

A Study on Impact of International Container Vessels during and Post Pandemic

Dr.M.Sekar, Assistant Professor, Indian Maritime University, Chennai- 600 119, India

Introduction

The international trade is totally relying on shipping, more than 90% of the international trade is dependent on shipping. The dependence of shipping in the international trade is due to its low-cost transportation. The container ships are more popular in the international trade, as the containers are easy to handle at ports, reducing the turnaround time for ship, reducing the dwell time of cargo, containerization provides better security for the cargo, also used in multimodal and intermodal transportation and also facilitating liner trade. The outbreak of COVID virus has put the entire world shipping industry in mess, causing great havoc to all economies.

This paper analysis the impact of COVID on the traffic of international container vessels and also, how the impact has affected the growth of world container port throughput.

If the world container port throughput is affected, then the traffic of container vessels is also affected. The traffic of the world container port throughput is linked with number of container ships around the globe and with container ships in dead weight. The Study is analysed, with 10 years' data (2011-2020) taken from secondary sources. The data is analysed using DEA-Efficient Frontier. The efficient frontier signifies an efficiency mark in the entire set of decision-making units (DMU). Before applying DEA, it is ascertained that the world container port throughput is correlated with number of container ships around the globe and similarly world container port throughput is correlated with container ships in dead weight. To study the impact of growth of world container port throughput, compound annual growth rate (CAGR) is calculated on a year-on-year basis.

Table-1 Correlation between container port throughput and No. of container ships.
Table-2 - Correlation between container port throughput and container ships in Dead weight

Year	Container Port Throughput in TEU (in Million) (x)	Number of Container Ships (y)	Container Ships in Dead weight tons (in thousands) (y)
2011	584.33	4966.00	183691.41
2012	618.16	5096.00	196820.99
2013	648.92	5079.00	206322.14
2014	680.53	5101.00	216199.14
2015	692.43	5111.00	228229.99
2016	703.52	5225.00	244398.64
2017	757.12	5150.00	245683.48
2018	795.74	5198.00	253632.59
2019	811.22	5304.00	266087.20
2020	775.00	5371.00	274856.49

Data Analysis and Interpretation

(Source of Data: UNCTADSTATS & statista.com)

Correlation between container port throughput and No. of container ships. R Calculation

$$r = \frac{\sum ((X - M_x)(Y - M_y)) / \sqrt{((SS_x)(SS_y))}}{68464.583 / \sqrt{((53110.509)(125200.9))}} = 0.8396$$

The author wants to know whether there is, any relation exists between world container port throughput and number of container ships before calculating DEA. So, correlation was calculated between the above two variables it is found that the $r = 0.8396$ meaning there is a strong positive correlation between the above two variables.

Correlation between container port throughput and Container Ships in Dead weight R Calculation

$$r = \frac{\sum ((X - M_x)(Y - M_y)) / \sqrt{((SS_x)(SS_y))}}{20043784.381 / \sqrt{((53110.509)(8300401095.207))}} = 0.9546$$

Before calculating DEA, it has to ascertained whether there is any relation exist between world container port throughput and container ships in dead weight. Hence when calculating correlation between the above two variables it is found that the $r = 0.9546$ meaning there is a strong positive correlation between the above two variables.

Table-3-Measuring Efficiency of World Container Port Throughput Year on Year using DEA with Number of Container ships in the world as Input

Year	(O)Container Port Throughput in TEU (in Million)	(I)Number of Container Ships	Efficiency	Relative Efficiency
(a)	(b)	(c)	(d)=(b)/(c)	(e)=d/0.1531
2011	584.33	4966.00	0.1177	0.76863
2012	618.16	5096.00	0.1213	0.79239
2013	648.92	5079.00	0.1278	0.83460
2014	680.53	5101.00	0.1334	0.87148
2015	692.43	5111.00	0.1355	0.88498
2016	703.52	5225.00	0.1346	0.87954
2017	757.12	5150.00	0.1470	0.96033
2018	795.74	5198.00	0.1531	1.00000
2019	811.22	5304.00	0.1529	0.99908
2020	775.00	5371.00	0.1443	0.94257

Relative Efficiency:

$$0 \leq \text{Relative Efficiency} \leq 1$$

Efficiency of DMU_i / Efficiency of DMU_{Best}

While applying DEA, every year was made as decision making unit. Number of container ships throughout the world was marked as input and world container port throughput was marked as output (single input and output model). In 2020 the world container Port throughput is around 775.00 million TEU's compared to 811.12 million TEU's in 2019, in fact the pandemic hit was at peak in 2020 and many countries suffered during this period, this indicates the container vessel movement globally got affected essentially due to pandemic. The efficiency and relative efficiency of 2018 was the highest, calculated based on the single input and output model. The efficiency during 2020 is 0.1443 compared to 0.1529 in 2019. The relative efficiency also plunged to 0.94257 in 2020 compared 0.99908 in 2019, This drop in efficiency and relative efficiency during 2020 confirms that the COVID has an impact on container vessel traffic.

Table-4-Measuring Efficiency of World Container Port Throughput Year on Year using DEA, with Container Ships (World) in Dead weight as Input

Year	(O)Container Port Throughput in TEU (Twenty-foot Equivalent Unit) in Million	(I)Container Ships in Dead weight tons (in thousands)	Efficiency	Relative Efficiency
(a)	(b)	(c)	(d)=(b)/(c)	(e)=d/0.003181
2011	584.33	183691.41	0.003181	1.00000
2012	618.16	196820.99	0.003141	0.98733
2013	648.92	206322.14	0.003145	0.98873
2014	680.53	216199.14	0.003148	0.98952
2015	692.43	228229.99	0.003034	0.95375
2016	703.52	244398.64	0.002879	0.90492
2017	757.12	245683.48	0.003082	0.96877
2018	795.74	253632.59	0.003137	0.98627
2019	811.22	266087.20	0.003049	0.95840
2020	775.00	274856.49	0.002820	0.88639

Relative Efficiency:

$$0 \leq \text{Relative Efficiency} \leq 1$$

Efficiency of DMU_i / Efficiency of DMU_{Best}

In the second model, the world container port throughput and container ships dead weight in tons is taken as indicators to find whether there is an impact of COVID on the traffic of container vessel globally. The analysis is made by using Data Envelopment Analysis. In the analysis every year was made as decision making unit. Container ships dead weight in tons (world) is taken as input and world container port throughput is marked as output (single input and output model). The efficiency and relative efficiency of 2011 was the highest, calculated based on the single input and output model. The efficiency during 2020 has declined to 0.002820 compared to 0.003049 in 2019. The relative efficiency also been dropped to 0.88639 in 2020 compared to 0.95840 in 2019. This witnesses a complete fall in the efficiency of container port throughput during 2020 which confirms that the COVID has an impact on international container vessel traffic.

Table-5-Measuring the growth of World Container Port Throughput Year on Year by using CAGR

YEAR	Container Port Throughput in TEU (in Million)	CAGR (%) YoY	CAGR (%) 2011 to 2018	CAGR (%) 2011 to 2019
(a)	(b)	(c)	(d)	(e)
2011	584.33	0.00	3.93	3.72
2012	618.16	5.82		
2013	648.92	4.85		
2014	680.53	4.94		
2015	692.43	1.76		
2016	703.52	1.59		
2017	757.12	7.68		
2018	795.74	5.02		
2019	811.22	2.01		
2020	775.00	-4.44		

(Source of Data: UNCTADSTATS & statista.com)

The CAGR for 2020 shows a negative growth of -4.44 % as compared to a marginal growth of 2.01% in 2019. From 2019 to 2020 there is complete negative growth on container port throughput essentially due to the impact of COVID.

Conclusion and Discussion

It is understood (table-3) the efficiency during 2020 is 0.1443 compared to 0.1529 in 2019. Further the world container Port throughput in 2020 is around 775.00 million TEU's compared to 811.12 million TEU's in 2019 this decline in traffic is due to the fact the pandemic was at its peak in 2020 and many countries suffered during this period. The relative efficiency also weakened to 0.94257 in 2020 compared 0.99908 in 2019, proving a low traffic of container vessel globally essentially due to COVID. The calculation of DEA in the second model, also shows there is an impact of COVID on container port throughput, that is, (table-4) the efficiency during 2020 is 0.002820 compared to 0.003049 in 2019. The relative efficiency also has dropped to 0.88639 in 2020 compared to 0.95840 in 2019 substantiating the impact of COVID on the traffic of container vessel which was sluggish globally. From 2019 to 2020 there is complete negative growth on container port throughput essentially due to the impact of COVID. Still the pandemic is continuing it is difficult to ascertain post pandemic reaction on container vessels. The above analysis reflects that the world container port throughput has declined in 2020, which means the traffic of container vessels throughout the world has suffered enormously, essentially due to the impact of COVID.