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Research Article/Araştırma Makalesi

The Evaluation of Turkey's Foreign Trade during COVID-19

COVID-19 Döneminde Türkiye Dış Ticaretinin Değerlendirilmesi

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Abstract

The value of the Turkish currency decreased by 44% in 2021. The trade balance was directly impacted by exchange rate fluctuation. Moreover, COVID-19 had a significant impact on the trade balance globally as well as in Turkey. In this study, we attempt to assess how COVID-19 has affected trade between Turkey and the EU27 counties. We employ the J-curve and S-curve approaches using various samples and sub-samples. Before examining how COVID-19 influences trade balances, we first looked at the long-term relationship of bilateral trade between Turkey and the EU27, including the impact of the real exchange rate on the trade balance. The findings indicate that, first; there is no indication of a J-curve or an S-curve in Turkey's trade balance. Second, the Turkish trade balance benefited more from a real fall of the Turkish currency during the pandemic era. In comparison to pre-pandemic correlations, the pandemic cross-correlation coefficients are lower. Despite some delays, it turned out well. The Turkish trade balance is improved by the weakening of the Turkish Lira and the effects of COVID-19 during the pandemic, even if there is no indication of a J-curve or an S-curve.

Jel Codes: *F1, F10, F14, F13*
Keywords: *COVID-19, International Trade, J Curve, Exchange Rate, Marshall-Lerner conditions*

Öz

2021 yılında Türk lirası %44 değer kaybetti. Ticaret dengesi kur dalgalanmasından doğrudan etkilenmektedir. Öte yandan, COVID-19, Türkiye'de olduğu gibi dünyada da ticaret dengesinin önemli ölçüde etkilenmesine sebebiyet vermiştir. Bu çalışmada, COVID-19'un-Türkiye ile AB27 ülkeleri arasındaki ticareti nasıl etkilediğini değerlendirmeye çalıştık. Çeşitli dönem ve alt dönemlerini kullanarak J-eğrisi ve S-eğrisi yaklaşımlarını baz aldık. COVID-19'un ticaret dengelerini nasıl etkilediğini incelemeden önce, reel döviz kurunun ticaret dengesi üzerindeki etkisi de dahil olmak üzere ilk olarak Türkiye ile AB27 arasındaki ikili ticaretin uzun vadeli ilişkilerini ele aldık. Bulgular, ilk olarak, Türkiye'nin ticaret dengesi için J-eğrisi veya S-eğrisi etkisinin olmadığı kanıtına varılmıştır. İkincisi, Türk ticaret dengesi, salgın döneminde Türk parasının reel değer kaybından dolayı yararlandığı gözlenmiştir. Pandemi öncesi korelasyonlara kıyasla, pandemi sırasında çapraz korelasyon katsayıları daha düşüktür. Türk ticaret dengesi, bir J-eğrisi veya S-eğrisi belirtisi olmasa bile, pandemi sırasında Türk lirasının değer kaybı ile birlikte COVID-19'un etkilerinden yararlanmıştır.

Jel Kodları: *F1, F10, F14, F13*
Anahtar Kelimeler: *COVID-19, Uluslararası Ticaret, J Eğrisi, Döviz Kuru, Marshall-Lerner Koşulu*

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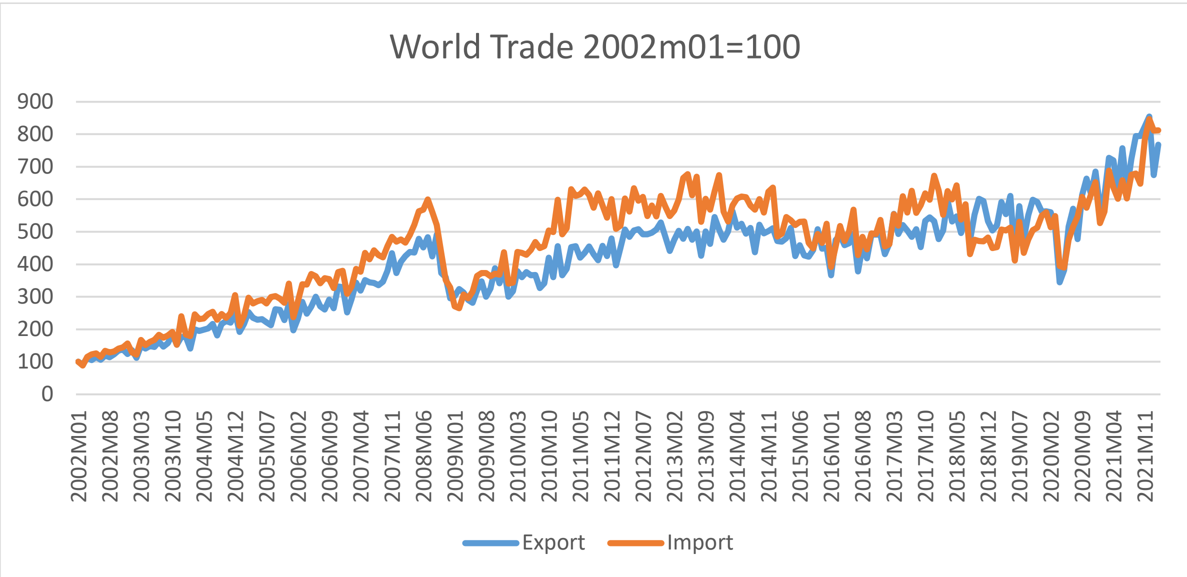
1. Introduction

The COVID-19 pandemic hit the world economy hard, with serious consequences for all countries and individuals. The IMF called it "a crisis like no other" in 2020. Since the beginning of the pandemic, countries and commodities around the world have taken a variety of restrictive measures. These restrictions have negatively affected international trade in goods, with few exceptions. All exceptions are goods that are directly related to the COVID-19 pandemic and are referred to as "COVID-19 related products".

Figure 1 shows monthly data on world exports and imports (indexed to 2002m01). Based on Figure 1, the value of exports has decreased by almost 39% compared to before COVID-19 (value of exports in December 2019 to the minimum value of exports during the pandemic (April 2020)). This rate for import has decreased by 29% (value of import in December 2019 to the minimum value of import during the pandemic (May 2020)). The decrease in the rate of export is almost equal to that of the 2008 financial crisis (the ratio between the maximum rate of export that occurred in 2008m09 and the minimum value of export that occurred in 2008m12 during the 2008 financial crisis was almost 40%). Therefore, COVID-19 has affected world trade almost as much as the 2008 financial crisis.

Figure 1: Total World Exports and Imports Based on Data from Tradmape.Com (Index; 2002m01=100)



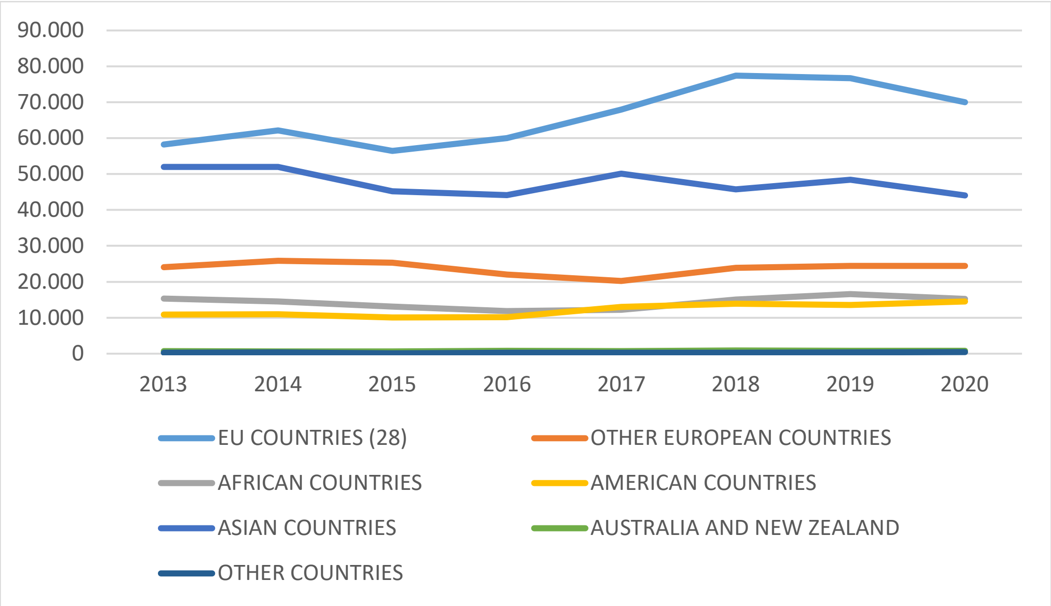
Source: Tradmape.com (US Dollar thousand).

The purpose of this study is to examine the relationship between the real exchange rate and the trade balance between Turkey and the European Union under the impact of COVID-19 by using the J curve framework. This study uses both linear and nonlinear methods to analyse data and identify potential patterns and relationships.

This paper makes two contributions to the literature. The main contributions of this paper are new evidence on the J-curve and the S-curve (in particular the impact of the recent devaluation of the Turkish Lira on trade between Turkey and the EU27) and the impact of COVID-19.

The EU zone is Turkey's largest trading partner. The value of Turkey's exports to the EU28 in 2019 and 2020 is $76.7 and $70.02 billion, representing 42% and 41% of Turkey's exports, respectively. Figure 2 shows the value of Turkey's exports by country group.

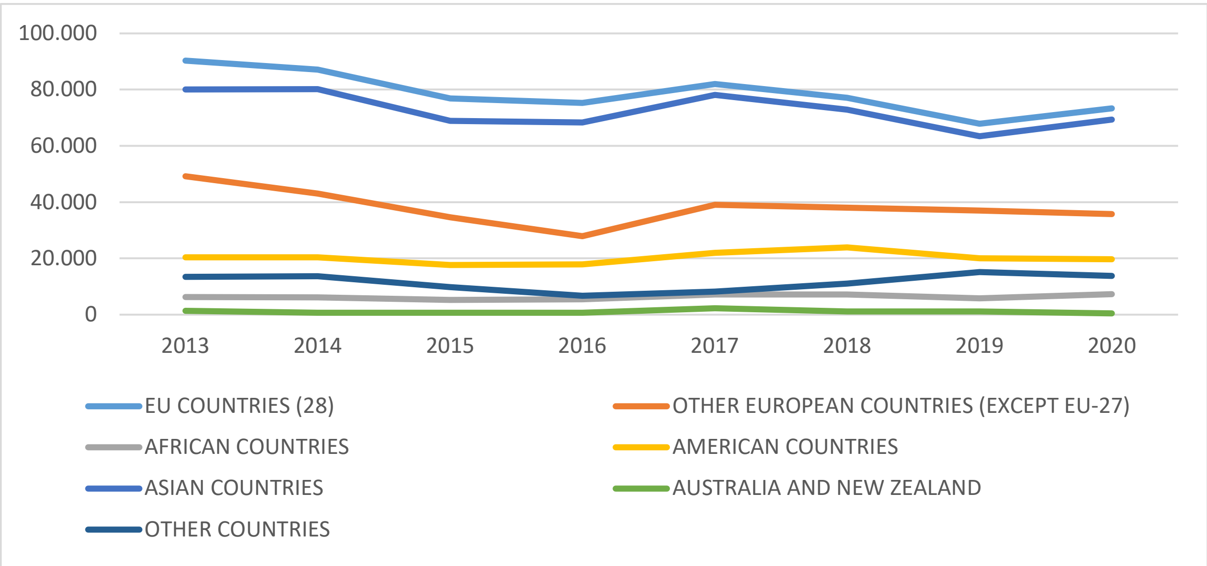
Figure 2: Turkey's Export Value by Country Group ($Millions)



Source: TÜİK (Turkish Statistical Institute)

Furthermore, Figure 3 shows the value of imports to Turkey from different regions. Almost the same result is valid for export. The EU28 is the largest region for Turkey's imports. The value of Turkey's imports from the EU28 in 2019 and 2020 is $67.9 billion and $73.3 billion, respectively, accounting for 32% and 33% of Turkey's imports.

Figure 3: Value of Turkish Imports by Country Group ($millions):



2. J-Curve Phenomenon

In the 1980s, many industrialized countries decided to float their currencies in the hope that they could fix their trade deficits and protect them from external threats. This decision, based on the Marshall-Lerner condition and the elasticities of import and export demand, enabled them to implement effective fiscal and monetary policies to better manage their economies. While it is possible for the trade balance to deteriorate in the short run due to delays in the response of trade flows to changes in the exchange rate, in the long run it will improve due to delays, similar to the letter J (Bahmani-Oskooee & Goswami, 2003). However, although (Magee, 1973) claims that it is possible to deteriorate the trade balance after currency devaluation, this should rather be seen as an exception. Essentially, the floating exchange rate is an effective tool to help economies manage better.

The trade balance's reaction to a devaluation or currency depreciation can be summarized by the J-curve phenomenon. The current account balance after a real currency devaluation might follow the form of a J-curve that first declines and then rises as exports and imports progressively adjust to a real exchange rate adjustment. When such a J-curve is present, the overshooting of the exchange rate is exacerbated, and currency depreciation may initially have a contractionary effect on output. The impact of a nominal exchange rate shift on the real exchange rate can be mitigated by limited exchange rate pass-through and domestic price rises (Krugman et al., 2014). Thus, devaluation of the domestic currency improves the trade balance after a short period of time. In other words, the relationship between currency depreciation and trade balance changes over time; so, the short-term and long-term effects of the trade balance are different. The difference in the time response of the trade balance to the changes in the value of the domestic currency will shape a J-shaped curve. In the extensive studies of researchers, S-shaped, inverted L, and even M-shaped curves have also been observed. while J-shaped has been observed in most studies (Bahmani-Oskooee & Ratha, 2007) (Bahmani et al., 2013).

The J curve hypostasis has been examined with two different methods, namely bilateral trade balance and aggregate trade balance. The bilateral trade balance method pays attention to the trade flow between a country and its trading partner. However, the aggregate trade balance method deals with the trade flow of a country and other parts of the world as a whole (Kyophilavong et al., 2013).

A decrease in the value of the domestic currency leads to a decrease in imports and an increase in exports; however, the important factor in this analysis is the monetary value of exports and imports; thus, the improvement in the balance of payments depends on the net change in the amount of the country's foreign exchange receipts and payments of the country. In general, according to Marshall-Lerner condition, the depreciation of the domestic currency leads to an improvement in the country's trade balance if the sum of the absolute values of the price elasticity of exports and imports is greater than one $((|\mathrm{PED}_{ex}|) + (|\ \mathrm{PED}_{im}|) > 1))$ (Bahmani et al., 2013). On the other hand, limited production capacity and structural bottlenecks, income redistribution, increase in production costs, and inflationary and recessionary effects due to currency devaluation complicate its final effect on the trade balance to some extent. Moreover, it is possible that the price elasticity of exports and imports is lower in the short run than in the long run. Imports and exports are low, and the growth of the price of imported goods is higher compared to exported goods in terms of domestic currency (Magee, 1973).

Hence, the depreciation of the national currency has two effects: quantitative and price. The quantity effect means that demand for exports increases when domestically produced goods become cheaper, and that imports decrease when imported goods become more expensive. As a result, the quantity effect improves the current account balance. The price effect means that when the national currency depreciates, exported goods become cheaper in foreign currency and imported goods become more expensive in national currency. Therefore, the price effect is taken into account, which leads to a deterioration of the country's current account balance. Finally, the impact of a depreciation of the country's currency depends on which of these two effects dominates the trade balance. In general, the prevailing view is that in the short run, the price effect prevails over the quantity effect, and in the long run, assuming that Marshall Lerner's condition is established, the quantity effect prevails over the price effect (R. Krugman et al., n.d.).

X country's trade balance is made up of the value of its exports minus the value of its imports, and this situation is known as MLC. Each value is calculated by multiplying a price by a quantity. When a country's currency is devalued, the resulting drop in price should lead to a rise in exports and a fall in imports, but the trade balance can only improve if exports or imports are large enough to counteract the decline in price. Thus, either export volume must rise or import volume must fall (Bahmani et al., 2013).

The J-curve firstly was developed by (Magee, 1973), further expanded upon by (M. Bahmani-Oskooee, 1985) and (Rose & Yellen, 1989b). Bahmani-Oskooee employs a method to test the J-curve, whereas Rose and Yellen is the first study to use time series to reject the J-curve (Ahmad & Yang, 2004). Baek (2007), in his study entitled "The J-Curve Effect and The US-Canada Forest Products Trade", used the ARDL approach by using seasonal data from 1989 to 2005, as a result of the paper the author did not find evidence to confirm the existence of the J-curve effect between the trade of forest products between America and Canada.

Bahmani-Oskooee & Ardalani (2007) tested the J-curve in 66 industrial sectors of the United States of America. They used monthly data for the period from 1991 to 2001 and they use of VAR method concluded that J-curve effect is confirmed in only 6 cases and the decrease in the value of the dollar had a long-term effect in 22 cases.

Halicioglu (2008) in a study titled " The Bilateral J-Curve: Turkey versus er 13 Trading Partners", using annual data from 1985 to 2005 and the ARDL method, showed that the J curve between Turkey and none of its trading partners is confirmed.

Hsing (2009) evaluated the J-curve in bilateral trade between Croatia, the Czech Republic, Hungary, Poland, Slovakia, and Slovenia with the United States. The empirical results indicate that the J-curve is not valued for any of these six countries. After a shock that leads to a decrease in the real value of money, the trade balance improves for the Czech Republic, but worsened for Poland, Hungary, Slovakia and Slovenia. In the case of Croatia, the trade balance improves at first and then declines, also the estimation of the convergence equation indicates that, except Czech Republic depreciation of the real currency in the long run leads to a worsening of the trade balance for the other five countries. Aftab & Khan (2008) in a study investigated the bilateral J-curve between Pakistan and its trading partners using quarterly data from 1980 to 2005 using the ARDL method and concluded that the J-curve is not confirmed.

Bahmani-Oskooee & Ratha (2010) divide the literature into two categories: publications using bilateral trade data and research using aggregate trade data. Also Bahmani-Oskooee et al. (2016) tested the J-curve in Mexico using ARDL nonlinear model. The study between Mexico and its thirteen trading partners showed that exchange rate changes have an asymmetric effect on Mexico's bilateral trade balance and the J curve effect was detected.

Ojaghlou (2021) by using Nonlinear Autoregressive Distributed Lag (NARDL) and Johansen-Juselius cointegration techniques, test to explore the Marshall-Lerner condition and J-curve influence on bilateral trade between Turkey and its two major Germany and the United States from 2005 Q4 to 2020 Q1 (before outbreak of covid-19 pandemic). Findings support J-curve phenomenon in both Turkey-Germany and Turkey-USA. Ojaghlou & Uğurlu (2023) investigate J-curve effect between China-EU27 and China-USA under COVID-19. They recognized inverted J-Curve effect.

3. The Bilateral Trade Balance Model and Methodology

According to studies by Rose & Yellen (1989) and Bahmani-Oskooee & Brooks (1999), two scale variables (one for Turkey and the other for the trade partner) as well as the real exchange rate was used and the trade balance model is represented linearly by equation (1), where $Y_{Tr,t}$ is the index of Turkey's real GDP, $Y_{j,t}$ is the index of nation j's, and is the trade balance with trading partner j. $RER_{j,t}$ is the bilateral real exchange rate between the Turkish lira and the currency of country j; TB is the ratio of Turkey's exports to country i over her imports from country j.

Bahmani-Oskooee & Ratha (2004) state that although we don't know the coefficients of $Y_{Tr,t}$ (b) and $Y_{j,t}$ (c) in advance, we do anticipate that the coefficient of real exchange (d) will be positive if real depreciation will eventually lead to an improvement in the trade balance.

$$LnTB_{j,t} = a + b.LnY_{TR,t} + c.LnY_{j,t} + d.LnRER_{j,t} + \varepsilon_t \qquad (1)$$

In our case, the model can be written as below:

$$LnTB_{EU,t} = a_3 + b_3.LnY_{TR,t} + c_3.LnY_{EU,t} + d_3.LnRER_{EU,t} + \upsilon_t \qquad (2)$$

Variables and series related to equation (2) is summarized in Table 1.

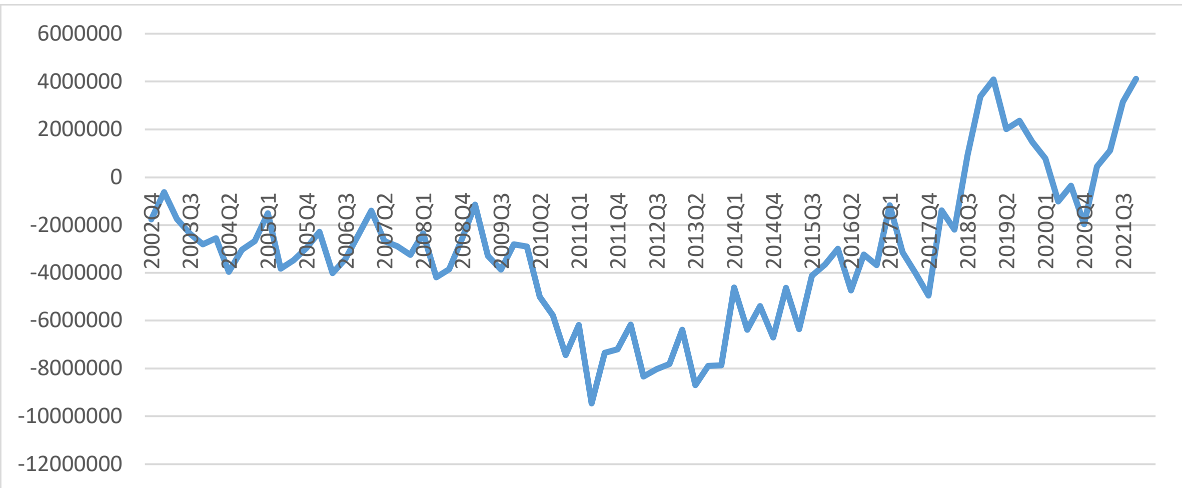
Table 1: Variables and Sources

Series[2]	Data Sources
EUR/TL	Central Bank of Tukey Database
Export value with the TR_EU27	Trademap
Import value with the TR_EU27	Trademap
CPI_{EU27}	FRED
CPI_{TR}	TÜİK (Turkish Statistical Institute)
Real GDP_{EU27}[3]	FRED
Real GDP_{TR} (GDP Index)[4]	FRED

Figure 4 shows the trade balance of Turkey and the EU27 from 2002Q3 to 2021Q4. As Figure 4 shows, the trade balance between Turkey and the EU27 is mostly negative. After 2018Q3, it became positive due to the sharp decline/depreciation of the Turkish lira. The trade balance started to decline again, mainly due to COVID -19 and policies to protect the value of the national currency against foreign currencies. The value of the trade balance between Turkey and the EU27 is 4,120,002 (thousand US dollars), higher than 4,087,238 (thousand US dollars) (pre-pandemic peak).

Figure 4 shows the trade balance of Turkey and the EU27 from 2002Q3 to 2021Q4. As Figure 4 shows, the trade balance between Turkey and the EU27 is mainly negative. While after 2018Q3, because of the sharp decrease/devaluation in the Turkish Lira, it became positive. The trade balance started to decrease again, mainly because of COVID-19 and the protection policy of the Turkish Lira against foreign currencies. The value of the trade balance of Turkey-EU27 is 4,120,002 (US Dollar thousand) which is larger than 4,087,238 (US Dollar thousand) (maximum value before the pandemic).

Figure 4: Turkey-EU27 Trade Balance (US Dollar thousand):



[2] All data are seasonally adjusted using the MA method.
[3] Gross Domestic Product by Expenditure in Constant Prices: Total Gross Domestic Product for Turkey, Index 2015=100, Quarterly, Seasonally Adjusted.
[4] Gross Domestic Product by Expenditure in Constant Prices: Total Gross Domestic Product for Turkey, Index 2015=100, Quarterly, Seasonally Adjusted

3.1. Unit Root Test

Most economic and business time series are non-stationary and therefore the type of models we have studied cannot be used (directly). The usual approach to modelling trends is to consider models that become stationary after some transformations (Ugurlu, 2023). Unit root tests exmine whether trend data should first be differenced or regressed on deterministic functions of time to make the data stationary (Zivot & Wang, 2006). Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests were applied to determine the order of integration. The results of these tests are presented in Table 2 as follows:

Table 2: Unit Root Tests Results:

Variables	ADF[5]		PP[6]	
	Include Intercept	Include Trend and Intercept	Include Intercept	Include Trend and Intercept
$\mathbf{LnRER_{TL\_EU}}$	0.12(2)	-3.47(2)**	1.68 (20)	-2.83(12)**
$\mathbf{\Delta LnRER_{TL\_EU}}$	-9.89(1)***	-9.94(1)***	-8.14(46)***	-9.80(52)***
LnY_{EU}	-1.16(7)	-2.86(7)	-1.33(7)	-2.71(6)
$\Delta\ LnY_{EU}$	-4.23(6)***	-4.21(6)***	-5.33(29)***	-5.29(29)***
LnY_{Tr}	-1.28(7)	-2.87(7)	-1.28(12)	-2.33(10)
$\Delta\ LnY_{Tr}$	-4.09(6)***	-4.15(6)***	-5.56(55)***	-5.71(59)***
$LnTB_{Tr-EU}$	-1.35(2)	-1.78(2)	-0.54(5)	-4.94(4)***
$\Delta LnTB_{Tr-EU}$	-17.29(0)***	-17.36(0)***	-18.85(7)***	-19.46(8)***

Note: The signs *, ** and *** represent 10%, 5%, and less than 1% significance level, respectively.

All variables are stationary at I (0), I (1), and none are stationary at I(2), as shown in Table 2, real exchange rate is stationary at I(0)[7] and other series are stationary at I(1). Therefore, all variables are stationary at a combination of I(0) and I(1). Due to this, the ARDL bound and NARDL model, which combines a nonlinear long-run relationship with a nonlinear and asymmetric error correction using constructed partial sum decompositions, were taken into consideration. These models were developed by Pesaran et al. (2001) and Shin et al. (2014), respectively.

NARDL long-run relationship:

$$y_t = \beta^+ {x_t}^+ + \beta^- {x_t}^- + u_t \ and \ \ x_t = x_0 + {x_t}^{POS} + {x_t}^{NEG}$$

Where x^{pos}_t and x_t^{neg} are:

$${x_t}^+ = \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} max(\Delta x_j, 0), {x_t}^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} min(\Delta x_j, 0)$$

And β^+, β^- are:

[5] Based on AIC
[6] Based on Bartlett Kernel
[7] the series shows existence of trend

$$\Delta y_t = \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} \gamma_j \Delta y_{t-j} + \sum_{j=0}^{q} (\pi_j^+ \Delta x_{t-j}^+ + \pi_j^- \Delta x_{t-j}^-) + \varepsilon_t,$$

where null hypothesis ρ = θ $^+$ = θ $^-$ = 0 long-run steady state of the system can be written as follows by the asymmetric cumulative dynamic multipliers:

$$m_h^+ = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\vartheta x_t^+}$$

$m_h^- = \sum_{j=0}^{h} \frac{\partial y_{t+j}}{\vartheta x_t^-}$ h= 0, 1, 2, …

where m_h^+ and m_h^- tend toward the respective asymmetric long-run coefficients $\beta^+ = \theta^+ / -\rho$ and $\beta^- = \theta^- / -\rho$, respectively, as h → ∞.

ARDL (eq3) and NARDL model (eq4) of Eq(2) is as follows:

$$\Delta lnTB_{TR-EU27} = \alpha_0 + \sum_{q=1}^{p1} \alpha_{1q} \Delta lnTB_{TR-EU27,t-q} + \sum_{q=0}^{p2} \alpha_{2q} \Delta lnY_{EU27,t-q} + \sum_{q=0}^{p3} \alpha_{3q} \Delta lnY_{TR,t-q} + \sum_{q=0}^{p4} \alpha_{4q} \Delta lnRER_{TR- \quad ,t-q} + \beta_1 lnTB_{TR-EU27,t-1} + \beta_2 Y_{TR,t-1} + \beta_3 Y_{EU27,t-1} + \beta_4 RER_{TR-EU27,t-1} + \varepsilon_t \text{ (eq3)}$$

$$\Delta lnTB_{TR-EU} = \alpha_0 + \sum_{q=1}^{p1} \alpha_{1q} \Delta lnTB_{TR-EU27,t-q} + \sum_{q=0}^{p2} \alpha_{2q} \Delta lnY_{EU27,t-q} + \sum_{q=0}^{p3} \alpha_{3q} \Delta lnY_{TR,t-q} + \sum_{q=0}^{p2} \alpha_{3q} \Delta lnRER_{TR-EU27,t-q}^{pos} + \sum_{q=0}^{p3} \alpha_{4q} \Delta lnRER_{TR-EU \quad ,t-q}^{neg} + \beta_1 lnTB_{TR-EU27,t-1} + \beta_2 lnY_{TR,t-1} + \beta_3 lnY_{EU27,t-1} + \beta_4 lnRER_{TR \quad ,t-1}^{neg} + \beta_5 lnRER_{TR-EU27}^{Pos} + \varepsilon_t \text{ (eq4)}$$

Table 3 shows the estimation of the long-run coefficients of our models (eq3 and eq4);

Table 3: Long Run Coefficient

	Full sample		Covid19 period	
Variables	ARDL(3,2,2,0)	NARDL (3,1,2,2,0,)	ARDL(4,2,3,3)	NARDL (2,2,0,2,2)
C	-17.72*** (-2.48)	-17.65** (-2.33)	-23.67*** (-4.69)	-0.78 (-0.20)
LnRER	-1.7*** (-4.70)		-1.82 ** (-4.59)	
Ln RER^{pos}	-	-1.69*** (-2.69)	-	0.51 (1.37)
Ln RER^{neg}	-	-1.59 (-1.50)	-	-1.13** (-3.14)
LnY_{TR}	3.03* (1.81)	1.04 (1.38)	-66.19** (-5.29)	-5.18*** (-4.67)
LnY_{EU27}	3.07* (1.81)	2.96 (1.50)	11.68*** (5.97)	5.44** (-4.67)
ECt-1	-0.16***[8] (-3.47)	-0.16***[9] (-3.06)	-0.88**[10] (-4.60)	-0.86** (-2.91)
F-Bounds	3.68** (upper bound of 5%=3.67)	3.26*** (upper bound of 1%=4.37)	30.92*** upper bound of 1%=4.66)	7.82** (upper bound of 1%=4.37)
χ^2_{Serial}	3.34 (Prob.> 0.10)	1.85 (Prob.> 0.10)	0.19 (Prob.> 0.10)	6.69 (Prob.> 0.10)
$\chi^2_{RESET,ARCH}$	1.74 (Prob.> 0.10)	1.79(Prob.> 0.10)	0.71 (Prob.> 0.10)	0.48(Prob.> 0.10)
CUSUM	Stable	Stable	Stable	Stable
CUSUMSQ	Stable	Stable	Stable	Stable

Note: ***, ** and * indicates the 1%, 5%, and 10% significance levels, respectively.

The estimated results are summarised in table 3 and based on (Pesaran et al., 2001) the null hypothesis in ARDL (Autoregressive Distributed Lag) bounds testing is that there is no long-run relationship between the series (β_1=β_2=β_3=β_4=0) and in case of NARDL (β_1=β_2=β_3=β_4=β_5=0), and also it assumes that the coefficients on the lagged levels of the dependent and independent variables in the ARDL model are zero. χ^2_{Serial} is the Lagrange multiplier test of residual serial correlation, distributed as χ2(4) at 5% significance level, is known as the "Serial correlation " test. Heteroskedasticity tests of the ARCH are known as the

[8] ECT_{-1} = lnTB - (-1.70lnRER+85Y_{TR}-+.3.07 Y_{EU}-17.72)
[9] ECT_{-1} = lnTB-(-1.69 lnRER^{POS} -1.59 lnRER^{NEG} + 1.04 lnY_{TR}-2.96 lnY_{EU}-17.65)
[10] ECT_{-1} = lnTB - (-1.1.82lnRER-6.19Y_{TR}-+11.68 Y_{EU}-23.67)

$\chi^2_{RESET,ARCH}$ test. At the 5% level of significance, the test regresses the squared residuals on the lagged squared residuals and a constant. t-test values are shown in parentheses.

The critical bound of 5% of significance is presented for the CUSUM and CUSUMQ statistics. The abbreviations CUSUM and CUSUMSQ stand for the cumulative sum of recursive residuals and their squares, respectively. If the plot of these statistics stays inside the crucial bound of 5% significance level (M. Bahmani-Oskooee & Wang, 2006).

Table 3's findings show that in every model, the F-test supports cointegration. The calculated coefficients of the real exchange rate must be statistically significant and in the positive range for the Turkish lira to appreciate and the trade balance to improve over time. The real exchange rate coefficients (in both ARDL Bound and NARDL models) are all negative and most of them are statistically significant at 99% and 95%, as shown in Table 3. Only in the case of NARDL (2,2,0,2,2), which belongs to COVID19, is the coefficient of the real exchange rate positive for the period, but not statistically significant. The magnitude of the ECT is negative in all the estimated models, ranging from -1 to 0. This indicates the speed of adjustment of the long-run relationships between the selected variables in all the models. Thus, when we use the nonlinear and linear ARDL models, we find no significant and positive long-run relationship between real exchange rate and other variables in all the models. Thus, the J-curve phenomenon cannot be accepted for Turkey's trade with the EU27 in the long run.

Therefore, there is no such J-Curve effect. Our findings are consistent with the results of Karamelikli (2016), Bahmani-Oskooee & Durmaz (2016), Bahmani-Oskooee & Karamelikli (2020). Some previous studies pointed out that when using data with aggregation bias, the long-run effect is difficult to detect and recommended using Turkish trade flows at the commodity level with each major partner (M. Bahmani-Oskooee & Karamelikli, 2020).

To better understand the pure effect of COVID-19 on trade, we apply the asymmetric effect of the exchange rate to dynamic multipliers by looking at different subsamples.

Figure 5 and Figure 6 show the dynamic multipliers of the exchange rate for two NARDL models of the combinations of long-run and short-run asymmetry. The effects start positive for both RER^{+} and $RER^{-}$and persist until the third period. The J-curve effect is seen after the third period. This graph also shows that any decrease (increase) in the real exchange rate leads to an increase (decrease) in the trade balance, and our results suggest that an increase in the real exchange rate has a larger impact than a decrease.

Figure 5: NARDL Multiplier (full sample)

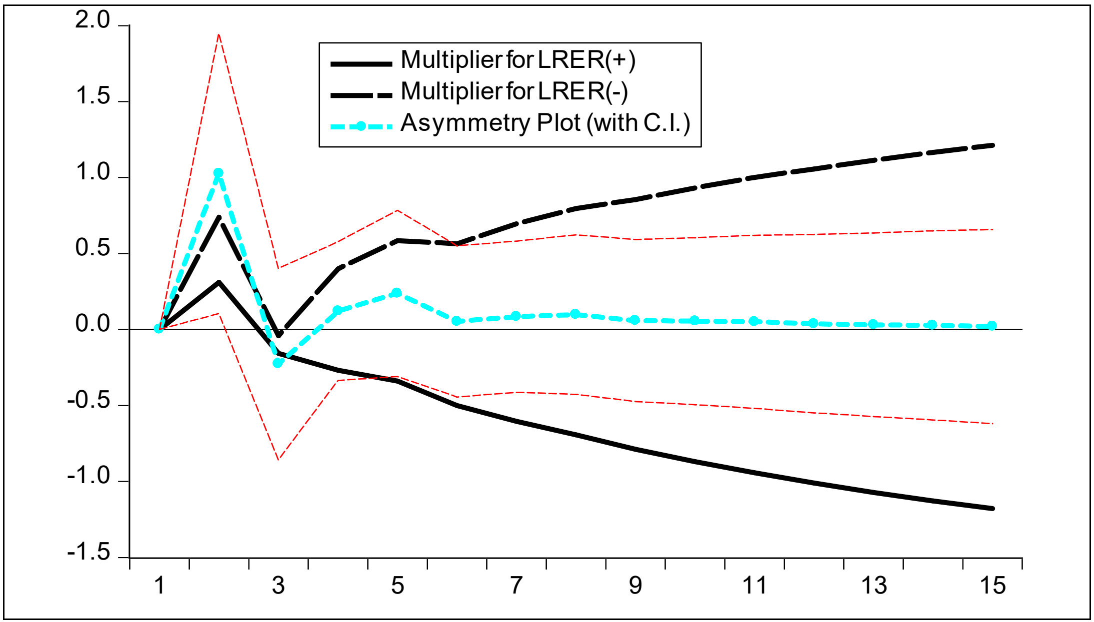
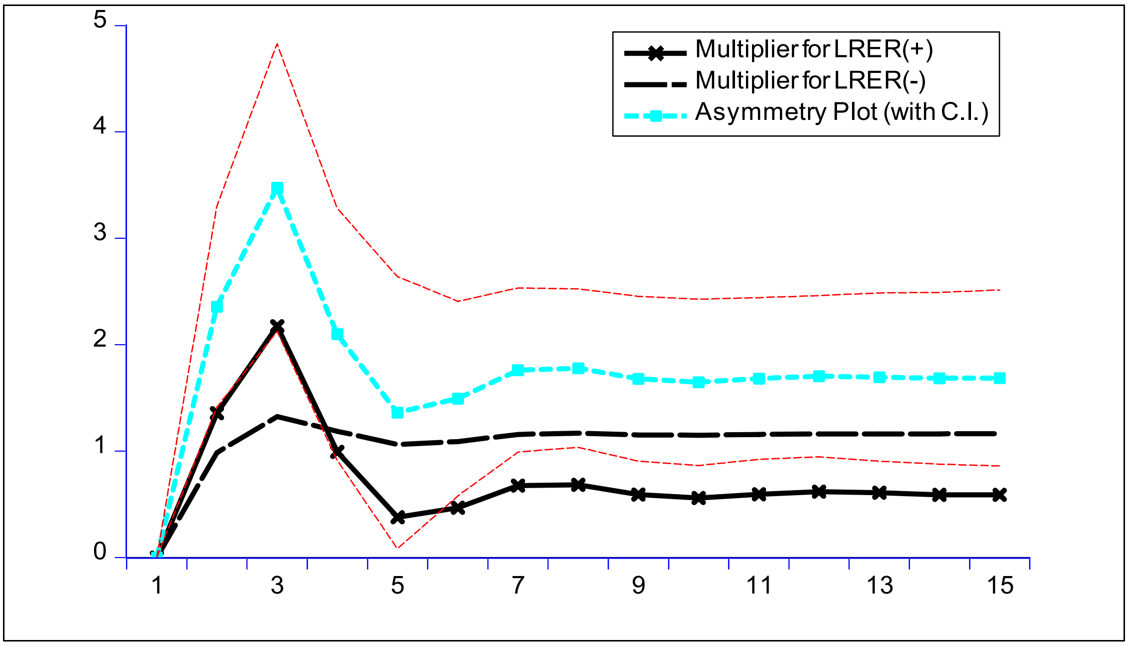


Figure 6 shows the pattern of dynamic adjustment in the symmetric case (dynamic multiplier with asymmetric effect) for Turkey during the COVID-19 period. Figure 6 shows that there is no such asymmetric effect and that both have positive effects on Turkey's trade balance. Our results indicate that real exchange rate decreases have a greater impact than real exchange rate increases. Therefore, their difference has a positive impact on the trade balance.

Figure 6: NARDL Multiplier (During Covid-19):



when we compare Figure 5 and Figure 6, it is understood that positive effect of the increase in real exchange has a larger impact on the improving trade balance of Turkey. In addition, during the pandemic period, a real currency depreciation or devaluation of the Turkish Lira had a more positive impact on Turkey's trade balance.

3.2. S-Curve

The J-curve pheromone and the S-curve idea are so similar. By, the S-curve was first used (Backus et al., 1994). According to (Backus et al., 1994), there is a positive cross-correlation between the future values of the trade balance and the current real exchange rate. The relationship between the present real exchange rate and the trade balance's historical values, on the other hand, is negative (M. Bahmani-Oskooee & Ratha, 2009). The cross correlation between real exchange rate and trade balance is positive only between the current value of real exchange rate and future values of trade balance, and it is negative between past values of trade balance and the current value of exchange rate, according to a study by (Backus et al., 1994).

The cross-correlation pattern looks like the letter S when it is plotted. S-curve phoneme has been attempted to test by researcher in 30 least developed countries (LDCs). The result shows that the S-curve effect is not supported in some countries. Bahmani-Oskooee et al. (2008) tested 20 African countries for the S-curve and the result shows that only 8 out of 20 countries support the S-curve. The empirical studies show that the S-curve is empirically supported in limited cases (Bahmani-Oskooee & Fariditavana, 2014).

There is evidence of the S-curve when results are plotted against their respective lead times or lags and the underlying cross-correlation functions are asymmetric, with the coefficients being positive for lead times (or positive lags) but negative for negative lags (Bahmani-Oskooee & Ratha, 2009).

In accordance with Bahmani-Oskooee & Fariditavana (2014), we define cross-correlation coefficients between the present RER and historical values of TB as:

$$corr_k = \frac{\sum(RER_t - \overline{RER})(TB_{t+k} - \overline{TB})}{\sqrt{\sum(RER_t - \overline{RER})^2(TB_{t+k} - \overline{TB})^2}}$$

Where TB; Trade balance and RER: Real exchange rate (Bahmani-Oskooee & Fariditavana, 2014) used trade balance as follows:

$$TB = \frac{IMPORT - EXPORT}{GDP_{TR}}$$

We calculate the cross-correlation between the real bilateral exchange rate and the trade balance for the aggregate bilateral trade balance with different lags (10 lags (-10,-9,-8,-7,-6,-5, -4, -3, -2, -1) and 10 leads (1, 2, 3, 4, 5, 6, 7, 8, 9, 10)) for three samples (full sample, before the pandemic and during the pandemic).

In this study for the S-curve, we use two proxies for trade TB. The first is the one used by Bahmani-Oskooee & Fariditavana (2014). The result is summarized in Table 4. The other is the ratio between Turkey's exports to country i and imports from country j, which we used for the J-curve (the result is summarized in Table 5).

Table 4: Cross-Correlation Test Results[11]

	Full Sample		Before COVID19		COVID19 Period	
	lag	lead	lag	lead	lag	lead
0	-0.9576	-0.9576	-0.9626	-0.9626	-0.9997	-0.9997
1	-0.9464	-0.9377	-0.9485	-0.9411	-0.8656	-0.8712
2	-0.935	-0.9177	-0.9341	-0.9192	-0.733	-0.7437
3	-0.9235	-0.8974	-0.9193	-0.897	-0.603	-0.6182
4	-0.9118	-0.877	-0.9042	-0.8744	-0.4766	-0.4956
5	-0.8999	-0.8565	-0.8887	-0.8514	-0.3549	-0.3767
6	-0.8879	-0.8358	-0.8729	-0.8281	-0.239	-0.2624
7	-0.8757	-0.8149	-0.8568	-0.8043	-0.1298	-0.1536
8	-0.8634	-0.7939	-0.8403	-0.7803	-0.0282	-0.0511
9	-0.8509	-0.7728	-0.8236	-0.7559	**0.0649**	0.044
10	-0.8381	-0.7514	-0.8065	-0.7312	**0.1486**	0.131

The cross-correlation between the real exchange rate and the trade balance between Turkey and the EU27, as shown in Table 4, does not support the S-curve at the aggregate level. The cross correlation between the real exchange rate and the trade balance at 10 times lag is about $-0.9 < \text{ Full Sample }_{lag_i} < -0.8$ and for 10 lead $-0.9 < \text{ Full Sample }_{lag_i} < -0.8$ and all coefficients are negative. The coefficients of the cross-correlation become smaller when we use data from before the COVID-19 period, but the correlation is still negative and also in the same range. The negative coefficients of the cross-correlation between the real exchange rate and the trade balance become more positive during the pandemic, even in lead and lag, suggesting that the interaction between the real exchange rate and the trade balance during the pandemic is different from that before the pandemic. The result of the cross-correlation between Turkey's exports and imports is summarised in Table 5.

Table 5: Cross-Correlation Test Results

	Full Sample		Before COVID19		COVID19 Period	
	lag	lead	lag	lead	lag	lead
0	-0.663	-0.663	-0.315	-0.315	-0.001	-0.001
1	-0.658	-0.663	-0.328	-0.291	0.072	-0.124
2	-0.657	-0.652	-0.345	-0.286	-0.039	-0.105
3	-0.657	-0.635	-0.362	-0.270	-0.066	-0.149
4	-0.660	-0.619	-0.382	-0.250	-0.033	-0.213
5	-0.662	-0.593	-0.399	-0.237	**0.106**	-0.195
6	-0.661	-0.564	-0.409	-0.223	**0.272**	-0.183
7	-0.665	-0.537	-0.424	-0.198	**0.269**	-0.186
8	-0.657	-0.512	-0.410	-0.189	**0.207**	-0.197
9	-0.645	-0.491	-0.392	-0.167	**0.183**	-0.272
10	-0.634	-0.470	-0.376	-0.152	**0.115**	-0.296

[11] following (Bahmani-oskooee & Fariditavana, 2014) and previous research, all data are de-trended using Hodrich-Prescott (HP) filter

Results of table 5 is similar to Table 4 so that Cross-Correlation not support the S-curve aggregate hypotisis in level. In this case Cross-correlation between real exchange rate and trade balance with 10 lag are around $-0.7 < \text{ Full Sample }_{lag_i} < -0.6$ and for 10 lead $-0.7 < \text{ Full Sample }_{lag_i} < -0.4$ and all coefficients are negative. White coefficients of cross-correlation get smaller when we used data of before COVID19 period but still correlations are negative and the range for both lead and lag is between $-0.4 < \text{ Before COVID19} < -0.1$. The negative coefficients of cross-correlation between real exchange rate and trade balance during the pandemic got smaller even in lead and lag. The coefficients turned positive (bolded number) , which indicates the interaction between real exchange rate and trade balance during the pandemic was different from before the pandemic. Shows that during the COVID19 epidemic, a curve similar to the inverse S-curve appeared. Because the value of the cross-correlation of lag is positive. According to S-Curve theory, the cross-correlation of leads should be positive.

The results of Table 5 are similar to Table 4, so the cross-correlation provides no support for the S-curve aggregate level. In this case, the cross-correlation between the real exchange rate and the trade balance with 10 lags are $-0.7 < \text{ Full Sample }_{lag_i} < -0.6$ and for 10 lead $-0.7 < \text{ Full Sample }_{lag_i} < -0.4$ and all coefficients are negative. The coefficients of the cross-correlation become smaller when we use data from before COVID19, but the correlations are still negative and the range for both lead and lag is between $-0.4 < \text{ Before COVID19} < -0.1$. The negative coefficients of the cross-correlation between the real exchange rate and the trade balance during the pandemic even became smaller in the lead and lag. The coefficients became positive, indicating that the interaction between the real exchange rate and the trade balance was different during the pandemic than before the pandemic. It shows that a curve similar to the inverse S-curve occurred during the COVID19 pandemic. This is because the value of the cross-correlation of the lag is positive. According to the S-curve theory, the cross-correlation of the leads should be positive.

4. Conclusion

According to the World Bank, the Turkish economy had an exchange rate crisis in the second half of 2018 that had a negative impact on economic growth at 2019. The depreciated Lira immediately impacts trade by driving up costs and destabilizing the banking system. This study makes an effort to determine the impact of COVID -19 on trade between Turkey and EU27 countries. For this purpose, we applied the J-curve and S-curve methods, using different samples and subsamples. We examined the long-term relationship of bilateral trade between Turkey and the EU27, including the impact of the real exchange rate on the trade balance, and then we examined how COVID -19 affected the trade balance using the J-curve and S-curve models. The results show that there is no evidence of a J-curve and S-curve due to the initially improving and later deteriorating trade balance between Turkey and the EU27. Dynamic multiplier analyses show that there is no such asymmetric effect and our results suggest that real exchange rate reductions have a larger positive impact than real exchange rate increases. Therefore, their difference has a positive effect on the trade balance. During the pandemic, the positive effect of an increase in the real exchange rate has a greater impact on improving

Turkey's trade balance. Consequently, a real depreciation of the Turkish lira had a more positive effect on Turkey's trade balance during the pandemic. The cross-correlation coefficients during the pandemic are lower than the pre-pandemic correlations. Even with some lags, they became positive. Thus, although the J-curve and the S-curve were not detected, the depreciation of the Turkish lira and the impact of COVID -19 favour the Turkish trade balance.

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Etik Beyanı: Bu çalışmanın tüm hazırlanma süreçlerinde etik kurallara uyulduğunu yazar beyan eder. Aksi bir durumun tespiti halinde Fiscaoeconomia Dergisinin hiçbir sorumluluğu olmayıp, tüm sorumluluk çalışmanın yazarına aittir.

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The Evaluation of Turkey's Foreign Trade during COVID-19

Mortaza Ojaghlou

Extended Abstract

The pandemic COVID-19 hit the world economy hard, with serious consequences for all countries and individuals. The IMF called it "a crisis like no other" in 2020. Since the beginning of the pandemic, countries and commodities around the world have taken a variety of restrictive measures. These restrictions have negatively affected international trade in goods, with few exceptions. All exceptions are goods that are directly related to the pandemic COVID-19 and are referred to as "COVID-19 related products". Turkey had a double problem and that was the exchange rate fluctuation. The value of the Turkish currency decreased by 44% in 2021. The trade balance was directly impacted by exchange rate fluctuation. On the other hand, COVID-19 had a significant impact on the trade balance globally as well as in Turkey. The value of exports has decreased by almost 39% compared to before COVID-19 (value of exports in December 2019 to the minimum value of exports during the pandemic (April 2020)). This rate for import has decreased by 29% (value of import in December 2019 to the minimum value of import during the pandemic (May 2020)). The decrease in the rate of export is almost equal to that of the 2008 financial crisis (the ratio between the maximum rate of export that occurred in 2008m09 and the minimum value of export that occurred in 2008m12 during the 2008 financial crisis was almost 40%). Therefore, COVID-19 has affected world trade almost as much as the 2008 financial crisis.

In this study, the relationship between the real exchange rate and the trade balance between Turkey and the EU27 and then COVID-19 examine the impact on international trade for Turkey and the EU27 in the J-curve framework using linear and nonlinear methods were tested. We select EU27, because the EU zone is Turkey's largest trading partner. The value of Turkey's exports to the EU28 in 2019 and 2020 is $76.7 and $70.02 billion, representing 42% and 41% of Turkey's exports, respectively. the value of imports to Turkey from different regions. Almost the same result as for the export value. The EU28 is the largest region for Turkey's imports. The value of Turkey's imports from the EU28 in 2019 and 2020 is $67.9 billion and $73.3 billion, respectively, accounting for 32% and 33% of Turkey's imports. This paper makes two contributions to the literature. The main contributions of this paper are new evidence on the J-curve and the S-curve (in particular the impact of the recent devaluation of the Turkish lira on trade between Turkey and the EU27) and the impact of COVID-19.

In the 1980s, the majority of industrialized nations made the decision to float their currencies in an effort to close their trade imbalances and defend against external dangers. The Marshall-Lerner condition (MLC) and the elasticities of import and export demand suggest that they might implement effective fiscal and monetary policies to manage their economies with a floating exchange rate. The trade balance could worsen following a currency depreciation, mostly due to delays in trade flows' reactions to a change in the exchange rate. Due to the lags, the trade balance will worsen in the short term but improve in the long term, much like the letter J. When such a J-curve is present, the overshooting of the exchange rate is exacerbated, and currency depreciation may initially have a contractionary effect on output. The impact of a nominal exchange rate shift on the real exchange rate can be mitigated by

limited exchange rate pass-through and domestic price rises. J-curve is based on Marshall-Lerner condition. According to Marshall-Lerner condition: the depreciation of the domestic currency leads to an improvement in the country's trade balance if the sum of the absolute values of the price elasticity of exports and imports is greater than one. On the other hand, limited production capacity and structural bottlenecks, income redistribution, increase in production costs, and inflationary and recessionary effects due to currency devaluation complicate its final effect on the trade balance to some extent. Moreover, it is possible that the price elasticity of exports and imports is lower in the short run than in the long run. Imports and imports are low, and the growth of the price of imported goods is higher compared to exported goods in terms of domestic currency. For instance, X country's trade balance is made up of the value of its exports minus the value of its imports, and this situation is known as MLC. Each value is calculated by multiplying a price by a quantity. When a country's currency is devalued, the resulting drop in price should lead to a rise in exports and a fall in imports, but the trade balance can only improve if exports or imports are large enough to counteract the decline in price. Thus, either export volume must rise or import volume must fall.

Also, the correlation between real exchange rate and trade balance is examine by S-curve methodology. According to S-curve hypnotises, there is a positive cross-correlation between the future values of the trade balance and the current real exchange rate. The relationship between the present real exchange rate and the trade balance's historical values, on the other hand, is negative. The cross correlation between real exchange rate and trade balance is positive only between the current value of real exchange rate and future values of trade balance, and it is negative between past values of trade balance and the current value of exchange rate.

The cross-correlation between the real exchange rate and the trade balance for Turkey and the EU27, as shown in Table 4, does not support the S-curve at the aggregate level. The cross correlation between the real exchange rate and the trade balance at 10 times lag is about $-0.9 < \text{Full Sample}_{lag_i} < -0.8$ and for 10 lead $-0.9 < \text{Full Sample}_{lag_i} < -0.8$ and all coefficients are negative. The coefficients of the cross-correlation become smaller when we use data from before the COVID19 period, but the correlation is still negative and also in the same rage. The negative coefficients of the cross-correlation between the real exchange rate and the trade balance become more positive during the pandemic, even in lead and lag, suggesting that the interaction between the real exchange rate and the trade balance during the pandemic is different from that before the pandemic. Results of table 5 is similar to Table 4 so that Cross-Correlation not exhibiting support for the S-curve aggregate level. In this case Cross-correlation between real exchange rate and trade balance with 10 lag are around $-0.7 < \text{Full Sample}_{lag_i} < -0.6$ and for 10 lead $-0.7 < \text{Full Sample}_{lag_i} < -0.4$ and all coefficients are negative. White coefficients of cross-correlation get smaller when we used data of before COVID19 period but still correlations are negative and the range for both lead and lag is between $-0.4 < \text{Before COVID19} < -0.1$. The negative coefficients of cross-correlation between real exchange rate and trade balance during the pandemic got smaller even in lead and lag. The coefficients turned positive, which indicates the interaction between real exchange rate and trade balance during the pandemic was different from before the pandemic. Shows that during the COVID19 epidemic, a curve similar to the inverse S-curve appeared. Because the value of the cross-correlation of lag is positive. According to S-Curve theory, the cross-correlation of leads should be positive.

To summarized there is no evidence of a J-curve and S-curve due to the initially improving and later deteriorating trade balance between Turkey and the EU27. Dynamic multiplier analyses show that there is no such asymmetric effect, and our results suggest that real exchange rate reductions have a larger positive impact than real exchange rate increases. Therefore, their difference has a positive effect on the trade balance. During the pandemic, the positive effect of an increase in the real exchange rate has a greater impact on improving Turkey's trade balance. Consequently, a real depreciation of the Turkish lira had a more positive effect on Turkey's trade balance during the pandemic.