IS THERE AN ASYMMETRIC RELATIONSHIP BETWEEN EXPORTS AND IMPORTS IN TURKEY?: AN EMPIRICAL EVIDENCE

Prof. Dr. Cüneyt KOYUNCU
Bilecik Şeyh Edebali Üniversitesi
İİBF İktisat Bölümü
cuneyt.koyuncu@bilecik.edu.tr

Res. Ast. Hüseyin Safa ÜNAL[1]
Bilecik Şeyh Edebali Üniversitesi
İİBF İktisat Bölümü
hsafa.unal @bilecik.edu.tr

ABSTRACT

This study tries to find out if there is an asymmetric relationship between the value of imported goods and the value of the exported goods in Turkey for the monthly periods of 1960:1-2019:8. According to empirical results, the linkage between imports and exports is nonlinear. Thus, NARDL approach is conducted in order to determine the existence of any asymmetric relationship. It is found that there is an asymmetric relationship between the series in the long run but not in the short run. 1% increase in the exports results in a 0.746% increase in the imports of Turkey. On the other hand, when the exports decrease by 1%, it decreases the imports by 0.669% in Turkey. Model diagnostic tests show no autocorrelation, heteroscedasticity or misspecification problems in the model.

Key Words: Exports, Imports, NARDL, Asymmetry

TÜRKİYE'NIN İHRACATI VE İTHALATI ARASINDA ASİMETRİK BİR İLİŞKİ VAR MIDIR?: AMPİRİK KANITLAR

ÖZET

Bu çalışma Türkiye'nin ithalat ve ihracat malları arasında, 1960:1-2019:8 periyodu için asimetrik bir ilişki olup olmadığını bulmayı amaçlamaktadır. Aylık veri kullanılmıştır. Ampirik sonuçlara göre, ithalat ve ihracat arasında doğrusal olmayan bir bağlantı bulunmaktadır. Bu sebeple, herhangi bir asimetrik ilişkiyi tespit etmek için NARDL metodu kullanılmıştır. Seriler arasında uzun dönemli asimetrik ilişki bulunduğu saptanmasına rağmen, kısa dönemde bu ilişkinin varlığı tespit edilememiştir. Türkiye'nin ihracatında gerçekleşen %1'lik bir artış, ithalatında %0.746'lık bir yükselmeyle sonuçlanmaktadır. Diğer yandan, ihracatta oluşan %1'lik bir düşüş, ithalatı %0.669 oranında azaltmaktadır. Model diagnostik testleri otokorelasyon, değişen varyans (heteroskedasticity) ve yanlış model belirlenmesi (misspesification) gibi sorunların bulunmadığını göstermektedir.

Anahtar Kelimeler: İhracat, İthalat, NARDL, Asimetri

1. INTRODUCTION

This study aims to find the long run relationship between imports and exports in Turkey. This association is important for a current account deficit to be sustainable in the long run. Bahmani-Oskooee (1994) finds that the cointegration relationship between imports and exports of Australia guarantees a long run equilibrium linkage between the exports and imports. So, Australian trade deficit is a short run problem but does not pursue in the long run. As it is the

[1]Corresponding author.

case in Australia, Korean imports and exports are converging in the long run (Bahmani-Oskooee & Rhee, 1997). That is, any imbalance in the foreign trade disappears in the long run in Korea. Moreover, Afzal (2008) claims that in Asian countries such as Pakistan, India, Sri Lanka, Korea and Thailand, imports and exports move together in the long run. That is, any deterioration of the balance of trade is not a long run problem. So, macroeconomic precautions are enough to reach an equilibrium in the long run. But, if the data differ for the same economy, and methods are changed, then it is highly likely to reach different findings. Hye and Siddiqui (2010), for instance, emphasize that international budget constraint of Pakistan is not sustainable, although imports do not cause exports, exports cause imports. So, the current account deficit is not sustainable in the long run for Pakistan.

When the country sample is changed, results for the cointegrating relationship may change as well. So, the nature of this relationship does not appear to be standard. For instance, the study in which Tang and Alias (2005) examine the long run relationship between the volume of imports and exports in the member countries of Organization of Islamic Conferences reveals that there is a long run relationship between imports and exports only in 4 out of 27 countries. Furthermore, Narayan and Narayan (2005) seek for the long run relationship between imports and exports in 22 least developed countries. Imbalances in trade seems to be sustainable only in 6 of those economies because there is cointegration relationship only in these 6 economies. Husein (2014) studies the presence of a cointegration relationship between imports and exports in 9 Middle East and North Africa countries. He confirms the existence of such a relationship only in Iran, Israel, Jordan and Tunisia. But, for him only in Iran and Israel, elasticities satisfy the unity condition which is necessary for a sustainable current account deficit in the long run.

Rather than the cointegration, Michael (2002) has an interest in the causality between imports, exports, and income. In his study investigating the relationship in Trinidad and Tobago, he asserts that there is a unidirectional Granger causality from exports to income, a bidirectional causality between exports and imports, and bidirectional causality between imports and income. Although the causal relationship between exports and imports is bidirectional, causality from exports to imports is stronger. In line with the findings of Michael (2002), Mohamed et al. (2014) claim that the causality relationship between exports and imports is bidirectional in Tunisia based on the Toda-Yamamato approach.

Testing the cointegration and causality between exports and imports is a hard job to accomplish due to many reasons. Different economies with different GDP compositions would not establish similar foreign trade policies. So, the motivation behind exporting a good might or might not be importing another good from the rest of the World based on the GDP composition, needs of the domestic economy and the production structure. For example, if the manufacturing sector is import dependent, then each item of the exported goods will require import of raw materials. Or, exports may increase income level (GDP) which in return makes imports more attractive. At this point, the direction of the causality is indefinite.

In this study we examine if the association between export and imports is nonlinear by employing NARDL approach and a sample of Turkish economy covering the months between 1960:1 and 2019:8. Estimation results imply an asymmetric relationship between the series in the long run but not in the short run.

The following part is about the data and the methodology. The third part summarizes the empirical findings while the last part concludes the study.

2. DATA AND THE METHODOLOGY

This study examines the long-run and short-run asymmetric relationship between the series of imports and exports of Turkey for the period between January 1960 and August 2019. The seasonally adjusted, monthly data are in US dollars. Imports include the value of the goods received from the rest of the world. Exports represent the value of the goods provided to the rest of the world by Turkey. Exports and imports data are retrieved from FRED (2019) economic database of the Federal Reserve Bank of St. Louis. Logarithmic transformations of both of the series (logEXP & logIMP) are utilized for the convenience in the interpretation.

The nonlinear autoregressive distributed lag (NARDL) method is employed for the statistical analyses. Due to many advantages over standard cointegration tests, ARDL method in cointegration analysis has been gaining popularity. An example of a proper ARDL model allowing both long run and short run relationship between logEXP and logIMP variables is as follows:

$$\Delta logIMP_t = \mu + \eta logIMP_{t-1} + \delta logEXP_{t-1} + \sum_{i=1}^{p-1} \beta_i \Delta logIMP_{t-i} + \sum_{i=0}^{q-1} \alpha_i \Delta logEXP_{t-i} + \varepsilon_t \quad (1)$$

μ is the constant term. η and δ are long-term coefficients, where the short-term coefficients are β_i and α_i. ε_t is the white noise error term of the model. Model (1) is applicable when the link between the variables is symmetric and linear. But there will be a misspecification problem if the relationship is nonlinear or asymmetric. On the other hand, Shin et al. (2014) construct NARDL model allowing to asymmetric relationship in both short and long run sense. So that, asymmetric effects of both increase and the decrease of an independent variable are considered in the same model. Partial sums of the logEXP variable utilized in the NARDL approach are as follows:

$$logEXP_t^+ = \sum_{j=1}^{t} \Delta logEXP_t^+ = \sum_{j=1}^{t} \max(\Delta logEXP_j, 0) \quad (2)$$

$$logEXP_t^- = \sum_{j=1}^{t} \Delta logEXP_t^- = \sum_{j=1}^{t} \min(\Delta logEXP_j, 0) \quad (3)$$

The appropriate NARDL model seeking for the asymmetric relationship between logEXP and logIMP variables can be constructed as:

$$\Delta logIMP_t = \mu + \eta logIMP_{t-1} + \delta^+ logEXP_{t-1}^+ + \delta^- logEXP_{t-1}^- + \sum_{i=1}^{p-1} \beta_i \Delta logIMP_{t-i} + \sum_{i=0}^{q-1} (\alpha_i^+ logEXP_{t-i}^+ + \alpha_i^- \mathrm{logEXP}_{t-i}^-) + \varepsilon_t \quad (4)$$

The null hypothesis to test the long run asymmetry is $H_0: \delta^+ = \delta^-$, and the null hypothesis to test the short run asymmetry is $H_0: \alpha^+ = \alpha^-$, for any $i = 0, \ldots, q-1$. Rejecting the first null hypothesis means that a long run asymmetry exists, and rejecting the second implies that there is short run asymmetry between logEXP and logIMP in the model (4). However, if both of the null hypotheses cannot be rejected, then the model (4) has no longer the proper specification. Then, the model (1), in which symmetric relationship between the variables are utilized, will have the correct specification for the analyses. Yet, if only the null hypothesis for short-run is rejected, then the cointegrating NARDL model with short-run asymmetry as in Equation (5) will be used. And, if only the null hypothesis for long-run is rejected, then the cointegrating NARDL model with long-run asymmetry as in Equation (6) has to be utilized.

$$\Delta logIMP_t = \mu + \eta logIMP_{t-1} + \delta logEXP_{t-1} + \sum_{i=1}^{p-1} \beta_i \Delta logIMP_{t-i} + \sum_{i=0}^{q-1} (\alpha_i^+ \mathrm{logEXP}_{t-i}^+ + \alpha_i^- logEXP_{t-i}^-) + \varepsilon_t \quad (5)$$

$$\Delta logIMP_t = \mu + \eta logIMP_{t-1} + \delta^+ logEXP_{t-1}^+ + \delta^- logEXP_{t-1}^- + \sum_{i=1}^{p-1} \beta_i \Delta logIMP_{t-i} + \sum_{i=0}^{q-1} (\alpha_i \Delta logEXP_{t-i}) + \varepsilon_t \quad (6)$$

3. EMPIRICAL FINDINGS

For NARDL analysis to be conducted, series have to be stationary either at levels or at first differences. In conventional cointegration methods, the series utilized in the study have to be integrated of the same order. For instance, it is not allowed that one series is I(0) and the other is I(1). But, NARDL approach allows the analysis to be pursued even if the integration order of the series is different. To determine the integration order of the series, Augmented Dickey Fuller test for unit root is conducted. And, results are double checked by conducting Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. Table 1 summarizes these test results. Both of the methods show that logEXP and logIMP variables are non-stationary at levels. However, the both series are stationary at their first differences. Hence, logEXP and logIMP are both integrated of order 1. (i.e., I(1)).

Table 1: Unit Root Tests (Trend: Constant)

	H0: Variable has unit root		H0: Variable is stationary	
Variable	ADF test statistic	1% Critical Value	KPSS test statistic	1% asymptotic critical value
logEXP	-1.837	-3.439	3.184***	0.739
dlogEXP	-38.141***	-3.439	0.172	0.739
logIMP	-2.184	-3.439	3.141***	0.739
dlogIMP	-20.899***	-3.439	0.233	0.739

*** indicates statistical significance at 1% level.

As a second step of the analysis, optimal lag length has to be chosen. Bayesian Information Criteria (BIC) is used as the selection criteria. In Table 2, the lowest BIC belongs to NARDL (3,3) model among the ones in which 2, 3, and 4 lags are checked.

Table 2: Optimal Lag Length Selection (BIC)

Model	BIC
p(2), q(2)	-657.852
p(3), q(3)	-662.794
p(4), q(4)	-654.111

Table 3 lists the F-statistic of the nonlinear cointegration test and the lower and upper bounds for the critical values. F-statistic=9.1805>7.84. That is, even at 1% significance level, F-statistic is higher than the upper bound critical value, and a nonlinear cointegration is found between the value of imports and the exports of Turkey.

Table 3: Nonlinear Cointegration Tests

F-statistic: 9.1805	Critical Values	
Significance Level	I(0)	I(1)
10%	4.04	4.78
5%	4.94	5.73
2.50%	5.77	6.68
1%	6.84	7.84

The critical values are retrieved from Pesaran et al. (2001) Case III.

Short run and long run asymmetry F-test results are listed in Table 4. Because only long run F-test gives statistically significant results at 10% level, there exists asymmetry only for the long run but not for the short run. That is, the proper NARDL model having only long run asymmetry is model (6), but not model (5).

Table 4: Short-run and Long-run Symmetry Tests

	F-statistic	P-value
Long-run	2.931*	0.087
Short-run	0.12	0.729

* indicates statistical significance at 10% level.

Table 5 is a summary of the NARDL estimation results. The coefficients for both the long run increasing (LR^+) and the long run decreasing (LR^-) effect of the exports on imports are statistically significant at 1% level. That is, the monthly data from 1960:1 to 2019:8 shows that when the exports increase by 1%, it causes a jump in the imports by 0.746% in Turkey. When the exports decrease by 1% on the other hand, it causes a decline in the imports by 0.669% in Turkey. The coefficient for $logIMP_{(t-1)}$ shows the convergence speed of the error correction model (ECM). That is, in one period of time, 13.3% of a one-time shock is absorbed. In other words, it takes approximately 7.5 months for the effects of a shock on the imports to fully disappear.

Table 5: NARDL(3,3) Estimation Results

Variable	Coefficient	p-value
Constant	2.219*** (0.426)	0.000
$logIMP_{(t-1)}$	-0.133*** (0.026)	0.000
$logEXP^{+}_{(t-1)}$	0.099*** (0.025)	0.000
$logEXP^{-}_{(t-1)}$	0.089*** (0.0279)	0.001
$\Delta logIMP_{(t-1)}$	-0.472*** (0.040)	0.000
$\Delta logIMP_{(t-2)}$	-0.156*** (0.037)	0.000
$\Delta logEXP^{+}_{(t)}$	0.629*** (0.075)	0.000
$\Delta logEXP^{+}_{(t-1)}$	0.278*** (0.084)	0.000
$\Delta logEXP^{+}_{(t-2)}$	0.322*** (0.082)	0.000
$\Delta logEXP^{-}_{(t)}$	0.532*** (0.111)	0.000
$\Delta logEXP^{-}_{(t-1)}$	0.704*** (0.117)	0.000
$\Delta logEXP^{-}_{(t-2)}$	0.071 (0.108)	0.510
LR^{+}	0.746***	0.000
LR^{-}	-0.669***	0.000

*** indicates statistical significance at 1% level.
Standard errors are in the parentheses.

As to the model diagnostic test results reported in Table 6, since all of the test statistics are statistically insignificant at 1% level except Jarque-Bera test, we can say that there is not any problem in NARDL (3,3) model in terms of autocorrelation, heteroscedasticity and misspecification.

Table 6: Model Diagnostic Tests

Tests	Test Statistic	p-value
Portmanteau test up to lag 40 (chi2)	58.7	0.028
Breusch/Pagan heteroskedasticity test (chi2)	0.035	0.851
Ramsey RESET test (F)	1.802	0.146
Jarque-Bera test on normality (chi2)	662.2***	0.000

*** indicates statistical significance at 1% level.

4. CONCLUSION

This study is an attempt to examine the linkage between the value of imported goods and the value of the exported goods in Turkey for the period between January 1960 and August 2019. NARDL approach is utilized to find if there is any asymmetric relationship between the variables. Empirical findings indicate that the relationship between the exports and the imports is nonlinear, but the asymmetric association between the series does not exist in the short run. However, estimation results based on the monthly data show that there is a long run asymmetric relationship between the value of exports and the value of imports in Turkey for the relevant time period. When the exports increase by 1%, it results in an increase in the imports by 0.746% in Turkey. But, when the exports decrease by 1%, it decreases the imports by 0.669% in Turkey.

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