

Determinants of Trade Balance for Turkey: ARDL Based Bounds Testing Approach

*Prof.Dr. Özlem Taşseven¹, Prof.Dr. Nüket Saracel, Dr. Öğr. Üyesi Naci Yılmaz
Doğuş University, Doğuş University, Doğuş University*

This paper analyses the determinants of trade balance such as gross domestic product of Turkey, gross domestic product of foreign countries (EU), real exchange rates and oil prices by using quarterly data for the period 1998 and 2018. The model used is ARDL (the autoregressive distributed lag) bound testing approach of cointegration. The outcome of our research is that there is a cointegration relationship between trade balance and its determinants. In the long run absorption approach is validated for Turkey. It is found that the appreciation of real exchange rate and an increase in oil prices reduces the trade deficit in a significant way. In the long run it is found that a 1% increase in gross domestic product of Turkey leads to 4.97 % improvement in trade balance, whereas 1% increase in the gross domestic product of European countries increases trade balance by 0.41 %. It is seen that a 1% appreciation of real exchange rate leads to nearly 0.31 % increase on trade balance. It is seen that a 1% decrease in oil prices leads to 0.65 % increase on trade balance.

Keywords: Trade Balance, ARDL Bounds Testing, Cointegration, J Curve Effect, Marshall Lerner Condition, Turkish Economy.

Jel Classification: C32, F10, F41

Türkiye için Dış Ticaret Belirleyenleri: ARDL Sınır Testi Yaklaşımı

Bu çalışma Türkiye’de 1998–2018 dönemine ilişkin üç aylık veriler kullanılarak ticaret dengesinin belirleyicileri olan Türkiye’nin gayri safi yurtiçi hasılası, AB ülkelerinin gayri safi Yur içi hasılası, reel döviz kuru ve petrol fiyatlarını analiz etmektedir. Kullanılan model eşbütünleşme yönteminin ARDL (ardışık bağlanım) yaklaşımına dayanılarak tahmin edilmiştir. Araştırma sonucunda ticaret dengesi ile belirleyicileri arasında eş bütünleşik bir ilişki olduğu bulunmuştur. Türkiye için uzun dönemde absorbe yaklaşımının geçerli olduğu saptanmıştır. Reel kuru artmasının ve petrol fiyatlarındaki artışın ticaret açığını istatistiksel olarak anlamlı şekilde azalttığı görülmüştür. Uzun dönemde Türkiye’nin reel yurtiçi gelirinde yüzde 1’lik bir artışın ticaret dengesinde yaklaşık yüzde 4.97’lük iyileşmeye, yurtdışı gelirdeki yüzde 1’lik bir artışın ise yüzde 0.41’lik bir iyileşmeye neden olduğu görülmüştür. Reel kurdaki yüzde 1’lik artma yani Türk lirasının değer kaybı, ticaret açığında yüzde 0.31’lik artışa sebep olmuştur. Petrol fiyatlarındaki yüzde 1’lik azalma ise ticaret dengesinde yüzde 0.65’lik bir artışa sebep olduğu görülmüştür.

Anahtar Kelimeler: Ticaret Dengesi, ARDL Sınır Testi, Eşbütünleşme, J Eğrisi Etkisi, Marshall Lerner Koşulu, Türkiye Ekonomisi

¹ Corresponding Author: Özlem Taşseven, Doğuş Üniversitesi, Acıbadem, 34722, Kadıköy İstanbul, Tel: 02164447997/1643, e-mail: otasseven@dogus.edu.tr

Introduction

Trade balance is one of the important problems of Turkish economy. The trade deficit which is the main component of the deficits in current account balance, have been a major subject of research so far. Over the years the deficit in trade balance has been increasing. This led to the sustainability problem of the trade deficit in Turkey. Turkey had to seek foreign debt and/or rely an inflow of foreign direct investment in order to finance these deficits.

The impacts of real exchange rate on a country's trade balance have been examined in the empirical literature in the context of the Marshall Lerner condition and the J-curve theory. Lerner (1944) states that according to Marshall Lerner condition, currency devaluation improves the trade balance only if the sum of the absolute values of import and export demand price elasticities exceeds unity. In the short run J-curve effect occurs and when the real exchange rate decreases, the trade balance improves in the long run. According to the Marshall and Lerner condition, a sufficient condition for a country's trade balance to improve after a depreciation of its currency against to foreign currencies is that the sum of price elasticities of demand for imports and exports should be equal or greater than one. The more substitutes available for the imported goods, the larger the elasticity value is. If imported good is a necessity, the elasticity will be smaller. Over the long run (given more time for adjustment), the elasticity will be larger. The J curve refers to the time flow of the trade balance following currency devaluation (depreciation). The flow traces a path similar to the letter J, that is, after the devaluation, trade balance worsens for a while (due to inelastic import demands) before improving.

On the other hand, the *absorption approach* expands the scope of *elasticity approach* by investigating how domestic expenditure must change compared to domestic income in order for devaluation to be successful in improving the trade balance. When the national income(GDP) contains domestic consumption, investment, government spending and net exports, then absorption includes the sum of domestic consumption, investment, government spending. If the total income exceeds absorption, then the country will export its surplus and the trade balance will be in surplus (Husted and Melvin, 2013; Salvatore, 2011; Seyidoğlu, 2007).

There are many factors affecting the trade balance of a country including domestic and foreign growth as a measurement of demand. The real exchange rate affects the trade balance as well, when the real exchange increases, Turkish products become cheaper for foreigners therefore an increase in exports and a decrease in trade deficit is expected if the country is running a deficit. The oil prices affect the balance based on whether the country is net exporter or importer. Since Turkey is a net importer country, it is expected that the increase in oil prices deteriorates trade balance.

The objective of this paper is to investigate the determinants trade balance for Turkey such as gross domestic product of Turkey, gross domestic product of foreign countries (EU), real exchange rate and oil prices. The existence of cointegration is examined by using bounds testing cointegration approach developed by Pesaran and Shin (1999) and Pesaran, Shin and Smith (2001).

This paper proceeds as follows: Section 2 presents the studies on trade balance in the literature. Section 3 defines methodology and data used in the paper. The results obtained from the estimated models are presented. Finally, section provides concluding remarks.

Overview of the literature on trade balance

Some determinants of the trade balance could be specified based on the empirical studies on trade balance in the literature. The exchange rate policy is one of the most important issues in determination of the trade balance. A decrease in real exchange rate indicates that domestic goods would be cheap to the foreigners in real terms which will stimulate exports. Another factor used in the empirical studies on the determination of the trade balance is the absorption approach of balance of payment. The change in monetary aggregates, oil prices, short term capital inflows and interest rates are the other factors that affect trade balance. In this section the studies on the determinants of trade balance in the literature is presented on Turkish economy and the rest the of the world respectively.

Altıntaş and Çetin (2008) examine the short- and long-run relationships between trade balance, real exchange rates, income and money supply for Turkey by using monthly data for the period 1989-2005. They use the bound testing approach to cointegration within autoregressive distributed lag (ARDL) framework. They conclude that the absorption approach performs better in the case of Turkey. They found that in the long run, a one percent increase in real domestic income leads to a 1.3 percent deteriorates the trade balance, while a percent increase in foreign income improve 0.60 percent in trade balance. Real effective exchange rate and monetary aggregate variables are not found to be statistically significant. They state that the negative and significant effect of real exchange on trade balance in the short-run implies that there is a weak evidence for the J-curve pattern.

Azgun (2011) analyses the relations between the basic macroeconomic variables that determine the budget deficits and current accounts deficits. The author determines the dynamics of the relation between these two deficits via vector-autoregression model using quarterly data between 1989 and 2009. The results of the variance decomposition show that while the shocks of public and private consumption expenditures explain approximately 30% of the estimation error variance of goods and services balance, exchange rate shocks explain 21% and interest rates explain approximately 10% of the estimation error variance of the foreign trade balance. Insel and Kayıkçı (2013) examines the linkage between current account deficits and some quarterly macroeconomic variables in Turkey using the Autoregressive Distributed Lag (ARDL) model between 1987 and 2009. It is found that inflation affects the current account balance positively, whereas growth, openness, oil prices and appreciation of the real exchange rate cause the current account balance negatively. The response for a given shock takes four quarters for the current account balance to return to its long-run equilibrium level. It is seen that the effects of savings, openness, oil prices, and real exchange rate are not significant. It is found that an increase in investment worsens the current account in the short run, depending on the profitability of investment, the current account balance could improve in the long run.

Özmen (2014) investigates external trade dynamics of Turkey and the effect of real exchange rate changes on Turkish trade concentrating on manufacturing industry sectors. He investigates if the determinants of exports, imports and production are invariant to sector factors or not. He finds that the Turkish trade deficits are caused by imports of medium-high and high technology products. It is seen that exports of medium-high and high technology intensity products are found to have higher elasticity compared to low technology products in external real conditions. The effect of real exchange rates on external trade are found to be not invariant to sectoral factors.

Karagöl and Erdoğan (2016) investigates the determinants of the current account deficit using quarterly oil prices, the real effective exchange rate, the real interest rate and Bist100 as explanatory variables for years between 2003-2015 for Turkey. They found cointegration relationship between export-import ratio and its determinants. They concluded that current

account deficit has an inertia in the explanation of current account. The import dependency of exports was found to be significant as well.

Ari and Cergibozan (2017) investigate the trade balance dynamics in Turkey using cointegration test, vector error correction model and impulse response analysis. They use the quarterly ratio of exports to imports, the real effective exchange rate, real domestic income, the real foreign (world) income for the period between 1987 and 2015. They found that in the long run devaluation of the domestic currency improves the trade balance whereas increase in foreign income decreases the trade balance. In the short run based on the vector error correction test results, it is found that the real effective exchange rate has no effect on the trade balance, domestic and foreign income have negative effects. Besides, they found that J-curve hypothesis doesn't hold for Turkey.

Falk (2008) examines the determinants of the trade balance using panel data and regression analysis for 32 industrialized and emerging economies between 1990 and 2007. The trade balance is measured as the difference between the value of country's exports and imports divided by nominal GDP. The independent variables used are the real effective exchange rate index, foreign income measured as weighted average real GDP per capita of the 40 major trading partners, real domestic GDP per capita, the primary balance as a ratio of GDP. Fixed effects model and linear mixed models allowing for random slope coefficients, show that the trade balance as a percentage of GDP is significantly positively related to real foreign GDP per capita of the trading partners. Real domestic GDP per capita affects the trade balance negatively. A real depreciation of the real exchange rate index increases the trade balance. It is found that the effects differ significantly between countries with a positive FDI position and that of a negative or zero FDI position. For countries that have a positive net FDI position, it is seen that the trade balance is less sensitive to movements of the real effective exchange rate index.

Kakar et. al.(2010) examine the short and long-run relationship between the trade balance, income, money supply, and real exchange rate for Pakistan. The determinants of trade balance are analyzed using annual data of gross domestic product, M3 for money supply and real exchange rate between 1970 and 2005. According to the bounds test it is seen that there is a stable long-run relationship between the trade balance and income, money supply, and exchange rate variables. The results show that exchange rate depreciation is positively related to the trade balance in the long and short run, confirming the Marshall Lerner condition. It is also concluded that money supply and income have an important role in determination of the trade balance. The exchange rate variable has a weaker effect when compared to income and monetary aggregate variables.

Gu (2012) conducts aggregate and disaggregate analysis in order to investigate the trade balance of China by using economic, socio-cultural and political indicators between 1984 and 2008. Aggregate analysis involves the estimation of the model between China and the rest of the world. Disaggregate analysis covers the estimation of the model for China and its major trade partners. Bilateral trade data for 12 top trade partners are used. The explanatory variables used in the aggregate analysis are the real effective exchange rate based on the relative unit labor cost, income of China, world income, foreign direct investment inflows. These variables are also used in the disaggregated analysis, additionally relative labor cost per hour between China and its trading partner is utilized. Dynamic ordinary least squares and fully modified ordinary least squares methods are carried out in order to estimate the long run relationship between the trade balance and its determinants. Disaggregate analysis reveals that labor cost and foreign direct investment are important determinants of trade balance for China. Low labor cost has a greater influence than the foreign investment inflows.

Yeshineh (2017) studies both the short-run and long-run relationships of trade balance with the independent variables income, money supply, real exchange rate, budget balance and foreign income in Ethiopia using annual data between 1970 and 2009. The foreign income is calculated as the trade share weighted average GDP of top 20 trading partners of Ethiopia. The bound testing approach of cointegration and error correction model is undertaken in order to investigate whether a long run relationship exists between trade balance and its determinants. The variance decomposition (VDC) and impulse response functions (IRF's) are also used. The author concluded that there is a long run relationship between trade balance and its determinants. The estimated results show that exchange rate appreciation is negatively related to the trade balance in the long-run and short-run consistent to economic theories. The empirical results show that income, budget balance and money supply has a significant role in determining the trade balance in the both long and short run in Ethiopia, exchange rate has less importance in determining the behavior of trade balance. Income, budget balance and money supply have significant impact on trade balance.

Data set and the model used in the analyses

Using a functional representation, the trade balance equation of interest in this paper can be indicated as in Eq. 1 below.

$$tbal = f(lgdgdp, lfgdp, lrer, loil) \quad (1)$$

In the equation (1) the determinants of trade balance are selected as gross domestic product of Turkey, foreign (EU countries) gross domestic product, real exchange rate and oil prices. The data set used in the analyses is quarterly and covers the period 1998Q1 to 2018Q3. The variable to be explained is trade balance of Turkey (tbal). The trade balance is calculated as $[(\log(\text{exports}) - \log(\text{imports}))]$, exports and imports are measured in million U.S.dollars. Exports and imports series are converted into Turkish lira using quarterly USD nominal exchange rate and then divided by domestic producer prices index with 2010 as base year. Exports and imports are obtained from Turksat.

Gross domestic product of Turkey (ldgdp) is converted to real terms by dividing the nominal GDP by domestic producer prices index using 2010 as the base year. Real gross domestic product of EU countries converted to Turkish lira (lfgdp) is obtained from Eurostat website. Another explanatory variable used in estimations is the quarterly real exchange rate. The data is obtained from Bank of International Settlements. CPI based real effective exchange rate index with 2010 as base year is used. The series are measured in logs and represented as lrer in the models. Oil prices (loil) are the Europe Brent Spot Price FOB measured in dollars per barrel. The oil prices are obtained from Federal Reserve Economic Database.

Methodology and empirical results

The bounds testing approach of Pesaran et al. (2001) can be used if the variables are either stationary or integrated of order one. In other words, bounds testing cannot be applied if the order of integration for variables is two or higher. In order to determine the order of integration, Augmented Dickey Fuller (ADF) tests are applied to the levels and the first differences. The numbers in parentheses are the lags used for the ADF (1979, 1981) test, which are augmented up to a maximum of 5 lags. The choice of optimum lag for the ADF test was decided on the basis of minimizing the Schwarz information criterion. The ADF test results are given in tables 1 and 2.

Table 1

ADF Test Results for Levels of Variables

Variables	With trend and intercept		With intercept only	
	Lags	ADF	Lags	ADF
<i>tbal</i>	0	-4.32***	0	-2.46
<i>ldgdp</i>	5	-3.36**	5	0.63
<i>lfgdp</i>	0	-1.89	0	-1.11
<i>lrer</i>	0	-2.23	0	-2.51
<i>loil</i>	0	-2.72	0	-2.47

The critical values for ADF test for the models with trend and intercept are -4.09, -3.47 and -3.16 for 1%, 5% and 10 % levels of significance respectively. The critical values with intercept only are -3.52, -2.90, and -2.58 for 1%, 5% and 10 % levels of significance respectively. Rejection of null hypothesis is shown with * 10 %, ** for 5 % and *** for 1 % level of significance.

The test results given in Table 1 suggest that the null hypothesis of a unit root is rejected for *tbal* at 1 % significance level and for *ldgdp* at 5 % significance level. The results confirm unit root cannot be rejected for *lfgdp*, *ler* and *loil* at all levels of significance. As can be seen from Table 1, null hypothesis of a unit root cannot be rejected for all variables with intercept only case for all levels of significance.

Table 2

ADF Test Results for First Difference of Variables

With intercept only		
Variables	Lags	ADF
<i>dtbal</i>	1	-7.87***
<i>dldgdp</i>	5	-4.79***
<i>dlfgdp</i>	4	-8.06***
<i>dloil</i>	0	-8.97***

The critical values for ADF test for the models with intercept only are -3.52, -2.90, and -2.58 for 1%, 5% and 10 % levels of significance respectively. Rejection of null hypothesis is shown with * for 10 %, ** for 5 % and *** for 1 % significance.

When table 2 is examined, all variables are found to be stationary when their first differences are taken. The letter 'd' shows that the variable is differenced once.

Table 3

Kpss Test Results for Levels Of Variables

With trend and intercept			With intercept only	
Variables	Bandwidth	KPSS	Bandwidth	KPSS
<i>tbal</i>	4	0.069***	5	0.105***
<i>ldgdp</i>	5	0.189***	6	1.219
<i>lfgdp</i>	6	0.182***	0	1.204***
<i>lrer</i>	6	0.183***	6	1.084
<i>loil</i>	6	0.183***	6	0.7982

The critical values for KPSS test for the models with trend and intercept are 0.21, 0.14 and 0.11 for 1%, 5% and 10 % levels of significance respectively. The critical values with intercept only are 0.73, 0.46 and 0.34 for 1%, 5% and 10 % levels of significance respectively. Rejection of null hypothesis is shown with * for 10 %, ** for 5 % and *** for 1 % significance.

The KPSS (1992) unit root results yield some contradictory estimates for variable time series. The test results suggest that the null hypothesis of stationarity can be rejected for all variables with trend and intercept only case at 1 % significance level. As can be seen from Table 3, null hypothesis of stationarity is rejected for *tbal* and *lfgdp* with intercept case at 1 % significance level. When table 4 is examined, all variables with trend and intercept case are found to be integrated order one in levels at different levels of significance, when their first differences are taken.

Table 4

Result of KPSS Test For First Differences of Variables

With trend and intercept			With intercept only	
Variables	Bandwidth	KPSS	Bandwidth	KPSS
<i>dtbal</i>	20	0.126**	20	0.139*
<i>dldgdp</i>	14	0.072*	14	0.180*
<i>dlfgdp</i>	1	0.191***	2	0.215*
<i>dlrer</i>	2	0.279**	3	0.405**
<i>dloil</i>	11	0.056*	10	0.124*

The critical values for KPSS test for the models with trend and intercept are 0.21, 0.14 and 0.11 for 1%, 5% levels of significance respectively. The critical values with intercept only are 0.73, 0.46 and 0.34 for 1%, 5% levels of significance respectively. Rejection of null hypothesis is shown with * for 10 %, ** for 5 % and *** for 1 % significance.

ADF and KPSS unit root tests do not allow the possibility of a structural break. Zivot and Andrews (1992) propose a variation of Perron (1989)'s test in which they assume that the exact time of the break-point is unknown. The null hypothesis states that the variables have a unit root with a structural break in both the intercept and trend. Since all variables depict upward or downward trend, a break in both the intercept and trend is considered.

Table 5

Result of Zivot And Andrews One-Break Test

Variables	Lag	t-statistics	Break year
<i>tbal</i>	1	-5.251**	2010:3
<i>ldgdp</i>	5	-4.398*	2003:3
<i>lfgdp</i>	0	-3.620*	2015:2
<i>lrer</i>	1	-3.210*	2006:4
<i>loil</i>	0	-4.689*	2014:4

The critical values for Zivot and Andrews test are -5.57, -5.08 and -4.82 at 1 %, %, 5 % and 10% levels of significance respectively. * denotes statistical significance at 10% level ** denotes statistical significance at 5% level, *** denotes significance at 1 %.

The results for Zivot and Andrew unit root test are presented in Table 5. The results suggest that the null of unit root for *tbal* could be rejected at 5 % significance; it can be rejected for the rest of the variables at 10 % level of significance. However, it can be argued that data may contain two structural breaks. Lee and Strazicich (2003) state that considering only one break when in fact two are present can result in loss of power of the test. Lee and Strazicich test results assuming two structural break dates are given in Table 6.

Table 6

Result of Lee and Strazicich two breaks test

Variables	Lag	Min t-statistics (tau)	Break years
<i>tbal</i>	7	-4.780***	2001:3 and 2013:2
<i>ldgdp</i>	8	-4.375***	2000:4 and 2009:3
<i>lfgdp</i>	8	-2.436	2004:3 and 2006:3
<i>lrer</i>	7	-1.901	2001:1 and 2002:2
<i>loil</i>	7	-3.925**	2001:1 and 2014:4

The critical values for Lee and Strazicichtest are -4.073, -3.563 and -3.296 at 1 %, %, 5 % and 10% levels of significance respectively. * denotes statistical significance at 10% level ** denotes statistical significance at 5% level, *** denotes significance at 1 %.

Lee and Strazicich unit root tests allow the possibility of two structural breaks which are determined endogenously. The test results given in Table 6 suggest that the null of unit root with breaks for *lfgdp* and *lrer* could not be rejected; it can be rejected for *loil* at 5 % level of significance, for *tbal* and *ldgdp* at 1 % significance. Unit root test results show that the variables are integrated of orders at different levels of significance. As illustrated by Pesaran et al. (2001), bounds testing for cointegration is followed by an analysis of an autoregressive distributed lag model (ARDL) based on Pesaran and Shin (1999). This model allows examining both the short run and long run dynamics. Let us consider the vector error correction model in Eq. (1):

$$\Delta Y_t = \mu + \lambda Y_{t-1} + \sum_{j=1}^{p-1} \gamma_j \Delta Y_{t-j} + \varepsilon_t \quad (2)$$

In Eq. (2), $Y_t = [y_t x_t]'$ is defined as the variable vector in which y_t represents the endogenous variable *tbal*, that is, the trade balance and x_t represents the explanatory variables which are assumed affecting the trade balance including gross domestic product of Turkey, gross domestic product of European countries, real exchange rate and oil prices. The possible cointegration relationship could be written as follows:

$$\Delta y_t = \alpha + \phi y_{t-1} + \delta x_{t-1} + \omega \Delta x_t + \sum_{j=1}^{p-1} \beta_{p,j} \Delta y_{t-j} + \sum_{j=1}^{q-1} \beta_{x,j} \Delta x_{t-j} + \varepsilon_t \quad (3)$$

In Equation (3), ϕ and δ are the long run multiplier coefficients, while Δy_{t-j} and Δx_{t-j} express the short run dynamic structure of error correction model. The bounds testing approach requires the ordinary least squares (OLS) estimation of Equation (3), and then the absence of a long run relationship between the level values of y_t and x_t is tested by use of the F -statistics in line with the below hypotheses:

$$H_0: \phi = 0, \delta = 0, \quad H_1: \phi \neq 0, \delta \neq 0$$

In Eq. (3), the rejection of H_0 hypothesis by the standard F (or Wald) tests leads to the acceptance of H_1 hypothesis and indicates a long run equilibrium relationship between the variables. The statistics such estimated, then are compared with the non-standard distributed asymptotic critical value bounds reported in Pesaran et al. (2001). If estimated F -statistic falls outside of the critical value bounds, we can definitely infer whether or not there exists a cointegrating relationship between the variables, regardless of the order of integration of the variables. In this case, if F -statistic exceeds its respective upper critical values, this means rejection of the null hypothesis of no cointegration between the variables. If F -statistic is found below the lower critical value bounds, we cannot reject non-existence of a cointegrating relationship. If estimated statistic lies between the bounds, we cannot make any conclusive inference as to the existence of a possible cointegrating relationship and need to know the order of integration of the underlying regressors.

In the ARDL model, the null hypothesis of no levels relationship was tested for Equation 3. Testing for cointegration by using Equation 3 requires deciding the optimal lag length first. AIC criterion select the optimal lag length as four. There is no autocorrelation in the residual term for the first four lags. The results of the test according to the four-lag model are given in Table 7. The hypothesis of no long-run relationship is rejected with both 5 and 1 percent significance levels since the F statistic is above the upper bound levels.

Table 7
Results for the Bounds Test for Cointegration

k	F stat	Upper (1%)	Lower (1%)	Upper (5%)	Lower (5%)	Decision
4	6.15	4.92	3.81	3.97	3.05	Cointegration

k is the lag length.

Table 8
Long Run Coefficients (Equation 4)

Dependent Variable: *tbal*

	Coefficient	Standard Error	t-statistics	p-value
<i>tbal</i> _{<i>t-1</i>}	0.487	0.124	3.918	0.0003
<i>tbal</i> _{<i>t-2</i>}	0.175	0.141	1.236	0.222
<i>tbal</i> _{<i>t-3</i>}	-0.454	0.132	-3.260	0.002
<i>tbal</i> _{<i>t-4</i>}	0.167	0.127	1.317	0.193
<i>ldgdp</i> _{<i>t</i>}	0.497	0.113	4.368	0.0001
<i>ldgdp</i> _{<i>t-1</i>}	0.310	0.146	2.120	0.039
<i>ldgdp</i> _{<i>t-2</i>}	0.219	0.132	1.655	0.104
<i>ldgdp</i> _{<i>t-3</i>}	-0.272	0.136	-1.996	0.051
<i>ldgdp</i> _{<i>t-4</i>}	0.255	0.107	2.365	0.022
<i>lfgdp</i> _{<i>t</i>}	0.041	0.055	0.757	0.452
<i>lfgdp</i> _{<i>t-1</i>}	-0.085	0.074	-1.149	0.256
<i>lfgdp</i> _{<i>t-2</i>}	0.130	0.079	1.635	0.108
<i>lfgdp</i> _{<i>t-3</i>}	-0.071	0.075	-0.942	0.350
<i>lfgdp</i> _{<i>t-4</i>}	0.145	0.074	1.958	0.056
<i>loil</i> _{<i>t</i>}	-0.065	0.019	-3.387	0.001
<i>loil</i> _{<i>t-1</i>}	0.020	0.025	0.806	0.424
<i>loil</i> _{<i>t-2</i>}	0.069	0.027	2.538	0.014
<i>loil</i> _{<i>t-3</i>}	-0.122	0.029	-4.125	0.0001
<i>loil</i> _{<i>t-4</i>}	0.078	0.020	3.854	0.0004
<i>lrer</i> _{<i>t</i>}	-0.306	0.101	-3.035	0.003
<i>lrer</i> _{<i>t-1</i>}	0.285	0.104	2.723	0.009
<i>lrer</i> _{<i>t-2</i>}	0.005	0.107	0.054	0.957
<i>lrer</i> _{<i>t-3</i>}	-0.172	0.104	-1.658	0.103
<i>lrer</i> _{<i>t-4</i>}	0.191	0.085	2.232	0.030
s1	-0.012	0.031	-0.405	0.686
s2	0.037	0.040	0.921	0.361
s3	0.082	0.032	2.546	0.014
c	-1.523	2.154	-0.707	0.482
Trend	-0.001	0.002	-0.658	0.513

Once the existence of a potential cointegration relationship between the variables is verified, the next step is to determine the optimal lag length for ARDL model. Following the literature, AIC (Akaike Information Criterion) is used and the lag lengths of the model for long run equilibrium were determined as ARDL (4,4,4,4,4). Three seasonal dummies and a trend term is added as well.

$$tbal_t = c + \alpha_{1i} \sum_{i=1}^4 tbal_{t-i} + \alpha_{2i} \sum_{i=0}^4 ldgdp_{t-i} + \alpha_{3i} \sum_{i=0}^4 lfgdp_{t-i} + \alpha_{4i} \sum_{i=0}^4 lrer_{t-i} + \alpha_{5i} \sum_{i=0}^4 loil_{t-i} + \alpha_{6i} S1 + \alpha_{7i} S2 + \alpha_{8i} S3 + \varepsilon_t \quad (4)$$

Table 9
Diagnostic Checks for the Long Run Model

R-squared	0.879	Mean dependent var	-0.187
Adjusted R-squared	0.807	S.D. dependent var	0.046
S.E. of regression	0.020	Akaike info criterion	-4.671
Sum squared resid	0.019	Schwarz criterion	-3.781
Log likelihood	206.4	Hannan-Quinn criter	-4.315
F-statistic	12.26	Durbin-Watson stat	1.976
Prob(F-statistic)	0.000		

Resulting long run relationship is rearranged in which obtained from the estimation of equation 4 with Ordinary Least Square (OLS) as:

$$tbal_t = 0.497ldgdp + 0.041lfgdp - 0.065loil - 0.306lrer \quad (5)$$

The estimation results reveal that in a long run period satisfying a stationary relationship exists between the determinants of trade balance for Turkey during 1998 and 2018. The findings are in accordance with model expectations. The gross domestic product of Turkey and European Union countries affect the trade balance in a positive and significant way. It is found that the appreciation of real exchange rate and an increase in oil prices reduces the trade deficit in a significant way. A 1% increase in gross domestic product of Turkey leads to 4.97 % improvement in trade balance, whereas 1% increase in the gross domestic product of European countries increases trade balance by 0.41 %. It is seen that a 1% decrease in real exchange rate leads to nearly 0.31 % increase on trade balance. The increase in the value of foreign currency can regarded as an improvement in the trade balance. In that case an increase in real exchange rate could be considered as solution to trade deficit problem. It is seen that a 1% decrease in oil prices leads to 0.65 % increase on trade balance.

The ARDL specification of the short run dynamics can be derived by constructing an error correction model (ECM). All coefficients of short run equation are coefficients relating to the short run dynamics of the model's convergence to the equilibrium and the coefficient of the

error term represents the speed of adjustment. Short-run relationships is estimated by OLS using Equation. An ARDL (3,3,3,3,3) specification is used in which AIC is minimized. Three seasonal dummies are used in order account for seasonality in the data.

$$\Delta tbal_t = c + \alpha_{1i} \sum_{i=1}^3 \Delta tbal_{t-i} + \alpha_{2i} \sum_{i=0}^3 \Delta ldgdp_{t-i} + \alpha_{3i} \sum_{i=0}^3 lf gdp_{t-i} + \alpha_{4i} \sum_{i=0}^3 \Delta lrer_{t-i} + \alpha_{5i} \sum_{i=0}^3 \Delta loil_{t-i} + \alpha_{6i} S1 + \alpha_{7i} S2 + \alpha_{8i} S3 + \delta_1 ECT_{t-1} + \varepsilon_t (6)$$

The short run coefficients of the variables are presented in table 10 for the error correction model.

Table 10
Short Run Coefficients (Equation 3)

Dependent Variable: $\Delta tbal_t$	Coefficient	Std. Error	t-Statistics	p-value
c	-1.525	0.238	-6.385	0.00
$\Delta tbal_{t-1}$	0.111	0.106	1.048	0.29
$\Delta tbal_{t-2}$	0.286	0.106	2.687	0.00
$\Delta tbal_{t-3}$	-0.167	0.100	-1.677	0.10
$\Delta ldgdp_t$	0.497	0.100	4.936	0.00
$\Delta ldgdp_{t-1}$	-0.201	0.106	-1.894	0.06
$\Delta ldgdp_{t-2}$	0.017	0.105	0.166	0.86
$\Delta ldgdp_{t-3}$	-0.255	0.099	-2.573	0.01
$\Delta lf gdp_t$	0.041	0.043	0.959	0.34
$\Delta lf gdp_{t-1}$	-0.205	0.061	-3.341	0.001
$\Delta lf gdp_{t-2}$	-0.074	0.060	-1.241	0.22
$\Delta lf gdp_{t-3}$	-0.145	0.054	-2.682	0.01
$\Delta loil_t$	-0.065	0.016	-4.074	0.00
$\Delta loil_{t-1}$	-0.026	0.017	-1.480	0.14
$\Delta loil_{t-2}$	0.043	0.019	2.289	0.02
$\Delta loil_{t-3}$	-0.078	0.018	-4.309	0.0001
$\Delta lrer_t$	-0.306	0.072	-4.209	0.0001
$\Delta lrer_{t-1}$	-0.024	0.080	-0.306	0.76
$\Delta lrer_{t-2}$	-0.018	0.079	-0.236	0.81
$\Delta lrer_{t-3}$	-0.191	0.062	-3.049	0.00
S1	-0.012	0.028	-0.451	0.65
S2	0.037	0.036	1.024	0.31
S3	0.082	0.029	2.785	0.00
ECT_{t-1}	-0.623	0.097	-6.391	0.00

Table 11
Regression Statistics of the Error Correction Model

R-squared	0.831	Mean dependent var	0.0001
Adjusted R-squared	0.756	S.D. dependent var	0.039
S.E. of regression	0.019	Akaike info criterion	-4.802
Sum squared resid	0.019	Schwarz criterion	-4.066
Log likelihood	206.4	Hannan-Quinn criter	-4.508
F-statistic	11.133	Durbin-Watson stat	1.976
Prob(F-statistic)	0.000		
Heteroskedasticity Test:			
Breusch-Pagan-Godfrey	1.024	Prob(HeteroskedasticityTest: Breusch-Pagan-Godfrey)	0.46
	1.322	Prob(Serial Correlation LM Test)	0.273
Serial Correlation LM Test			

A number of diagnostic tests to the ECM are applied, it is found that there is no evidence of serial correlation, heteroskedasticity and ARCH (Autoregressive Conditional Heteroskedasticity) effect in the disturbances. The model also passes the Jarque-Bera normality test which suggests that the errors are normally distributed. As the results indicate, when the trade balance deviates from its long-run equilibrium level as a response to any shock in the explaining variables, it returns to the equilibrium level quite quickly. The coefficient of the lagged Error Correction Term is -0.623; that is obtained from the relationship found above. This means that after any shock, it takes six months for the trade balance to return to its long-run equilibrium level.

Conclusion

In this paper, the determinants of the Turkish trade balance such as real exchange rate and gross domestic product (national income), gross domestic product of (foreign income) are reviewed together with the additional variable of oil price. The short- and long-run relationships between trade balance and its determinants are analysed for Turkey by using quarterly data for the period 1998-2018. A long run relationship is found to exist between gross domestic product of Turkey, gross domestic product of foreign countries (EU), real exchange rate and oil prices using autoregressive distributed lag (ARDL) bound testing approach. It is found that in the long run the gross domestic product of Turkey and European Union countries affect the trade balance in a positive and significant way, whereas the appreciation of real exchange rate and oil prices reduces the trade balance in a significant way.

In the literature, absorption approach examines the effect of income changes in the process of correcting a trade balance disequilibrium through a change in the exchange rate. In the ARDL

specification of the long run, gross domestic product of Turkey is found to be positive and significantly affecting trade balance implying the validity of absorption approach.

Marshall-Lerner condition indicates that trade balance of a country can improve after a depreciation of domestic currency only when the sum of the price elasticities of the demands for imports and exports of that country is equal or larger than 1. On the other hand, J-curve effect means that there is a temporary deterioration in trade balance before a net improvement in a country's trade balance happen after a depreciation or devaluation. In the ARDL specification of the short run equation it is found that there is negative and significant effect of real exchange on trade balance which implies that there is a weak evidence for the J-curve pattern.

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