

Volatility Spillover from Global Container Freight Indices to Port Throughputs in Turkey

Abdullah AÇIK¹

ABSTRACT: *The purpose of this study is to determine the relationship between the container freight rates and the volume of container handled at Turkish ports. To do this, causality in variance analysis is used which enables to determine the volatility spillover from global container freight indices, which are Shanghai Containerized Freight Index (SCFI) and China Containerized Freight Index (CCFI), to container volume handled in Turkish ports. The data set used in the study consists of 93 observations on a monthly basis covering the dates between November 2010 and July 2018. According to the results obtained, a significant volatility spillover has been only detected from the CCFI variable to the container volume. In addition, it has been found that the container volume in Turkish ports has reacted negatively to a positive shock in China container freight index. It is hoped that these results will help the port operators in the policy development stages by providing a leading indicator.*

Keywords: Turkish ports, Container freight indices, Transport costs, Causality in variance

JEL Codes: C43, D24, R41

Küresel Konteyner Navlun Endekslerinden Türkiye'deki Limanların Çıktısına Oynaklık Yayılımı

ÖZ: *Bu çalışmanın amacı konteyner navlun endeksleriyle Türk limanlarında elleçlenen konteyner hacmi arasındaki ilişkiyi tespit etmektir. Küresel konteyner navlun endekslerinden olan Şangay Konteynirleşmiş Navlun Endeksi (SCFI) ve Çin Konteynirleşmiş Navlun Endeksi (CCFI) değişkenlerinden Türk limanlarında elleçlenen konteyner hacmine olan oynaklık yayılımını tespit etmeyi sağlayan varyansta nedensellik analizi kullanılmıştır. Çalışmada kullanılan veri seti Kasım 2010 ve Temmuz 2018 tarihleri arasında kapsayan aylık bazda 93 gözlemden oluşmaktadır. Elde edilen sonuçlara göre sadece CCFI endeksinden konteyner hacmine anlamlı bir oynaklık yayılımı tespit edilmiştir. Ayrıca, Türk limanlarındaki konteyner hacminin Çin navlun endeksindeki pozitif şoklara negatif tepki verdiği belirlenmiştir. Bu sonuçların liman işletmecilerine bir öncü gösterge sağlayarak politika geliştirme süreçlerinde yardımcı olacağı umulmaktadır.*

Anahtar Kelimeler: Türk limanları, Konteyner navlun endeksleri, Taşıma maliyetleri, Varyansta nedensellik

JEL Kodları: C43, D24, R41

Geliş Tarihi / Received: 30/01/2019

Kabul Tarihi / Accepted: 19/03/2019

¹ Res. Asst., Dokuz Eylül University, Maritime Faculty, abduallah.acik@deu.edu.tr, orcid.org/0000-0003-4542-9831

1. Introduction

The majority of trade in the world is carried out via maritime transportation, and therefore its role in the international arena is very important. The main motivation of transport activities is the freight income, and formation of the freight rate in the market is directly related to the demand for transport activities. Stopford (2009) expresses the factors that affect demand for maritime transport under 5 headings; world economy, seaborne commodity trades, average haul, random shocks and transport costs. The most effective of these is the situation in the world economy, since the maritime transport has a derived demand structure (Branch, 1988:1). However, according to Stopford (2009), the influence of transport costs upon seaborne trade should not be underestimated, although their influence is not as much as that of the world economy. Transport costs have an important role in shaping the trade (Behar and Venables, 2011: 98).

Container ports undertake the task of linking sea transport with land and are directly affected by the demand for maritime transport, and, of course, transportation costs. The amount of containers handled in ports has a direct relevance to the country's trade and macroeconomic conditions. Therefore, it is not enough to discuss the volume of containers handled at the ports only by considering the freight rates (transport costs) in the market, which may lead to incorrect evaluations. Nevertheless, it is certain that the freight rates in the market have an effect on container transportation, and fluctuations in freight rates also affect traffic in ports. As the container cargoes are generally valuable cargoes, the ratio of transportation costs to the value of the cargo is quite low (Korinek and Sourdin, 2009). Nevertheless, freight rates are a cost for traders and the rates directly affect the international competitiveness of commercial actors. Since considering freight rate alone is inadequate in evaluating containerized trade, it is more reasonable to investigate whether the fluctuations in the freight market cause fluctuations in ports. For this purpose, one of the most suitable methods developed is the causality in variance analysis. This analysis allows to determine the causality between fluctuations and thus the flow of risks between variables. As the container freight rates around Turkey could not be reached in a time series form, container freight indices of China and Shanghai, which are two of the world's major container trading centers, have been included in the analysis. To analyze their effects on port volumes, the total volume of containers handled in Turkish ports has been considered.

According to the results of the analysis carried out with the data covering the dates between November 2010 and July 2018, volatility spillover effect only from China container freight index to container handling volume has been determined. In addition, the volume of container handled at the ports reacts negatively to a positive shock in the China freight index. In this respect, since there has been no study examining this relationship in the literature, this study is hoped to have a unique contribution.

The rest of the study is organized as follows; the theoretical framework for the study is drawn and the related literature is examined in the second section; the method used in the study is introduced in the third section; the data set used in the analysis is investigated and the results are analyzed in the fourth section; and lastly, the findings related to the study are discussed and evaluations are made in the last section.

2. Literature Review

This section aims to form a theoretical framework by examining the relevant literature. For this purpose, the freight indices used in the study are introduced, and the related literature is summarized.

Several indices are used to monitor the current market situation and market behavior. They are also used to estimate possible future movements of the markets in order to get a solid position against the risks (Karamperidis et al., 2013). These indices differ according to the markets they represent. The most common indices in the freight markets, which is the subject of the study, are Baltic Dry Index (BDI), Baltic Capesize Index (BCI), Baltic Supramax Index (BSI), Baltic Panamax Index (BPI), Baltic Dirty Tanker Index (BDTI), Baltic Clean Tanker Index (BCTI), Shanghai Containerized Freight Index (SCFI) and China Containerized Freight Index (CCFI). The last two ones are indices specific to container markets and have been used in econometric tests in this study for the results intended to be achieved.

SCFI consists of 15 different individual shipping routes from the freight rates of export containers shipped from Shanghai region. Freight information has been obtained from 17 panelists of the shipper's/freight forwarders and 20 panelists of the liner companies (Shanghai Shipping Exchange, 2018a). CCFI likewise represents the export container freight rates shipped from China region. Freight information has been obtained from the volunteerism of 22 prestigious and high market share companies. CCFI is positioned as a key freight indicator for container trade in the world. It addresses a wide range of segment ranging from small businesses to big policy makers who are associated with container trade. It is also regarded as the second most effective freight index in the world after BDI (Shanghai Shipping Exchange, 2018b). Both of the container indices are useful indicators for the health of container shipping in the world (Flex Port, 2018). However, the CCFI has a greater force in terms of indications, because the SCFI includes only the freight rates on the spot market, while the CCFI includes both spot and contractual freight rates. Therefore, CCFI is considered to be more representative, more macroeconomic and more comprehensive than SCFI (Shanghai Shipping Exchange, 2018c; Crucial Perspective, 2018).

In the literature, there has been no study investigating the effects of global container freight indices on container volume at ports. A study similar to the study we wanted to do has been carried out by Kim (2016) in the international arena. The author aims to determine the impact of exchange rate movements, global economic activity and

BDI volatility on South Korea's ports loaded throughput. The volatility in BDI, one of the leading indicators for the global maritime market, has been found to have a negative impact on port cargo throughput. However, there is no decomposition of the cargo type in this study and the results are generalized. Container and dry bulk cargo markets have very different structures, therefore analyzing markets by diversifying can make it possible to achieve healthier results. In addition, some of the studies on the port throughput in the international area have focused on the effect of the exchange rate volatility on the port throughput and obtained significant results (Kim, 2017; Chi and Cheng, 2016).

Academic studies conducted within the Turkish ports are mostly related to port performance and efficiency. Some measure the performance of several ports for the specified year comparatively (Ateş et al., 2013; Ateş and Esmer, 2014; Güner, 2015a; Güner, 2015b; Akgül et al., 2015; Demirci and Tarhan, 2016), while others examine the historical efficiency of a single (Saglam et al., 2018) or several ports (Akyürek, 2017). These studies measure the efficiencies of the ports and offer various policies to port operators. In another study approaching ports from different view, Korkmaz (2012) examines the impact of the number of ships calling at Turkish ports to the industrial production index and the total trade volume in Turkey. The author has determined that the number of the vessels has a positive effect on both the industrial production index and the trade volume in the country. In another study to be mentioned in Turkish literature, Akar and Esmer (2015) estimate the demand for Turkish ports until the 2023 by using some macroeconomic variables. Firstly, modeling has been made by using past values of variables and coefficients have been obtained. Later on, the estimated future values of the macroeconomic variables have been used to estimate future container traffics in Turkish ports. In addition, they have stated that the Turkish ports is not going to have any capacity problems during the period discussed.

As it can be seen from the studies presented, there is no study examining the effect of container freight rates on the output volumes of container ports at international or domestic scale. Theoretically, transportation costs certainly affect the export and import motivations. However, diagnosing the effect statistically and discovering the key indicators to follow are useful for port users. In this respect, this study is the first in the literature by testing the spillover effect from the two main container freight indices to the volume of container handled in Turkish ports and by approaching the subject from a different viewpoint. The causality in variance analysis has been used for this purpose and it is introduced in the next section.

3. Methodology

While analyzing econometric relations, many kinds of analysis methods are applied. The methods are selected considering the type of data, the established theory and the purpose of the study, and it is hoped that the targeted results are going to be achieved. One of the most common types of these methods is the causality analysis and they also vary within themselves.

Considering the aim of the paper, which is to determine the effect of container freight indices on the total volume of container handled in Turkish ports, the most appropriate method can be thought to be as causality in variance. To put this in more detail, freight rates are a cost for stakeholders involved in trading activities and affect their trade motivations. However, there are a lot of macro variables affecting trade and it is not possible for freight to be the basic variable alone. Therefore, when it is considered absolute to have an effect on the cargo handled at the ports, it is likely that the volatility in freight rates affect the volatility in the amount of cargo handled at the ports. In other words, those concerned container handling volume in the port are reacting to information from the freight market. In this respect, this type of causality analysis can be said to be quite appropriate for the nature of the study.

The first versions of the tests that determine the volatility transition between the variables have been developed by Cheung and Ng (1996). Cross correlation function (CCF) of squared univariate GARCH residual lie in the basis of this test. However, some problems arise in this method. When the volatility processes are leptokurtic, the corresponding CCF-based Portmanteau values may have problems in small samples due to the significant oversizing (Nouira et al., 2018). To overcome this problem, Hafner and Herwatz (2006) have developed a volatility spillover test based on the Lagrange multiplier (LM) principle. They have also used Monte Carlo simulation and showed that the LM approach provides more robust results to the mentioned problems (Nazlioglu et al., 2013; Chang and McAleer, 2017). The causality in variance test developed by Hafner and Herwatz (2006) has been used in this study, which allows to test the volatility spillover between the two variables (Bayat et al., 2015).

The change in the variance is an indication of how the new information has reached and how the market evaluates the information (Hu et al., 1997; Koseoglu and Cevik, 2013; Papież and Śmiech, 2013). In particular, with regard to the port and freight variables that are the subject of this study, it is expected that the amount of cargo handled in the port will be sensitive to and respond to the information coming from the freight market.

4. Findings

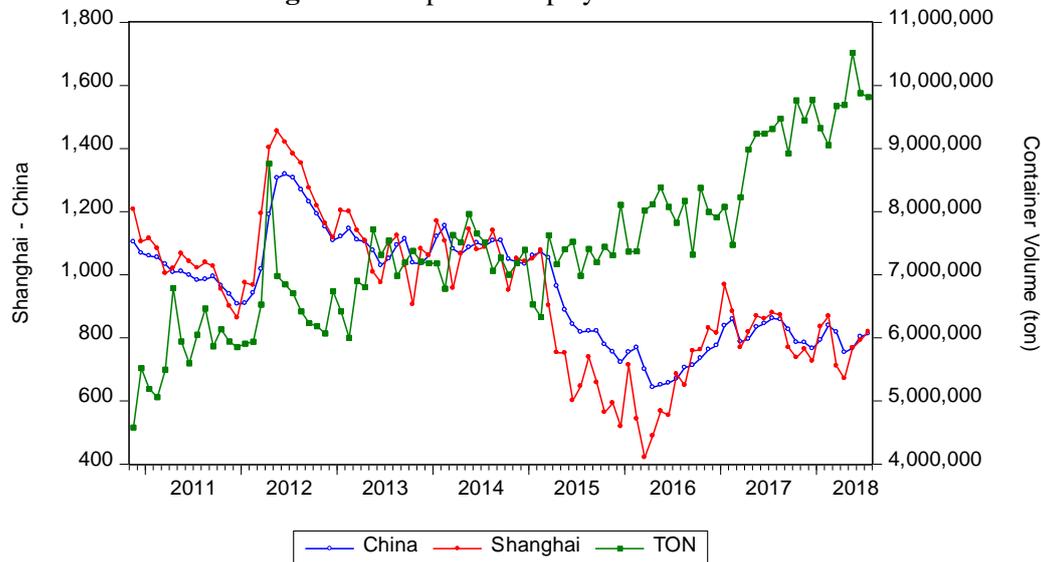
The data set used in the study consists of 93 observations on a monthly basis covering November 2010 through July 2018. The data set is presented as raw, logarithmic and return series in Table 1. Taking the logarithms of the data facilitates the processability and makes the discrete series continuous. The reason for including statistics of differenced return series in the table is that the series contain unit roots according to the results presented in Table 2. In addition, it is more appropriate to study with returns series in financial volatility analysis.

Table 1: Descriptive Statistics of the Variables

	SHANGH			Ln	Ln	Ln	Δ Ln	Δ Ln	Δ Ln
	CHINA	AI	TON	CHI.	SHA.	TON	CHI.	SHA.	TON
Mean	953.3	937.5	7423826.	6.84	6.81	15.80	-0.00	-0.00	0.00
Median	985.6	966.6	7318569.	6.89	6.87	15.80	-0.00	-0.01	-0.00
Maximum	1319.2	1455.2	10518507	7.18	7.28	16.16	0.15	0.31	0.29
Minimum	643.2	421.1	4579290.	6.46	6.04	15.33	-0.09	-0.27	-0.22
Std. Dev.	168.8	226.0	1248925.	0.18	0.25	0.16	0.04	0.10	0.07
Skewness	0.05	-0.04	0.32	-0.21	-0.63	-0.10	0.37	0.12	0.64
Kurtosis	2.05	2.54	2.69	2.01	3.00	2.81	4.51	3.41	4.75
Jarque-Bera	3.46	0.83	1.99	4.48	6.21	0.29	11.01	0.89	18.1
Probability	0.17	0.65	0.36	0.10	0.04	0.86	0.00	0.63	0.00
Observations	93	93	93	93	93	93	92	92	92

Source: Bloomberg, 2018; UDHB, 2018

The graphical representations of the variables used in the study are presented in Figure 1. This is not enough to make statistically significant inferences, but it is still important to provide a preliminary idea about the relationships. When the container volume handled in the ports is examined, it can be said that there is an increasing trend. Although there are small declines in some times, the general trend is on an upward trend. Factors such as Turkey's economic growth, increase in trade volume of the country, and policy about being a logistics base in the region might have been effective in this upward trend observed in the covered period. On the other hand, both of the container freight indices follow fluctuating courses. Sometimes an increasing trend and sometimes a decreasing trend can be observed. Both indices move along a parallel course. However, it can be said that the Shanghai index is more volatile, because both the highest and the lowest freight points have been observed in this index in the covered period. The relationship between the freight indices and container volume appears to be mostly negative. There are many reasons for this, and the increase in volume cannot be explained by the decline in the index alone. However, it is not unreasonable to assume that the decrease in transportation costs encourages trade.

Figure 1: Graphical Display of the Variables

Source: Bloomberg, 2018; UDHB, 2018

In order to apply the causality in variance analysis, the variables must be stationary. Therefore, Augmented Dickey Fuller (Dickey & Fuller, 1979), Phillips-Perron (Phillips & Perron, 1988), and Kwiatkowski-Phillips-Schmidt-Shin (Kwiatkowski et al., 1992) tests have been applied for the stationarity controls and the results are presented in Table 2. According to the first ADF test, all variables are not stationary at the level, ie they contain unit roots. When the first differences are taken, they become stationary. According to the PP test, only the Ton variable is stationary at the level, while the other two have unit roots. Finally, according to the KPSS test, only Shanghai variable is stationary at the level. The results of the unit root tests performed with different tests vary. Therefore, the first differences of all series are taken and it is aimed to obtain more robust results in the causality in variance test.

Table 2: Unit Root Test Results

	Variable	Level		First Difference	
		Intercept	Trend and Intercept	Intercept	Trend and Intercept
ADF	China	-1.2433	-1.9340	-6.8685*	-6.8295*
	Shanghai	-2.1282	-2.5441	-10.343*	-10.289*
	Ton	-1.8089	-6.1224*	-13.697*	-13.616*
PP	China	-1.3626	-1.8953	-5.6127*	-5.5719*
	Shanghai	-2.1282	-2.4420	-10.469*	-10.408*
	Ton	-2.6427***	-6.1009*	-21.350*	-21.115*
KPSS	China	0.8340	0.1354**	0.1082***	0.1095***
	Shanghai	0.7317*	0.1166***	0.0694***	0.0597***
	Ton	1.1641	0.1400**	0.1799***	0.1262**

ADF and PP Critical values for Intercept: -3.504727 for *1%, -2.893956 for **5%, -2.584126 for ***10%.
 ADF and PP Critical Values for Trend and Intercept: -4.063233 for *1%, -3.460516 for **5%, -3.156439 for ***10%.
 KPSS Critical values for Intercept: -0.739000 for *1%, 0.463000 for **5%, 0.347000 for ***10%.
 KPSS Critical Values for Trend and Intercept: 0.216000 for *1%, -0.146000 for **5%, 0.119000 for ***10%.

Correlation analyzes have been applied to statistically determine the significance of the relationship between variables, which are roughly mentioned in Figure 1. The results of the correlation analysis, which allows to determine the direction and power of the relationship between the variables, are presented in Table 3. The distribution of data in the analysis type is an important issue. Normally distributed data is usually analyzed by Pearson correlation analysis. According to the Jarque-Bera test statistics in Table 1, while the Shanghai data is normally distributed, the other two variables do not show normal distribution characteristics. For this reason, both Spearman and Pearson correlation analysis have been applied.

According to the results, Spearman correlation indicates a weak negative relationship between variables. This can be interpreted as the increase in container freight rates has a negative effect on the amount of cargo handled at Turkish ports, however, this effect is not very strong. Furthermore, there is no significant relationship between the cargo volume and the freight indices according to Pearson correlation. In addition, there is a positive significant relationship between the two container freight indices as expected, because both indices move together. After obtaining the preliminary information about the theoretical relationship between the variables, the causality analysis has been applied.

Table 3: Correlation between Variables

			<i>Pearson</i>	
		TONNAGE	CHINA	SHANGHAI
<i>Spearman</i>	TONNAGE		-0.10 (-1.038)	-0.15 (-1.491)
	CHINA	-0.24 (-2.354)	0.30	0.13 0.54 (6.187)
	SHANGHAI	0.02*	0.56 (6.526)	0.00
		-0.19 (-1.874)	0.00*	

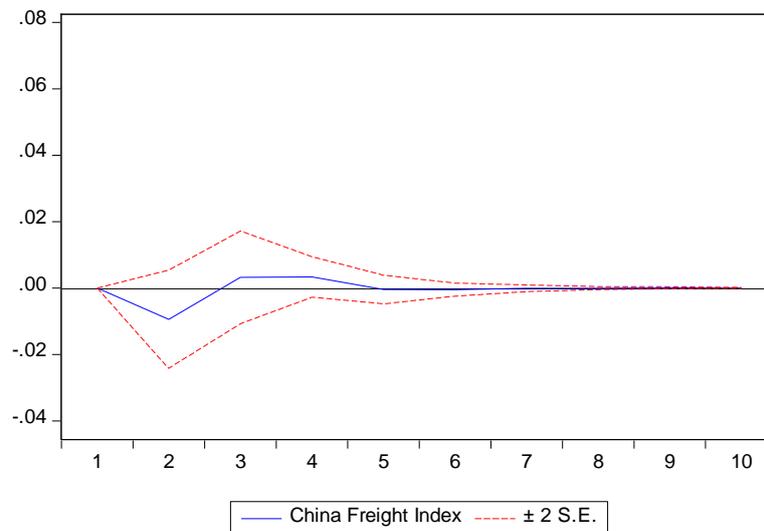
In order to examine the effect of volatility spillover between variables, causality in variance test has been applied. For this test to be applied, variables must be stationary. As shown in Table 2, the series become stationary when the first differences are taken, namely when they become a series of returns. After making sure that all the series are stationary, causality in variance analysis has been applied and the results are presented in Table 4. According to the results of the test, it is expected that there should be volatility transition from both indexes to the container volume. However, a significant causality has been determined only from China freight index to container volume.

Table 4: Results for Causality in Variance Test

INDEX	INDEX to TON	TON to INDEX
SHANGAI	0.58 (1.06)	0.13 (3.97)
CHINA	0.08* (5.04)	0.29 (2.40)

*Significant at 90%

It is expected that the effect of volatility spillover from China freight index on the volume of containers handled at ports is negative according to the theoretical background and correlation analysis results presented in Table 3. In order to verify this effect statistically, the VAR equation is estimated with China freight index and container volume variables, and impulse response analysis is applied. In the VAR Equation, Akaike information criterion (AIC) and Hannan-Quinn (HQ) information criterion show the most appropriate lag of 2, while Schwarz information criterion (SC) 1. For this reason, the VAR equations have been estimated with 2 lags and impulse response analysis has been applied and the result of the analysis is presented in Figure 2. According to the results, 1 standard deviation shock from the China freight index has a negative impact on the container volume and this negative effect continues until the 3rd period.

Figure 2: Response of Container Volume to the China Freight Index

5. Conclusion

Transportation costs are one of the most important factors affecting international seaborne trade. Despite the fact that containers mostly include value-added cargoes and the ratio of transportation costs to the cargo value is low, transportation costs are still likely to affect the demand for container transportation. In addition, while the freight rates are income indicators for carriers, they become cost indicators for the shippers. Since the demand for ports is directly related to the demand for maritime transport, it is quite natural that there is a relationship between the freight rates and the volume of cargo handled at the ports. In this context, this study aims

to examine the relationship between freight rates and container volume handled in Turkish ports and to confirm this relationship statistically. Since the container volume is affected by many factors and cannot be evaluated only by considering transportation costs, it is thought that the causality in variance method is the most suitable one that enables to determine the relationship between volatilities of the variables. Analyses have been carried out under the assumption that stakeholders interested in container transport in Turkish ports would react to news from freight indices (transportation costs).

As the container freight rates are not known regionally, Shanghai and China freight indices have been included in the analyses as a proxy of the general freight rates. These indices are the most common and inclusive indices used to monitor container freight transport in the world. According to the results, there is a volatility spillover effect from China freight index to the volume of containers handled in ports of Turkey. In other words, freight rate fluctuations are the cause of the volatility in container handling volumes in Turkey, and those concerned in container trade react to the information from the China freight market. According to the impulse response analysis derived from the established VAR equation in order to determine whether this response is positive or negative, the container volume reacts negatively to the positive shock in the China freight index.

Since the analysis used is a volatility spillover test, and based on the causality relationship in variance, it may be wrong to attribute all changes in container traffic in Turkish ports to changes in container freight indices. Factors such as exchange rates and political relations between countries are much more effective in terms of international trade volume. Therefore, it cannot be concluded that the container transport costs affect the general trend. Also the theoretical impact of transportation costs on demand for transportation activities varies in general, but is generally low. However, this does not mean that transport costs have no effect at all, and as a result of this study, there is a volatility spillover to the container traffic in Turkish ports from the container freight indices that represent the transportation costs. The information of the increase in container transport costs are evaluated by some port users and these users react negatively by canceling imports or exports of some goods.

A similar study has also been carried out by Kim (2016), but the author used BDI and do not go through a separation of cargo types. In this respect, this study is a first in the literature in terms of examining the container market and using the causality in variance method. The results obtained from this study can be taken into consideration especially by the port operators. Fluctuations and volatilities in China freight index can be monitored and its reflections on freight traffic at ports can be anticipated. The port operators may also reduce the shrinkage in demand by applying price policies against possible increases in the freight index.

The biggest limitation of the study is related to the data set, as the available container freight indices start in November 2010. If the length of time covered by

the sample can be expanded, more reliable results can be obtained. Further studies may expand the samples by including the amounts of cargo handled at ports of other countries in order to obtain more generalizable results. The subject can also be analyzed through a single port and more port-oriented results can be achieved in order to implement more particular policies.

References

- Akar, O. and Esmer, S. (2015). Cargo Demand Analysis of Container Terminals in Turkey. *Journal of ETA Maritime Science*, 3(2), 117-122.
- Akgül, E. F., Fişkin, C. S., Düzalan, B., Erdoğan, T. and Çetin, Ç. K. (2015). Liman Rekabetçiliği ve Etkinlik: Türkiye'deki Konteyner Limanları Üzerine Bir Analiz. 2. *Ulusal Liman Kongresi*, İzmir.
- Akyürek, E. (2017). Türkiye Karadeniz Limanları Verimlilik Analizi. *Verimlilik Dergisi*, 4, 29-45.
- Ateş, A. and Esmer, S. (2014). Farklı Yöntemler ile Türk Konteyner Limanlarının Verimliliği. *Verimlilik Dergisi*, 1, 61-76.
- Ateş, A., Esmer, S., Çakır, E. and Balci, K. (2013). Karadeniz Konteyner Terminallerinin Göreceli Etkinlik Analizi. *Dokuz Eylül Üniversitesi Denizcilik Fakültesi Dergisi*, 5 (1), 1-22.
- Behar, A. and Venables, A. J. (2011). *Transport Costs and International Trade*. Handbook of Transport Economics, 97-115.
- Bloomberg (2018). *Container Freight Indices*, <https://www.bloomberg.com/professional/>, (Accessed: 20.08.2018)
- Branch, A. E. (1988). *Economics of Shipping Practice and Management (2nd ed)*. New York: Springer Science & Business Media.
- Chang, C. L. and McAleer, M. (2017). A Simple Test for Causality in Volatility. *Econometrics*, 5(1), 1-5.
- Cheung, Y. W. and Ng, L. K. (1996). A Causality-in-Variance Test and Its Application to Financial Market Prices. *Journal of Econometrics*, 72(1-2), 33-48.
- Chi, J. and Cheng, S. K. (2016). Do Exchange Rate Volatility and Income Affect Australia's Maritime Export Flows to Asia?. *Transport Policy*, 47, 13-21.
- Crucial Perspective (2018). <https://crucialperspective.com>, (Accessed: 26.09.2018)
- Demirci, A. and Tarhan, D.B. (2016). Türkiye'de Faaliyet Gösteren Liman İşletmeleri ve Bu İşletmelerin Etkinliklerinin Veri Zarflama Analizi Yöntemiyle Ölçümü. *Uluslararası İktisadi ve İdari Bilimler Dergisi*, 2(2), 144-160.

- Dickey, D. A. and Fuller, W. A. (1979). Distribution of the Estimators for Autoregressive Time Series with A Unit Root. *Journal of the American Statistical Association*, 74, 427–431.
- Flex Port (2018). www.flexport.com, (Accessed: 26.09.2018)
- Güner, S. (2015a). Investigating Infrastructure, Superstructure, Operating and Financial Efficiency in The Management of Turkish Seaports Using Data Envelopment Analysis. *Transport Policy*, 40, 36-48.
- Güner, S. (2015b). Proposal of a Two-Stage Model for Measuring the Port Efficiency and an Implication on Turkish ports. *Alphanumeric Journal*, 3(2), 99-106.
- Hu, J. W. S., Chen, M. Y., Fok, R. C. and Huang, B. N. (1997). Causality in Volatility and Volatility Spillover Effects between US, Japan and Four Equity Markets in the South China Growth Triangular. *Journal of International Financial Markets, Institutions and Money*, 7(4), 351-367.
- Karamperidis, S., Jackson, E. and Mangan, J. (2013). The Use of Indices in the Maritime Transport Sector. *Maritime Policy & Management*, 40(4), 339-350.
- Kim, C. B., (2016). Impact of Exchange Rate Movements, Global Economic Activity, and the BDI Volatility On Loaded Port Cargo Throughput in South Korea. *The Asian Journal of Shipping and Logistics*, 32(4), 243-248.
- Kim, C. B., (2017) Does Exchange Rate Volatility Affect Korea's Seaborne Import Volume?. *The Asian Journal of Shipping and Logistics*, 33(1), 43-50.
- Korinek, J. and Sourdin, P. (2009). Maritime Transport Costs and Their Impact on Trade. *Organization for Economic Co-operation and Development TAD/TC/WP. 7*, 1-24.
- Korkmaz, O. (2012). Türkiye'de Gemi Tasimaciliginin Bazi Ekonomik Göstergelere Etkisi. *Business and Economics Research Journal*, 3(2), 97-109.
- Koseoglu, S. D. and Cevik, E. I. (2013). Testing for Causality in Mean and Variance Between the Stock Market and The Foreign Exchange Market: An Application to the Major Central and Eastern European Countries. *Finance a Uver*, 63(1), 65.
- Kwiatkowski, D., Phillips, P.C.B., Schmidt, P. and Shin, Y. (1992). Testing the Null Hypothesis of Stationarity Against the Alternative of A Unit Root. *Journal of Econometrics*, 54, 159-178.
- Nazlioglu, S., Erdem, C. and Soytas, U. (2013). Volatility Spillover Between Oil and Agricultural Commodity Markets. *Energy Economics*, 36, 658-665.

- Nouira R, Amor T. H., and Rault C, (2018). Oil Price Fluctuations and Exchange Rate Dynamics in the MENA Region: Evidence from Non-Causality-in-Variance and Asymmetric Non-Causality Tests. *Quarterly Review of Economics and Finance*, 1-23.
- Papież, M. and Śmiech, S. (2013). Causality-in-Mean and Causality-in-Variance Within the International Steam Coal Market. *Energy Economics*, 36, 594-604.
- Phillips, P.C.B. and Perron, P. (1988). Testing for Unit Root in Time Series Regression. *Biometrika*, 75, 335-346.
- Sağlam, B. B., Açık, A., and Ertürk, E. (2018). Evaluation of Investment Impact on Port Efficiency: Berthing Time Difference as a Performance Indicator. *Journal of ETA Maritime Science*, 6(1), 37-46.
- Shanghai Shipping Exchange (2018a). <http://en.sse.net.cn/brief/function0303.jsp>, (Accessed: 26.09.2018).
- Shanghai Shipping Exchange (2018b). http://en.sse.net.cn/indices/introduction_ccfi_new.jsp, (Accessed: 26.09.2018).
- Shanghai Shipping Exchange (2018c). <https://en.sse.net.cn>, (Accessed: 26.09.2018).
- Stopford, M. (2009). *Maritime Economics*, London: Routledge.
- UDHB (2018). *Container Statistics*, https://atlantis.udhb.gov.tr/istatistik/istatistik_arsiv.aspx, (Accessed: 20.10.2018).