

Effects of U.S. Economic Sanction on Virginia's Port Throughput

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Abstract

In the year of 2018, U.S. imposed economic sanctions on other countries, such as Iran, Russia, Korea, and Hongkong, which incurs a significant influence on port industry. In such context, the primary purpose of this study is to investigate the effects of U.S. economic sanction on Virginia's port throughput, the three-year (2017, 2018, 2019) data of the PoV vessel transactions have been examined and are used to analyze the characteristics of the PoV handling capacity, container shipping, as well as trends in trade flow. Findings show that the overall decreasing in the TEU transactions suggests that the Economic Sanctions Policy and Implementation may affect the operation performance of the port, and most of months in 2018 had less numbers of TEUs than that of 2017. Regarding the duration of each container at the port, evidence suggests that post the implementation of the economic sanctions, the container operations at the PoV have been changed.

1. Introduction

In recent years, U.S. economic sanction laws and regulations have had a significant influence on shipping operations [1]. Particularly as of year 2018, a number of countries were subject to U.S. sanctions, including Cuba, China, Hong Kong, Iran, Iraq, Libya, etc [2]. These sanctions laws and regulations are complex and enforced by the U.S. Department of the Treasury, and affected different parties such as shipowners, vessels, as well as other service providers. Once the sanctions are imposed, the impact on container business immediately emerged. According to Maritime 2019 Report [3], the throughput of some ports in U.S. decreased post sanctions issued in 2018.

The Port of Virginia (PoV) is the center of international logistics in the Commonwealth of Virginia, and it is an important node in the logistics system of United States. The PoV increased capacity by forty percent with 1 million additional containers annually in the past a few years. Since 2017, the PoV has been the East Coast's leading rail port, with over thirty four percent of its cargo arriving and departing on track. In order to investigate the impact of the U.S. economic sanctions on port throughput, we plan to conduct the study in the context of the PoV. Specifically, three-year (2017, 2018, 2019) data of the

PoV vessel transactions will be analyzed. The characteristics of the PoV handling capacity, container shipping, as well as trends in trade flow will be analyzed and presented.

2. Background Analysis

The Port of Virginia (PoV) is the center of international logistics in the Commonwealth of Virginia. The Port of Virginia moves cargo through world-class facilities and transports to and from markets around the globe, carrying the goods and supplies that manufacturers, corporations, and individual consumers use in their everyday lives.

As shown in Figure 1, the principal facilities of the Port of Virginia are four marine terminals, all on the harbor of Hampton Roads. The PoV has been the East Coast's leading rail port, with over 34% of its cargo arriving and departing on track, and increased capacity by 40% with 1 million additional containers annually [4].

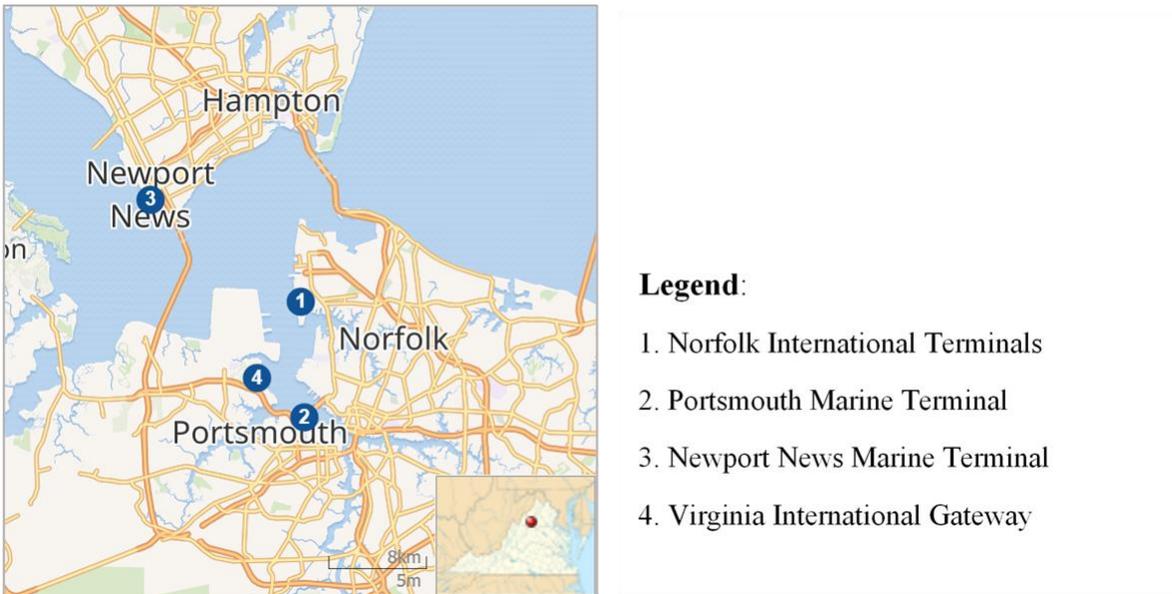


Figure 1. Terminals of Port of Virginia.

Figure 2 describes the cargo transportation process at PoV. When the ships arrive at the port, all the goods need to be cleared at the customs, after clearance, these containers will be unloaded to the specified yard, then products will be distributed to the destination by trucks or trains.

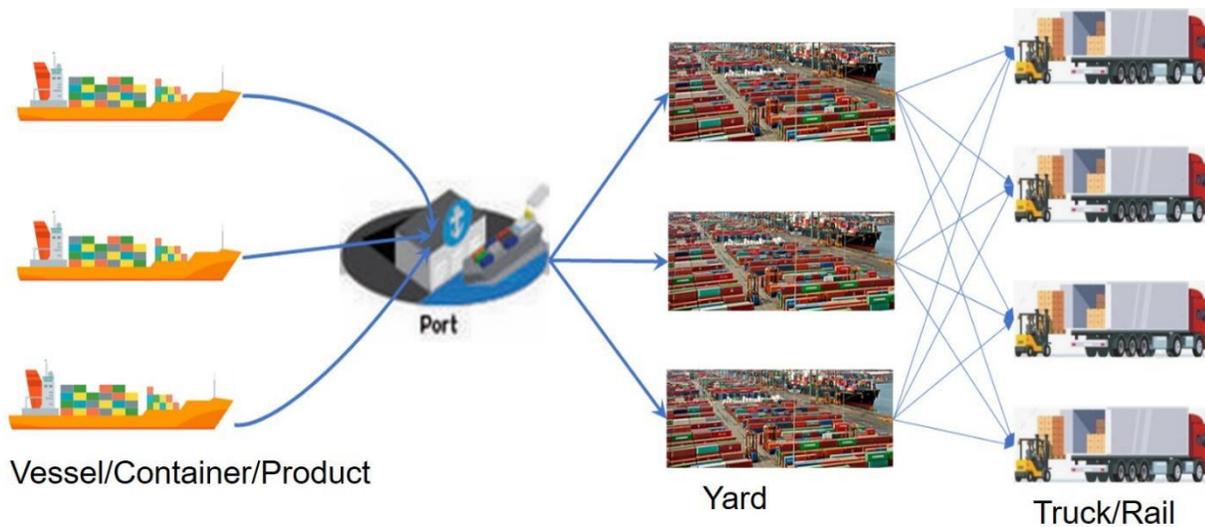


Figure 2. Flow chart of logistic process of PoV.

We observe that the Top 30 U.S. ports also experienced the fastest growth in the year 2019. As shown in

Table 1, among the top 10 container ports, capacity increases helped Houston and Savannah improve upon previous year’s performances with increases of 6.8% and 8.2% respectively. Regarding the overall performance of the whole national ports, we find that there is a slowdown with 0.6% compared to the year of 2018. The main reason is due to the trade tension with other countries, which incurs by the U.S. economic sanctions imposed in 2018 [5]. During year 2018, the U.S. government strengthened sanctions targeting Iran, Russia and Venezuela, in addition to sanctioning an agency of the Chinese government and completing the second largest sanctions-related enforcement action on record. To date, no secondary sanctions have been imposed, and the U.S. government has granted temporary waivers to eight countries — including China, India, Japan and South Korea.

According to [6], the slowdown was largely due to a 6.3% slide in imports from China resulting from the U.S.-China trade war. The increase in tariff rates in May and wider range of products covered in September meant the downturn accelerated through the year. Imports from other Asian countries—particularly Vietnam and Taiwan—partly offset the decline as importers sought to switch their supplies to lower cost countries.

Table 1. The U.S.’s 30 Largest Container Ports (2019)

Rank	Port	TEU Throughput (1,000,000s)	Percent Throughput Change from 2018
1	Los Angeles, CA	4.87	-3.3
2	Newark, NJ	4.26	1.4
3	Long Beach, CA	3.97	-9.0
4	Savannah, GA	2.35	5.7

5	Houston, TX	1.95	7.8
6	Seattle, WA	1.48	-5.7
7	Tacoma, WA	1.35	11.2
8	Norfolk, VA	1.34	2.1
9	Charleston, SC	1.21	0.3
10	Oakland, CA	1.09	2.4
11	Miami	0.84	12.2
12	Port Everglades	0.55	-23.9
13	Baltimore	0.52	2.3
14	Philadelphia	0.47	-11.4
15	New Orleans	0.38	9.2
16	San Juan, PR	0.29	-12.2
17	Jacksonville	0.26	-1.3
18	Mobile	0.22	29.1
19	Wilmington, DE	0.21	5.2
20	Boston	0.17	3.9
21	West Palm Beach	0.15	-5.5
22	Wilmington, NC	0.13	7.0
23	Chester, PA	1.11	11.1
24	Gulfport, MI	0.094	-6.0
25	San Diego	0.072	4.4
26	Port Hueneme	0.063	-7.6
27	Tampa	0.062	24.2
28	Freeport, TX	0.053	12.8
29	Everett, WA	0.031	-9.6
30	Honolulu	0.029	-22.1
National		28.9	-0.6

Data source: https://www.scmr.com/article/top_30_u.s._ports_2020_responding_to_the_pandemic

The U.S. economic sanctions not only have a significant impact on domestic ports operations and throughput, but also have an impact on other countries' trade and water transportation. For example, the US sanctions infect economic, social, cultural, and political structures in Iran [7]. Particularly, its impact on container business was instantaneous and port throughput shrank by 38 percent [8]. In China, evidence shows that shipping companies sanctioned by the United States, such as COSCO Shipping company, PetroChina Shipping company, and Hong Kong Kunlun Shipping company, having been facing greater impacts, such as seized goods, frozen assets and properties, cancellation of charter contracts by charterers, inability to collect and pay with U.S. banks and U.S. dollars, and inability to

obtain insurance services and commitments from the Shipowners' Mutual Insurance Association Letter and civil fines and criminal penalties [4].

In order to investigate the impact of the U.S. economic sanctions on port throughput, we plan to conduct the study in the context of the PoV in the following sections. Three-year (2017, 2018, 2019) data of the PoV vessel transactions will be analyzed. The characteristics of the PoV handling capacity, container shipping, as well as trends in trade flow will be analyzed and presented.

3. PoV Transaction Data Analysis

We have examined the flow of containers through the PoV between 2017 and 2019. The raw data were processed to remove records with incomplete information and also removed those containers with a size that is not 20ft, 40ft, and 45 ft. Note that the removed records are a very small proportion (e.g., <0.1 percent of all records). In addition, when comparing the number of containers, all containers were converted into twenty-foot equivalent units (TEUs).

Based on the cleaned Gate-Rail-Vessel Transactions, it was found that there were 2,852,602 TEUs, 2,683,131 TEUs, and 2,784,567 TEUs processed at the PoV in 2017, 2018, and 2019, respectively. This makes 2018 the year with the lowest number of TEU transactions among the three years. More specifically, comparing to the number of TEUs processed in 2017, the number decreased by 5.9 percent in 2018. The number was slightly picked up in 2019, resulting in 3.8 percent more TEU transactions than that of 2018. Nevertheless, the number is still 2.4 percent less than that of 2017. The overall decreasing in the TEU transactions suggests that the Department of State's Office of Economic Sanctions Policy and Implementation may affect the operation performance of the port. By further checking the monthly distributions of TEU transactions in Figure 3, can see that most of months in 2018 had less numbers of TEUs than that of 2017. The distribution line of 2019 is closer to that of 2017. If the sanction occurred in May 2018 has notable impact, we expect to see TEUs after May 2018 that follow different patterns from the previous year. Visually, from Figure 3 we can see that the TEUs in the periods between June and December 2018 and 2019 show larger variations than that of 2017. This further leads us to consider that the economic sanction has some impact on the operation of the port.

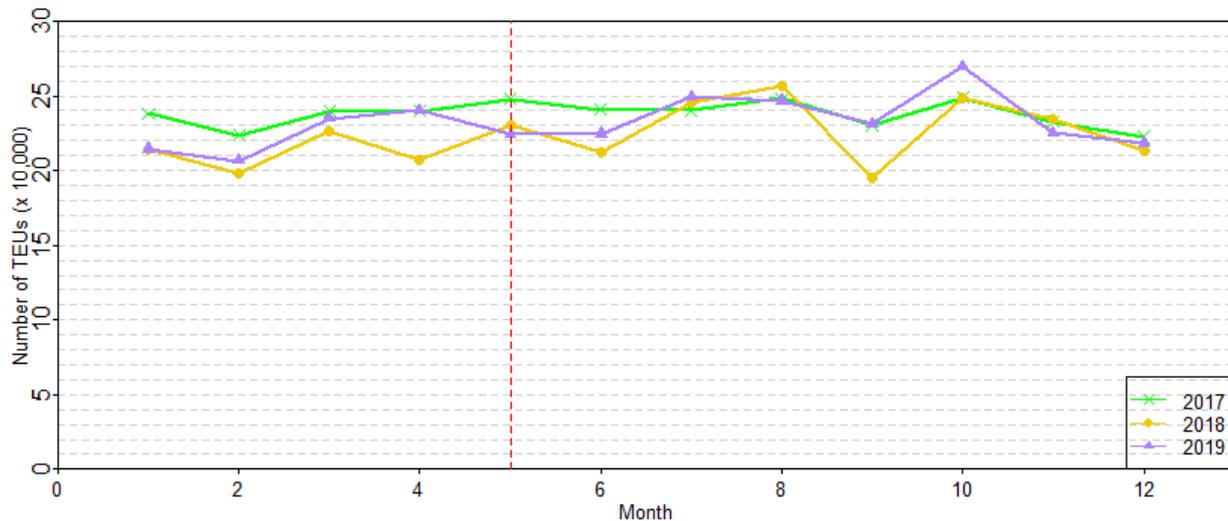


Figure 3. The Monthly Distributions TEU Transactions at the PoV.

To be more objective,

Table 2 provides a closer look at the changes of TEUs distributions in different periods. We understand that there may be some seasonal changes in handling containers. We organized the data into two periods in each year: January – May and June – December. The of 2017 data were used as the base for comparison. For January – May of 2018, the average number of TEUs was 9.4 percent less than the same period of 2017. In January – May of 2019, the monthly average was 5.8 percent less than that of 2017. For the period of June – December, the monthly averages have been reduced by 3.5 percent in 2018 and increased by 0.1 percent in 2019, respectively. Overall, post the implementation of sanctions, the changes of monthly handled TEUs on average are no more than 6 percent when compared to the same period prior to the sanction. Though the changes in the monthly averages are relatively small, it deserves to note the changes of their variations. As shown in

Table 2, the standard deviation for January – May of 2019 is 60.1% larger than that of 2017. Meanwhile, the standard deviations for June – December of 2018 and 2019 are 131.7% and 85.3%, respectively, larger than that of the same period in 2017. Note these notable changes all occurred post the implementation of the economic sanctions, and therefore suggesting the impact of the sanction. In particular, we can note that the initial period (June – December 2018) shows larger variation, which may be attributed to the uncertainty at the initial stages of the sanction. As the sanctions moved forward, the involved entities may have better ways to respond and therefore led to more stable operations. Thus, a smaller standard deviation was observed for June – December 2019 as against to the same period of 2018.

Table 2. Comparison of TEU Distributions in Different Periods

Year	January – May				June – December			
	Mean	Mean Change	Std.	Std. Change	Mean	Mean Change	Std.	Std. Change
2017								
2018								
2019								

2017	237,841	---	8,689	---	237,628	---	9,812	---
2018	215,432	-9.4%	13,336	+53.5%	229,424	-3.5%	22,730	+131.7%
2019	224,018	-5.8%	13,908	+60.1%	237,782	+0.1%	18,181	+85.3%

Other than comparing the overall changes of the TEUs handled at the POV, we further examined the changes in the container flow structure. As shown in Figure 4, three types of container flow are handled at the PoV, including export, import, and transient containers. Proportionally, it can be seen that there were no notable changes in the proportions of each type of container flow. Among all TEUs, 42-43% are for exporting in each year, 44-46% are for importing, and 11-13% are transient ones. The results suggest that the economic sanctions announced in 2018 did not reshape the structure of the container flow at the port.

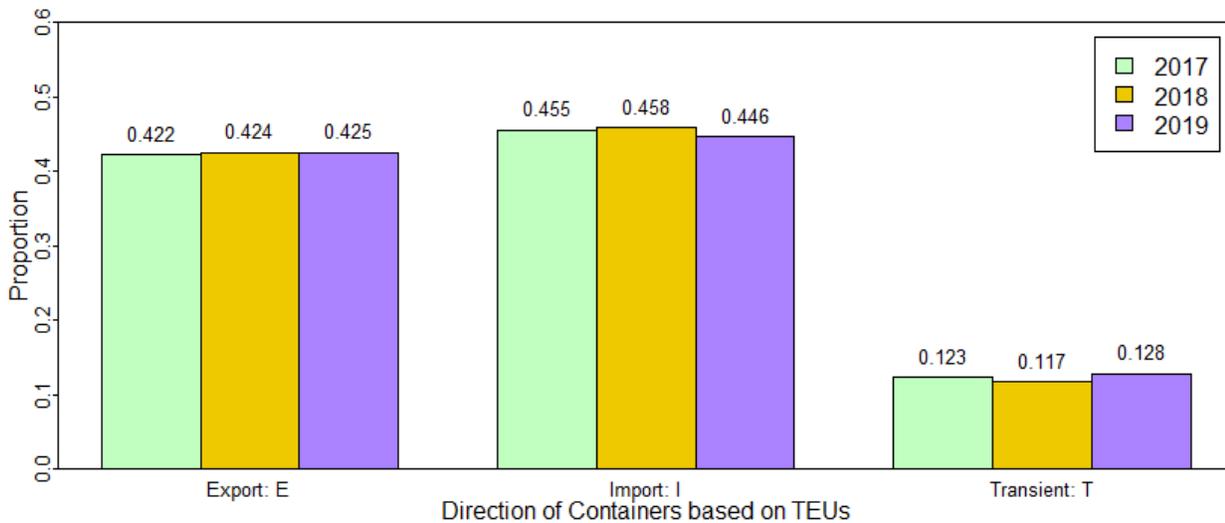


Figure 4. Container Flow at the Port of Virginia in Three Years.

The container transaction records include the arrival date and time of each container and the date and time the equipment departed. Thus, we can calculate the duration that each container stays at the port as:

$$\text{Duration} = \text{DepartureTime} - \text{ArrivalTime} \quad (1)$$

Note that we assume that the “equipment” means the container as no other information was available in the data set). Not every container has the departure time in each month’s transactions. We subset those with both arrival time and departure time and examined their empirical cumulative distribution function (CDF) plot of the duration at the port to see if there was change after the implementation of economic sanctions. As shown in Figure 5, the pairwise comparisons between the CDF curves indicate that there were difference between the distribution of the duration at port post the implementation of economic sanctions. For example, the CDF curve in 2018 (i.e., the yellow curve in Figure 5(a)) is shifted to the right side of the one in 2017 (i.e., the green curve in Figure 5(a)). Alternatively, it suggests that the duration of containers at the port tends to be longer than that of 2017. Similar finding was observed for 2019 curve as well. Statistically, we applied the Two-sample Kolmogorov-Smirnov test to compare these

CDF curves and found that both 2018 and 2019 curves are significantly different from the 2017 one (p -value <0.001). In the meantime, the 2019 curve is also significantly different from the 2018 one (p -value <0.001). This suggests that post the implementation of the economic sanctions, the container operations at the PoV has been changed.

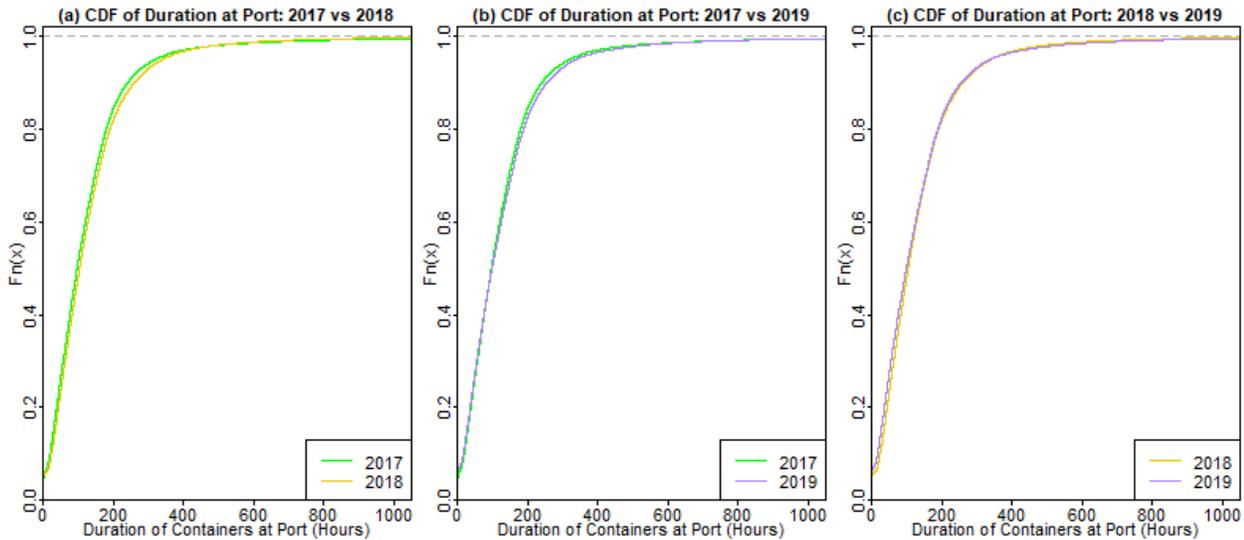


Figure 5. The Comparisons between CDF Curves of Duration at the PoV.

4. Discussion

This study specifically used three-year data of port of Virginia to analyze the influence of U.S. economic sanctions on port throughput. Findings show that the overall decreasing in the TEU transactions suggests that the Department of State's Office of Economic Sanctions Policy and Implementation may affect the operation performance of the port, and most of months in 2018 had less numbers of TEUs than that of 2017. Regarding the duration of each container at the port, evidence suggests that post the implementation of the economic sanctions, the container operations at the PoV has been changed.

In the future, most recent month and year data can be collected at different ports to investigate the various changing characteristics. Moreover, further study can focus on analyzing the impact on ports of sanctioned country. Last but not the least, to cope with unpredictable shock from external environment, shipping companies need to rethink and redesign their supply chain network to keep transportation sustainability. Lee [9] suggest that designing a supply chain framework with alignment, adaptability, and agility, can help to research the goal of modern supply chain.

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