) to send goods more efficiently to other states, especially in the Midwest and Mid-Atlantic…an estimated 90% of trucks leaving these DCs are for out-of-state destinations.

Table 3 Port of Virginia Containers Moved to Satellite Ports	***Richmond Marine Terminal***		***Virginia Inland Port***	
Loaded	**Tons**	**TEUs**	**Tons**	**TEUs**
Exports	**216,103**	**16,165**	**61,452**	**5,265**
Imports	**344.844**	**41.518**	**180.560**	**31.178**
Total Loaded	**560,947**	**57,683**	**242,012**	**36,443**
Empties				
Exports		**25,881**		**25,750**
Imports		**53**		**121**
Total Empties		**25,934**		**25,871**
Total Moved	**560,947**	**83,617**	**242,012**	**62,314**

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** include 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 (FY 2021). 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.

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

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. The total impacts are the sum of the direct, indirect, and induced impacts reported in Table 5. Indirect impacts are the business-to-business (B2B) flows supported by direct output demand, value-added, compensation, and jobs.

The output shown as indirect impacts in Table 5 is the B2B spending for inputs and supplies from other American 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 supported 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 generated as the income earned by households and businesses spent in the process of meeting the direct and indirect demands, primarily for household consumption along with taxes paid to state and local governments 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.

Table 5 POV Cargo-Moving Virginia Impacts ($ millions)	*Output Sales*	*Value Added*	*Labor Income*	*Employment*
Direct Impact	**$2,781.6**	**$1,410.5**	**$1,181.3**	**16,864**
Indirect Impact	**$3,004.3**	**$1,683.8**	**$1,243.7**	**17,460**
Induced Impact	**$3,248.6**	**$1,848.4**	**$1,079.7**	**18,008**
Total Impacts	**$9,034.5**	**$4,409.7**	**$3,504.7**	**52,332**

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 the United States in FY 2021 was $9,034.5 million, supporting a value added of $4,409 million, of which $3,504.7 million went for labor income for 52,332 workers.

EXPORTS MADE IN THE U.S.

The nationwide 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 the USA*. 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 American businesses produced $26,765.9 million in containerized exports facilitated by the POV in FY 2021, as reported in Table 6.

For the exports (and imports), we only use the foreign trade value and tons data reported by month 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 serve to illustrate the variety of export products grown, processed, or manufactured by businesses in the United States. The types of American 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 Group 31 manufacturing group.

Table 6 USA-made Exports Value by Major Sectors	***FY 2021 Dollar Value ($ mill.)***
11 Agric., forestry, & fishing products	**$3,534.0**
21 Nonmetallic mining products	**$636.9**
31 Food, bev., textiles, & apparel mfg.	**$4,926.6**
32 Wood, paper, chem., plastics mfg.	**$8,992.7**
33 Metal, machin., electronics, transpt. & furniture mfg.	**$5,958.6**
90s Waste, scrap, used/spec classif. goods	**$2,717.1**
Total Exports (facilitated by the POV)	**$26,765.9**

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 $26.8 billion in international export products sold in FY 2021 by American businesses was a direct economic output impact. These exporting businesses buy inputs and supplies from other American businesses, thus supporting a very large FY 2021 indirect output impact of $32.1 billion. The employees of exporting businesses and their suppliers spend most of their earnings in the US, yielding an additional $17.9 billion induced impact. The direct export sales of $26.8 billion generate a cumulative total of $76.8 billion in business purchases facilitated by the POV being spent nationwide, as shown in Table 7. The sum of the direct, indirect, and induced value-added, or GDP, is $32.7 billion. This value-added includes $17.7 billion in labor income for 258,441 employees.

Table 7 *USA-made* *Exports Impacts* *($ in millions)*	Output Sales	Value-added	Labor Income	Employment
Direct Impact	**$26,766.2**	**$9,067.4**	**$4,399.9**	**47,994**
Indirect Impact	**$32,091.1**	**$13,551.0**	**$7,606.7**	**110,213**
Induced Impact	**$17,905.7**	**$10,047.4**	**$5,663.3**	**100,234**
Total Impacts (facilitated by the POV)	**$76,763.0**	**$32,665.8**	**$17,669.9**	**258,441**

IMPORTS USED AS INPUTS INTO THE U.S.

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 nationwide economic impacts of getting these goods unloaded and transported across America are included as part of the $5.4 billion port operations impacts already discussed.

Our focus here are the FY 2021 separate, additional impacts of Americans' use and purchase of these imports, $37.4 billion worth in Table 8. That amount is not US production, an expense not income.

Table 8 *USA-used Imports, Value by Major Sectors*	*FY 2021* *Dollar Value ($ mill.)*
11 Agric., forestry & fishing products	**$1,493.7**
21 Nonmetallic mining products	**$245.3**
31 Food, bev., textiles, & apparel mfg.	**$5,380.4**
32 Wood, paper, chem., plastics mfg.	**$8,462.6**
33 Metal, machinery, electronics, transport & furniture mfg.	**$21,364.5**
90s Waste, scrap, used/spec classification goods	**$404.7**
Total Imports (facilitated by the POV)	**$37,351.2**

Importantly, as it moves through the supply chain to American businesses and households, value is added by the manufacturers, wholesalers, warehousing companies, and retailers who use these imports as inputs in producing their products and services. The final sales price to customers average about 2.48 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 greater profit potential or lower costs for American businesses. The types of American-used import goods are reported in Table 8 by NAICS two-digit codes. The largest sector by value is NAICS Code Group 33: Machinery, Electronics, and Furniture, with FY 2021 imports in this sector valued at $21.4 billion.

With USA exports, the dollar value is the final price of the output. The American use of imports is quite different from export production. The imports to America are inputs for different types of durable goods manufacturers (e.g., Stihl), nondurable goods producers (e.g., International Paper, MeadWestvaco), wholesalers (e.g., BJs, Costco), and retailers (e.g., Family Dollar, Home Depot, Kohl, Lenox, Lowes, Target, Walmart) along with thousands of small businesses With these foreign imports, the $37.4 billion in businesses' costs (FY 2021) are inputs for further processing by America's manufacturers, wholesalers, and retailers. The impact in United States is the value-added by American businesses, equal to the final price minus the import input purchases.

Therefore, to identify the US economic impacts, we 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.

Viewing foreign imports as part of the intermediate inputs used by American businesses, a conservative estimate is that they average about 40.3 percent of the final American output value. What this means is the total import-based output price is 2.48 times the value of the imported inputs (2.48 X multiplier), with additional spending inside the US at least equal to about 59.7 percent of total sales. With a 2.48 X multiplier, the $37.4 billion of imported inputs in FY 2021 yields an estimated final import-based sales value of $92.8 billion. We report this

$92.8 billion in Table 9 as the FY 2021 *direct* US spending flow from American use of the imports that proceed through the Ports of Virginia.

Table 9 USA-used Imports through POV ***($ in millions)***	***Output Sales***	***Value-added***	***Labor Income***	***Employ-ment***
Direct Impact	**$92,771.1**	**$35,239.1**	**$20,666.2**	**242,853**
Indirect Impact	**$93,454.9**	**$42,123.6**	**$25,279.6**	**357,206**
Induced Impact	**$68,514.3**	**$38,445.3**	**$21,670.1**	**383,536**
Total Impacts (facilitated by the POV)	**$254,740.3**	**$115,808.0**	**$67,615.9**	**983,595**

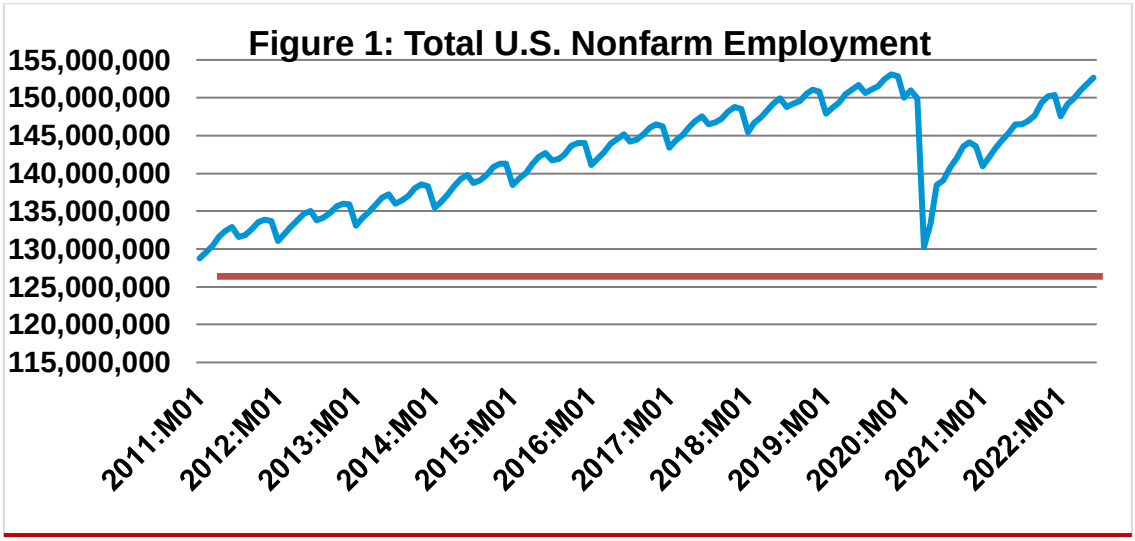
US manufacturers, producers, wholesalers, and retailers making those sales generated nationwide value-added of $35.2 billion (59 percent of which went for labor income) and made purchases from other US businesses, an indirect output demand of $93.5 billion. The full FY 2021 economic impacts are reported on the bottom line in Table 9. The $254.7 billion in output sales, supporting $115.8 billion in value added, with $67.6 billion in labor income earned by 983,595 American workers is a very large and often underappreciated economic impact related to the POV operations.

PORT OF VIRGINIA IMPACT RECAP

The total FY 2021 national impacts attributable to the Port of Virginia were reported by type and category in Table 1, summing to $340.5 billion in output, creating $152.9 billion in value added, of which $88.8 billion was labor income earned by 1,294,368 employees and proprietors. It should be emphasized that commodities included here have moved in containers (bulk commodities are not included).

POV'S STABILIZING INFLUENCE ON THE U.S. ECONOMY

In assessing POV's economic impact on the United States in FY 2021, it is important to keep in mind the situation within the national economy during that time. Economic conditions in the United States changed dramatically with the repeated lockdowns of economic activity that were imposed in early 2020 in response to the pandemic. Figure 1 depicts the trend in total nonfarm employment in the United States between January 2011 and July 2022. As these data illustrate, between February and April of 2020 almost 21 million jobs were lost nationally (or approximately one out of every seven jobs in the country). That job loss effectively wiped out more than nine years of accumulated employment growth. In addition, total nonfarm employment in the United States did not fully recover to its pre-pandemic level until April of 2022, more than two years after the lockdowns were first imposed.



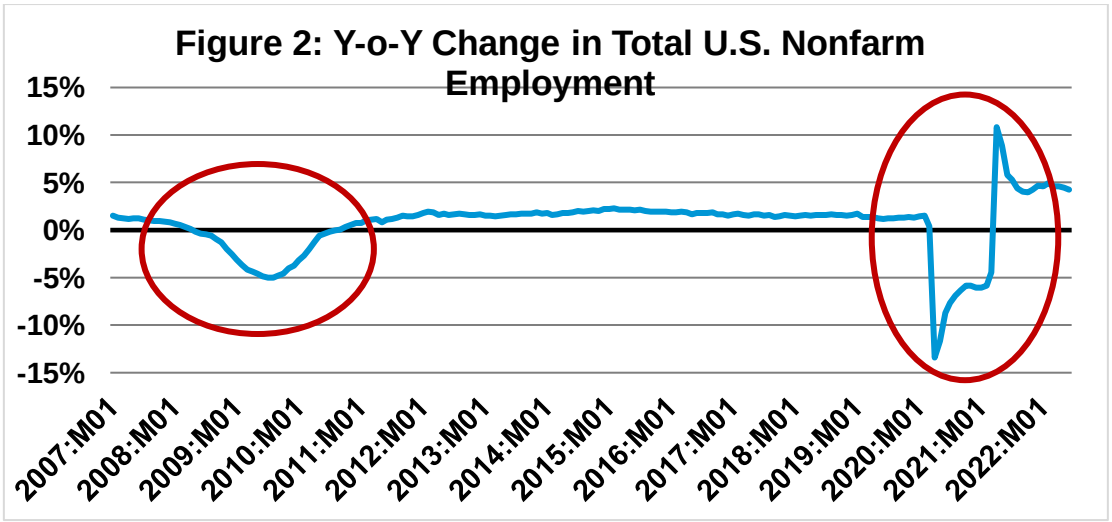
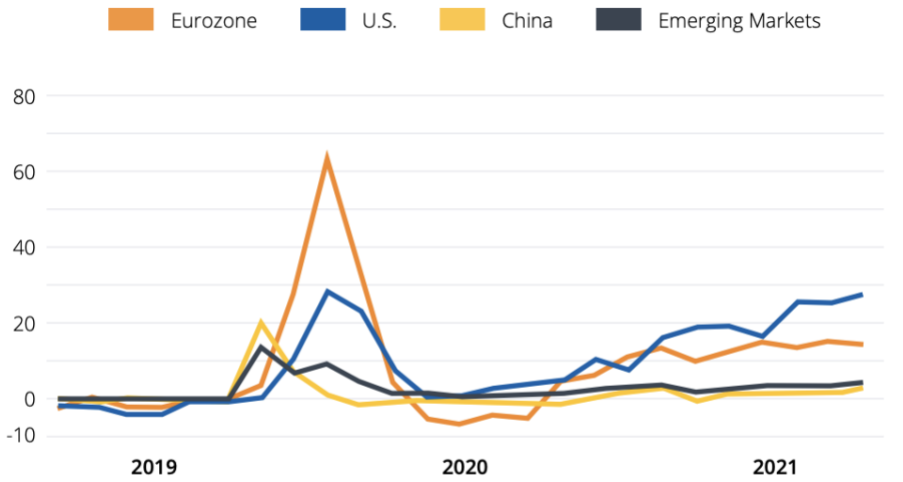


Figure 2 provides additional context for these numbers by comparing the year-over-year change in total nonfarm employment in the United States over this period compared to what the nation experienced during the "Great Recession" of 2007. As these data show, in April of 2020 the United States experienced a year-over-year jobs loss of 13.4 percent. By way of comparison, at the bottom of the Great Recession, the worst recession to hit the country since the Great Depression, the United States' year-over-year job loss was only 5.0 percent.

Finally, in Figure 3 we see the relative level of disruptions in the global supply chain. In early 2020, supply chain disruptions were at a peak. The Eurozone was hit hardest but the U.S. also suffered by comparison to other areas. As 2020 and 2021 progressed, the U.S. has seen its relative share of disruptions increase to the point where we are now, unfortunately, leading.

Figure 3: Index of Global Supply Chain Disruptions (100=most disrupted)



Based on the difference between the supply delivery times subindex and the supply delivery times based on manufacturing output subindex (both part of the PMI)

Source: Statista

It is important to realize that even in this historically challenging economic environment, in FY 2021, POV's cargo tonnage still grew by 6.0 percent compared to FY 2018, while the port operations, production of exports, and value-added provided the imports associated with that cargo directly and indirectly supported nearly 1.3 million full-time and part-time jobs nationally. This clearly demonstrates the stabilizing influence that POV had on the national economy during what was one of the worse, if not the worse, economic downturns the country has ever experienced. Obviously, leadership is still required as supply chain disruptions increase in their challenge to the nation.

LOOKING FORWARD

The Ports of Virginia continues to offer vision, an investment in infrastructure, and concern for business. In a world where global trade is at risk and the connections among the nations are tenuous, the economic engine that is the Port of Virginia is a welcome cornerstone for building toward an emerging future. While the "China Option" was the default position for many businesses in the past, this view is now being challenged. More companies are looking for alternatives including bringing production back to the U.S. These global transitions have begun and are likely to continue to disrupt comfortable trade patterns, established partners, and supply chain routines for at least the next five years. Future challenges are likely to be labor shortages, continued supply chain disruptions, production movement, and increased dependency of businesses, especially small- and medium-size, on the knowledge, skills, and insights of the Port of Virginia.

The Port of Virginia has been able to adjust nimbly to unpredictable schedules and labor shortages (The Virginian-Pilot 12/21/21). They proactively assessed the needs and put the pieces together to allow the operations to be robust to many unknowns and offer not only a stabilizing force but a rising influence on the economy. A combination of thoughtful planning, supply-chain coordination, new technologies and routing and scheduling optimization make possible the standout performance in the US (The Hill 12/22/21). 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.

One of the keys to managing the future is the ability for one entity to manage across facilities and modes of transportation. It makes it easier to divert a ship to another terminal if one is congested; it makes it easier to assist customers and access data. The future requires 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).

The Port of Virginia is likely going to be asked to offer insights from deep data analytics to help customers reduce costs, improve service (e.g., increasingly close access to shipping points as customers emerge in new locations), and drive long-term goals – this will require a further embrace of collaborative efforts with customers. Additional pressure from competitors and customers will require refined operational proficiency. Further demands for real-time data availability is now acknowledged and would allow visibility of everything in the yards, shipment movements (e.g., inventory, tracking, billing, productivity, orders) along with offering an ability for analysis and industry benchmarking.

Continued funding is critical to maintain POV's advantages and attract companies' utilization of their services. Traditionally this has been perceived as funding railway connections, greater channel width, bigger cranes and higher bridges (The Hill 12/22/21). This will increasingly be supplanted by further investments in analytics and insights. Small businesses' inability to acquire the raw materials, parts, components, and products will disproportionately affect economic growth. While they traditionally lead the economic turnaround, they do not have the volume and leverage to get the attention of suppliers. Ports will increasingly need to assist small businesses with not only performing their regular duties but offering businesses constative services for their emerging challenges.

Virginians appreciate jobs, increased income, and tax support for better public services. "(L)eaders 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). 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. With high energy prices, higher cost logistics, pressures for sustainability, and "buy local" campaigns, all signals point to the reduction of transportation in response to the increasing costs although the Port of Virginia is likely to buck this trend with its assets. Economics drives behavior so we are likely to see reduced overall imports where ocean transportation costs become significant despite the overwhelming added-value they play in the national economy. Further, the increasing uncertainty and risks of ocean transport are driving these trends further and faster. Air transportation becomes more flexibly viable but only for a limited range of products, materials, and parts.

In summary, 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 deserves support as additional initiatives are required. Especially since the Port of Virginia's success requires further preparation into new areas while continuing to buttress their traditional competitive advantages. Their commitment to automation has set it apart – those investments made record productivity possible - "The highly automated Port of Virginia has been weathering the current crisis better than its counterparts" (National Review .com 01/12/22).

As has been shown in this analysis, Virginia's ports are vital for the nation's economy. The ability to obtain high quality, low cost materials, parts, and products where they are needed and when they are needed is one of the greatest competitive advantages. This is the power of logistics facilitated by the port. These conveyed inputs are then converted into value-added goods that produce 2.5 times their purchase value which in turn drives additional tax revenues, job opportunities, and income. But, the new challenges require data, deep insights, consultancy, omnichannel connectivity, further supply chain optimization, resiliency to a range of disruptions, and shared knowledge. These are the new leadership requirements and a continued step forward in the Port of Virginia's focus on customer needs.

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BIOGRAPHICAL SKETCH

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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 four 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.

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