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Are Housing and Ship Demolition Markets Integrated? Evidence From Turkey

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ABSTRACT

The purpose of this study is to investigate the impact of the demand for new houses to ship demolition prices in Turkey through new house sales statistics and Turkish ship demolition prices. In this direction, asymmetric causality test is used which allows to separate the shocks contained in the variables and to determine the causal relationships between these shocks. According to test results, causality relations are determined from positive shocks in house sales to positive shocks in demolition price and from negative shocks in house sales to negative shocks in demolition price. On the other hand, any significant causality from demolition prices to new house sales cannot be determined. This situation shows that changes in the new house sales are determinative for ship demolition prices in Turkey.

INTRODUCTION

Ship demolition market is affected by both maritime developments and developments in other sectors using iron, and this situation causes it to have a complex structure. The effect stem from the developments in the freight market is due to the supply of ships in the market. Since the supply in maritime transport is inelastic in the short run, it cannot respond to increasing demand immediately and freight rates may rise to high levels in a short time. Accordingly, new ship orders increase due to increased revenues and when these new ships enter the market, they generate surplus supply in the market. As the operational costs of the new ships are lower than the old ones, the old ships cannot compete with the new ships when the freight is very low. Old ships that cannot carry out transportation in the market are sent to demolition and their commercial life is terminated if the price offered by demolition yards is at satisfying levels. Then the freight levels in the market decreases and forms a new equilibrium rate (Buxton, 1991). Since the freight rates consequently increase and decrease in the long run, researchers define structure of freight market as mean-reverting (Tvedt, 2003).

The ship demolition market is centered in a few number of countries in the world which are Bangladesh, India, Pakistan, Turkey and China. In 2020, their shares in the market are 40.4%. 30.5%. 17.4%. 9.2% and 1.1% respectively (UNCTAD, 2021). In times gone, demolition activities were conducted in many different countries, however these activities have been displaced over time due to the search for cheap labor and the regional demand for recycled steel (Stopford, 2009).

Prices in the demolition market are also determined by the demand for scrap iron in that country. Therefore, the demolition sector has a complex and non-linear structure, because the offer of a higher demolition price does not always mean more ships are to be dismantled, or the suggestion of a lower demolition price does not always mean that fewer ships are dismantled. This requires an asymmetric network of relationships. In the literature, there are several studies examining the relationship between the demolition market and the freight market (Açık & Başer, 2017; Açık & Başer, 2018a), its relationship with the international scrap market (Kagkarakis et al., 2016) and its relationship with the construction market (Açık & Baran, 2019). However, studies examining the relationship of scrap iron with the housing sector, which is one of the biggest customers of demolition sector, are just emerging. The impact of ship demolition prices on construction costs in Turkey has been investigated by Açık & Baran (2019) and it has been found that positive demolition price shocks have triggered positive construction cost shocks. However, this study has not examined the possible impact of the construction sector on the demolition market. Since the demolition prices have an impact on construction costs, the housing sector can be considered a customer for the ship demolition market that can have an impact on the ship demolition prices. However, this question remains unclear in the literature. The new housing sales volume, which is an objective indicator of the construction sector away from inflation and nominal values, is considered as a reliable indicator to determine the interaction with the demolition sector, and the effect of the housing sector on the demolition market is examined by asymmetric causality method.

As the changes in the new housing sales amount indicate the demand for new houses, it is inevitable that the changes in demand may affect the prices in the ship demolition sector. On the other hand, as the ship demolition sector is also affected by developments in the freight market, its relationship with housing sector is likely to be asymmetric. Therefore, the asymmetric causality method proposed by Hatemi-J (2012a) is considered to be appropriate for the purpose of this study. The results show that the increase in new house sales is reflected in the increase in ship demolition prices, indicating that demand for new house sales is important for the Turkish ship demolition sector.

The literature on ship demolition market is presented in the second section, and the framework of the study is drawn. The method used in the research is introduced in the third section. After examining the data set, the findings obtained from analyzes are presented in the fourth section.

LITERATURE REVIEW

Studies in the literature have approached the ship demolition market from six main aspects; (i) its relationship with the freight market (Açık & Başer, 2017; Açık & Başer; 2018a); (ii) its relationship with the demolition market (Kagkarakis et al., 2016; Açık & Başer, 2019); (iii) its relationship with the construction sector (Açık & Baran, 2019); (iv) the ship owners' decision for demolition in different market conditions (Yin & Fan, 2018); (v) the factors affecting the probability of demolition in major yards (Knapp et al., 2008); (vi) process of ship sale for demolition (Karlis & Polemis, 2016); (vii) its relationship with steel prices (Tunç & Açık, 2019); (viii) and its relationship between interest rate (Açık et al., 2020).

The ship demolition market is also related to the freight market and its structure becomes asymmetrical. In the first of the studies related to the freight market, Açık & Başer (2017) discussed the relationship between freight rates and the tonnage of ships sent for demolition with a general analysis. At the end of the study, the authors found a negative correlation between the freight rates and the tonnage of the ship demolished. This situation is interpreted as the inability of the old ships against falling freight levels when excess supply occurs in the market. In addition to freight rates, interest rates also have a negative effect on the tonnage of ships sent for demolition, as they affect the cost of purchasing new or second hand ships (Açık et al., 2020). On the other side of the complexity, ship demolition prices are placed, because ship demolition prices are an evaluation criterion for older ships in the market and high prices can be effective in demolition decisions of shipowners as also mentioned by (Knapp et al., 2008). In this respect, the study examining the issue was again conducted by Açık & Başer (2018a) and the relationship between freight rates and demolition prices was examined. The study found a positive correlation between freight rates and ship demolition prices, and this was attributed to two factors: (i) the high demolition price is indicative of a buoyant economy, which consequently causes high demand for transport resulting in a high freight rates (ii) demolition yards offer higher prices to ships due to the low number of ships sent to the demolition due to high freight rates.

Since the customers of the ship demolition market are the sectors that use scrap iron, it is likely to have a relationship with global scrap iron market. The share of ship demolition in the global scrap market is very low (Mikelis, 2013), which prevents it from assuming a price-determining role. Even this situation causes ship demolition prices to be inefficient, which means prices can not follow random walk (Açık & Başer, 2018b). The relationship between international scrap prices and ship demolition prices was analyzed by Kagkarakis et al. (2016) using Granger causality analysis. They determined one-way causality from the international scrap steel price to the ship demolition price, which confirms the inability of price-determination for ship demolition market. In addition to being influenced by global scrap prices, Açık & Başer (2019) conducted a study showing that they follow each other's prices while setting demolition prices. On the customer side of the ship demolition market, a paper very close to the subject we have examined in this study was carried out by Açık & Baran (2019). The authors examined the effect of Turkish ship demolition prices on construction costs in Turkey with an asymmetric causality test. The results revealed that positive shocks in the demolition price were identified as the cause of positive shocks in construction costs in Turkey. The main reason for this is that steel prices are closely related to ship demolition prices and they significantly affect demolition prices as indicated by Tunç & Açık (2019). Considering the interaction in previous study, in order for ship demolition prices to affect construction costs, the housing sector must be a customer of the demolition market. Therefore, it is inevitable that developments in the housing sector will affect the demolition market, and this is a question mark in the authors' work. In this respect, our study assumes a complementary role and examines the impact of changes in Turkish new house sales on Turkish demolition prices and makes an original contribution to the literature.

METHODOLOGY

Many statistical methods are used to examine the relationships between variables. Their choices may vary according to the data available, the desired result and the theoretical point of view. One of the most common is causality tests and was first developed by Granger (1969). According to this method, if own and past values of a series explain the present and future values of the other series better than its own values, a Granger causality can be mentioned among them (Dura et al., 2017). However, in later studies, it has been shown that linear causality analysis failed to identify nonlinear relationships between the variables (Adıgüzel et al, 2013; Bal & Rath, 2015; Kumar, 2017).

Asymmetric causality method proposed by Hatemi-J (2012a) is one of the methods developed by considering standard linear causality as insufficient. This method separates the shocks of the variables as negative and positive, and presents the causal relationship between these shocks in four different combinations. It includes the view of Toda & Yamamoto (1995) test and considers the possible nonlinear structures in the series (Shahbaz et al, 2017). Given that asymmetric positive and negative shocks can produce different causal impacts (Hatemi-J, 2012b), it provides a very good advantage in diversifying the results. Hatemi-J (2012a) uses bootstrap simulations in order to calculate critical values, since the possible autoregressive conditional heteroscedasticity in the series should be evaluated (Tugcu et al., 2012). Therefore, thanks to the leverage corrections, this method provides more accurate critical values (Hatemi-J & Uddin, 2012). In addition, the asymmetric test does not oblige to data to be normally distributed and this provides a great advantage (Hatemi-J, 2012a) considering that financial series are exposed to too many unexpected shocks and events causing non-normal distributions.

In this method, the series do not have to be stationary since it includes Toda & Yamamoto (1995) process, but the maximum degree of integration needs to be found (Umar & Dahalan, 2016). It is investigated by unit root tests and if there is unit root, additional lag(s) is added to established unrestricted vector autoregression (VAR) equations (Hatemi-J & Uddin, 2012).

If signs of nonlinear structures can be detected, it can be said that nonlinear methods are more appropriate (Lim & Ho, 2013). In this direction, before the application of the asymmetric causality test, BDS (Broock et al., 1996) Independence test, ARCH LM (Engle, 1982) test, Ljung-Box (Ljung & Box, 1979) test and Normality test are applied to the residuals of autoregressive moving averages (ARMA) models developed for each variable in order to investigate non-linear structures.

DATA AND FINDINGS

Among the variables discussed, the house sales variable includes the first sales amounts of mortgaged and other sales types in Turkey. Second hand house sales statistics are excluded from the study considering the lack of relationship with construction iron. The Turkish demolition and house sales data consists of 77 monthly observations and covers the period between January 2013 and May 2019. The graphical display of the variables is presented in Figure 1. In the graph, the sudden decline in house sales due to the recent economic fluctuations and the rise in interest rates can be clearly seen.

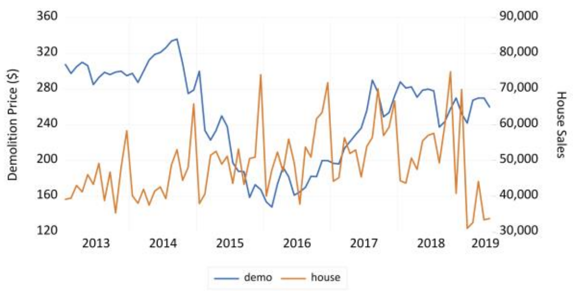

Figure 1. Graphical display of the variables (Sources: Athenian Shipbroker, 2019; TurkStat, 2019)

Descriptive statistics of the demolition price and house sale are presented in Table 1. In the period under consideration (January 2013-May 2019), an average of 49 thousand new houses have been sold per month. Sales increased to 75 thousand at most while the lowest was 31 thousand. In the demolition prices, pricing is made based on US dollars per Light Displacement Tonnage (LDT), which is used for measurement of the steel content of the ships. The total demolition value is calculated by multiplying LDT by the current demolition price (Allum, 2013).

Table 1. Descriptive statistics of the variables (Sources: Athenian Shipbroker, 2019; TurkStat, 2019).

Variables	Demo	House	Δ Ln Demo	Δ Ln House
Mean	251.5	49186	-0.002	-0.001
Med.	267.5	48255	0.006	0.02
Max.	336	74815	0.16	0.53
Min.	148	31048	-0.24	-0.81
Std. Dev.	51.1	9907	0.07	0.24
Skew.	-0.42	0.63	-0.85	-0.97
Kurt.	1.99	3.07	4.64	4.40
J-B.	5.52	5.18	17.8	18.3
JB Pro.	0.06	0.07	0.00	0.00
Obs.	77	77	76	76

The logarithms of the series have been taken before the analysis in order to increase the processability of the series and to make the discrete data continuous. In addition, better distribution properties may be obtained by doing so. The statistics of the variables that are converted to return series via formula given in the Equation (1) are also presented in the table. When the distribution of return series is examined, it is seen that they do not show normal distribution and this situation may indicate that they are not linear. However, this information needs to be verified by improved nonlinearity indicators.

$$R_t = \ln(P_t) - \ln(P_{t-1}) \quad (1)$$

Since the method used in the study follows Toda & Yamamoto (1995) process, the stationarity of the series is not compulsory. Only the maximum integration degree needs to be determined. For this purpose, Augmented Dickey-Fuller (ADF) (Dickey & Fuller, 1979) and Philips Perron (PP) (Phillips & Perron, 1988) tests are performed. The results presented in Table 2 indicated that, the null of unit root has been rejected at level for hose sales variable, while the null of unit root for demolition price has been rejected at first difference. In this case, house sales are determined as I (0) and demolition prices as I (1), which indicate that maximum order of integration (dmax) value is 1.

Granger causality test has been also performed to determine the possible linear relationship between the variables and the results are presented in Table 3. In order to apply the standard Granger causality analysis, the series must be stationary. Therefore, the level of house sales and the first difference of demolition have been used. The most appropriate lag for VAR equations has been chosen as maximum 7, and it has been determined that the fourth lag having the lowest Akaike information criterion (AIC) value (-2.80) is the optimal lag. The results revealed that, no significant causal relationship has been found. This provides an indication that it is not possible to obtain results with linear methods in nonlinear variables. Therefore, the non-linear structures of the series are examined and the appropriateness of the asymmetric causality test is checked in the further sections.

In order to examine the nonlinear structures in the variables, the most appropriate ARMA models are estimated for both variables in return form. When the residuals of the model are separated, the series is freed from the deterministic parts. Afterwards, ARCH LM, BDS Independence, Normality and Ljung-Box tests are applied to the residuals of the model. The rejection of the null hypothesis in any of these tests can be interpreted as a sign of nonlinear structures. Firstly, ARMA (1, 8) model with -2.62 AIC value has been found as the most appropriate one for demolition price. As a result of the tests applied to the residuals, the null hypothesis has been rejected only in the normality test. Secondly ARMA (11, 2) model with -0.53 AIC value has been found as the most appropriate one for house sales. When tests were applied to residues, the null hypothesis has been rejected in ARCH LM, BDS Independence and Ljung-Box tests. Accordingly, it may be concluded that the housing sales variable has a strong nonlinear structure and the demolition price variable has a weak nonlinear structure. In this case, asymmetric causality test can be applied and the results can be interpreted safely.

Table 2. Unit root test results

		Level		First Difference	
	Variable	**Intercept**	**Trend and Intercept**	**Intercept**	**Trend and Intercept**
ADF	Ln House	-6.56***	-6.73***	-10.6***	-10.7***
	Ln Demo	-1.57	-1.39	-7.95***	-8.03***
PP	Ln House	-6.85***	-6.95***	-20.6***	-22.6***
	Ln Demo	-1.68	-1.53	-7.82***	-7.75***

Note: Critical Values: -2.58* for 1%0, -2.90** for 5%, -3.51*** for 1% at Intercept; -3.16* for 10%, -3.47** for 5%, -4.08*** for 1% at trend and intercept.

Table 3. Standard granger causality test

H_0 Hypothesis	Chi-Square	DF.	Prob.
House does not granger cause demolition	6.68	4	0.15
Demolition does not granger cause house	5.43	4	0.24

Table 4. Asymmetric causality test results

		House => Demolition				Demolition => House			
		H^+D^+	H^+D^-	H^-D^-	H^-D^+	D^+H^+	D^+H^-	D^-H^-	D^-H^+
Optimal Lags; VAR(p)		1	1	1	1	1	1	1	2
Additional Lags		1	1	1	1	1	1	1	2
Test statistics (MWALD)		3.72	0.14	6.85	0.92	0.16	1.30	1.36	2.32
Asym. chi-sq. p-value		0.05*	0.70	0.00*	0.33	0.68	0.25	0.24	0.12
Critical Values	1%	10.4	10.7	11.3	7.84	6.30	8.54	7.98	7.39
	5%	4.72	5.03	4.39	4.50	3.57	4.74	3.59	4.58
	10%	3.06	2.96	2.85	2.86	2.61	3.04	2.59	3.12

The two-way causality test results between the variables are presented in Table 4. The results revealed that, significant causal relationships have been found only from the house sales variable to demolition prices. Positive shocks in home sales are the cause of positive shocks in the demolition price, and negative shocks in home sales are the cause of negative shocks in the demolition price.

DISCUSSION AND CONCLUSION

The ship demolition sector is complex due to its relationship with both the freight market and the iron and steel market. It is affected both by the developments in the freight market and by global scrap prices. This situation makes it difficult to determine econometric relations by linear methods. When the literature on ship demolition sector is examined, it is observed that the studies made on the customers of ship demolition sector are insufficient. In particular, there are almost no studies examining the relationship between ship demolition and construction sector. The only study available in the literature was conducted by Açık & Baran (2019) and the impact of the change in ship demolition prices on Turkish construction costs was examined. The authors found that positive shocks in ship demolition prices were the cause of positive shocks in construction costs. These results show that the construction sector is a customer of the ship demolition sector. However, in the study conducted by the authors, the impact of the housing sector on the ship demolition sector was not examined and constitutes an important gap. Our study examines the impact of the construction sector on ship demolition market by taking on an integral role using the number of new house sales in Turkey. Our results show that the increase in house sales leads to an increase in ship demolition prices and the decrease in house sales causes a decrease in ship demolition prices, and indicate that the Turkish construction sector is effective in Turkish demolition market prices.

These results show that new house sales numbers in Turkey can be used as a leading indicator for ship owners who want to evaluate their ships in the Turkish demolition market. This is because there is an asymmetric causality relationship from house sales to demolition prices. Past and current house sales values can significantly explain future demolition prices. Furthermore, considering the fact that other ship demolition prices follow Turkish prices in the study conducted by Açık & Başer (2019), this indicator quality increases its importance for all international shipowners.

The limitation of the study is the available data set, and more results that are robust can be obtained if longer dataset is obtained. Further studies can obtain results that are more generalizable by examining the relationship discussed here with panel data sets for countries with intense ship demolition activities.

Compliance With Ethical Standards

Conflict of Interest

The author declares that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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