The National Implications of the Port of Baltimore & Tradepoint Atlantic

Submitted by:

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Submitted to:

Maryland Stakeholders

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The National Implications of the Port of Baltimore & Tradepoint Atlantic

Executive Summary

Port of Baltimore Enjoys Massive Competitive Advantages . . .

The Port of Baltimore possesses many competitive advantages, including, but not limited to recent investments in physical capital; continued dredging to support an already deep channel; Baltimore's centralized location in the mid-Atlantic; and the natural advantages involved with shipping by sea. Moving freight by rail rather than truck reduces prices by over 80 percent. Even more notable is the cost-effectiveness of waterborne freight. Shipping a bulk commodity such as coal by ship reduces unit costs by well over 99 percent. Thus, for every mile freight travels by water rather than rail, savings amount to over $2 per ton-mile. The advantage of ships over trucks is well over $14 per ton-mile.

Cargo imported or exported using the Port of Baltimore in 2015 supported more than 435,000 jobs in Maryland and the key states that are linked to current port operations, as shown in Exhibit ES-1. Almost 86 percent of these jobs are related to imports while 56 percent are linked to Maryland. These jobs include those directly tied to the industries that use the commodities moving through the port as well as employment in the supply chains for these industries and the jobs in the consumer economy supported by workers in the directly affected industries and their supply chains.

Exhibit ES-1. Jobs supported by cargo moving through the Port of Baltimore, 2015

Location	*Imports*	*Exports*	*Total*
Maryland	228,871	14,756	243,627
Other key states	144,879	46,618	191,497
Total	373,750	61,374	435,124

. . . But Punches Far Beneath its Weight . . .

Despite these remarkable advantages and the size of its immediate market, the Port of Baltimore is not nearly as impactful as it should be. Given its location, it would be reasonable to presume that the Port of Baltimore would compete favorably with the Port of Virginia and the Port of New York and New Jersey, particularly for freight headed to - or coming from - the Midwest. Much of the cargo moving to and from these ports is carried on highways, the least cost-effective freight mode. Shorter highway distances should equate to lower costs. In a highly competitive industry like logistics, these potentially lower costs would presumably lead to greater market share for Baltimore.

Data regarding total cargo volume tell another tale, however. In 2015, Baltimore handled almost 27,000 kilotons of cargo. New York handled almost 58,000 kilotons, more than twice the volume of Baltimore. Norfolk handled more than 102,000 kilotons, nearly four times Baltimore's volume.

Existing constraints in Baltimore represent a major explanation for the apparent contradiction between the Port of Baltimore's geographic advantages and its relatively poor performance relative to Norfolk and New York. Two constraints are especially critical.

1. Limits on the capacity of the Port of Baltimore. While Baltimore's harbor has a 50-foot channel, the channel only serves one terminal. By extending this deep-water channel to Tradepoint Atlantic, a proximate developable site encompassing more than 3,000 developable acres, the capacity of the Port of Baltimore to serve the largest ships would be dramatically expanded.

2. Limits on double-stack train movements. The inability of the Howard Street Tunnel to accommodate double-stack freight cars is a well-researched bottleneck that severely restricts the ability of freight rail service in Baltimore.

. . . Creating Opportunities to Unleash Massive New Efficiencies on the East Coast

Despite its physical handicaps, the total estimated impacts of imports and exports moving through Baltimore include more than 435,000 jobs with associated income in excess of $22 billion and $67 billion in business sales. While Maryland enjoys a significant share of these benefits, the Port of Baltimore supports more than 191,000 jobs in 15 other states with income of $10 billion and business sales exceeding $32 billion. Roughly 12 percent of total benefit accrues to Pennsylvania, 8 percent to New Jersey, and about a quarter among 13 remaining key states.

The localized benefit of the Port of Baltimore (large fraction of impact in Maryland) is at odds with the logistical advantage that Baltimore offers. If the Port of Baltimore could compete on equal footing with nearby East Coast ports, this logistical advantage would almost certainly translate into significant increases in cargo movements between Baltimore and key states. This would be particularly true of a wide swath of states, starting with central Pennsylvania and moving west through Ohio and the industrial and agricultural heartland of the country.

Pittsburgh represents an example of the logistical advantages of the Port of Baltimore versus its rivals in Virginia and New York/New Jersey. Baltimore is closer to Pittsburgh than its rival ports, and yet has far less market share than geography would suggest. Most of the cargo moving to and from Pittsburgh moves by truck, which costs an estimated $14.24 per ton-mile. Using the mileage penalty of traveling cargo (i.e. the greater distance compared to Baltimore), potential savings if cargo moved through Baltimore can be estimated. For exports alone, potential savings approach $17 billion per annum based on 2015 trade flows. The total potential savings if this cargo had moved through Baltimore instead of the POV or the PONYNJ are estimated at $17.4 billion.

Key Implication – Invest in Baltimore, Invest in Efficiency

The implication is that 1) extending Baltimore's deep-water channel to Tradepoint Atlantic and 2) addressing the Howard Street Tunnel to allow for the accommodation of double-stack freight cars would trigger outsized, positive efficiencies and economic impacts on the East Coast of the United States. Few projects are as likely to trigger as significant efficiencies as positioning the Port of Baltimore to better compete for cargo that is now being transported at costs much higher than is necessary. The result of these excess costs is a less competitive export sector, fewer jobs, higher costs for consumers and businesses, and less economic dynamism, including in key Midwestern markets.

I. The Importance of Logistics in a Global Economy

The increasingly globalized economy places a premium on the ability to transport commodities (finished goods or intermediate products) at the lowest cost. In international trade, lowest cost is a calculus that incorporates three major modes: waterborne, rail, and highway.

These modes have distinct cost profiles and delivery flexibility. Ships have the lowest costs, but the least flexibility, while trucks have the highest costs and greatest flexibility. Rail sits in the middle along the dimensions of cost and flexibility.

Statistics regarding revenue freight per ton-mile clarify the differentials between water, rail, and highway modes. These revenue data for truck and rail are not recent. 2004 represents the final year for which costs for all modes are available. However, the ratio of revenues has been consistent over time.[1] Data regarding ocean freight are representative. In this instance, the rate was for shipping coal between Rotterdam and the Port of Virginia. The rate in October 2013 was between $12.60 and $15.10 per ton over a distance of 4,165 nautical miles, with the variation explained by size of the vessel.[2] This translates into a fraction of one cent per ton-mile.

The comparison of rates per ton- mile, shown in Exhibit 1, is remarkable. Moving freight by rail rather than truck reduces prices by more than 80 percent. Even more notable is the cost-effectiveness of waterborne freight. Shipping a bulk commodity such as coal by ship reduces unit costs by well over 99 percent.

Thus, for every mile freight travels by water rather than rail, savings amount to more than $2 per ton-mile. The advantage of ships over trucks is well in excess of $14 per ton-mile. This is critical to Baltimore's competitive advantage as a port that can move cargo by water closer to large portions of the Northeastern and Midwestern U.S. than any other East Coast port.

Exhibit 1. Average Freight Revenue Per Ton-mile

Mode	*Rates/ton-mile*	*Costs as share of truck costs*
Truck	$14.24	100.00%
Class I rail	$2.35	16.50%
Ocean freight (coal)	$0.0036	0.03%

Source. Bureau of Transportation Statistics, Coal Age

- **The Port of Baltimore has Unique Locational Advantages, but Significant Physical Constraints**

The Port of Baltimore and Tradepoint Atlantic are uniquely well-situated on the East Coast to efficiently serve markets in the eastern portions of this country and Canada. More than 40 percent of the U.S. population and more than 50 percent of Canada's population are within a day's drive of

[1] Bureau of Transportation Statistics, US Department of Transportation "Table 3-21: Average Freight Revenue Per Ton-mile (Current cents)." The average truck cost per ton-mile, 1990-2004 was $13.37; the average for rail was $2.40. https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_03_21.html

[2] Gambrel, William, "Ocean Freight Rates for Coal," Coal Age, December 17, 2013 The largest vessels—Capesize—accommodate 130,000 to 150,000 deadweight tons, up to almost twice the capacity of Panamax ships.

the Port of Baltimore. This exceeds the population access of any other East Coast port and is more than double the population reach of West Coast ports.[3]

Moreover, compared to other major ports in the Mid-Atlantic region, Baltimore has better access to key destinations in the industrial and agricultural Midwest that are major importers and exporters of commodities and finished goods. Baltimore's traditional rivals in serving these inland markets are the Port of Virginia, located in Norfolk at the mouth of the Chesapeake Bay, and the Port of New York and New Jersey.

Exhibit 2 compares the highway mileage between each of these ports and shipping destinations in the Northeast and Midwest. For Pennsylvania, Baltimore is substantially closer to major destinations compared to Norfolk and significantly closer to destinations compared to New York, except for the City of Philadelphia which is roughly equidistant from Baltimore and New York. In upstate and western New York, Baltimore is clearly closer than Norfolk and generally as close as the Port of New York and New Jersey. Moving west to Ohio, Kentucky, Michigan, Indiana, Illinois, and Missouri, *Baltimore has significant proximity advantages*. For destinations in each of these states, cargo moving from Norfolk or New York would have to travel at least 5 percent farther (Norfolk to Louisville) and as much as 43 percent farther (Norfolk to Cleveland) to reach its destination.

Exhibit 2. Distance between Baltimore, Norfolk, New York, and various cities

Destination	*Baltimore*	*Norfolk*		*New York*	
	Miles	Miles	Relative to Baltimore miles	Miles	Relative to Baltimore miles
Washington, DC	51	190	373%	226	443%
Harrisburg, PA	92	301	327%	181	197%
Philadelphia, PA	103	273	265%	97	94%
Pittsburgh, PA	259	427	165%	389	150%
Rochester, NY	355	572	161%	338	95%
Buffalo, NY	374	566	151%	376	101%
Cleveland, OH	386	552	143%	466	121%
Columbus, OH	415	568	137%	553	133%
Cincinnati, OH	518	603	116%	657	127%
Detroit, MI	542	710	131%	628	116%
Indianapolis, IN	589	716	122%	728	124%
Louisville, KY	621	652	105%	756	122%
Chicago, IL	714	882	124%	794	111%
St Louis, MO	832	911	109%	970	117%

Source. Google maps

Another perspective is gained by considering the population within 250 miles of Baltimore, Norfolk, and New York. More than 31 million people live within a 250-mile radius of Norfolk while well over 50 million live within 250 miles of Baltimore and New York. When the overlapping counties are assigned to the closest port, however, the non-overlapping population within 250 miles of each

[3] Florida Department of Transportation, "Intermodal Logistics Centers: Boosting Florida's Economy through Freight Logistics".

port creates clear distinctions. New York is the most logical port for its proximate area which has a population of 44 million. Baltimore serves an area with less than half the population served by the PONYNJ, approximately 20 million people. Norfolk's non-overlapping service area includes roughly 11 million people.

Exhibit 3 presents the disparity between the volumes of total cargo value and volume and containerized cargo handled by the three ports and the non-overlapping populations within 250 miles of each port. The Port of Baltimore consistently handles a smaller share of the value and volume of all cargo and of all containers than its roughly 27 percent of the non-overlapping population within 250 miles of the ports.

Alternatively, the POV handles substantial shares of the total cargo value and volume and container volume, but is associated with only 15 percent of the non-overlapping population within 250 miles. The PONYNJ has the most clearly aligned share of the total cargo value (55 percent) and container volume (65 percent) and its share of the non-overlapping population within 250 miles (58 percent).

Exhibit 3. Comparison of non-overlapping population within 250 miles and cargo flows

		Baltimore	*New York*	*Norfolk*	*Total*
Population	Millions	20.3	44.0	11.0	75.3
	Share of total	27%	58%	15%	100%
Cargo value, 2015	Millions	$54,693	$144,057	$64,167	$262,916
	Share of total	21%	55%	24%	100%
Cargo, 2015	Kilotons	26,985	57,858	102,248	187,091
	Share of total	14%	31%	55%	100%
Container, 2015	Number	840,314	6,371,720	2,549,271	9,761,305
	Share of total	9%	65%	26%	100%

Sources. American Association of Port Authorities, Indiana Department of Workforce Development, Sage

Given its geographic advantages, it would be reasonable to assume that the Port of Baltimore competed favorably with the Port of Virginia and the Port of New York and New Jersey, particularly for freight headed to or coming from the Midwest. Much of the cargo moving to and from these ports is carried on highways, the least cost-effective freight mode. Shorter distances should equate to lower costs. In a highly competitive industry like logistics, these potentially lower costs would presumably lead to greater market share.

The data on total volume of cargo moving through these ports, however, tell another tale. As noted in Exhibit 3, in 2015, Baltimore handled almost 27,000 kilotons of cargo while New York handled almost 58,000 kilotons, more than twice the volume of Baltimore. Norfolk handled more than 102,000 kilotons, almost four times the volume of Baltimore. Of course, some cargo is moving to and from nearby locations. The proximity of ports to their metropolitan locations is a particular advantage for the PONYNJ, located within the largest metropolitan area in the U.S. with a metropolitan population of roughly 20 million. Moreover, much of the volume at the Port of Virginia is high-volume coal exports. Nevertheless, there is still a substantial volume of other cargo at these ports that clearly exceeds that which moves through Baltimore.

Existing physical constraints in Baltimore represent primary explanations for the apparent contradiction between the Port of Baltimore's geographic advantages and its relatively poor performance in terms of handling freight relative to Norfolk and New York. Two physical constraints that are susceptible to human intervention are especially critical.

1. Limits on the capacity of the Port of Baltimore. While Baltimore's harbor has a 50-foot channel, the channel only serves one terminal. By extending this deep-water channel to Tradepoint Atlantic, the capacity of the Port of Baltimore to serve the largest ships would be dramatically expanded. Additional investments in on-shore cargo handling would also substantially increase the volume of cargo that could move through Baltimore, taking advantage of its proximity to major shares of the U.S. population and industrial base.

2. Limits on double-stack train movements. The inability of the Howard Street Tunnel to accommodate double-stack freight cars is a well-researched bottleneck that severely restricts the ability of freight rail service in Baltimore.

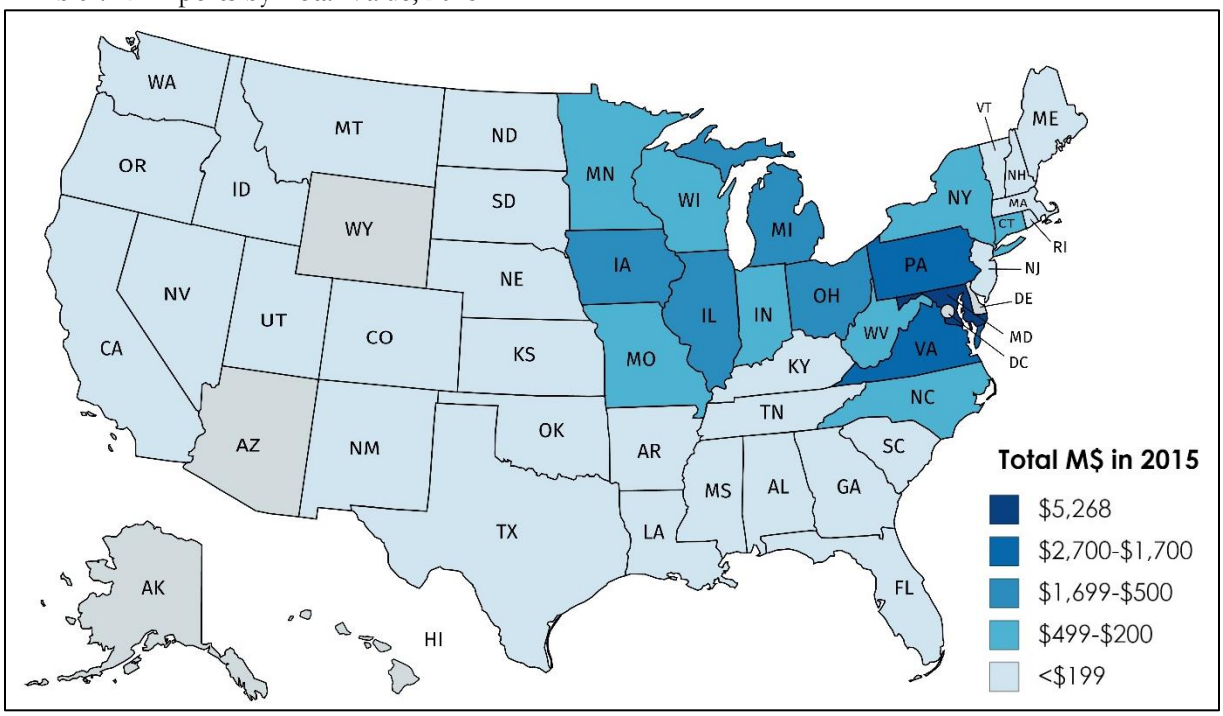
II. Port of Baltimore: Key States and Key Commodities

The movement of cargo through the Port of Baltimore is part of a national and global logistics system that supports thousands of businesses and industries not only in Maryland, but across nearby states. Many major industries and businesses as well as agricultural enterprises in the Midwest, from Ohio to Iowa, benefit from the Port of Baltimore. Outside the U.S., the Port of Baltimore is connected to ports around the world, located on every continent save for Antarctica.

- **Exported Commodities**

The Port of Baltimore operates on a national level. In 2015, exports originating in 48 states moved through Baltimore. Over 90 percent of the value of these exports, however, originated in 14 states, as shown in Exhibit 4, with Maryland accounting for over 30 percent of the value of all exports. The value per ton of these exports averaged about $1,200, but varied widely by state from over $13,000 for exports from Indiana to $138 for exports from West Virginia where coal is the dominant exported commodity. The volume of exports also varied from over 8,000 kilotons originating in Pennsylvania (coal, again) to 16 kilotons from Kentucky.

Exhibit 4M. Exports by Total Value, 2015



Source. US DOT Freight Analysis Framework

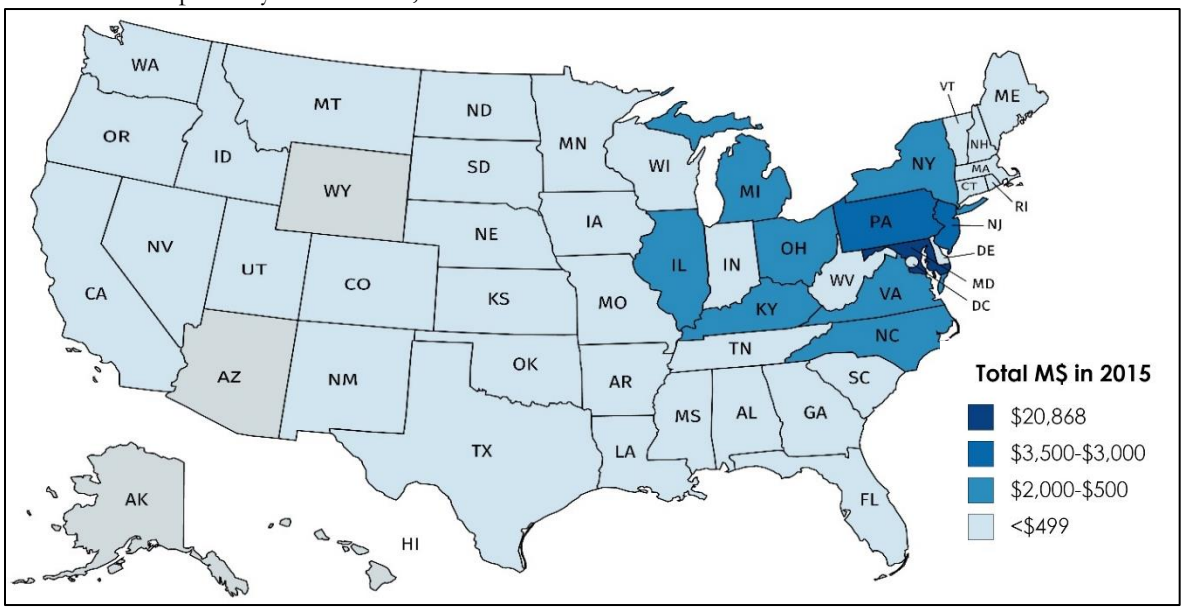
Exhibit 4. Exports from Key States Ranked by Total Value, 2015 (Values in millions)

State	Total KTons	Total value	Share of top states	Cumulative for top states	Share of all states	Cumulative for all states	Dollars/ ton
Maryland	1,858	$5,268	33.5%	33.5%	30.3%	30.3%	$2,835
Pennsylvania	8,133	$2,686	17.1%	50.6%	15.4%	45.8%	$330
Virginia	434	$1,796	11.4%	62.1%	10.3%	56.1%	$4,144
Ohio	155	$1,505	9.6%	71.7%	8.7%	64.7%	$9,739
Michigan	107	$1,002	6.4%	78.0%	5.8%	70.5%	$9,377
Iowa	74	$872	5.6%	83.6%	5.0%	75.5%	$11,865
Illinois	84	$589	3.8%	87.3%	3.4%	78.9%	$6,993
Indiana	35	$473	3.0%	90.4%	2.7%	81.6%	$13,410
Missouri	1,614	$440	2.8%	93.2%	2.5%	84.2%	$273
Wisconsin	32	$337	2.1%	95.3%	1.9%	86.1%	$10,417
New York	32	$283	1.8%	97.1%	1.6%	87.7%	$8,796
West Virginia	1,629	$225	1.4%	98.5%	1.3%	89.0%	$138
Kentucky	16	$150	1.0%	99.5%	0.9%	89.9%	$9,422
Delaware	37	$82	0.5%	100.0%	0.5%	90.3%	$2,183
Top exporting states	14,239	$15,708	100.0%		90.3%		$1,103
All 48 exporting states	14,404	$17,387	110.7%		100%		$1,207

Source. US DOT Freight Analysis Framework

Exhibit 5 provides similar information about imports moving through the Port of Baltimore. A dozen key states account for more than 91 percent of the value of all imports, while imports through the Port of Baltimore were transported to 47 states. Maryland was even more dominant in imports, accounting for 56 percent of the total value of all imports coming through Baltimore. On average, these imports were worth almost $3,000 per ton, approximately 250 percent of the average value per ton of exports. Unit values from key states varied from $776 per ton for New York to over $21,000 per ton for Kentucky. Volumes showed similar variety ranging from 7,580 kilotons in Maryland to 23 kilotons in Tennessee.

Exhibit 5M. Imports by Total Value, 2015



Source. US DOT Freight Analysis Framework

Exhibit 5. Imports to Key States Ranked by Total Value, 2015 (values in millions)

State	*Total KTons*	*Total value*	*Share of top states*	*Cumulative for top states*	*Share of all states*	*Cumulative for all states*	*Dollars/ ton*
Maryland	7,580	$20,868	61.2%	61.2%	55.9%	55.9%	$2,753
Pennsylvania	683	$3,224	9.5%	70.7%	8.6%	64.6%	$4,718
New Jersey	490	$3,152	9.2%	79.9%	8.4%	73.0%	$6,432
Michigan	252	$1,847	5.4%	85.4%	5.0%	78.0%	$7,322
Ohio	337	$1,276	3.7%	89.1%	3.4%	81.4%	$3,785
New York	1,262	$980	2.9%	92.0%	2.6%	84.0%	$776
Kentucky	39	$826	2.4%	94.4%	2.2%	86.2%	$21,414
Illinois	333	$757	2.2%	96.6%	2.0%	88.3%	$2,274
Virginia	142	$631	1.9%	98.5%	1.7%	90.0%	$4,453
Indiana	97	$289	0.8%	99.3%	0.8%	90.7%	$2,968
Delaware	25	$122	0.4%	99.7%	0.3%	91.1%	$4,829
Tennessee	23	$106	0.3%	100.0%	0.3%	91.3%	$4,678
Top exporting states	11,264	$34,078	100.0%		91.3%	11,264	$3,025
All 47 exporting states	12,581	$37,306	109.5%		100.0%	12,581	$2,965

Source. US DOT Freight Analysis Framework

While imports and exports through the Port of Baltimore reach almost every corner of the continental U.S., they also span the globe. Exhibit 6 lists the top countries for exports and imports through Baltimore in terms of volume. While these top countries represent much of the total cargo volume (86 percent of export volume and 63 percent of import volume), foreign trade moving through the Port of Baltimore is destined for and originates from every continent except for Antarctica.

Exhibit 6. Port of Baltimore: Top Export and Import Countries by Volume, 2015

Export Country	*Export Tons (000)*	*Import Country*	*Import Tons (000)*
India	5,404	Chile	2,352
Netherlands	2,792	Canada	1,589
South Korea	1,932	China	1,200
Brazil	1,068	Brazil	990
China	1,065	Mexico	692
Ukraine	929	Germany	641
Japan	804	Spain	513
United Kingdom	664	Russia	510
Germany	301	Japan	430
Turkey	247	United Kingdom	410

Source. Port of Baltimore

Data regarding specific commodities included in these imports and exports are also available. Exhibit 7 lists the exported commodities, their values, and whether these exports originated in Maryland or other states. For each commodity, the share of total value originating from states other than Maryland is listed. The top four commodities are motorized vehicles, machinery, mixed freight, and coal. Collectively these four commodities account for almost three-quarters of the value of all exported commodities; each accounted for at least $1.5 billion in value.

Exhibit 7. Exports through the Port of Baltimore from Top States, 2015 (values in millions)

Commodity	*Total value by commodity*	*Share of total value*	*Value for commodities originating from Maryland*	*Value for commodities originating from outside Maryland*	*Value share for commodities originating from outside Maryland*
Alcoholic beverages	$10.8	0.1%	$7.4	$3.3	31.0%
Animal feed	$19.4	0.1%	$0.0	$19.3	99.9%
Articles-base metal	$125.7	0.8%	$34.7	$91.1	72.4%
Base metals	$350.2	2.2%	$84.4	$265.7	75.9%
Basic chemicals	$227.1	1.4%	$59.0	$168.0	74.0%
Building stone	$0.0	0.0%	$0.0	$0.0	N.A.
Cereal grains	$31.6	0.2%	$14.5	$17.1	54.2%
Chemical prods.	$380.6	2.4%	$186.6	$194.0	51.0%
Coal	$1,464.3	9.3%	$25.1	$1,439.2	98.3%
Electronics	$249.7	1.6%	$127.8	$121.8	48.8%
Fertilizers	$12.9	0.1%	$0.2	$12.7	98.7%
Fuel oils	$0.6	0.0%	$0.0	$0.6	100.0%
Furniture	$29.1	0.2%	$14.6	$14.5	49.8%
Gasoline	$0.2	0.0%	$0.0	$0.2	100.0%
Gravel	$0.1	0.0%	$0.0	$0.1	99.9%
Logs	$69.3	0.4%	$6.3	$63.0	90.9%
Machinery	$1,965.9	12.5%	$365.5	$1,600.4	81.4%
Meat/seafood	$77.0	0.5%	$5.4	$71.6	93.0%
Metallic ores	$185.4	1.2%	$0.3	$185.1	99.8%
Milled grain prods.	$19.6	0.1%	$2.1	$17.5	89.2%
Misc. mfg. prods.	$88.7	0.6%	$41.0	$47.7	53.8%
Mixed freight	$1,743.5	11.1%	$414.6	$1,328.9	76.2%
Motorized vehicles	$6,514.7	41.5%	$2,843.8	$3,670.8	56.3%
Natural sands	$0.2	0.0%	$0.0	$0.2	100.0%
Newsprint/paper	$42.3	0.3%	$6.9	$35.4	83.7%
Nonmetal min. prods.	$74.5	0.5%	$24.7	$49.9	66.9%
Nonmetallic minerals	$1.8	0.0%	$0.2	$1.5	86.2%
Other ag prods.	$65.3	0.4%	$64.8	$0.4	0.7%
Other foodstuffs	$203.9	1.3%	$134.7	$69.2	33.9%
Paper articles	$21.9	0.1%	$3.8	$18.1	82.7%
Pharmaceuticals	$58.0	0.4%	$37.5	$20.5	35.3%
Plastics/rubber	$297.4	1.9%	$70.5	$226.9	76.3%
Precision instruments	$102.4	0.7%	$23.3	$79.1	77.3%
Printed prods.	$10.9	0.1%	$4.2	$6.7	61.4%
Textiles/leather	$76.9	0.5%	$58.4	$18.5	24.1%
Tobacco prods.	$20.5	0.1%	$0.0	$20.5	100.0%
Transport equip.	$653.1	4.2%	$235.5	$417.6	63.9%
Waste/scrap	$378.6	2.4%	$361.4	$17.3	4.6%
Wood prods.	$134.2	0.9%	$9.2	$125.0	93.2%
Total	$15,707.8	100.0%	$5,268.4	$10,439.4	66.5%

Source. US DOT Freight Analysis Framework

- **Imported Commodities**

In a similar manner, Exhibit 8 lists imported commodities, their values, and whether these imports were destined for Maryland or for other states. For each commodity, the share of total value of commodities imported to states other than Maryland is indicated. Top imports by value include motorized vehicles, base metals, machinery, and basic chemicals; together these comprise almost 70 percent of total value.

Exhibit 8. Imports through the Port of Baltimore destined for Top States

Commodity	*Total value by commodity*	*Share of total value*	*Value for commodities destined for Maryland*	*Value for commodities destined for outside Maryland*	*Value share for commodities destined for outside Maryland*
Alcoholic beverages	$356.3	1.0%	$277.8	$78.5	22.0%
Animal feed	$13.7	0.0%	$4.2	$9.6	69.8%
Articles-base metal	$500.3	1.5%	$250.2	$250.1	50.0%
Base metals	$5,962.2	17.5%	$4,419.2	$1,543.0	25.9%
Basic chemicals	$2,000.8	5.9%	$1,001.7	$999.1	49.9%
Building stone	$0.8	0.0%	$0.7	$0.0	3.0%
Cereal grains	$29.4	0.1%	$22.9	$6.5	22.0%
Chemical prods.	$287.0	0.8%	$225.3	$61.7	21.5%
Electronics	$481.7	1.4%	$144.2	$337.4	70.1%
Fertilizers	$39.5	0.1%	$39.4	$0.1	0.2%
Fuel oils	$119.2	0.3%	$119.1	$0.1	0.0%
Furniture	$822.1	2.4%	$674.6	$147.6	17.9%
Gasoline	$413.8	1.2%	$413.7	$0.1	0.0%
Gravel	$0.0	0.0%	$0.0	$0.0	100.0%
Logs	$3.1	0.0%	$0.3	$2.8	89.8%
Machinery	$3,665.0	10.8%	$1,414.1	$2,250.9	61.4%
Meat/seafood	$331.4	1.0%	$241.2	$90.2	27.2%
Metallic ores	$1,324.0	3.9%	$343.0	$981.1	74.1%
Milled grain prods.	$53.2	0.2%	$36.3	$16.8	31.7%
Misc. mfg. prods.	$265.0	0.8%	$185.9	$79.1	29.9%
Mixed freight	$7.3	0.0%	$0.6	$6.7	92.4%
Motorized vehicles	$11,679.4	34.3%	$7,740.1	$3,939.3	33.7%
Newsprint/paper	$395.3	1.2%	$346.4	$48.9	12.4%
Nonmetal min. prods.	$269.5	0.8%	$147.4	$122.1	45.3%
Nonmetallic minerals	$302.1	0.9%	$115.8	$186.3	61.7%
Other ag prods.	$665.0	2.0%	$412.4	$252.6	38.0%
Other foodstuffs	$1,504.9	4.4%	$914.4	$590.5	39.2%
Paper articles	$16.3	0.0%	$7.7	$8.6	52.6%
Pharmaceuticals	$444.7	1.3%	$59.2	$385.5	86.7%
Plastics/rubber	$708.9	2.1%	$298.2	$410.7	57.9%
Precision instruments	$56.8	0.2%	$26.2	$30.6	53.9%
Printed prods.	$71.0	0.2%	$50.6	$20.5	28.8%
Textiles/leather	$724.2	2.1%	$612.4	$111.9	15.4%
Tobacco prods.	$0.2	0.0%	$0.2	$0.0	0.0%
Transport equip.	$26.8	0.1%	$12.1	$14.7	55.0%
Waste/scrap	$163.4	0.5%	$15.5	$148.0	90.5%
Wood prods.	$370.4	1.1%	$295.1	$75.3	20.3%
Total	$34,078.1	100.0%	$20,868.2	$13,209.9	38.8%

Source. US DOT Freight Analysis Framework

III. Cargo flows at East Coast ports: Norfolk to New York

Detailed data regarding the flow of exported and imported cargo by points of origin and destination allow for a deeper dive into the commodities moving through the Port of Baltimore and other East Coast ports. These data provide perspectives on the total value and volume of these cargo flows.

Exhibit 9 summarizes the value of exported commodities moving through the Port of Baltimore by state. As described in more detail later in this report, the states identified here represent over 90 percent of total value of exports through the Port of Baltimore. These states include Maryland's neighbors, but also extend well into the industrial and agricultural heartland. For the sake of comparison, the value of exports from these same states that move through ports located in Norfolk, New York, Philadelphia, and Delaware (Wilmington) are included. In 2015, commodities valued at $15.7 billion were exported through the Port of Baltimore; one-third of these commodities originated in Maryland. Exports through Norfolk and New York[4] were valued at $31.0 billion and $21.4 billion, respectively. Philadelphia and Delaware moved much less cargo.

Exhibit 9. Value of exports by State and by Port for Baltimore's key exporting states, 2015

State of origin	*Port (Values in millions)*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	$5,268	$738	$618	$80	$7	$6,712
Pennsylvania	$2,686	$2,114	$3,301	$2,645	$49	$10,795
Virginia	$1,796	$9,292	$5,586	$33	$4	$16,711
Ohio	$1,505	$1,989	$2,261	$286	$58	$6,100
Michigan	$1,002	$867	$1,237	$37	$97	$3,240
Iowa	$872	$629	$570	$25	$0	$2,096
Illinois	$589	$2,738	$1,585	$80	$10	$5,002
Indiana	$473	$656	$1,497	$129	$48	$2,804
Missouri	$440	$890	$862	$30	$95	$2,316
Wisconsin	$337	$817	$723	$26	$7	$1,910
New York	$283	$579	$2,684	$284	$40	$3,869
West Virginia	$225	$7,940	$242	$79	$2	$8,488
Kentucky	$150	$1,674	$185	$6	$1	$2,015
Delaware	$82	$58	$73	$25	$320	$558
Total	$15,708	$30,980	$21,426	$3,765	$740	$72,618
Total excluding home state	$10,440	$21,688	$18,740	$1,120	$418	$52,407

Source. US DOT Freight Analysis Framework

Exhibit 10 takes the values in the prior exhibit and apportions them to each of these ports by state. Thus, 78 percent of the value of exports from Maryland moved through Baltimore. More than half (56 percent) of the value of Virginia's exports moved through Norfolk, while 69 percent of the value of New York exports went through New York. It is logical that exporters from these three states would primarily rely on the ports in their home states. More interesting are the values of cargo originating in other states (i.e. those without an in-state deep water port). For example, only a quarter of the value of Ohio's exports moved through Baltimore despite the added miles that were

[4] The Port of New York and New Jersey is considered a single entity in this report and is referred to as "New York."

required to reach Ohio destinations from either Norfolk (33 percent of the value of Ohio exports) or New York (37 percent of the value of Ohio exports). The same is true for Illinois, Indiana, Missouri, Wisconsin, and Kentucky. A similar pattern is likely true in Pennsylvania where any exports through Norfolk (25 percent of total value) would travel farther distances than exports using Baltimore (20 percent). Given that most of Pennsylvania is closer to Baltimore than New York City, the same may also be true for much of the value of Pennsylvania exports going through New York.

When the values of home states are excluded, Norfolk captures 41 percent of the value of exports from states that are generally closer to Baltimore. New York captures 36 percent of this non-home state value; this is despite most of Pennsylvania and much of western New York being closer or equidistant to Baltimore.

Exhibit 10. Total export flow for top states, shares through each port by state, 2015

State of origin	*Port*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	78%	11%	9%	1%	0%	100%
Pennsylvania	25%	20%	31%	24%	0%	100%
Virginia	11%	56%	33%	0%	0%	100%
Ohio	25%	33%	37%	5%	1%	100%
Michigan	31%	27%	38%	1%	3%	100%
Iowa	42%	30%	27%	1%	0%	100%
Illinois	12%	55%	32%	2%	0%	100%
Indiana	17%	23%	53%	5%	2%	100%
Missouri	19%	38%	37%	1%	4%	100%
Wisconsin	18%	43%	38%	1%	0%	100%
New York	7%	15%	69%	7%	1%	100%
West Virginia	3%	94%	3%	1%	0%	100%
Kentucky	7%	83%	9%	0%	0%	100%
Delaware	15%	10%	13%	4%	57%	100%
Total	22%	43%	30%	5%	1%	100%
Total excluding home state	20%	41%	36%	2%	1%	100%

Source. US DOT Freight Analysis Framework

Exhibit 11 presents the value of imports moving through the Port of Baltimore and the states that account for more than 90 percent of the value of these imports. As in Exhibit 10, the value of imports to these states moving through other East Coast ports is also presented.

For Maryland, more than $34 billion worth of imports are destined for these top states with almost $21 billion headed to locations in Maryland. New York is the port of choice for these states, accounting for commodities worth more than $92 billion with over $70 billion destined for New Jersey and New York destinations. Philadelphia accounts for almost $21 billion worth of these imports with almost $12 billion headed for Pennsylvania locations. The value of imports moving through Delaware is much smaller at $1.4 billion with the vast majority destined for in-state locations.

Exhibit 11. Value of imports by State and by Port for Baltimore's key importing states, 2015

Destination state	*Port (Values in millions)*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	$20,868	$580	$771	$392	$25	$22,636
Pennsylvania	$3,224	$219	$10,727	$11,963	$71	$26,204
New Jersey	$3,152	$182	$47,529	$5,025	$46	$55,934
Michigan	$1,847	$526	$1,727	$228	$3	$4,331
Ohio	$1,276	$893	$3,061	$785	$3	$6,019
New York	$980	$262	$23,941	$936	$75	$26,194
Kentucky	$826	$1,759	$572	$25	$0	$3,183
Illinois	$757	$443	$1,664	$954	$2	$3,819
Virginia	$631	$14,475	$525	$146	$6	$15,783
Indiana	$289	$296	$999	$108	$1	$1,692
Delaware	$122	$11	$406	$145	$1,211	$1,895
Tennessee	$106	$132	$175	$2	$0	$415
Total	$34,078	$19,778	$92,097	$20,710	$1,443	$168,107
Total excluding home state (1)	$13,210	$5,303	$20,627	$8,747	$232	$48,120

Note. 1. Home state for New York includes the value of imports to New Jersey and New York.
Source. US DOT Freight Analysis Framework

Exhibit 12 takes the values presented in the prior exhibit and distributes them by the state where these commodities are destined. More than 92 percent of the value of commodities imported into Maryland come through Baltimore. A similar percentage of in-state imports applies for Virginia (91.7 percent), New York (91.4 percent) and New Jersey (85 percent).

More interesting are the shares of the value of imports that are destined for other states. A greater value of imports destined for Michigan moves through Baltimore (42.6 percent) than New York (39.9 percent) or Norfolk (12.1 percent). This likely has much to do with Baltimore's leadership status as a roll-on/roll-off cargo port and the importance of the auto parts sector in Michigan.

In general, however, New York dominates these non-home states, capturing more than half the value of imports to Ohio, 44 percent of the value of imports to Illinois, 59 percent of the value of imports to Indiana, and 42 percent of the value of imports to Tennessee. This dominance occurs despite the longer highway distances that freight travels from New York to these destinations compared to freight originating in Baltimore.

While Baltimore competes more robustly with Virginia in many of these states, Virginia still dominates in Kentucky. For all these states that lack an in-state deep water ocean port, New York imports 43 percent of the total value, Baltimore imports 27 percent of the value, while Norfolk accounts for 11 percent of total value. For imports, Baltimore's geographic advantage helps more than it does with exports. Nevertheless, even the flow of imports fails to fully reflect the shorter distances that are available for imports coming through the Port of Baltimore.

Exhibit 12. Total import flow for top states, shares through each port by state, 2015

Destination state	*Port*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	92%	3%	3%	2%	0%	100%
Pennsylvania	12%	1%	41%	46%	0%	100%
New Jersey	6%	0%	85%	9%	0%	100%
Michigan	43%	12%	40%	5%	0%	100%
Ohio	21%	15%	51%	13%	0%	100%
New York	4%	1%	91%	4%	0%	100%
Kentucky	26%	55%	18%	1%	0%	100%
Illinois	20%	12%	44%	25%	0%	100%
Virginia	4%	92%	3%	1%	0%	100%
Indiana	17%	17%	59%	6%	0%	100%
Delaware	6%	1%	21%	8%	64%	100%
Tennessee	26%	32%	42%	0%	0%	100%
Total	20%	12%	55%	12%	1%	100%
Total excluding home state	27%	11%	43%	18%	0%	100%

Source. US DOT Freight Analysis Framework

The following exhibits total all cargo for those states that are key for both imports and exports. That is, each of these states uses the Port of Baltimore both for exporting and importing products and commodities. In total, imported and exported commodities associated with these states are valued at almost $275 billion.

Exhibit 13. Total cargo flow for selected states, by value, 2015 (values in millions)

Destination/ origin state	*Port*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	$26,136	$1,318	$1,490	$472	$32	$29,448
Pennsylvania	$5,910	$2,333	$15,298	$14,608	$120	$38,269
Virginia	$2,427	$23,767	$6,150	$179	$10	$32,533
Ohio	$2,781	$2,882	$5,750	$1,071	$61	$12,545
Michigan	$2,849	$1,393	$3,044	$265	$100	$7,651
Illinois	$1,346	$3,181	$3,719	$1,034	$12	$9,292
Indiana	$762	$952	$2,702	$237	$49	$4,702
New York	$1,263	$841	$28,964	$1,220	$115	$32,403
Kentucky	$976	$3,433	$798	$31	$1	$5,239
Delaware	$204	$69	$479	$170	$1,531	$2,453
Total	$44,654	$40,169	$68,394	$19,287	$2,031	$174,535
Total excluding home state	$18,518	$11,205	$39,430	$4,679	$500	$74,332

Source. US DOT Freight Analysis Framework

Exhibit 14 takes the state-by-state values presented in the prior exhibit and distributes them among the five ports. Not surprisingly, importers and exporters tend to favor in-state ports. When cargo moving between states and their respective in-state ports is excluded, the dominance of New York becomes more evident. More than half the cargo, by value, from the states without an in-state deep-

water port moves through New York, despite the logistical advantage that Baltimore holds over New York for most locations in these states.

Exhibit 14. Total cargo flow for selected states, shares through each port by state, 2015 (values in millions)

Destination/ origin state	*Port*					
	Baltimore	Norfolk	New York	Philadelphia	Delaware	Total
Maryland	89%	4%	5%	2%	0%	100%
Pennsylvania	15%	6%	40%	38%	0%	100%
Virginia	7%	73%	19%	1%	0%	100%
Ohio	22%	23%	46%	9%	0%	100%
Michigan	37%	18%	40%	3%	1%	100%
Illinois	14%	34%	40%	11%	0%	100%
Indiana	16%	20%	57%	5%	1%	100%
New York	4%	3%	89%	4%	0%	100%
Kentucky	19%	66%	15%	1%	0%	100%
Delaware	8%	3%	20%	7%	62%	100%
Total	26%	23%	39%	11%	1%	100%
Total excluding home state	25%	15%	53%	6%	1%	100%

Source. US DOT Freight Analysis Framework

IV. Economic Impacts Associated with Current Port of Baltimore Cargo

A substantial part of the economic benefits of deep-water ocean ports is the web of importing and exporting businesses that rely on these ports. In an increasingly globalized economy, markets for products can be far flung. Alternatively, supply chains providing critical inputs to American business and industry are worldwide and most often connected by water. Maritime ports collectively handle 75 percent of US international trade by volume, according to the 2016 annual Port Performance Freight Statistics Program report to Congress.[5]

The estimate of the economic impacts of the businesses and industries that rely on the Port of Baltimore is presented in two parts. The impacts of commodities exported via Baltimore are reasonably straightforward. These products represent the output of dozens of industries; and the value of exports amounts to sales for these industries. These values can be modeled as new demands for the products and outputs of these industries.

The impacts of imported commodities are more complex. A substantial portion of the value of imports is represented by finished goods that are essentially ready for sale to final consumers. Obvious examples are the many imported cars and trucks unloaded at Baltimore, the largest Ro-Ro port on the East Coast. Modeling the impacts of these finished goods can be based on the assumption that they enter the distribution system with little or no additional changes (i.e. additional manufacturing or assembly). The wholesale and retail industry that constitutes the bulk of the distribution system adds a predictable amount of value, typically measured as the increase in price between the price of the imported commodity and its wholesale and retail price. This increase in value becomes the basis for modeling economic impacts.

Alternatively, the most commonly imported chemical commodity is categorized as "Radioactive Chemical Elements & Isotopes", which covers many individual chemical commodities with highly varied uses from scientific instrumentation to medical diagnostics. These commodities are not finished products but intermediate materials used in the manufacture or assembly thereof. Because of this intermediate quality, the best measure of economic impact is complicated. For some imported commodities (e.g., metallurgical coal), the value of the commodity (e.g., the value of coal needed to produce coke) can be linked to the finished product (e.g., steel). Yet, for other commodities this relationship between imported commodities and finished goods is unclear. As a default, this analysis assumes that imports enter the distribution system where the value added by wholesalers, distributors, commodity brokers, and similar agents becomes the basis for modeling economic impacts. For this analysis, only metallic ores and nonmetallic minerals fall into this category. All other commodities are assumed to be essentially finished goods entering the distribution system through wholesalers and then moving onto retail establishments.

[5] https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/PPFS_Annual_Report.pdf, p. 1.

- **Impacts of Commodities Exported through the Port of Baltimore**

Based on the assumption that exports are essentially finished products, the economic impacts of these products can provide an estimate of the jobs, income, and business sales that are supported by the Port of Baltimore. These impacts are summarized in Exhibit 15, which lists total jobs (full- and part-time), the associated income, and business sales for each exported commodity. In total the production of these exported products supports more than 61,000 jobs with income of $4 billion and associated business sales of $17.6 billion. These impacts include the indirect (supply chain) effects and the sales supported in the consumer economy (induced effects).

Exhibit 15. Total annual impacts of exports by commodity

Commodity	*Total impacts (direct, indirect, and induced effects)*		
	Jobs	Income (millions)	Business sales (millions)
Alcoholic beverages	26	$1.6	$7.3
Animal feed	214	$12.1	$64.9
Articles-base metal	-	$0.0	$0.0
Base metals	1,562	$103.9	$502.0
Basic chemicals	937	$65.8	$314.9
Building stone	-	$0.0	$0.0
Cereal grains	251	$11.3	$48.7
Chemical prods.	1,081	$76.0	$363.6
Coal	11,064	$751.3	$3,459.7
Electronics	12	$0.9	$2.9
Fertilizers	86	$5.8	$31.9
Fuel oils	2	$0.2	$1.1
Furniture	195	$10.9	$37.7
Gasoline	1	$0.1	$0.3
Gravel	1	$0.1	$0.2
Logs	737	$35.5	$86.6
Machinery	13,845	$911.0	$3,326.4
Meat/seafood	30	$1.0	$3.0
Metallic ores	1,068	$76.5	$356.9
Milled grain prods.	210	$11.6	$56.1
Misc. mfg. prods.	421	$24.5	$81.1
Mixed freight	6,784	$418.6	$1,584.2
Motorized vehicles	12,660	$817.7	$4,429.5
Natural sands	2	$0.1	$0.5
Newsprint/paper	318	$20.8	$90.8
Nonmetal min. prods.	503	$30.3	$123.3
Nonmetallic minerals	21	$1.4	$3.6
Other ag prods.	4	$0.2	$0.6
Other foodstuffs	834	$46.0	$184.2
Paper articles	162	$10.6	$46.4
Pharmaceuticals	130	$9.6	$40.6
Plastics/rubber	1,820	$114.1	$654.1
Precision instruments	825	$60.4	$194.4
Printed prods.	97	$5.1	$16.6
Textiles/leather	215	$11.3	$47.8
Tobacco prods.	96	$6.3	$41.6
Transport equip.	3,320	$244.2	$999.5
Waste/scrap	163	$10.3	$40.5
Wood prods.	1,678	$94.2	$325.2
Total	61,374	$4,001.3	$17,568.7

Exhibit 16 disaggregates the impacts in the prior exhibit into those impacts supported in Maryland and those supported in other key states. Roughly one-quarter of the total impacts are attributable to Maryland.

Exhibit 16. Total annual impacts of exports summarized by commodity: Maryland versus Key States

Commodity	*Maryland*			*States outside Maryland*		
	Jobs	Income (millions)	Business sales (millions)	Jobs	Income (millions)	Business sales (millions)
Alcoholic beverages	18	$1.1	$5.0	8	$0.5	$2.2
Animal feed	0	$0.0	$0.1	213	$12.1	$64.8
Articles-base metal	-	$0.0	$0.0	-	$0.0	$0.0
Base metals	377	$25.0	$121.0	1,186	$78.8	$381.0
Basic chemicals	244	$17.1	$81.9	693	$48.7	$233.1
Building stone	-	$0.0	$0.0	-	$0.0	$0.0
Cereal grains	115	$5.2	$22.3	136	$6.1	$26.4
Chemical prods.	530	$37.3	$178.3	551	$38.7	$185.3
Coal	190	$12.9	$59.3	10,874	$738.4	$3,400.4
Electronics	6	$0.5	$1.5	6	$0.4	$1.4
Fertilizers	1	$0.1	$0.4	85	$5.7	$31.5
Fuel oils	-	$0.0	$0.0	2	$0.2	$1.1
Furniture	98	$5.5	$18.9	97	$5.4	$18.8
Gasoline	-	$0.0	$0.0	1	$0.1	$0.3
Gravel	0	$0.0	$0.0	1	$0.1	$0.2
Logs	67	$3.2	$7.9	670	$32.3	$78.7
Machinery	2,574	$169.4	$618.5	11,271	$741.6	$2,707.9
Meat/seafood	2	$0.1	$0.2	27	$1.0	$2.8
Metallic ores	2	$0.1	$0.6	1,066	$76.4	$356.3
Milled grain prods.	23	$1.2	$6.0	188	$10.3	$50.1
Misc. mfg. prods.	194	$11.3	$37.5	226	$13.2	$43.6
Mixed freight	1,613	$99.5	$376.7	5,171	$319.1	$1,207.5
Motorized vehicles	5,526	$357.0	$1,933.6	7,133	$460.8	$2,495.9
Natural sands	-	$0.0	$0.0	2	$0.1	$0.5
Newsprint/paper	52	$3.4	$14.8	266	$17.4	$76.0
Nonmetal min. prods.	166	$10.0	$40.8	336	$20.3	$82.5
Nonmetallic minerals	3	$0.2	$0.5	18	$1.2	$3.1
Other ag prods.	4	$0.2	$0.6	0	$0.0	$0.0
Other foodstuffs	551	$30.4	$121.7	283	$15.6	$62.5
Paper articles	28	$1.8	$8.0	134	$8.8	$38.4
Pharmaceuticals	84	$6.2	$26.2	46	$3.4	$14.3
Plastics/rubber	432	$27.0	$155.1	1,389	$87.0	$499.1
Precision instruments	187	$13.7	$44.2	637	$46.7	$150.2
Printed prods.	38	$2.0	$6.4	60	$3.1	$10.2
Textiles/leather	163	$8.6	$36.3	52	$2.7	$11.5
Tobacco prods.	-	$0.0	$0.0	96	$6.3	$41.6
Transport equip.	1,197	$88.1	$360.4	2,123	$156.1	$639.1
Waste/scrap	156	$9.8	$38.7	7	$0.5	$1.8
Wood prods.	115	$6.4	$22.2	1,564	$87.8	$303.0
Total	14,756	$954.4	$4,345.5	46,619	$3,046.8	$13,223.2

Source. US DOT Freight Analysis Framework

Finally, Exhibit 17 allocates these impacts to Maryland and each of the key exporting states that utilize the Port of Baltimore. Pennsylvania benefits more than Maryland from its exports through the Port of Baltimore. Virginia, the other major state economy bordering Maryland, enjoys roughly half of the benefits that accrue to Maryland. These benefits extend well into the Midwest with Iowa and Illinois benefitting with more than 3,000 jobs each while over 2,000 jobs are supported in Michigan and Missouri. More than 4,600 jobs are supported by New York industries exporting commodities through the Port of Baltimore.

Exhibit 17. Total annual impacts of commodities exported through Port of Baltimore by state

State	*Total impacts (direct, indirect, and induced effects)*		
	Jobs	*Income (millions)*	*Business sales (millions)*
Maryland	14,756	$954.4	$4,345.5
Pennsylvania	16,760	$1,100.4	$4,742.8
Virginia	7,081	$444.3	$1,740.9
Ohio	1,594	$110.5	$481.7
Michigan	2,184	$140.9	$726.4
Iowa	3,140	$208.7	$919.8
Illinois	3,258	$213.5	$827.1
Indiana	1,891	$124.6	$568.0
Missouri	2,326	$156.6	$727.5
Wisconsin	1,408	$91.7	$376.3
New York	4,632	$301.8	$1,405.5
West Virginia	1,691	$111.7	$503.1
Kentucky	396	$25.7	$123.5
Delaware	258	$16.3	$80.8
Total	61,374	$4,001.3	$17,568.7

Source. US DOT Freight Analysis Framework, IMPLAN

- **Impacts of Commodities Imported through the Port of Baltimore**

The following impacts of imported commodities are based on the value added by the wholesale and retail sectors of the value-added chain. The estimate of value added is derived from information provided by IMPLAN, a software package that incorporates a broad range of economic data from government agencies. For most manufactured goods, IMPLAN provides estimates of the shares of final retail value that are contributed by the manufacturing, transportation, wholesale, and retail sectors. For example, manufacturing accounts for 48 percent of the retail value of the output of breweries (i.e. beer), while transportation accounts for 2 percent, wholesalers account for 29 percent, and retail accounts for 21 percent. Using these data, the value added by wholesalers and retailers can be estimated for almost all imported commodities.

The economic impacts associated with the value added by wholesalers and retailers for commodities imported through the Port of Baltimore are summarized in Exhibit 18. These impacts are associated with imports to Maryland and 11 other key states that account for over 90 percent of the total value of imports moving through the Port of Baltimore in 2015. These imports support more than 370,000 jobs in these states with income of $18 billion and business sales of $49 billion. These impacts include direct impacts in the wholesale and retail sectors, the indirect jobs in the supply

chains for these industries, and the induced impacts as direct and indirect workers spend their incomes in the local economy.

Exhibit 18. Total impacts of imports by commodity

Commodity	*Total impacts (direct, indirect, and induced effects)*		
	Jobs	Income	Business sales
Alcoholic beverages	5,196	$274.2	$787.8
Animal feed	350	$12.1	$30.3
Articles-base metal	9,127	$423.3	$1,191.0
Base metals	96,343	$4,473.7	$12,589.6
Basic chemicals	27,566	$896.7	$2,195.3
Building stone	17	$0.5	$1.3
Cereal grains	284	$12.7	$35.2
Chemical prods.	3,954	$128.6	$314.9
Coal	-	$0.0	$0.0
Electronics	13,079	$696.2	$1,565.8
Fertilizers	392	$19.6	$55.9
Fuel oils	964	$50.6	$142.4
Furniture	12,114	$580.1	$1,651.5
Gasoline	3,347	$175.6	$494.2
Gravel	-	$0.0	$0.0
Logs	57	$2.7	$7.7
Machinery	47,198	$2,681.2	$7,049.1
Meat/seafood	4,104	$223.6	$646.2
Metallic ores	1,635	$138.2	$271.9
Milled grain prods.	580	$24.9	$68.7
Misc. mfg. prods.	7,591	$277.3	$710.6
Mixed freight	160	$8.2	$23.5
Motorized vehicles	61,298	$3,551.8	$9,540.6
Natural sands	-	$0.0	$0.0
Newsprint/paper	3,994	$160.8	$459.9
Nonmetal min. prods.	2,106	$96.9	$272.2
Nonmetallic minerals	373	$31.5	$62.0
Other ag prods.	8,812	$404.1	$1,129.7
Other foodstuffs	17,128	$735.4	$2,026.4
Paper articles	165	$6.6	$19.0
Pharmaceuticals	5,101	$260.4	$711.4
Plastics/rubber	15,546	$797.7	$2,286.2
Precision instruments	662	$35.2	$79.2
Printed prods.	2,214	$71.5	$174.7
Textiles/leather	14,843	$598.2	$1,858.9
Tobacco prods.	2	$0.1	$0.3
Transport equip.	339	$18.9	$48.9
Waste/scrap	1,649	$66.4	$190.0
Wood prods.	5,458	$261.4	$744.1
Total	373,750	$18,197.2	$49,436.3

Source. US DOT Freight Analysis Framework

Exhibit 19 disaggregates the total impacts of imports into those occurring in Maryland and those occurring in other key states. More than 60 percent of the total impacts are estimated to occur in Maryland, including over 230,000 jobs with income of $11 billion and associated business sales of over $30 billion. Impacts in the other key states total almost 143,000 jobs with income of $7 billion and associated business sales of almost $19 billion.

Exhibit 19. Total impacts of imports summarized by commodity: Maryland versus Key States

Commodity	*Maryland*			*States outside Maryland*		
	Jobs	Income (millions)	Business sales (millions)	Jobs	Income (millions)	Business sales (millions)
Alcoholic beverages	4,052	$213.8	$614.3	1,145	$60.4	$173.5
Animal feed	106	$3.7	$9.2	244	$8.4	$21.2
Articles-base metal	4,565	$211.7	$595.7	4,562	$211.6	$595.3
Base metals	71,410	$3,315.9	$9,331.5	24,933	$1,157.8	$3,258.1
Basic chemicals	13,801	$448.9	$1,099.1	13,764	$447.7	$1,096.2
Building stone	16	$0.5	$1.3	1	$0.0	$0.0
Cereal grains	221	$9.9	$27.5	62	$2.8	$7.7
Chemical prods.	3,104	$101.0	$247.2	850	$27.7	$67.7
Electronics	3,917	$208.5	$468.9	9,162	$487.7	$1,096.8
Fertilizers	392	$19.6	$55.8	1	$0.0	$0.1
Fuel oils	964	$50.6	$142.3	0	$0.0	$0.1
Furniture	9,940	$476.0	$1,355.1	2,174	$104.1	$296.4
Gasoline	3,346	$175.5	$494.0	1	$0.1	$0.1
Gravel	-	$0.0	$0.0	-	$0.0	$0.0
Logs	6	$0.3	$0.8	51	$2.4	$6.9
Machinery	18,212	$1,034.5	$2,719.9	28,987	$1,646.7	$4,329.2
Meat/seafood	2,987	$162.8	$470.3	1,117	$60.9	$175.8
Metallic ores	424	$35.8	$70.4	1,212	$102.4	$201.5
Milled grain prods.	397	$17.0	$46.9	184	$7.9	$21.8
Misc. mfg. prods.	5,325	$194.5	$498.4	2,267	$82.8	$212.2
Mixed freight	12	$0.6	$1.8	148	$7.6	$21.8
Motorized vehicles	40,623	$2,353.8	$6,322.6	20,675	$1,198.0	$3,217.9
Newsprint/paper	3,472	$139.8	$399.8	522	$21.0	$60.1
Nonmetal min. prods.	1,152	$53.0	$148.9	954	$43.9	$123.3
Nonmetallic minerals	143	$12.1	$23.8	230	$19.5	$38.3
Other ag prods.	5,465	$250.6	$700.6	3,347	$153.5	$429.1
Other foodstuffs	10,407	$446.8	$1,231.3	6,721	$288.6	$795.2
Paper articles	78	$3.1	$9.0	87	$3.5	$10.0
Pharmaceuticals	679	$34.7	$94.8	4,422	$225.7	$616.7
Plastics/rubber	6,539	$335.5	$961.6	9,007	$462.2	$1,324.6
Precision instruments	305	$16.2	$36.5	357	$19.0	$42.7
Printed prods.	1,576	$50.9	$124.4	637	$20.6	$50.3
Textiles/leather	12,550	$505.8	$1,571.7	2,293	$92.4	$287.1
Tobacco prods.	2	$0.1	$0.3	-	$0.0	$0.0
Transport equip.	153	$8.5	$22.0	186	$10.4	$26.9
Waste/scrap	156	$6.3	$18.0	1,493	$60.1	$172.0
Wood prods.	4,348	$208.2	$592.8	1,110	$53.1	$151.3
Total	230,844	$11,106.7	$30,508.4	142,906	$7,090.4	$18,927.9

Source. US DOT Freight Analysis Framework

Exhibit 20 presents these estimated economic impacts by state. Among the key states using the Port of Baltimore for imported commodities, Pennsylvania and New Jersey each account for over 9 percent of the total impacts while Michigan accounts for over 5 percent. The remaining states account for between 3.7 percent (Ohio) and 0.3 percent (Tennessee) of the total impacts. In each of these key states, over 1,000 jobs are supported by imports through Baltimore with greater than 10,000 jobs supported in each of five states (not including Maryland).

Exhibit 20. Total annual impacts of commodities imported through Port of Baltimore by state

State	*Total impacts (direct, indirect, and induced effects)*		
	Jobs	Income (millions)	Business sales (millions)
Maryland	228,871	$11,143.3	$30,273.0
Pennsylvania	35,361	$1,721.7	$4,677.2
New Jersey	34,565	$1,682.9	$4,571.9
Michigan	20,260	$986.4	$2,679.9
Ohio	13,992	$681.2	$1,850.7
New York	10,746	$523.2	$1,421.4
Kentucky	9,058	$441.0	$1,198.1
Illinois	8,300	$404.1	$1,097.8
Virginia	6,920	$336.9	$915.3
Indiana	3,172	$154.5	$419.6
Delaware	1,340	$65.2	$177.2
Tennessee	1,165	$56.7	$154.1
Total	373,750	$18,197.2	$49,436.3

Source. US DOT Freight Analysis Framework, IMPLAN

The total impacts of commodities moving through the Port of Baltimore in 2015 — both exports and imports — are summarized in Exhibit 21. This summary estimates jobs, income, and business sales supported by these commodities in Maryland and 15 other states that are significant users of the port. Nine of these key states are significant importers and exporters—Pennsylvania, Michigan, Ohio, New York, Kentucky, Illinois, Virginia, Indiana, and Delaware. Four states (Iowa, Missouri, West Virginia, and Wisconsin) are key states only as exporters, while two states (New Jersey, Tennessee) are key states only for imports.

The total estimated impacts of imports and exports moving through Baltimore include more than 435,000 jobs with associated income in excess of $22 billion and $67 billion in business sales. While Maryland enjoys over half of these benefits, the Port of Baltimore supports more than 191,000 jobs in 15 other states with income of $10 billion and business sales of over $32 billion. Roughly 12 percent of the total benefits accrue to Pennsylvania and 8 percent are enjoyed by New Jersey. About one-quarter of the total economic impacts supported by commodities moving through the Port of Baltimore are distributed among 13 remaining key states.

Exhibit 21. Total annual impacts of commodities imported and exported through Port of Baltimore by state

State	*Total impacts (direct, indirect, and induced effects)*		
	Jobs	Income (millions)	Business sales (millions)
Maryland	243,627	$12,097.7	$34,618.5
Pennsylvania	52,121	$2,822.1	$9,420.0
New Jersey	34,565	$1,682.9	$4,571.9
Michigan	22,444	$1,127.4	$3,406.2
Ohio	15,587	$791.8	$2,332.4
New York	15,379	$825.1	$2,826.9
Kentucky	9,454	$466.7	$1,321.6
Illinois	11,557	$617.6	$1,924.9
Virginia	14,000	$781.2	$2,656.2
Indiana	5,063	$279.1	$987.6
Delaware	1,597	$81.5	$257.9
Tennessee	1,165	$56.7	$154.1
Iowa	3,140	$208.7	$919.8
Missouri	2,326	$156.6	$727.5
West Virginia	1,691	$111.7	$503.1
Wisconsin	1,408	$91.7	$376.3
Total	435,124	$22,198.4	$67,005.0

Source. US DOT Freight Analysis Framework, IMPLAN

The dominance of Maryland in terms of the economic benefits supported by the Port of Baltimore is clearly a reflection of the extent to which imports moving through the port tend to stay in Maryland. Of the $37 billion worth of commodities imported through Baltimore in 2015, 56 percent were destined for Maryland. Conversely, 30 percent of the value of exports through the Port of Baltimore originated in Maryland. In total, almost half of the value of all cargo moving through the Port of Baltimore was destined for or originated in Maryland.

Here is the key point. This localized benefit is at odds with the logistical advantage that Baltimore offers to importers and exporters in other states. If the Port of Baltimore could compete on equal footing with nearby East Coast ports, this logistical advantage would almost certainly translate into significant increases in cargo movements between Baltimore and the key states identified above. This would be particularly true of a wide swath of states, starting with central Pennsylvania and moving west through Ohio and the industrial and agricultural heartland of the country.

An example of the logistical advantages of the Port of Baltimore versus its nearby rivals in Virginia, New Jersey, and New York is presented in Exhibit 22, which examines the volume of cargo moving to and from the Pittsburgh metropolitan area from these ports. Baltimore is closer to Pittsburgh than each of its rival ports.

Most of the cargo moving to and from Pittsburgh moves by truck, which costs an estimated $14.24 per ton-mile. This cargo movement is dominated by the truck-based export of coal through Norfolk (6,460 kilotons) and Baltimore (7,100 kilotons). This accounts for almost 88 percent of the total volume of exports from Pittsburgh. Using the mileage penalty (i.e. the greater distance compared to Baltimore) that cargo travel, the mode on land, and the estimated cost per ton-mile of moving cargo by rail and truck, the potential savings if cargo moved through Baltimore can be estimated. For imports, the total potential savings are estimated at $388 million per annum, while

the potential savings for exports approach $17 billion with the great majority of these savings attributable to coal moved by truck to Norfolk. The total potential savings if this cargo had moved through Baltimore instead of the POV or the PONYNJ are estimated at $17.4 billion. These estimates are based on 2015 trade flows and are likely larger today.

Exhibit 22. Potential cost savings for exports from, imports to Pittsburgh

Type of cargo	*Port*	*Mode on land*	*Total KTons*	*Mileage penalty*	*Cost per ton-mile*	*Potential savings (millions)*
Imports	Maryland	Rail	29.6			
		Truck	96.5			
	New Jersey	Rail	44.0	103	$2.35	$10.7
		Truck	235.6	103	$14.24	$345.6
	New York	Rail	53.7	130	$2.35	$16.4
		Truck	-	130	$14.24	$0.0
	Virginia	Rail	0.9	168	$2.35	$0.4
		Truck	6.3	168	$14.24	$15.2
	Total	Rail	128.2			$27.4
		Truck	338.5			$360.8
		Rail + truck	466.7			$388.2
Exports	Maryland	Rail	45.3			$0.0
		Truck	7,236.6			$0.0
	New Jersey	Rail	0.3	103	$2.35	$0.1
		Truck	21.6	103	$14.24	$31.7
	New York	Rail	933.4	130	$2.35	$285.1
		Truck	-	130	$14.24	$0.0
	Virginia	Rail	1.7	168	$2.35	$0.7
		Truck	6,966.6	168	$14.24	$16,666.3
	Total	Rail	980.7			$285.9
		Truck	14,224.8			$16,698.0
		Rail + truck	15,205.5			$16,983.9
Imports + exports	Total	Rail	1,108.9			$313.3
		Truck	14,563.2			$17,058.8
		Rail + truck	15,672.2			$17,372.1

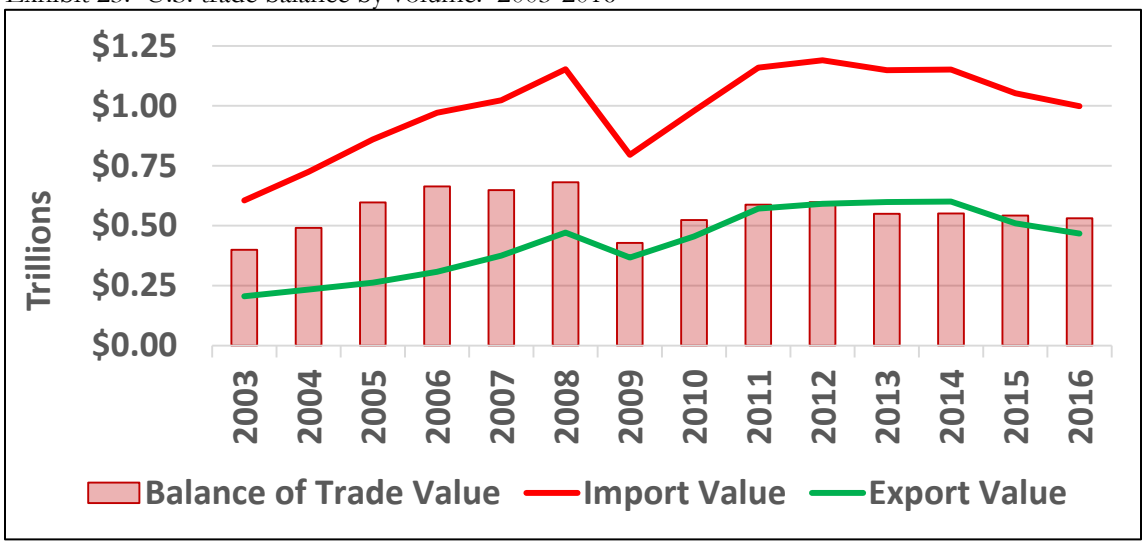
Source. US DOT Freight Analysis Framework, Google maps, Bureau of Transportation Statistics

The potential cost savings estimated in Exhibit 22 are national benefits that would help businesses in the Pittsburgh area become more cost-efficient and, thus, more competitive in national and global markets. The mileage penalties for major metropolitan areas in the Midwest (i.e. Ohio, Indiana, Michigan, Illinois, and Missouri) listed in Exhibit 2, above, are similar to those for Pittsburgh. Thus, the potential savings available for Pittsburgh would be available throughout the industrial and agricultural heartland.

V. Creating National Benefits

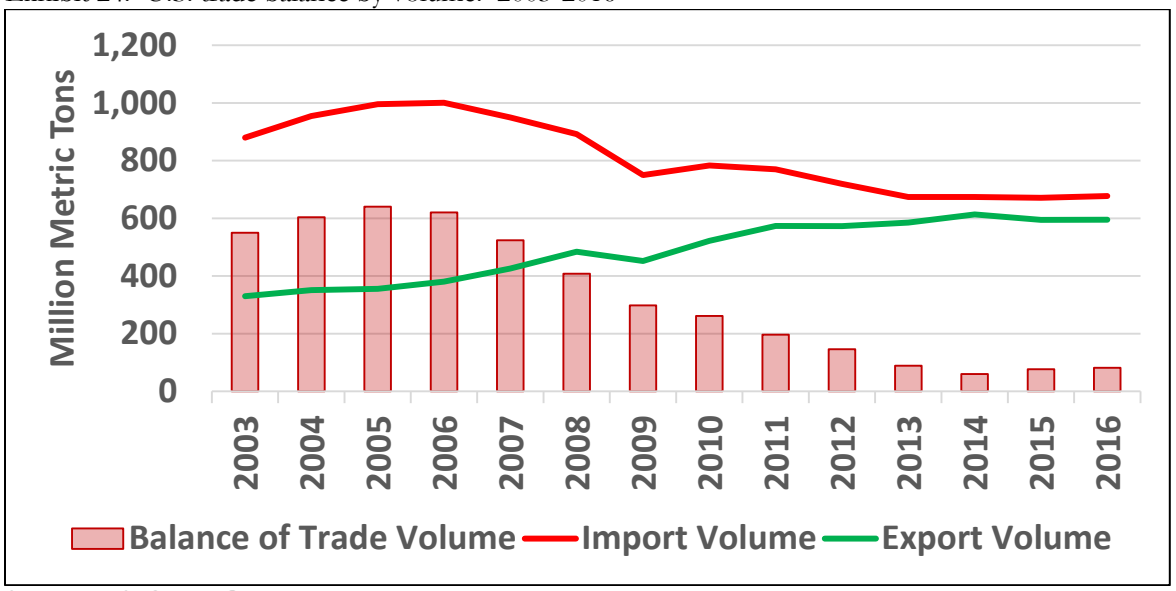
It is well known that the U.S. has endured a trade deficit for decades (Exhibit 23). Perhaps less well-known is that this deficit is attributable to disparities in the relative value of imports and exports. In recent years, the volume of exports has been converging with the volume of imports (Exhibit 24).

Exhibit 23. U.S. trade balance by volume: 2003-2016



Source. U.S. Census Bureau

Exhibit 24. U.S. trade balance by volume: 2003-2016



Source. U.S. Census Bureau

These trends in the trade balance indicate that the U.S. tends to rely on the export of bulk commodities, whereas we import more finished goods. This is reflected in the fact that a kilogram of imports since 2003 has been worth on average $1.21 while a kilogram of exports has been worth only $0.88. Thus, on the basis of volume, U.S. exports are valued on average at 73 percent of U.S.

imports. As the production of commodities becomes more automated, the employment required to create U.S. exports declines although the technology and financial resources need to create these exports increases. Moreover, the higher volume of exports generates more demands for transportation and logistics services (e.g., storage and cargo handling).

The decision to make investments in ports and related infrastructure should be driven by the potential for these investments to generate national benefits. As the current administration has indicated, an area of particular interest is facilitating exports.[6] Increasing exports has the twin virtues of creating new employment and helping to reduce the trade deficit. Given the nature of U.S. exports, this investment also needs to recognize the high volume, lower value nature of current exports, while also supporting, as possible, higher valued, more finished commodities and products.

In an increasingly global economy, one key to facilitating exports is optimizing the ability of America's ports to lower logistics costs for export industries. Lower logistics costs allow industries to reduce prices, making their products more competitive relative to their competitors from other countries.

Logistics costs are heavily dependent on publicly-owned infrastructure or public investment in other infrastructure. For exporters, the relevant infrastructure includes ports (e.g., channels, berths, terminals), highways, and rail lines. Investments in highways and rail lines includes not only the roadways, but also bridges and tunnels which can be the weakest links in these land-based networks. In Baltimore, the Howard Street Tunnel is a well-publicized example of the ability of a single obstacle to cripple the capacity of a larger transportation network, in this case, the rail network in the Baltimore region.

The power of investment to affect port-related activities can be seen in a comparison of the volume of container cargo moving through the ports at Norfolk and Baltimore over the last four decades. Norfolk has a well-established record of investment in the port, rail lines, and other infrastructure that has had dramatic impacts on the port's container volume and, with a 2016 announcement of $350 million in new investment, will likely have even greater impacts in the foreseeable future.[7] For over a decade starting in the mid-1970s, Norfolk and Baltimore handled similar volumes of containerized cargo. By the late 1980s, continuing investment in the port at Norfolk and related infrastructure resulted in Norfolk overtaking Baltimore in terms of container volume. As shown in Exhibit 25, Norfolk's ability to move containers has consistently grown since the 1980s while *Baltimore has shown little growth since the mid-1980s*. Indeed, in 1984, Baltimore handled 774,200 containers, a peak volume that Baltimore did not exceed until 2015, three decades later.

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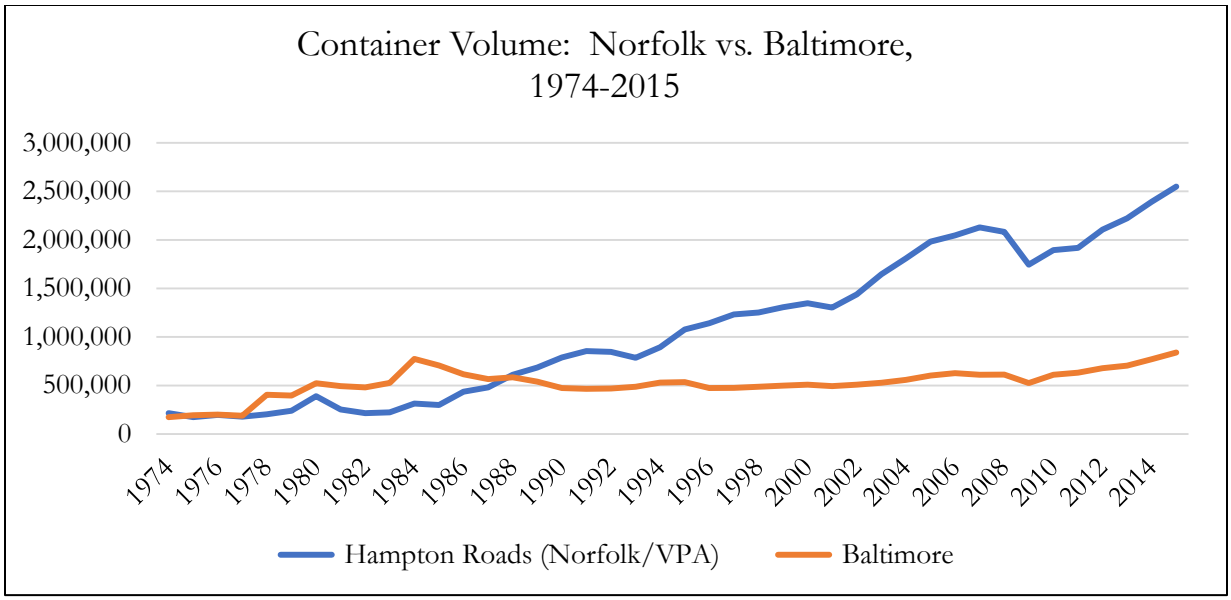
[6] Schlesinger, Jacob M., Christopher M. Matthews and Jacob Bunge, "Trump Administration Announces Deal With China to Boost Exports," Wall Street Journal, May 12, 2017 https://www.wsj.com/articles/trump-administration-announces-deal-with-china-to-boost-exports-1494558000

[7] Hutchins, Reynolds, "Major investment to bring much-needed capacity to Virginia port," Journal of Commerce, July 20, 2016 http://www.joc.com/port-news/us-ports/port-virginia/major-investment-bring-much-needed-capacity-virginia-port_20160720.html

Exhibit 25. Trends in container volume at the Port of Norfolk and the Port of Baltimore



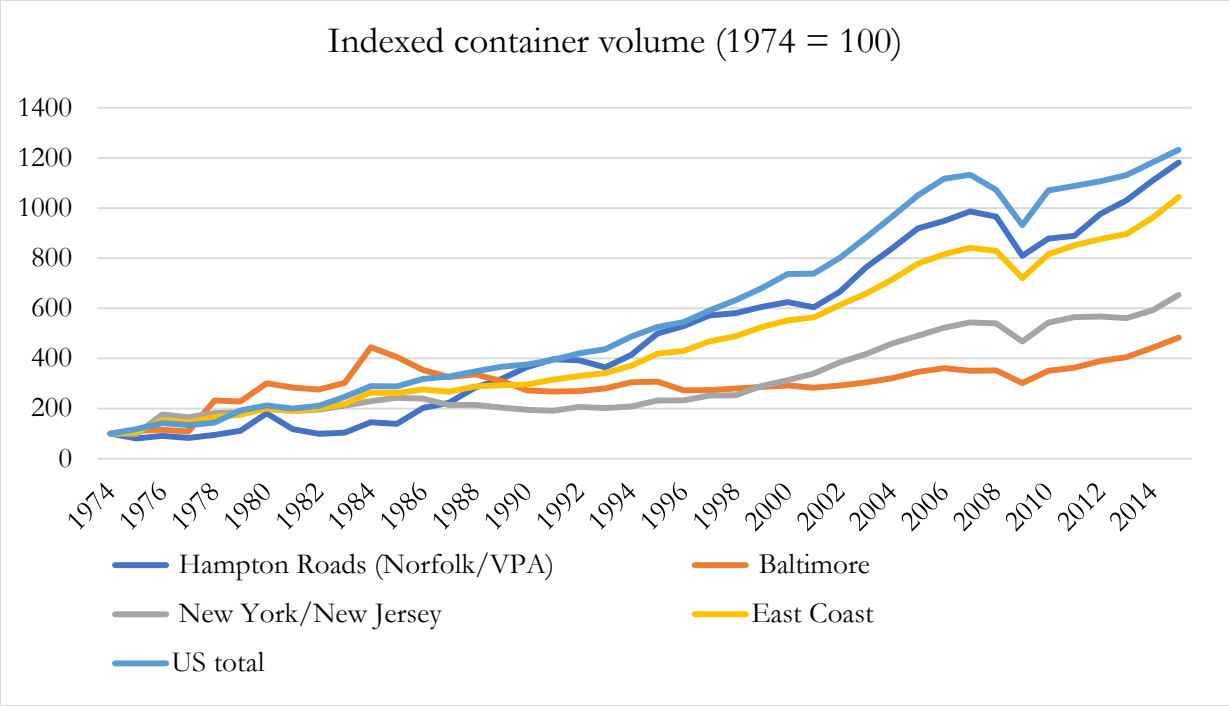
Source. US DOT Freight Analysis Framework

Baltimore's failure to keep up with container volumes at Norfolk is not an isolated case. Indeed, Baltimore has lagged behind the Port of New York and New Jersey, East Coast ports in general, and all U.S. ports.

Exhibit 26 sets the value of container cargo in 1974 at 100 for these ports and groups of ports. Subsequent changes in container volumes are prorated to this 1974 value. As shown, container volume for all U.S. ports has grown enormously over the period from 1974 to 2015 reaching an indexed value of 1283 in 2015, an average annual growth rate of 6.3 percent. Growth for Norfolk was almost as robust, growing at an average annual growth rate of 6.2 percent and reaching an indexed value of 1182 in 2015. All East Coast ports exhibited generally similar growth (average annual growth rate of 5.9 percent and an indexed value of 1044 in 2015). Significantly less robust growth was experienced at the Port of New York and New Jersey where average annual growth was 4.7 percent and the indexed value in 2015 was 654.

In this comparison with its primary competitors — the Port of New York and New Jersey and the Port of Virginia — and broader measures of port activities, Baltimore comes out at the bottom of the list. Average annual growth measured only 3.9 percent over those four decades. By 2015, the indexed value of container volume at Baltimore in 2015 was 483, only 39 percent of the value for all U.S. ports.

Exhibit 26. Trends in container volume the Port of Baltimore and other US ports



Source. US DOT Freight Analysis Framework

While containerized cargo is a subset of all cargo, the trends in container volumes reflect larger trends in moving cargo through Baltimore and its competitor ports. These trends are at odds with the geographical advantage that Baltimore holds over other East Coast ports. As noted above, Baltimore is closer to many inland centers of industry and commerce that generate products for export. Because moving goods by water is radically less expensive than moving goods by truck or rail, this geographic advantage means that the Port of Baltimore can reduce logistics costs for many exporters in the Midwest and Northeast.

Yet, despite the opportunity to reduce logistics costs significantly, the Port of Baltimore tends to underperform relative to other nearby East Coast ports. Exhibit 27 compares the value and volume of exports in 2015 that moved through Baltimore to exports that used the ports in Norfolk, Wilmington, Philadelphia, New Jersey, and New York. In total, 17 percent of the value and 11 percent of the volume of all exports using ports between Norfolk and New York moved through Baltimore. This average figure, however, is somewhat misleading because Baltimore dominates the export of motorized vehicles, accounting for well over half of the value and volume of this commodity moving through the six ports. Of the 40 commodities listed in Exhibit Y, Baltimore's share of total value reached or exceeded 10 percent for only 12 commodities, while the share of volume exceeded 10 percent for only 10 commodities.

Exhibit 27. Exports using Baltimore compared to other nearby ports, 2015

Commodity	*Baltimore*		*Total six ports*		*Maryland share of total*	
	Total M$	Total Ktons	Total M$	Total Ktons	Total M$	Total Ktons
Alcoholic beverages	$10.8	2.9	$207.1	90.3	5%	3%
Animal feed	$23.0	20.8	$1,708.9	1,398.2	1%	1%
Articles-base metal	$129.9	33.0	$1,574.7	259.4	8%	13%
Base metals	$356.6	142.4	$2,432.8	486.5	15%	29%
Basic chemicals	$310.0	32.6	$3,921.9	1,631.5	8%	2%
Building stone	$0.0	-	$12.0	28.0	0%	0%
Cereal grains	$31.6	13.8	$547.2	847.8	6%	2%
Chemical prods.	$385.0	56.5	$5,417.2	966.4	7%	6%
Coal	$1,464.3	11,339.4	$7,766.3	75,272.7	19%	15%
Electronics	$314.8	18.1	$9,037.3	193.0	3%	9%
Fertilizers	$12.9	9.1	$302.9	613.4	4%	1%
Fuel oils	$0.6	0.3	$7,568.9	25,031.4	0%	0%
Furniture	$31.4	5.2	$722.6	297.0	4%	2%
Gasoline	$0.2	0.2	$304.2	658.7	0%	0%
Gravel	$0.1	0.0	$19.6	26.1	0%	0%
Live animals/fish	$0.0	-	$9.1	9.9	0%	0%
Logs	$71.9	135.1	$208.7	317.2	34%	43%
Machinery	$2,553.3	252.0	$10,149.5	1,012.2	25%	25%
Meat/seafood	$78.0	49.7	$838.1	687.4	9%	7%
Metallic ores	$185.4	14.0	$1,166.0	4,945.4	16%	0%
Milled grain prods.	$19.7	11.5	$468.4	316.8	4%	4%
Misc. mfg. prods.	$94.4	5.0	$1,736.5	584.1	5%	1%
Mixed freight	$1,752.1	2.5	$9,308.3	201.5	19%	1%
Motorized vehicles	$6,924.8	707.3	$11,185.1	1,266.2	62%	56%
Natural sands	$0.2	0.5	$13.4	15.3	2%	3%
Newsprint/paper	$42.6	30.0	$1,197.0	1,333.3	4%	2%
Nonmetal min. prods.	$77.4	72.1	$1,486.0	353.3	5%	20%
Nonmetallic minerals	$1.8	3.7	$89.4	115.0	2%	3%
Other ag prods.	$65.3	18.8	$2,534.5	2,623.8	3%	1%
Other foodstuffs	$209.3	51.3	$2,076.7	1,013.4	10%	5%
Paper articles	$22.3	12.4	$193.7	94.0	12%	13%
Pharmaceuticals	$60.4	12.1	$1,570.5	189.1	4%	6%
Plastics/rubber	$313.3	63.9	$5,940.2	1,378.7	5%	5%
Precision instruments	$116.0	3.5	$1,581.7	62.0	7%	6%
Printed prods.	$10.9	2.2	$428.5	120.7	3%	2%
Textiles/leather	$87.4	6.6	$1,588.7	1,062.2	5%	1%
Tobacco prods.	$20.5	3.5	$238.4	49.6	9%	7%
Transport equip.	$1,086.6	12.8	$3,796.1	183.7	29%	7%
Waste/scrap	$383.8	1,113.2	$3,753.6	6,267.8	10%	18%
Wood prods.	$138.1	145.8	$1,028.1	1,228.4	13%	12%
Total/average	$17,386.6	14,403.9	$104,129.6	133,231.3	17%	11%

Source. US DOT Freight Analysis Framework

The underperformance of the Port of Baltimore creates an opportunity for investments to raise the port's performance which, in turn, can generate national benefits for exporters by lowering their costs and increasing their competitiveness. Exhibit 28 provides several characteristics of these export commodities that suggest which commodities might be key to creating significant national benefits.

Although the U.S. has run a trade deficit for years, for certain commodities the U.S. is a net exporter. This is true of 17 of the 40 commodities listed below.

For these commodities, the U.S. can be seen as having a comparative advantage relative to other countries. For each commodity, the exhibit also identifies whether the Port of Baltimore underperforms its 2015 average for value (17 percent of the six ports) and volume (11 percent of the six ports).

Finally, the exhibit supplies employment impacts associated with these commodities, both the direct jobs in the commodity itself and the total jobs (direct, indirect, and induced jobs). These estimates of employment impacts are derived from IMPLAN, an industry-standard source of econometric data.

Exhibit 28. Characteristics of exports using Baltimore

Commodity	*US is net exporter?*	*Baltimore underperforms its 2015 average*		*Employment impacts for industry per $1M of sales*	
		Value	Volume	Direct jobs	Total jobs
Alcoholic beverages		Yes	Yes	1.7	9.0
Animal feed	Yes	Yes	Yes	0.7	11.1
Articles-base metal		Yes		1.9	9.3
Base metals		Yes		0.9	8.3
Basic chemicals		Yes	Yes	1.0	8.1
Building stone	Yes	Yes	Yes	4.1	11.4
Cereal grains	Yes	Yes	Yes	3.3	15.9
Chemical prods.	Yes	Yes	Yes	1.0	8.1
Coal	Yes			1.2	7.9
Electronics		Yes	Yes	2.4	9.4
Fertilizers		Yes	Yes	0.4	7.6
Fuel oils	Yes	Yes	Yes	0.1	4.1
Furniture		Yes	Yes	4.9	14.8
Gasoline	Yes	Yes	Yes	0.1	4.1
Gravel		Yes	Yes	3.8	10.7
Live animals/fish		Yes	Yes	-	-
Logs	Yes			3.6	16.6
Machinery				3.1	11.4
Meat/seafood		Yes	Yes	15.0	21.6
Metallic ores	Yes	Yes	Yes	5.4	13.4
Milled grain prods.		Yes	Yes	0.6	12.6
Misc. mfg. prods.		Yes	Yes	5.3	15.2
Mixed freight	Yes		Yes	2.9	11.5
Motorized vehicles				0.5	8.4
Natural sands	Yes	Yes	Yes	3.8	10.7
Newsprint/paper	Yes	Yes	Yes	1.2	10.1
Nonmetal min. prods.		Yes		2.4	11.7
Nonmetallic minerals		Yes	Yes	5.9	14.0
Other ag prods.	Yes	Yes	Yes	5.5	12.4
Other foodstuffs		Yes	Yes	3.1	13.9
Paper articles		Yes		1.2	10.1
Pharmaceuticals		Yes	Yes	0.6	8.2
Plastics/rubber		Yes	Yes	1.8	8.3
Precision instruments	Yes	Yes	Yes	2.3	11.3
Printed prods.	Yes	Yes	Yes	6.3	16.3
Textiles/leather		Yes	Yes	3.4	14.1
Tobacco prods.		Yes	Yes	0.3	4.8
Transport equip.	Yes		Yes	1.2	8.8
Waste/scrap	Yes	Yes		2.9	12.2
Wood prods.		Yes		4.9	14.8

Sources. US DOT Freight Analysis Framework, IMPLAN

The combination of characteristics of export commodities listed in Exhibit 28 suggests which industries might be most likely to generate significant national benefits if investments in the Port of Baltimore led to lower logistics costs. For example, the U.S. is already a net exporter of animal feed,

a commodity underrepresented in the mix of exports using Baltimore. While the production of animal feed generates less than one job for every $1 million in sales, the total employment impact when indirect and induced jobs are included exceeds 11 jobs per $1 million in sales.

A similar case can be made for cereal grains, another net export underrepresented at the Port of Baltimore, which generates even more employment per $1 million in sales — 3.3 direct jobs and 15.9 total jobs. Other commodities, all among the country's net exports, but underrepresented at the Port of Baltimore, that represent significant employment opportunities include the following.

- Metallic ores—5.4 direct jobs and 13.4 total jobs
- Mixed freight—2.9 direct jobs and 11.5 total jobs
- Newsprint/paper—1.2 direct jobs and 10.1 total jobs
- Other agricultural products—5.5 direct jobs and 12.4 total jobs
- Precision instruments—2.3 direct jobs and 11.3 total jobs
- Printed products—6.3 direct jobs and 16.3 total jobs
- Waste scrap—2.9 direct jobs and 12.2 total jobs

These commodities include both bulk commodities (e.g., cereal grains) that are the mainstay of current U.S. exports and finished goods (e.g., precision instruments) that typically have more value-added than bulk commodities. Supporting the exports of these commodities will have the direct effect of generating more national benefits.

VI. Conclusion

The evidence presented here demonstrates the potential for investments in the Port of Baltimore to lower logistics costs for a wide range of businesses and industries, not only in Maryland, but also throughout the Mid-Atlantic and Northeast states from Virginia to New York. These benefits extend well into the Midwest, stretching as far west as Kentucky, Iowa, and Wisconsin.

These benefits arise from the fortuitous geographic proximity of the Port of Baltimore to a very large share of the national population. In comparison to Baltimore's major rivals - Norfolk and New York - the port is simply much closer to major business, industry, and population centers in the eastern part of the U.S. Baltimore is the westernmost port in the Northeastern U.S. and is more closely aligned latitudinally with the population and economic centers of the Midwest.

The Port of Baltimore, however, is hobbled by its unrealized potential to expand its capacity to move cargo of all kinds. The port needs a more extensive network of 50-foot channels to connect existing port terminals to the 50-foot channel that serves the port. Additional investments in existing port terminals, such as Tradepoint Atlantic, would leverage an expanded network of 50-foot channels and fundamentally expand the cargo throughput capacity of the port.

For the particular needs of containerized cargo, the Howard Street Tunnel needs to be expanded to accommodate double-stacked freight cars. This investment would allow double-stack service directly from the port to the national rail network.

Investments in this infrastructure will create national benefits by reducing the costs of moving cargo to and from many destinations to a deep-water seaport. Because Baltimore is closer to many Midwest and Eastern destinations than its rival ports, these investments will level the playing field for East Coast ports and make economically rational decision-making by importers and exporters much simpler.

Ultimately, lower logistics costs will increase the competitiveness of businesses and industries that utilize the Port of Baltimore. Increased competitiveness in the increasingly global economy translates into greater security for existing jobs and greater potential for increasing employment in manufacturing and other industries that use the Port of Baltimore. This increased competitiveness will also create the potential for reducing the trade deficit that the U.S. has endured for decades.

Bottom Line

The implication is that 1) extending Baltimore's deep-water channel to Tradepoint Atlantic and 2) addressing the Howard Street Tunnel to allow for the accommodation of double-stack freight cars would trigger outsized, positive efficiencies and economic impacts on the East Coast of the United States. Few projects are as likely to trigger as significant efficiencies as positioning the Port of Baltimore to better compete for cargo that is now being transported at costs much higher than is necessary. The result of these excess costs is a less competitive export sector, fewer jobs, higher costs for consumers and businesses, and less economic dynamism, including in key Midwestern markets.