

ASYMMETRIC PRICE TRANSMISSION OF EXCHANGE RATE AND DIESEL PRICES ON FISH PRICES IN TURKIYE

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ABSTRACT

The global demand for animal protein has increased due to accelerated development, economic growth, population expansion, and improved dietary preferences. However, this rising demand poses significant threats to economic stability and food security. Price increases also impact the consumption of fish products, which are an essential source of animal protein for human health. This study aims to analyze the effects of fluctuations in diesel prices and exchange rates on fish prices in Türkiye and to measure how fish prices respond to both negative and positive market shocks. The analysis was conducted using the NARDL model to examine price transmission among variables from 1994 to 2021. The findings reveal an asymmetric relationship between the variables and highlight the influence of shocks on overall fish prices. While exchange rate fluctuations and changes in fuel prices significantly affect fish prices in the long term, the lagged values of these variables play a critical role in the short term. In the long term, a 1% change in positive exchange rate shocks causes a 12% increase in fish prices while a similar change in negative shocks results in a 14% increase. Understanding price transmission is crucial for enhancing the effectiveness of fisheries policies both in the short and long term.

Keywords: Asymmetric price transmission, Fish prices, NARDL, Time series.

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INTRODUCTION

Variations in agricultural product and food prices have long threatened social development and economic stability worldwide. The surge in food prices since the early 2000s, particularly in 2008, triggered economic instability and resulted in a severe food crisis. Although food prices briefly decreased following the crisis, they surged again in 2010 (Aytekin and Hatirli, 2021). In recent years, rising costs of raw materials, energy, and oil have further disrupted countries both socially and economically. Concerns about the sustainability of the global food supply for a growing population have intensified debates on how to ensure adequate and stable access to food amid increasing volatility in agricultural and food prices (Altintas, 2016). Additionally, the increase in oil prices, coupled with rising exchange rates, has driven up agricultural production costs and the expenses associated with import-dependent food commodities (Yavuz and Dilek, 2019).

As the global population grows, incomes rise, and healthier eating habits become more widespread, the demand for animal protein continues to increase. Literature highlights that animal-derived proteins should supply half of the daily protein requirements for adequate

and balanced nutrition (Bashimov, 2017). However, current dietary patterns indicate that the intake of animal proteins, vitamins, and minerals necessary for human physiology is insufficient. Consuming fish is one of the most affordable and high-quality solutions to address this deficiency. Fish is particularly beneficial for human health due to its higher protein and lower fat compared to red meat. Additionally, omega-3 fatty acids found in fish have been shown to have beneficial effects in preventing or alleviating various diseases, including heart disease, cancer, and neurological disorders (Chen *et al.*, 2022). Despite these known benefits, fish consumption in Türkiye remains below the global average. Globally, fish account for 17% of the protein from animal-based foods, with estimates suggesting that by 2030, humans will directly consume 31% of fish production (Soh *et al.*, 2022). As of 2020, per capita fish consumption in Türkiye was 6.7 kg, compared to the global average of approximately 20.5 kg. However, with more family members joining the workforce, the demand for quick and convenient processed food products is rising. As a result, 75% of the world's fish catch is now processed and supplied for human consumption (Kucuk *et al.*, 2022). Türkiye's geographical advantages offer suitable conditions for aquaculture. By 2021, Türkiye's total aquatic products production had reached 799,844 tons,

with 68.2% coming from seafood, 25.5% from aquaculture, and 6.3% from freshwater products (TURKSTAT, 2022).

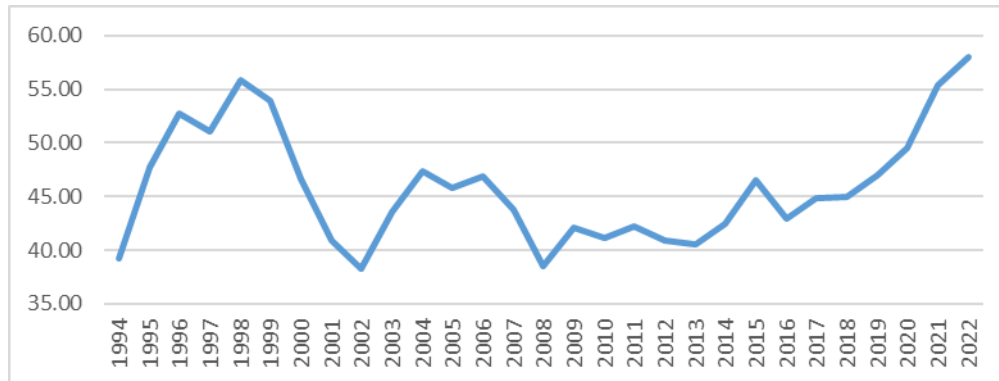


Figure 1. Annual Trends in Fish Prices in Türkiye (1994–2022), based on TURKSTAT data

The data for 2023 showed a 13.3% decrease in global food prices compared with 2022, whereas Türkiye experienced a 62.1% increase. Examining the last five years of data reveals that, since 2017, global food prices have increased by 1.27 times, while Türkiye's food prices have surged sixfold (FAO, 2023; TURKSTAT, 2023). This increase in food prices threatens food security and economic stability in all countries around the world, especially in developed countries. In Türkiye, several factors contribute to the rise in domestic food prices: the increasing cost of agricultural raw materials used in food production, higher prices of imported food products, rising national income due to economic growth, increasing food demand, and soaring oil and energy prices (Altintas, 2016). Since food prices have the largest share (25.4%) among the items that constitute inflation in Türkiye, the change in food prices is a determinant of inflation (Esturk and Albayrak, 2018; TURKSTAT, 2023). Aytekin and Hatirli (2021) closely relate this economic problem to society's welfare levels and necessary policies.

Previous research on price transmission in many marketplaces, particularly for agricultural goods, indicates that the prices do not exhibit a consistent relationship with each other. This is evident from studies conducted by Listorti and Esposti (2012), Ahn and Lee (2015), Fousekis *et al.* (2016), Kharin (2018), (Deb *et al.*, 2022) and Osei *et al.* (2024). Studies in the fisheries industry have demonstrated that the diesel price and the exchange rate have a significant influence on fish prices. Gao *et al.* (2022) and Guillen and Franquesa (2015) support this conclusion. As with most food products, fish prices tend to rise in parallel with increases in diesel prices. This study investigates the impact of exchange rates and diesel prices on fish pricing, given that fish, like other perishable food items, necessitates extensive processing and cold chaining processes. Accordingly, the model incorporates the positive and negative changes in

exchange rates and diesel prices through the NARDL approach. Additionally, the currency rate directly influences the raw materials required for fish processing, thereby influencing fish pricing. Overall, this demonstrates how fuel costs influence fish prices in a system that is dependent on the cold chain. According to the literature, the price of fuel is the primary reason for poor economic performance in the fishing industry (Guillen and Maynou, 2016). Ibrahim (2015) investigated the relationship between oil and food prices and discovered that only positive increases in oil prices had a short term effect on food cost inflation. According to Ibrahim (2015), there is a significant long term correlation between rising oil and food costs. Fish prices are found to have nonlinear correlations with trade deficits, exchange rates, and domestic income when fish trade balances are studied (Soh *et al.*, 2022).

Price transmission is a significant factor influencing costs, trade, income, food security, and fish stocks for nations with high levels of fish production and consumption. (Pincinato *et al.*, 2020; Deb *et al.*, 2022). Studies on the fishing industry have revealed that exchange rates and diesel prices have an impact on fish prices. Furthermore, numerous studies have tested and confirmed price transmission, demonstrating the impact of price changes in relevant sectors on fish prices (Guillen and Franquesa, 2015; Landazuri-Tveteraas *et al.*, 2018; Pincinato *et al.*, 2020; Deb *et al.*, 2022; Gao *et al.*, 2022; Liu *et al.*, 2022). Sapkota *et al.* (2015) found that there is symmetric price transmission in the short term and symmetric and asymmetric price transmission in the long term along the seafood value chain in the aquaculture sector in Bangladesh. Relevant studies show that price shocks occurring at any level of the supply chain can be transmitted to other levels with varying magnitudes and effects. Therefore, it is crucial to examine the factors influencing fish prices in the aquaculture sector, particularly the asymmetric impact of

diesel prices and exchange rates. In developing countries, asymmetric price transmission is especially pronounced in the agriculture and food sectors. The literature emphasizes that price increases in agricultural products are typically faster and stronger (Deb *et al.*, 2020; Ekananda, 2023), while in the fisheries sector, this transmission may be moderated through government intervention (Deb *et al.*, 2022). Although there is extensive literature examining price transmission in agricultural and food markets, empirical studies that specifically analyze the asymmetric effects of exchange rate and diesel price fluctuations on fish prices in Türkiye are limited. This study aims to fill this gap by applying the NARDL model to evaluate short and long run asymmetries specific to Türkiye's fisheries sector.

The study seeks to ascertain whether exchange rates and diesel prices have an uneven impact on fish prices. For this purpose, econometric methods capable of analyzing both linear and nonlinear structures, as well as short and long term dynamics, were employed. This study used a model that can analyze both short and long term changes, as well as unit root and cointegration tests, to investigate how short and long term changes in diesel prices and exchange rates affect fish prices in different ways. The study contributes to the literature by providing empirical evidence on asymmetric price transmission in Türkiye's fisheries sector and offers recommendations to enhance the sector's competitiveness.

MATERIALS AND METHODS

The year 1994, being the earliest available point for fish price data, was selected as the initial year for the analysis. The data were obtained from the Turkish Statistical Institute (TURKSTAT, 2023). In this study, fish prices were designated as the dependent variable, whereas exchange rates and diesel prices were chosen as the key independent variables due to their significant influence on the cost structure in the fisheries sector (Yildirim, 2013). In fishing activities, diesel prices are crucial for the operation of fishing vessels, the transportation of products, and the maintenance of the cold chain. Thus, changes in diesel prices directly affect operational costs and ultimately influence fish prices (Guillen and Maynou, 2016). Similarly, fluctuations in exchange rates affect the cost of imported inputs and the competitiveness of the domestic fisheries sector in international markets. Increases in the prices of imported items such as feed, nets, and equipment drive up fish prices. Moreover, since external market dynamics are closely tied to exchange rate movements, domestic supply and price stability are also impacted (Saygi and Bayhan, 2011). Other factors, including government subsidies, production levels, and seasonal conditions, may also affect fish prices. However, in the context of Türkiye, exchange rates and diesel prices are among the

most volatile and economically impactful variables. Therefore, they were included in the model. This selection enables a focused and robust analysis of the price transmission mechanisms within the fisheries sector. The examination of the long-term relationship between exchange rates and diesel prices in the fisheries sector is only possible through cointegration analysis (Yildiz *et al.*, 2023).

Cointegration is a statistical methodology used to examine the long-term equilibrium relationships between non-stationary time series variables whose statistical properties such as mean and variance vary over time. Introduced by Engle and Granger (1987), cointegration helps identify whether two or more non-stationary economic variables move together in the long term, despite being individually non-stationary. When cointegration exists, deviations from equilibrium are typically temporary, and the variables tend to return to their long-term path over time (Cemrek, 2006; Umoh and Effiong, 2013).

Engle and Granger proposed a two-step procedure to test for cointegration in univariate systems. First, a linear relationship between the series is estimated using Ordinary Least Squares (OLS). Then, the residuals of the model are tested for stationarity. If the residuals are stationary, the variables are considered to be cointegrated. However, this approach is limited in cases involving more than two variables, as it cannot effectively capture multiple cointegration relationships.

To overcome this limitation, the study adopts the Johansen cointegration test developed by Johansen (1988) and Johansen and Juselius (1990), which is based on maximum likelihood estimation (MLE) and enables simultaneous testing of cointegration relationships in multivariate systems. This method not only determines the number of cointegrating vectors but also provides more robust and detailed insights into the long-run dynamics of the system. For this reason, Johansen's methodology is preferred over the univariate approaches of Engle and Granger (1987) and Phillips and Hansen (1990).

In economic research, cointegration analysis is crucial for understanding long-term relationships between key variables such as inflation, exchange rates, and interest rates. Furthermore, once cointegration is established, an Error Correction Model (ECM) can be developed to capture both the short-term deviations and the long-term equilibrium adjustment process (Yildirim, 2013). This comprehensive approach makes cointegration a powerful tool for economic modeling, forecasting, and policy formulation.

Autoregressive Distributed Lag Model (ARDL) is a frequently used method in cointegration analyses. Bounds tests performed with ARDL determine long term relationships without taking into account the degree of integration between variables. However, since the

traditional ARDL model falls short in capturing the effects of positive and negative shocks, the NARDL model was preferred to overcome these limitations and to evaluate asymmetric relationships with a more flexible structure. This study utilizes the Nonlinear Autoregressive Distributed Lag (NARDL) model developed by Shin *et al.* (2014), which is an extension of the traditional ARDL model. The NARDL model offers a robust and flexible framework for examining both short- and long-run asymmetries in time series data. A key strength of the model lies in its robustness in delivering consistent cointegration results, even when faced with small sample sizes and data constraints. In addition, NARDL is more adaptable than traditional models such as the Engle-Granger (1987) two-step method, as it incorporates multiple error correction terms and captures asymmetric responses to positive and negative shocks (Pesaran *et al.*, 1999; 2001). With its flexible structure and ability to capture nonlinear and asymmetric dynamics, the NARDL model is highly significant for analyzing relationships among such variables. Economic variables like diesel prices and exchange rates have a notable impact on the prices of agricultural products such as fish. In Türkiye, the fisheries sector is particularly affected by exchange rate fluctuations due to its reliance on imported fuel and essential equipment. This dependency increases the operational costs of fishing activities and, consequently, raises fish prices. This external dependence increases the vulnerability of the sector to macroeconomic shocks, particularly highlighting the role of exchange rate volatility in shaping fish price dynamics.

In particular, short-term fluctuations in fuel prices can lead to long-term changes in market behavior. Similarly, exchange rate volatility affects the prices of imported inputs, thereby influencing production decisions and altering competitiveness in foreign trade. Hence, applying the NARDL model allows for a nuanced evaluation of how these shocks translate into price changes within Türkiye's fisheries sector.

The asymmetric long-run cointegration model in error correction form, which forms the basis of the

NARDL model, is as follows (Gordon 2017; Hu *et al.* 2018):

$$\Delta y_t = \alpha + \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} \gamma_j \Delta y_{t-j} + \sum_{j=1}^{q-1} (\varphi_j^+ \Delta x_{t-j}^+ + \varphi_j^- \Delta x_{t-j}^-) + \varepsilon_t = \rho \xi_{t-1} + \sum_{j=1}^{p-1} \gamma_j \Delta x_{t-j} + \sum_{j=1}^{q-1} (\varphi_j^+ \Delta x_{t-j}^+ + \varphi_j^- \Delta x_{t-j}^-) + \varepsilon_t \tag{1}$$

This study investigates exchange rates and diesel prices to identify their asymmetric effects on fish prices. Schorderet (2001) emphasized the importance of decomposing these variables into positive and negative components in order to investigate hidden cointegration between dependent and independent variables, which explains asymmetric effects in both the short and long run. Accordingly, the model incorporates the positive and negative changes in exchange rates and diesel prices, using the NARDL method to make predictions. Since the most accurate results were obtained in logarithmic form, the logarithms of the data were taken and used in the analysis. This study applies the NARDL model to the fishing sector, which is represented by the following general form:

$$\Delta \ln P_j = \alpha + \rho \ln P_{j,t-1} + \theta_{ij}^+ \ln X_{ij,t-1}^+ + \theta_{ij}^- \ln X_{ij,t-1}^- + \sum_{i=1}^{p-1} \gamma_{ij} \Delta \ln P_{ij,t-i} + \sum_{i=0}^q \pi_{ij}^+ \Delta \ln X_{ij,t-i}^+ + \sum_{i=0}^q \pi_{ij}^- \Delta \ln X_{ij,t-i}^- + \varepsilon_t \tag{2}$$

Here, X_t^+ and X_t^- represent the partial sums of positive and negative changes in the independent variable, respectively.

RESULTS

Table 1 shows the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test results for fish prices, exchange rates, and diesel prices.

Table 1. Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test statistics

Variables	Level		1. Difference	
	ADF	PP	ADF	PP
Fish price	-2.590	-4.730***	-5.255***	-21.724***
Exchange rate	-2.011	-1.989	-12.970***	-11.965***
Diesel prices	-4.067***	-4.299***	-17.738***	-17.738***

*: levels of significance: *:10%, **:5%, ***:1%

According to the analysis results, all variables became stationary at the first difference's 1% significance level. According to ADF and PP unit root test statistics,

all variables do not become stationary under the influence of a constant level. The series' stationarity at the first

difference indicates that the ARDL analysis meets its necessary conditions.

Stock and Watson (2012) emphasize the importance of selecting an appropriate lag length to obtain accurate results from time series models, especially when working with long datasets. In the case of monthly data, lag lengths such as 6, 12, or 24 are commonly used, as they provide sufficient data points for analysis (Wooldridge, 2015; Adeleye, 2018). In this study, monthly data were tested with lag lengths ranging from 1 to 6 based on model selection criteria, and the optimal lag length was determined to be 3, as it produced the most statistically robust results. This choice contributes to the reliability and stability of the model outcomes within the NARDL framework. Another test that demonstrates the model's suitability for long-term analysis and supports its reliability is the bounds test, which confirms the existence of cointegration. Table 2 presents the results of the cointegration test applied to fish prices, exchange rates, and diesel prices.

Table 2. Cointegration test

<i>f</i> value	Significant level	Lower bound I(0)	Upper bound I(1)
14.144***	%10	2.45	3.52
	%5	2.86	4.01
	%1	3.74	5.06

*: levels of significance: *:10%, **:5%, ***:1%

The cointegration analysis using the bounds test developed by Pesaran *et al.* (2001) compares the F-statistic with the determined lower and upper bounds. If the F-statistic is greater than the upper bound, it is concluded that there is cointegration between the variables. If the F-statistic is smaller than the lower bound, it is concluded that there is no cointegration. If the F-statistic falls between the lower and upper bounds, no definitive conclusion can be drawn, and further analysis using other methods is required. The results of the cointegration test, which used the limits test table from Pesaran *et al.* (2001), showed that the variables were statistically linked over a long period of time at a significance level of 1%.

Table 3 shows the long term asymmetry tests and the result of the model assumption test.

Table 3. Long term asymmetry tests and model assumption tests

Tests	<i>f</i> value	Prob.
Exchange rate (Wald Test)	0.253	0.615
Diesel prices (Wald Test)	0.221	0.638
Autocorrelation (Durbin Watson test)	2.008	-
Seri Correlation	0.263	0.769
Heteroscedasticity (White test)	1.097	0.303
Ramsey Reset Test	0.167	0.683

The Wald Test, a long term symmetry test in the NARDL model, rejects the null hypothesis of no asymmetric cointegration relationship at the 1% significance level. Fish prices and exchange rates, as well as fish prices and diesel prices, have an asymmetric relationship. There have been many studies on food markets with similar findings regarding asymmetric price transmission (Kinnucan and Forker, 1987; Goodwin and Holt, 1999; Abdulai, 2000; Ghoshray, 2007; Gizaw *et al.*, 2021). In addition, studies on the price transmission of different markets, especially agricultural product markets, clearly reveal that there is an asymmetric relationship between prices (Ahn and Lee, 2015; Fousekis *et al.*, 2016; Kharin, 2018). Vatsa and Baek (2023) analyze the impact of oil demand and supply shocks on meat products and find that there is asymmetric price transmission between oil prices and fish prices. Researchers have conducted studies on the market power of fish prices, the transmission of prices throughout the supply chain, and the determination of price transmission (Simioni *et al.*, 2013; Singh *et al.*, 2015; Sogn-Grundvåg *et al.*, 2021; Liu *et al.*, 2022; Acharjee *et al.*, 2023; Deb and Li, 2023).

An essential aspect of the bounds testing approach is the absence of autocorrelation between error terms. The Durbin-Watson and serial correlation tests, commonly used to identify autocorrelation, are present their results in Table 3. The Durbin-Watson statistical value (2.008) of the fish price model shows that there is no autocorrelation. Additionally, the absence of autocorrelation was tested using serial correlation coefficients. When interpreting the model assumptions, the p-value must be greater than 0.05. The results of the White test prove that the model has a constant variance. The Ramsey Reset Test, which was conducted to test the correct model setup, revealed no error in the model setup.

The CUSUM test graphs in Figure 2 show that there is no structural break in fish prices, and the model of fish prices is stable in the forecast period.

NARDL test results: Table 4 displays the NARDL model's short- and long-term forecast results, coefficients, and descriptive statistics, which show the impact of exchange rate and diesel price shocks on fish prices. A dummy variable was added to the model to eliminate structural breaks. The dummy variable coefficient shows that it is meaningful to be in the model.

Meo *et al.* (2018) say that the fact that the exchange rate and diesel prices have different coefficients in Table 4 shows that the NARDL model's short term predictions for fish prices include an asymmetric relationship. The error correction term suggests that approximately 30% of the long-term disequilibrium is corrected in each period. This suggests that fluctuations in exchange rates and diesel prices have a rapid impact on the fisheries sector in the short term, with their effects

persisting in the long term and gradually approaching equilibrium. These findings imply that short-term policies would be insufficient for the sector, and long-term strategies are needed to ensure price stability. The identified asymmetric relationship aligns with the literature, where it is highlighted that price increases are transmitted to consumers more rapidly and strongly, whereas price decreases are passed on more slowly and mildly (Peltzman, 2000). Meyer and Von Cramon-Taubadel (2004) emphasized that asymmetric price transmission in agricultural and food products can be explained by factors such as market power, storage, and

information flow. On the other hand, Vavra and Goodwin (2005) noted that prices are time-sensitive and that policy interventions can be effective in both the short and long term. They argued that while subsidies implemented in the short term may have an immediate impact on prices, this effect may diminish in the long term. Deb *et al.* (2022) emphasized that prices in the Indian fish market are responsive and that government intervention is effective in the short term. In contrast, this study, through the NARDL method, reveals that the identified asymmetric price transmission necessitates government intervention in both the short and long term.

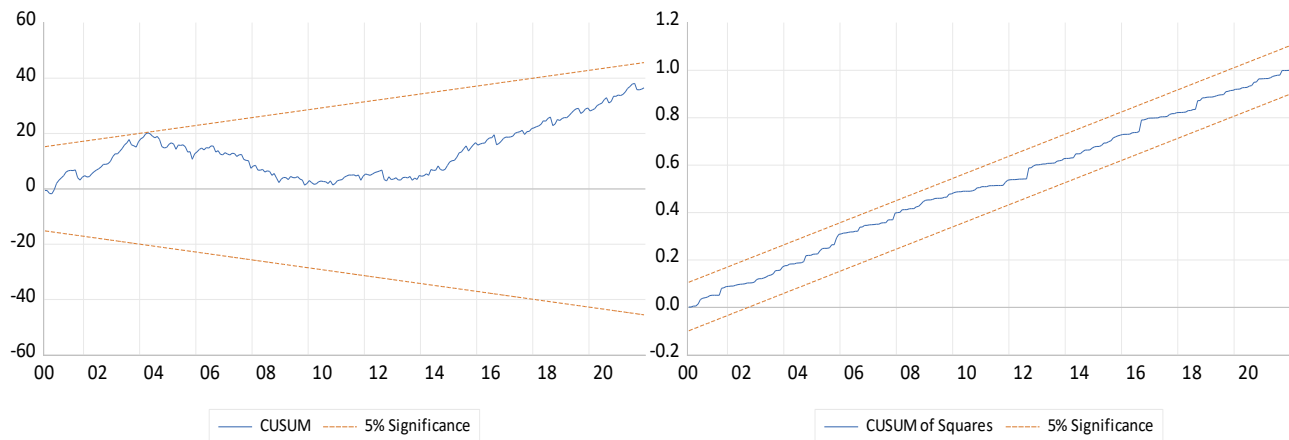


Figure 2. Fish prices CUSUM tests

Table 4. NARDL short- and long-term forecast results

Short term	Coefficient	Standard error	t value	p value
C	1.206711***	0.143049	8.435625	0.0000
D(LNFSH(-1))	0.229809***	0.052507	4.376717	0.0000
D(LNFSH(-2))	0.265318***	0.053877	4.924514	0.0000
D(LNEXRT_POS)	0.101059	0.063061	1.602568	0.1100
D(LNEXRT_POS(-1))	-0.173497**	0.069902	-2.482008	0.0136
D(LNEXRT_POS(-2))	0.109487*	0.063144	1.733934	0.0839
DUMMY	-0.056083***	0.011706	-4.791098	0.0000
CointEq(-1)*	-0.308941***	0.036510	-8.461772	0.0000
Long term	Coefficient	Standard error	t value	p value
LNEXRT_POS	0.120220***	0.028995	4.146259	0.0000
LNEXRT_NEG	0.140202***	0.044062	3.181922	0.0016
LNDSL_POS	-0.369578***	0.137627	-2.685369	0.0076
LNDSL_NEG	-0.247816	0.165840	-1.494309	0.1361
R ²	0.808			
Adjusted R ²	0.801			
f value	122.324			
p value	0.000			

*: levels of significance: *:10%, **:5%, ***,1%.

Table 4 reveals that the short term fish prices, which experienced price shocks one and two periods ago, significantly influence fish prices at the 1% significance level. Similarly, in their study, Dahl and Yahya (2019)

found that the prices of frozen salmon in the US market affected the prices of other fish species in the short and long term. Additionally, they identified a strong correlation between the markets. This relationship

emphasized that the uncertainty in the frozen salmon market will affect other fish markets in the short and long term and is important for producers and consumers, especially in the future.

Positive exchange rate shocks experienced one period ago are negative and statistically significant effect at the 5% significance level, and positive shocks experienced two periods ago are significant at the 10% significance level. In the long term, a 1% positive exchange rate shock leads to a 12% increase in fish prices, while a 1% negative shock results in a 14% increase. Gordon (2017) conducted a study determining the impact of exchange rate shocks on fish prices. According to Gordon (2017), exchange rate shocks put pressure on fish prices, and prices return to their previous level after a stable shock.

Researchers have determined that a 1% positive shocks in diesel prices leads to a 37% increase in fish prices. Vatsa and Baek (2023) revealed in their studies that oil prices have an asymmetric effect on fish prices in the long term and that the increase in oil prices has a higher impact on fish prices. It is known that fuel prices account for 50% of the fishing industry's costs. For this reason, increases in diesel prices increase consumer prices as they have a direct impact on fish prices. Given their high cost impact, diesel prices are considered an important factor for the fishing industry, governments, and researchers (Guillen and Maynou, 2016). According to studies conducted in Türkiye, fluctuations in exchange rates and oil prices, commencing from the end of 2021, significantly influenced food prices. Increases in oil prices in the same year were a significant factor in food inflation (Kadanali, 2021; Gungor and Erer, 2022).

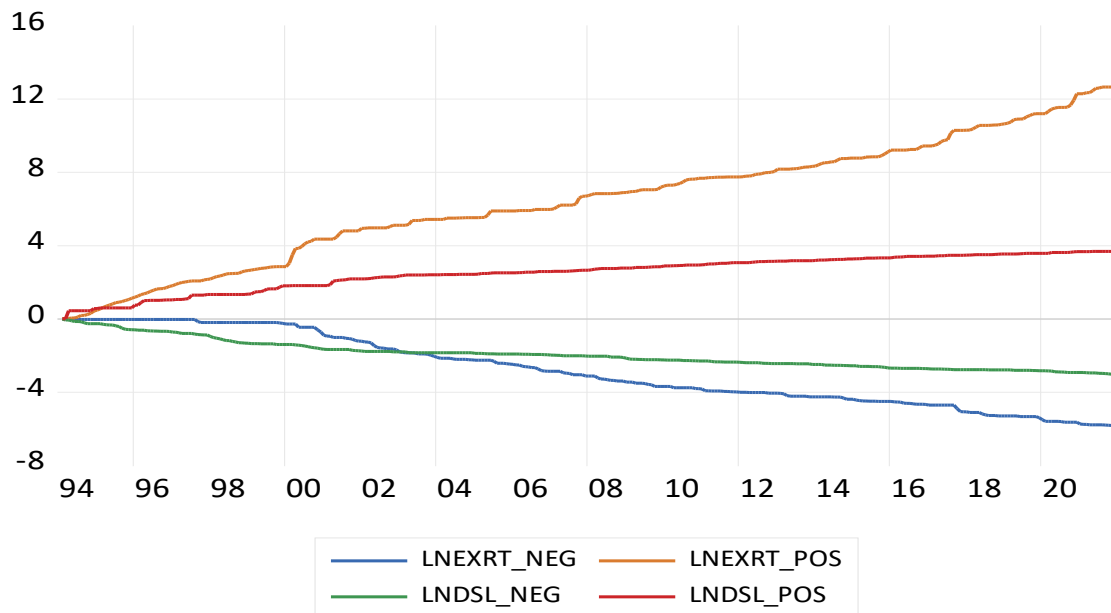


Figure 3. Asymmetric Long-Run Responses to Positive and Negative Shocks NARDL Estimation Results

Figure 3 illustrates the asymmetric long-run impacts of both positive and negative shocks in exchange rates and diesel prices on fish prices, confirming the model's findings. Positive shocks in diesel prices appear to have a strong and sharp effect on fish prices. In contrast, negative shocks in diesel prices have a weaker downward impact. The positive and negative shocks in exchange rates also exhibit an asymmetric pattern. While positive exchange rate shocks lead to a strong and steady increase in prices, negative shocks result in a slower and weaker decrease. Asymmetric price transmission in Türkiye's fisheries sector is clearly observable in the graph and supports the study's findings. In summary, it has been observed that price increases have a faster and stronger impact on consumer prices, whereas price decreases result in more limited effects. This situation

increases producers' costs while making it more difficult for consumers to afford products. Similarly, a study by Choi *et al.* (2020) identified this asymmetric effect on food prices. Considering the direction and magnitude of the asymmetric effect on food prices, it is concluded that policies developed accordingly could help maintain stability in the sector in both the short and long term. Liu *et al.* (2022) emphasize that asymmetric price transmission in China's seafood market is particularly strong in terms of consumer prices. These findings are consistent with the results obtained through the NARDL model in our study. Furthermore, Rahman and Salahuddin (2023) demonstrate that short-term policy interventions have only temporary effects on price dynamics, while markets tend to return to equilibrium in the long term. The findings of our study also support this

view, as government interventions appear to be effective in the short term, but market conditions become more dominant in the long term. In this context, especially in developing countries, policy tools should be designed in consideration of both the direction and duration of price shocks to protect consumers and maintain market balance.

Conclusion: This study aims to examine the impact of exchange rates and diesel prices on fish prices through NARDL analysis, which highlights both short-term and long-term relationships. The NARDL analysis reveals a price transmission between fish prices and exchange rates, as well as between fish prices and diesel prices. This transmission indicates that fish prices move in tandem with exchange rates and diesel prices over both short and long periods and that lagged values of fish prices also have a significant influence on current fish prices. While fluctuations in exchange rates and diesel prices have a significant long-term effect on fish prices, the lagged values of these variables play a crucial role in the short term.

The identification of price transmission in this study is expected to provide valuable insights for enhancing the effectiveness of current regulations in the fishing sector and for guiding the development of future policies. When formulating pricing-related policies, particularly for the fishing industry, it is important to consider the impact and intensity of price changes in one commodity on others.

Accurately identifying the extent of price shocks and their transmission to fish prices is crucial for designing effective consumption and production strategies. Long-term analysis allows for distinguishing whether price increases and market fluctuations are structural or temporary. The findings of this study are believed to be instrumental in shaping targeted strategies to increase sector producers' revenue while keeping market prices at sustainable levels. Based on the findings, it is recommended that the government implement targeted subsidies or price stabilization mechanisms to reduce diesel price volatility during periods of global oil price fluctuations. To mitigate the impact of exchange rate changes on production costs, tax reductions or state-backed credit schemes could be considered. Additionally, to strengthen the resilience of the fish market, input support for producers, tax incentives for wholesalers, and consumption-support measures for low-income consumers are proposed. Additionally, the fact that cost-driven price increases are more rapid and pronounced is particularly critical for developing countries. Therefore, instead of relying solely on temporary measures that respond to price fluctuations, it is essential to develop long-term policies that address the structural issues within the sector.

Expanding the model to include a broader time series, additional tests, and other variables affecting fish prices and experimenting with alternative methods will provide more comprehensive and impactful results. Moreover, developing structural models that reveal the effect of price transmission on other agricultural sectors will enhance the effectiveness of sector-specific policies. Furthermore, to contribute to a better understanding of price transmission in Türkiye's fisheries sector, it is recommended that future research incorporate seasonal effects and regional differences into the model. Ultimately, long-term structural reforms rather than short-term fixes are essential to ensure the sustainability and competitiveness of Türkiye's fisheries sector.

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