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ARTICLE

Seasonality in Freight Rates

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Abstract This paper inspects in detail the seasonality (deterministic) in container freight rates, and compares seasonality patterns in different freight rate indices. A deterministic seasonality unit root test is performed to achieve set objectives. This study concludes that all the indices (tested in this paper) exhibit significant deterministic seasonality. For January and August, there is no seasonal effect observed in all five series. At the same time, all the indices except Exports from Europe Rate Index (EEI) exhibit significant seasonal patterns in February, September, and December. All five indices exhibit significant seasonality during May, and the coefficient sign shows a drop in the freight rates. During March, October, and November; it is observed that only EEI exhibit significant seasonal patterns. The results could be beneficial for carriers and agents who are involved in the containerised freight transport business. Also, shippers could get a clear idea about the freight rates' nature across various trade routes.

Keywords Freight index, HEGY, Seasonality, Container freight rates, Shipping

1. Introduction

The global trade and development in the world economy drive the demand for liner services. The containerised freight is highly uncertain due to unexpected economic conditions. Ocean freight rate has a price structure (depending upon the weight of cargo, nature of cargo, a total distance of transportation, and many other factors) charged by the carrier, in this case, is the shipping line in context to containerised freight (packed and stuffed in shipping containers) for transporting cargo from the port of embarkation to the port of destination. However, post-financial crises markets were hit globally, particularly in 2008–09; the Ocean freight transport sector became very volatile, which is heavily impacted and is affecting the overall freight rate market, especially in containerised freight. The phenomenon is primarily because of the financial burden on shipping lines all around the globe as their market shares started contracting, resulted in weak demand for shipping services. The shipping industry has faced many challenges post-financial crises in 2008–09, primarily caused by a tenacious miss-match between supply capacity and demand. Post crises, the demand struggled to pick up the momentum while at the same time, the shipping lines added the supply capacity significantly to capture market share. The crisis resulted in freight rates remained under check. Ocean freight rates for containerised cargo have remained low, and competition on major East-West and North-South routes have intensified. The market improved slightly in 2011–12, but for continuous shipping lines to add new capacity in the market, the capacity grew by about 8% demand just only by just 2% in 2015–16, which crippled the global container shipping. However, the demand improved and grew by about 3% in 2016 UNCTAD, (2017). The sharp contraction of new deliveries supported the supply-demand balance towards the end of 2016. Besides, demand went up on major routes like Asia-Europe and intra-Asia, fueled by China's robust growth.

Nevertheless, the lessening of the supply-demand gap did not restore freight rates. Freight rates remained under check, and shipping lines brawled to maintain profits on specific trade routes. In the second half of 2016, shipping lines scrapped plans for newer ships and put more importance to network optimisation and also deployed ships wisely during peak and slack season on various trade routes. This gave some momentum to freight rates; thus, carriers could enjoy better margins after suffering for quite long. Cut-throat competition in the market has resulted in carrier consolidation, and many carriers have gone bankrupt, especially the case of Hanjin Shipping.

They add on to financial challenges, containerised freight market evidence consistent fluctuations in the freight rates, mainly because of seasonal factors. Seasonal fluctuation in ocean freight rates has led to inconsistent performance and profit margins for shipping lines. The present study is conducted by performing seasonal unit root tests to check the deterministic seasonality of various freight rates' indices. The paper is organised in the following way. The introduction section discusses the challenges of the containerised liner services and seasonality exhibited at different times in a year for different freight indices (freight markets). The review of related literature is presented in the next section about different studies carried out on the fluctuation of freight rates and seasonality. The third section discusses the methodology and HEGY model used in the study. The fourth section is related to the HEGY analysis using seasonal unit tests & the outcomes of the test are discussed in the last section. This study will prove to be beneficial for all shippers, ship-owners, agents, and policymakers alike.

Seasonality in containerised freight can occur more than once a year with several components and seasonality factors, including deterministic seasonality factors, such as Christmas, Chinese New Year, and Pre-Ramadan month Post-harvest season, and many more. These events occur during a fixed period of a calendar and affect the freight rates. Seasonality can also occur because of alteration in weather, the calendar, or the performance of shipping agents, shippers, or freight forwarders. In containerised freight transport, freight rate seasonality may also emerge because of factors that impact the shipping services' demand. Seasonal fluctuations and behaviour of freight rates compel industry managers and policymakers to get prepared for bad times. Kavussanos and Alizadeh-M (2001) has discussed that despite seasonality being a sensitive area, no convincing or impactful attempt is made in the past to comprehend nature and quantify the consequences of seasonal movements in container freight rates. This paper serves to fill this gap in the existing literature by performing quantitative analysis to unfold the hidden mechanism of freight rate seasonality. Yin and Shi (2018) have studied seasonality in the China container freight index. However, there has been a gap in the study's seasonality of the Global freight Index and the same sub-indices. This study performs Seasonal Unit Test and calculates deterministic Seasonality in Container Freight Rates. This study could potentially hold great importance for industry managers and policymakers.

2. Literature Review

Freight rates mainly include base rates, Bunker Adjustment Factor, Origin Terminal Handling Charges, Destination Terminal Handling Charges, Peak Season Surcharges, Low Sulphur Surcharges, Bill of Lading charges, and other miscellaneous charges. Freight rates are prone to fluctuate with intensifying market competition, and this possesses financial pressure on shippers. Cariou and Wolff (2006) exemplify the relationship between the bunker adjustment factor and bunker price, the freight rate and charter rate, and prove bunker adjustment factor (BAF) to be responsible for the freight rates' volatility. In the paper Angelidis and Skiadopoulos (2008), the Value at Risk (VaR) approach is used to measure risks originated due to ever-fluctuating freight rates. The supply-demand misleads to miss-match Behrens and Picard (2011) explains about often, ships have less cargo to transport during backhaul, which results in ships struggling with maintaining utilisation. Chen and Zeng (2010) suggested a model based on mixed-integer non-linear programming problems, which aims to optimise container shipping networks and operations and, in the meantime, tackle changing demand and freight rates. Evans (1977) states that stable freight rates are possible if the supply-demand conditions are stable. This, also confirms that through regression analysis done by many researchers, finds out that on most liner routes, a strong correlation between freight rates and stowage factor. Fusillo (2004) advocates the fact that cost savings by liner shipping companies should be passed on to shippers in the form of lower freight rates, also ordering new vessels and deploying vessels on a trade lane to impact freight rates in the long run. Often supply capacity adjustments on a trade route by liner shipping companies result from adjusting freight rates. If the freight rates face steep fall and if it seems to be a long-time affair, then the liner companies may withdraw/suspend loops, opt missed sailings, lay-up vessels, cascade vessels to other trade routes or scrap older fleet. Gouvernal and Slack (2012) studies how container freight rates vary globally and regionally and over time. Imai et al. (2006) states that the decision to deploy bigger ships on trades like Asia-Europe and Asia-North America is always considered keeping freight rates and feeder cost. Moreover, liner shipping companies' decision to order bigger ships for selected trades is considered after analysing current freight rates on those trades and forecasting the same once the ships will be delivered Lim (1994). Jansson and Shneerson (1978) describes that freight rates do not contain marginal cost incurred in transporting cargo, which provides a positive aura to some industries but negative to others. Therefore this protection offered by deviating from marginal cost is helpful in policy decision making. Lu (2007) mentions seven important points which are always impactful at any point in time of transporting freight through shipping containers, which are ocean freight rates, speed and reliability of the service, pilferage of cargo, inventory management, country's trade and company's policy, shipper market conditions, and the influence of the shippers' in the market. Freight rate plays an important role in the production of a container shipping service, i.e., if the demand for shipping service exceeds available supply, then the freight rates will rise, as discussed in (Lun et al. 2010; Meyer et al., 2012). Luo et al. (2009)

demonstrate an econometric analysis for volatile and fluctuating freight rates due to miss-match in demand for container shipping services and available supply capacity. Nevertheless, another analytical study was performed by McGinnis (1979) to read the shipper's attitude towards an array of variables that affect freight transportation choice. Munim and Schramm (2017) introduce a state-of-the-art volatility forecasting method for container shipping freight rates with an example of the Asia-North Europe trade route. Ryoo and Thanopoulou (1999) talks in detail about the formation of conferences wherein a variety of forms of co-operation in liner shipping. It was in the Asian trades and India specifically where freight rate co-operation appeared for the first time during the fall of the 19^{th} century. Slack and Gouvernal (2011) explains the nature of ocean freight rates for transporting containerised cargo and the role various surcharges imposed on freight rates. Understanding the fact that maritime business is highly capital intensive in nature and, therefore, Song et al. (2005) explains how overcapacity drives down freight rates, resulting in hampering liner shipping companies' profits Tongzon (2009) describes that the efficiency of a container seaport or a terminal can be estimated by accessing it is turnaround time, cargo dwell time, and the freight rates (Including or excluding inland haulage) charged by shipping companies for transporting a certain amount of cargo through that particular port. Therefore, freight rate is an important component in the selection of a port. Wang et al. (2015) states that demand for container shipping is dependent on the freight rates and develops a mechanism that adjusts the freight rates to maximise the profit. Wilmsmeier and Hoffmann (2008) taking an example of the Caribbean region analysed the impact of port infrastructure and liner shipping connectivity on freight rates. The Table 1 briefs about various studies done on freight/charter rate volatility and seasonality in the past in various segments of maritime shipping:

From the above, it quite clear that limited study has been made to investigate seasonality in Freight index markets. The seasonality in China container freight Index has been investigated in Yin and Shi (2018). However, there is a gap in understanding in seasonality Global container freight index and their sub-indices. The paper further attempts to find the same in the Global freight index and their sub-indices.

3. Methodology, Model & Data

The paper's objective is to analyse the seasonality of the various freight indices in the container markets. The seasonality is explored in the Exports from Europe rate Index (EEI), Exports from US rate Index (EUI) Imports to Europe rate Index, Imports to US rate Index, and Global freight rate Index of the container markets. This section contains analysis prepared on log values, seasonal unit root test, and deterministic seasonality. HEGY method is used to study the stochastic seasonality. Therefore, this paper adopts the HEGY method to test seasonal unit roots Hylleberg et al. (1990). The method has been recommended for monthly data based on Unit root tests' performance, as discussed in Rodrigues and Osborn (1999). Also, the same has been deployed in Yin and Shi (2018). This method is used without maintaining unit-roots all seasonal frequencies but in some seasonal frequencies.

3.1 HEGY seasonality analysis

We test for seasonality in the container freight rates of EEI, EUI, GFI (Global Freight Index), IEI (Imports to Europe index), and IUI (Imports to US index) which are sub-indices of the Global freight Index using the HEGY unit root tests. The descriptive statistics have been shown in Table 2, and the patterns have been shown in Figure 1.These are the significant routes of container trade and volumes. Hence these have been chosen for seasonality using the HEGY method. The series is converted to a logarithm form to avoid scaling issues. The log-transformed series are denoted as LEEI, LEUI, LGFI, LIEI, and LIUI, respectively. Table 3 present the results of seasonal unit root testing carried on the five indices. We estimate the p values using Monte-Carlo simulation methods. For LEEI, we are unable to reject the null of seasonal unit root at $\pm\pi/2$, $\pm 2\pi/3$, and $\pm 5\pi/6$. Similar behaviour can be observed for the other four indices, indicating seasonal behaviour present in the container freight rates under analysis. The monthly freight rates of the Global container freight index and their sub-indices EEI, EUI, IEI, and IUI from July 2011 till July 2017 have been obtained from the company Drewry maritime services.

This study considered EEI, EUI, GFI, IEI, and IUI by embracing the HEGY unit root tests. Wherein, EEI is calculated by considering prominent European ports to various destinations. EUI is calculated by considering prominent US ports to various destinations. Similarly, GFI is calculated by considering some eminent global port pairs. Likewise, IEI comprises of noteworthy port pairs from various origins to European ports, and IUI, as the name suggests, is about port pairs from various origin ports globally to US ports. European and the US seaports have significant contribution in the preparation of above indices. The rates have been obtained in US$/TEU.

Table 1. Some recent studies were done on freight rate fluctuations and seasonality

S. No.	Author(s), year	Contributions	Gaps
1	Yin and Shi (2018)	Uses HEGY method & Monte Carlo method to investigate the seasonality the container freight rates across different line services using China Containerized Freight Index (CCFI).	Seasonality with world container freight index.
2	Munim and Schramm (2017)	Deploy the ARIMARCH model for forecasting for container shipping freight rates.	Different forecast horizons need to be tested using the ARIMARCH model.
3	Wang et al. (2015)	Discuss that container shipment demand is not fixed but depends on the freight rates and is referred to as the “profit-based container assignment (P-CA)”.	Seasonality based modelling could also be explored, apart from demand-based.
4	Meyer et al. (2012)	Analyse the relationship between a ship’s speed and its fuel consumption.	No consideration of the potentially significant effects of such exogenous variables (weather, sea conditions).
5	Gouvernal and Slack (2012)	Analyse how container freight rates vary globally and regionally and over time using three relationships: the relationships between rates and physical distance; the role of market conditions and rates; and, the relationships between rates and economic development.	Data were taken for only one customer for the same month and other variable factors not considered.
6	Slack and Gouvernal (2011)	Discusses how the number of surcharges imposed by the carriers on the customers and their impact on container freight rates.	The surcharges on the European import trades.
7	Behrens and Picard (2011)	Investigate the role of transport markets in shaping the location of economic activity and the the pattern of trade.	Multi-region technological differences directly affect shipping routes chosen by carriers, freight rates across routes, and economic activity.
8	Chen and Zeng (2010)	Discusses the optimisation of the container shipping network and its operations under changing cargo demand and freight rates.	Projections of future fluctuating demand not considered.
9	Lun et al. (2010)	Examines how the factor and product markets are related to organisational capacity and firm performance in the container shipping industry.	Only container shipping was considered.
10	Luo et al. (2009)	Uses econometric analysis for understanding the fluctuation of the container freight rate due to the interactions between the demand for container transportation services and the container fleet capacity.	Global data not considered.
11	Tongzon (2009)	Evaluate the major factors influencing port choice from the Southeast Asian freight forwarders’ perspective, their decision-making style and port selection process.	South-East Asian Freight forwarders.
12	Wilmsmeier and Hoffmann (2008)	Analyses the impacts of port infrastructure and liner shipping connectivity on intra-Caribbean freight rates.	Based on port infrastructure and liner shipping connectivity on intra-Caribbean freight rates.
13	Angelidis and Skiadopoulos (2008)	Use VaR (Value-at-Risk) to measure the freight rate risk, applied to various freight markets for both dry & wet cargoes.	VaR for positions on freight derivatives.
14	Lu (2007)	Evaluates essential resources (marine equipment, information equipment, and corporate image) and capabilities (purchasing, operation, human resource management, customer service, information integration, pricing, and financial management) in the liner shipping context.	The main findings were derived from Taiwan data.
15	Cariou and Wolff (2006)	Analyse the monthly relationship between bunker adjustment factor (BAF) and bunker price and between freight rate and charter rate for the container trade in Europe/Far East.	The relationship between bunker adjustment factor (BAF) & world container freight index.

Table 1. Continued

S. No.	Author(s), year	Contributions	Gaps
16	Imai et al. (2006)	Analyse the container mega-ship viability by considering competitive circumstances based on different service network configurations for different ship sizes: hub-and-spoke for mega-ship and multi-port calling for conventional ship size.	Only two trade routes data used: Asia-Europe and Asia–North America.
17	Song et al. (2005)	Analyse the global container-shipping network based on the cost-efficiency and movement-patterns of the current container-shipping network.	Repositioning of empty containers, shipping lines liberty to make dynamic decisions, and predicting the trends of the container business.
18	Fusillo (2004)	Discuss how to minimise unit cost of Liner shipping firms by maximising capacity utilisation on every voyage. The speed of adjustment of liner shipping capacity to changes in freight rates.	Freight rates of the world were not considered.
19	Ryoo and Thanopoulou (1999)	Discusses how alliances can be deemed an identifiable form of co-operation in liner shipping.	Alliances for Asian carriers only were considered.
20	Evans (1977)	Discuss liner freight rates & how differential pricing policies lead to cross-subsidisation of low rated by higher-rated cargoes.	Seasonality trend of container freight rate not explored.

VaR, value at risk.
Source: Author's analysis.

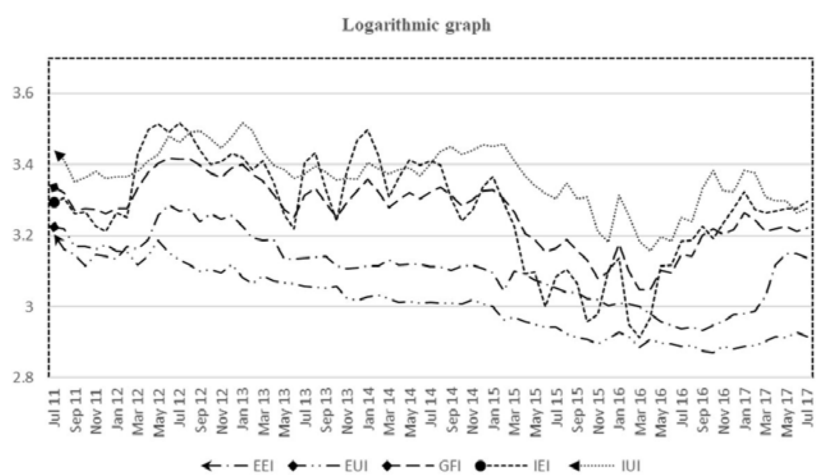

Figure 1. Logarithmic values of freight indices.

Next, we model the deterministic stationarity present in the container freight series. The results are given in Tables 2, 3, and 4. R^2 values are used to analyse the goodness of fit of a given OLS regression model. R^2 value shows the proportion of the variation in the data, as explained by the model. As the HEGY test is estimated using the OLS procedure, the R^2 value > 0.9 indicates that around 95% of the data's variation can be explained with the estimated regression model. Hence, it could be said that the estimated HEGY unit root tests capture the seasonality behaviour in the data. To test the null hypothesis of seasonality, we conduct the HEGY test at 5% significance level. If the estimated P-value given in the parenthesis is higher than 0.05, we do not reject the null hypothesis. Here, from the results, it is evident that seasonality is present in all the series under analysis. All the indices exhibit significant deterministic seasonality. For January and August, there is no seasonal effect observed in all five series. This dwindling trend can be seen especially for IEI and IUI. This is the time of the year which is often termed as slack winter season. The Europe and North American markets are shut from the second half of December and till the end of January due to Christmas celebrations. During this season the ocean carriers opt to suspend services in order to cut down costs. Similarly, the freight rates fall in August due to slump in Agricultural commodities trade. The volumes pick up after August as the harvest is ready after August in South America and African regions. Whereas all the indices except EEI exhibit significant seasonal patterns in February, September, and December. The sign of the coefficient is negative, indicating a drop in the freight rates. All five indices exhibit significant seasonality during May, and the coefficient sign indicates a drop in the freight rates. During March, October, and November; it is observed that only EEI exhibit significant seasonal patterns.

Table 2. Summary of statistics of various freight indices

	Summary statistics				
	EEI	EUI	GFI	IEI	IUI
Mean	1,300.89	1,058.06	1,879,329.00	1,996.73	2,360.11
SD.	270.64	250.51	386.48	630.89	425.21
CV^b	73,247.13	62,757.16	149,368.06	398,016.62	180,804.40
Skewness	0.37	0.61	–0.04	0.14	–0.14
Kurtosis	2.66	2.38	2.30	2.30	2.63
ARCH(12)c	389.90	456.01	348.71	213.22	219.23
L-B(12)d	423.33	507.04	377.07	264.10	234.32
J-B^e	2.01	5.71	1.52	1.70	0.67

EEI, Europe rate index; EUI, exports from US rate index; IEI, imports to Europe index; IUI, imports to US index.

Table 3. Seasonal unit root tests

Frequency		LEEI	LEUI	LGFI	LIEI	LIUI
Constant	α_0	4.532 (0.000)	4.972 (0.067)	4.755 (0.012)	5.217 (0.002)	2.733 (0.052)
Trend	β_0	–0.006 (0.014)	–0.007 (0.079)	–0.007 (0.011)	–0.010 (0.004)	0.002 (0.088)
0	$\pi_1=0$	–2.839 (0.100)	1.924 (0.486)	2.737 (0.125)	–3.277 (0.037)	–1.979 (0.443)
$\pi=0$	$\pi_2=0$	–1.958 (0.210)	–2.388 (0.0775)	–0.930 (0.732)	–1.156 (0.590)	–2.894 (0.027)
$\pm\pi/2$	$\pi_3=\pi_4=0$	11.306 (0.000)	3.597 (0.151)	0.576 (0.873)	0.904 (0.776)	2.374 (0.381)
$\pm2\pi/3$	$\pi_5=\pi_6=0$	3.820 (0.1198)	1.998 (0.458)	1.996 (0.475)	1.596 (0.565)	7.585 (0.002)
$\pm\pi/3$	$\pi_7=\pi_8=0$	12.304 (0.000)	5.375 (0.044)	3.393 (0.183)	6.866 (0.017)	7.656 (0.004)
$\pm5\pi/6$	$\pi_9=\pi_{10}=0$	4.421 (0.085)	3.385 (0.191)	1.757 (0.507)	2.549 (0.361)	4.855 (0.047)
$\pm\pi/6$	$\pi_{11}=\pi_{12}=0$	11.140 (0.000)	8.044 (0.002)	6.060 (0.016)	5.057 (0.047)	8.416 (0.000)
	R^2	0.982	0.944	0.978	0.975	0.958
	DW	2.126	2.044	2.076	1.890	2.030

*The *p* values have been tested at 5% significance level and have been given in ( ) above.

4. Conclusion & Discussion

This study assessed seasonality's impact and existence (in container freight rates) and its types with the timeline of existence. It also performs seasonal unit root tests and checks deterministic seasonality of various indices of the freight rates. Seasonality patterns are noticeable in the freight rates of containerised cargo are characterised based on trade patterns, changing demand of commodities, supply capacity fluctuations, service flexibility, geopolitical factors, and many other reasons. Broadly, this study performs a brief analysis and suggests that the seasonality patterns in specific routes for container freights between Europe and USA trade routes as well as Global Freight Rate Index. Europe's exports have seasonality in February, December, and September, where freight rates are seen to have fallen during Christmas and Chinese New Years' time. October and November months’ seasonality is shown for all indices, which indicate demand before Christmas. In May, a slump period is seen with a drop in freight rates on all routes, and monsoon is a cause of the disruption.

The months of January and August were found to have no deterministic seasonality. February, September, and December witness's seasonality in all the freight indexes except in the European Export freight index due to Christmas and Chinese New Year. The European Exports Rates Index has seasonality in March, October, and November. As per the introductory section, freight rates on different trade routes are majorly influenced by fluctuations in the amount of supply capacity deployed. However, sometimes weak demand volumes pressurise rates, and carriers need to cut supply capacity to maintain utilisation

Table 4. Deterministic seasonality in container freight rates

Month	Coefficient	LEEI	LEUI	LGFI	LIEI	LIUI
Const	β_0	0.403 (0.144)	0.234 (0.196)	0.178 (0.642)	0.795 (0.086)	0.482 (0.386)
January	β_1	–0.004 (0.145)	–0.002 (0.208)	–0.002 (0.628)	–0.008 (0.084)	–0.005 (0.375)
February	β_2	–0.114 (0.091)	–0.172 (0.041)	–0.336 (0.006)	–0.218 (0.044)	–0.226 (0.004)
March	β_3	–0.375 (0.007)	–0.224 (0.094)	–0.098 (0.142)	–0.161 (0.014)	–0.089 (0.165)
April	β_4	–0.317 (0.036)	–0.253 (0.060)	–0.055 (0.427)	–0.012 (0.856)	–0.118 (0.073)
May	β_5	–0.478 (0.011)	–0.194 (0.064)	–0.598 (0.001)	–0.422 (0.009)	–0.448 (0.000)
June	β_6	–0.445 (0.006)	–0.183 (0.0872)	–0.550 (0.001)	–0.524 (0.001)	–0.463 (0.000)
July	β_7	–0.141 (0.001)	–0.124 (0.034)	–0.038 (0.248)	–0.002 (0.939)	–0.053 (0.124)
August	β_8	0.061 (0.145)	0.042 (0.470)	–0.042 (0.227)	–0.045 (0.166)	–0.028 (0.435)
September	β_9	–0.290 (0.060)	–0.352 (0.032)	–0.257 (0.030)	–0.358 (0.007)	–0.198 (0.025)
October	β_{10}	–0.414 (0.006)	–0.314 (0.054)	–0.169 (0.138)	–0.162 (0.233)	–0.254 (0.003)
November	β_{11}	–0.153 (0.019)	0.004 (0.951)	0.096 (0.206)	0.0002 (0.995)	–0.086 (0.258)
December	β_{12}	–0.064 (0.330)	–0.203 (0.008)	–0.274 (0.000)	–0.121 (0.006)	–0.177 (0.012)
	R^2	0.978	0.936	0.972	0.959	0.954
	DW	1.936	1.846	2.042	1.998	2.042

*The *p* values have been tested at 5% significance level and have been given in ( ) above.

rates and, therefore, their earnings. When the demand and utilisation rates are low, ship-owners opt for missed sailings and often send vessels for surveys and repair/maintenance, if pending or required. Ship-owners would want to maximise their revenue by entering into time charter market during peak seasons Kavussanos and Alizadeh-M (2001), while carriers and forwarders impose GRIs (General Rate Increase) during peak seasons.

On the other hand, Shippers can use the said analysis to optimise better their shipments with lower costs and the same for buyers to plan their global supplies accordingly. The study also gives scope for shipping lines to plan and manage supply capacity in various regions and increase revenue. Apart from the above, their rates are also dependent on supply and demand for container services due to sudden shocks. This study can be of great importance and use for the shipping lines to plan their respective businesses by understanding seasonality patterns more closely and accurately than ever before. The deterministic seasonality can be explored due to certain factors like New Year, which occur at a specific calendar period. However, these may differ due to exceptional cases like an outbreak of war, political reasons, epidemic diseases, natural disasters, or calamity. We are amid an era where shipping lines are curbing costs and struggling to improve profitability. A lot of them have either gone bankrupt or acquired by others. Therefore, the challenges are enormous, and to survive in this immensely competitive market and capital-intensive business, shipping lines need to think strategically. The current study's strength lies in the data used as it is real-time data, which helped cultivate insightful results for the shipping lines and related stakeholders. To restore freight rates, shipping lines put their best efforts to manage supply-demand and implemented strategies like idling of ships and slow steaming. Cascading was another strategy that came in the limelight; however, cascading was pretty challenging on a few routes. Ships up to 12,000 TEU size were deployed on Transpacific and West Africa, which led to the deployment of even bigger ships on Asia-Europe and Asia-Mediterranean routes.

Although ship utilisation rate on some routes was shallow, thus rate restoration plans failed. Infrastructural barriers constrain quite a large fleet of the fleet deployed on the intra-Asia region due to developing economies increasing. Still, the trade volumes at ports and inland logistics did not follow suit. Some more key implications of this study are, first, the analysis derived in this study can be utilised by the ocean carriers to decide on sending the ships for surveys and repairs especially when the freight volumes are going to be low and impact freight rates – that's precisely the time when ship-owners should send their ships to the yards for surveys and repairs (e.g., in June, July and winter slack season). Inversely to this, they may opt to add extra sailings, ships of bigger size, increase the frequency and extra services when the freight volumes are high which is also called peak season (e.g., in the month of February, April, September and October). Another vital implication which can be derived is that the ocean carriers may opt to enter the time charter market when the peak season is on to step up revenues. These implications are will undoubtedly be helpful for the ocean carriers as they are derived with evidence and analysing past experiences; however, whether to implement fully or partially is ocean carriers' decision.

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