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**Article**

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## **An Empirical Evaluation of the Relationship between Trade Openness and External Debt: Turkish Case**

**Özlem Ayvaz Kızılgöl and Evren İpek<sup>®</sup>**

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### **ABSTRACT**

This paper aims to analyze the empirical relationship between trade openness and external debt for the Turkish economy, using quarterly time series data from the 1990:1-2012:2 periods. We utilize the bounds testing procedure to establish the cointegration relationship among variables and the ARDL analysis to detect short run and long run static effects. We support the results from the ARDL model through the application of GMM estimation, achieved with different model definitions. Empirical results indicate that increasing trade openness affects external debt positively in both the short run and long run.

**Key words:** *Foreign Debt, Openness, ARDL, GMM*  
JEL Classifications: F34, F13, C22

### **1. INTRODUCTION**

One of the basic problems of developing countries is the inadequacy of domestic resources for financing economic development. Thus, developing economies' need for external debt has increased gradually over time. Developing and changing economic events have transformed the attribute of external borrowing from an extraordinary financing form to a standard application.

Trade liberalization is an important factor that can improve the debt servicing capacity of an economy, as it may cause an increase in sources of foreign exchanges such as net exports and foreign direct investment. Market accession of developing countries for their products is a basic instrument to reduce their foreign debts by running a trade surplus. The restrictions on overseas market access can impede the indebted countries' efforts to earn the necessary foreign exchange to service their external debt and avoid resorting to unsustainable borrowing. Due to these reasons, the interlinkages between trade openness and external debt in developing countries have to be underlined for the procurement of sustainable solutions for external debt. There are two conflicting arguments regarding to the relationship between trade openness and external debts. The first one supports the inverse relationship between them. Accordingly, trade openness tends to boost economic growth, productivity, and exports, and hence has a positive impact on external debt servicing. The second perspective asserts a positive relationship between trade openness and external debt, proposing that trade taxes are important sources of revenue for developing countries. Trade liberalization policies require the reduction or elimination of imports and exports tariffs and result in a fiscal gap that has to be filled via increased borrowing. The other positive link between trade openness and external

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debt is based on the high dependence of developing countries on commodity exports. This case is connected with the debt problem in two ways. Firstly, world commodity prices have been declining for the last four decades; secondly there are sharp fluctuations in commodity prices that increase the uncertainty in the income stream of a country (Zafar and Butt, 2008:3-4).

In empirical literature, there are some studies that have offered supporting evidence for the positive relationship between trade openness and foreign debt. Lane (2000) empirically examined the determinants of external debt for 87 developing countries using data over the 1970-1995 period. He repeated his analysis with both cross-sectional and panel-data related from this period, and the results indicate that trade openness has a positive effect on external debt. Colombo and Longoni (2009) investigated the determinants of external debt for 61 developing countries, including Turkey, applying pooled OLS, fixed effects and GMM methods in an empirical analysis of the 1970-2001 era. Outcomes from all analytical techniques confirm a positive relationship of trade openness to external debt. Zakaria (2012) analyzed the effects of openness on foreign debt for Pakistan by using quarterly data related to the 1972-2010 period, following GMM methodology and estimating different model definitions. Results of the study showed that increasing trade openness raised external debt in the Pakistan economy. Hossain and Mitra (2012) evaluated the dynamic relations between trade openness, foreign aid, domestic investment, external debt, government spending, and economic growth for 33 African countries that are highly dependent on foreign aid, using panel data for the 1974-2009 periods. Granger causality results point out a unidirectional causality for the relationship between trade openness and external debt.

A key observation pointed out from the literature review is the lack of studies about the effects of trade openness on external debt for the Turkish economy. This gap in the empirical literature has been a major factor in motivating us to begin this study. This paper conducts an empirical analysis of the effects of trade openness on external debt for the Turkish economy by using quarterly data from the 1990:1-2012:2 periods, utilizing the bound test, ARDL analysis, and GMM methods. The upcoming sections of this study are organized as follows: in the second part of the study, the external debt problem in the Turkish economy is examined. In the third part, the methodology of bound testing, ARDL model, and GMM is introduced. The fourth part involves information about the data set and variables; moreover, the possible effects of the explanatory variables in the models are discussed. The fifth part interprets the empirical results from the ARDL and GMM analyses, and the last section presents the conclusion of the study.

## **2. EXTERNAL DEBT AND TRADE OPENNESS IN THE TURKISH ECONOMY**

### **2.1. External Debt**

External Debt Statistics Working Group, founded in 1984 by International Monetary Fund (IMF), Bank for International Settlements (BIS), World Bank (WB), and Organization for Economic Cooperation and Development (OECD), has provided a general definition of external debt in 1988 (Klein, 1994:56). Accordingly, gross external debts are the volume of principal repayments (with or without interest payments) or interest payments (with or without principal payments) that the residents of a country assume obligations to nonresidents depending on a contract at a given time. Gross external debt is the sum of liabilities. Net external debt is the difference between assets and liabilities. External borrowing, defined as the revenue generated by a state or a public authority from external resources, is used

intensively by developing countries in order to sustain the process of economic development (Bilginoğlu and Aysu, 2008:3).

The reasons behind external borrowing by developing and less developed countries can be listed as follows (Çöğürçü and Çoban, 2011:135; Bilginoğlu and Aysu, 2008:3; Adıyaman, 2006:22-23; Evgin, 2000:2-3; Türk, 1992:306).

- Inadequate domestic borrowing due to under developed capital markets.
- For financing big scaled investments that are effective in initiating and sustaining the process of economic development.
- To meet the required demand of foreign currency for the import of raw materials, and intermediate and capital goods.
- To overcome the balance of payments deficits.
- In cases when expenses due to extraordinary circumstances (natural disasters, war, crisis periods, etc.) can not be met by the government budget.
- For financing increased defense expenditure.
- To finance chronic budget deficits.
- To maintain price stability.
- For the payment of overdue debts.
- To increase national income.
- For expansion of employment.
- For re-distribution of income.
- To ensure balanced regional development.
- In the case of a savings gap.
- To provide social protection and a balanced economy.
- For ensuring efficiency in the allocation and use of resources.
- When the state is in need of reserves to protect the value of the national currency.

In an open economy total savings, which finance investment, equal to the sum of domestic and foreign savings. Reaching the planned growth rate becomes impossible when domestic savings are not enough to finance investment. In this situation increasing total savings via external borrowing enables investment and thus economic growth (Çöğürçü and Çoban, 2011:136). The most important macro-economic problem in an open economy is the conflicts

between internal and external balances that the government has to reconcile. Internal balance refers to a full employment level or an inflation rate of zero (or close to zero). External balance refers to ensuring a balance of current account or a sustainable external deficit (Arı, 2001:11).

Current account deficit is a permanent problem for the Turkish economy except in periods of economic recession and crisis. In the past, Turkey struggled to reach economic development and growth targets due to a lack of capital with inadequate domestic savings, which necessitated the use of external sources in order to finance growth. Compounded by insufficient levels of foreign direct investment, the current account deficit increased the need for external borrowing (Sarı, 2004:62; Çöğürçü and Çoban, 2011:133). In mid-1980s expanding foreign debt services created a considerable pressure on budget. As a result, domestic borrowing became a frequently used option for financing external debt, and high real interest rates aggravated the conditions. Debt payments became the most important factor in government budget planning after the end of 1980s (Sarı, 2004:50). This era is renowned as the period of liberalization by the IMF, which insisted on transitioning to market economy and opening up trade and capital markets. The IMF used external credit as a means of pressure for this purpose. Turkey accepted IMF's conditions in 1980 and initiated a structural transformation of the economy (Arı, 2001:73). Trade liberalization was followed by the liberalization of financial markets and allowing the free movement of capital (Arı, 2001:74). Policies resulting in the appreciation of the TL were carried out in a conscious way even in periods of large trade and current account deficits (Sarı, 2004:54). The economic crisis in the beginning of 2000's caused the largest external borrowing from IMF in history. Since then, the need for external borrowing has continued, because economic programs after the 2000s have not caused a considerable change in the economic structure established since the 1980s (Sarı, 2004:60). The external debt that was 16,2 billion dollars in the end of 1980, increased to 52,4 billion dollars in 1990; 118,6 billion dollars in the end of 2000; 292 billion dollars in the end of 2010, and finally 322 billion dollars in the second quarter of 2012 ([www.tcmb.gov.tr](http://www.tcmb.gov.tr)).

Although there are several criteria related to heavily indebtedness, World Bank uses four criteria to determine whether a country is heavily indebted. These are: Total External Debt/GNI<sup>1</sup>, Total External Debt/Export, Total External Debt Service/Export and Total External Debt Interest Service/Export. Accordingly, if three of these criteria exceed the heavily indebtedness level defined by World Bank, the country is accepted as heavily indebted (Sarı, 2004:72).

The values of the four indebtedness criteria for the Turkish economy and the heavily indebtedness levels defined by World Bank are represented in Table 2.1 and Table 2.2. As Table 2.1 depicts, Turkey was a heavily indebted country in the first half of the 1990s according to the Total External Debt/ Export, Total External Debt Service/ Export, Total External Debt Interest Service/ Export criteria. Similarly in 1994 (a year of crisis for the Turkish economy) and in 1999 (the economy suffered the shock of a big earthquake that hit the country in this year), Turkey exceeded the heavily indebtedness limits for the first three criteria.

According to Table 2.2, Turkey falls in the group of heavily indebted countries between 2001-2002 according to the Total External Debt/GNI criterion, in the 2000-2003 periods according to the Total External Debt/Export criterion, and in the 2000-2001 periods according to the

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<sup>1</sup> "External Debt" is gross value, and it is the sum of public sector, central bank, and private sector ([www.hazine.gov.tr](http://www.hazine.gov.tr))

Total External Debt Interest Service/Export criterion. Lastly, the Total External Debt Service/Export ratio indicates that the Turkish economy has exceeded the heavily indebtedness limits since 2000. It should be noted, however, that an economy's ability to finance external debt payments is determined in part by its export capacity and ability. Briefly, while a high external debt service/ export ratio reveals the heavily indebtedness of Turkey, the ratio also indicates a high capacity and ability for debt payment (Karagöl, 2010:25). As mentioned before, if three of these criteria exceeds the heavily indebtedness limits, this country is accepted as heavily indebted. Given this expression, it can be said that Turkey is in the category of heavily indebted countries in 2000, 2001 and 2002 years. Additionally, although the heavily indebtedness limit is not exceeded in the global financial crisis year of 2009, the increase in the external debt indicators is highly remarkable.

Years	Total External Debt	Total External Debt	Total External Debt Service	Total External Debt
	GNI	Export	Export	Interest Service Export
1990	32,2	376,4	55,2	27,8
1991	34,0	369,4	55,3	25,3
1992	35,0	373,3	57,2	23,4
1993	38,0	431,4	52,1	23,3
1994	50,1	362,3	51,4	21,7
1995	42,6	338,0	40,2	19,9
1996	43,3	342,8	49,1	13,1
1997	44,1	323,2	47,2	14,3
1998	46,9	359,2	61,2	15,7
1999	54,9	382,8	68,8	18,9
<b>Moderately Indebtedness Limit</b>	30-50	165-275	18-30	12-20
<b>Heavily Indebtedness Limit</b>	>50	>275	>30	>20

**Table 2.1** Limits to External Debt (1990-1999)

Years	Total External Debt	Total External Debt	Total External Debt Service	Total External Debt
	GNI	Export	Export	Interest Service Export
2000	44,70	427,8	79,0	22,7
2001	57,7	363,5	78,6	22,8
2002	56,2	359,2	80,2	17,8
2003	47,3	304,9	58,9	14,8
2004	41,2	254,8	48,3	11,3
2005	35,3	231,0	50,1	10,9
2006	39,4	242,7	46,8	10,9
2007	38,4	232,5	45,4	10,1
2008	37,4	210,3	40,4	8,9
2009	43,9	265,5	56,5	10,1
2010	39,5	254,7	48,6	7,3
2011	39,7	235,2	38,4	6,1
<b>Moderately Indebtedness Limit</b>	30-50	165-275	18-30	12-20
<b>Heavily Indebtedness Limit</b>	>50	>275	>30	>20

**Table 2.2** Limits to External Debt (2000-2011)

## **2.2. Trade Openness**

Globalization, the most popular concept of recent times, started with trade liberalization. Trade globalization refers to the development of free trade and increased interdependence and similarity among different countries. The globalization process has caused a dual economic structure in some countries and, at the same time, globalization has increased the development gap between the developed and developing countries (Uzun et al., 2011:126).

The concept of openness in economics is a controversial one in two ways. First, a uniformly agreed theoretical definition of openness does not exist. Second, there is no generally accepted measure of openness. Studies on the theory and practice of international economics have used different definitions and measurement methods (Arı, 2001:2). Trade openness, as a result or a reflection of trade liberalization, is an indicator of the strictness of a country's trade policies (Saçık, 2009:526). Furthermore, it is defined as the absence of barriers to international trade (Edwards, 1998:384). The identification of a country's openness depends on its openness to trade and factor flows. Trade flows include goods and services, while factor flows include capital and labor (Arı, 2001:2). According to Harrison (1995:2), trade openness is synonymous with the concept of neutrality. Neutrality is the position in which entrepreneurs are impartial between saving a unit of foreign exchange through import substitution and earning a unit of foreign exchange through export. Openness is a concept that is used to explain to what extent the countries are integrated with others, and whether inward or outward-oriented economic policies are applied intensively. Implementation of an open economic policy is possible with liberalization of trade and financial policies (Saçık, 2009:526). Rruka (2004:8) defines liberalization as smoothing the protection walls on export and import; and bringing foreign investment and competition into the economy. According to Thirlwall, however, trade liberalization is more than the smoothing of protection walls, and it requires the elimination of all barriers against exports and imports. Thus it can be said that a country's degree of liberalization is an indicator of its openness. Trade openness indicators are used to denote a country's level of integration or globalization (Saçık, 2009:526). Various trade openness measures have been used by researchers; the most commonly used method is calculating trade shares, obtained by proportioning the sum of export and import to GDP (Saçık, 2009:536).

The foreign trade volume of Turkey has increased considerably since the first half of the 1980s. The 1994 and 2001 crises had profound impacts on the country's trade balance. Trade deficits seemed to decrease in these crisis years due to sudden declines in the volume of imports. Foreign trade volume reached remarkable amounts after the 2001 crisis, reaching 392 billion dollars in 2012. Alongside considerable increases in the volume of trade, foreign trade deficits increased rapidly since the 2001 crisis. The enormous rise in Turkey's foreign trade deficits, which reached 89 and 65 billion dollars in 2011 and 2012, respectively, raise grave concerns about the sustainability of these deficits. Although Turkey's exports have been growing rapidly, increases in imports are continue to grow at a much faster rate, due to its high dependence on imports of intermediate and capital goods (Utkulu and Aydemir, 2008:9).

## **3. METHODOLOGY**

A review of the empirical literature up-to-date demonstrates that the Engle-Granger (1987), Johansen (1988), and Johansen-Juselius (1990) tests are the most widely utilized tests to detect long run relationships between variables. Nevertheless, these methods require all variables in the model to be integrated when they are first differenced and do not allow

integration in levels (Taşçı et al., 2009:109). The bound test, which is developed by Pesaran et al. (2001), makes it possible to utilize cointegration analysis with variables stationary in levels or stationary in different levels. However, in bound testing the integration level of series should be I(0) or I(1); none of the variables can be I(2) (Bolat et al., 2011:355). If the variables are I(2), the estimates with I(2) variables give misleading results, because F statistics that are calculated by Pesaran et al. (2001) are invalid if the variables are I(2) (Başar et al., 2009:304). The first step of the bound test is to estimate a UECM (Unrestricted Error Correction Model) using (3.1). In the second step, the collective significance of the coefficients of one lagged dependent and independent variables are tested by Wald Test. In order to determine the existence of the cointegration relationship, the calculated test statistic is compared with critical values from Pesaran et al. (2001:300-301). If the calculated F statistic is larger than critical values, the null hypothesis H(0) with no cointegration relationship is rejected (Altıntaş and Ayriçay, 2010:83). Optimal lag selection is an important stage in bound testing. The lag that provides minimum Akaike and/ or Schwarz criteria and at the same time does not cause an autocorrelation problem is accepted as optimum (Karagöl et al., 2007:76).

$$\Delta Y_t = \beta_0 + \sum_{i=1}^m \beta_{1i} \Delta Y_{t-i} + \sum_{i=0}^m \beta_{2i} \Delta X_{t-i} + \beta_3 Y_{t-1} + \beta_4 X_{t-1} + \varepsilon_t \quad (3.1)$$

$$Y_t = \beta_0 + \sum_{i=1}^p \beta_1 Y_{t-i} + \sum_{i=0}^q \beta_2 X_{t-i} + e_t \quad (3.2)$$

$$\Delta Y_t = \beta_0 + \beta_1 ECT_{t-1} + \sum_{i=1}^p \beta_2 \Delta Y_{t-i} + \sum_{i=0}^q \beta_3 \Delta X_{t-i} + u_t \quad (3.3)$$

Following the bound test procedure, the long run and short run relations between variables are investigated by the ARDL (Autoregressive Distributed Lag) model. In the ARDL model in (3.2), the dependent variable is estimated by its lagged values and the lagged values of its explanatory variables. Optimal lag length is determined separately for each explanatory variable. The long run relations among variables are interpreted through an examination of the long run coefficients that are calculated from the estimated ARDL model and by their statistical significance (Yamak and Tanrıöver, 2007:7). The short run relations between variables are detected by an error correction model that is based on the ARDL model using (3.3). In the error correction model, the first difference of the dependent variable is estimated with the lagged values of the first differenced dependent and independent variables. This model also involves a one lagged error term, which is obtained from the ARDL model. This variable is named as the error correction term, and it is expected to be negative and significant; if so, the cointegration relationship between variables is supported. The error correction term indicates how long it will take to get better if there is a deviation in the long run relationship because of any shocks (Keskin, 2008:228).

This study uses the GMM (Generalized Method of Moments), which was first presented in an important paper of Hansen (1982) and later developed by Arellano and Bond (1991). Several standard estimators including the instrumental variable method and the OLS are special conditions of GMM (Çamlica, 2010:50). The advantage of GMM is that it allows formulating models and specific estimators without the need for strong distribution assumptions (Greene, 2002). The stationarity of variables and existence of the required moment conditions for estimation are enough for GMM (Şahin and Genç; 2009:112). When the GMM method is utilized, the estimators will be extremely strong and robust (Gözcör and Pişkin, 2011:130), because the GMM method controls the problem of endogeneity in explanatory variables. OLS gives biased and inconsistent estimates when a lagged value of the dependent variable is used



as an explanatory variable in order to resolve the problem of endogeneity (Ildikó and Altăr, 2008:38; Baltagi, 2001; Kien and Heo, 2009:94). The originality of Hansen's study is that it indicates how to make a selection among estimators by allowing for autocorrelation, multicollinearity, and nonlinear situations (Wooldridge, 2001:91). The advantage of GMM is that it allows over-identification in the estimation of the parameters of the model. In case of over-identification, the general perspective is to use a Two Stage OLS method, but if there is autocorrelation, the GMM estimator is more consistent.

#### 4. MODEL AND DATA SET

This section introduces the external debt model that will be estimated in the empirical analysis. The explanatory variables of external debt are determined as trade openness, terms of trade, budget deficit, foreign exchange reserves, foreign direct investment, and inflation. Identification of the independent variables is based on the previous studies related to the topic. The variables and their definitions are as shown in Table 4.3.

<b>Variables</b>	<b>Symbols</b>	<b>Definitions</b>
External Debt	ED	External Debt/GDP
Trade Openness	TO	(Export +Import)/ GDP
Terms of Trade	TT	Export Prices/ Import Prices
Budget Deficit	BD	Budget Deficit/ GDP
Foreign Direct Investment	FDI	FDI/GDP
Foreign Exchange Reserves	R	Foreign Exchange Reserves
Inflation	INF	Growth Rate of Consumer Price Index

**Table 4.3** Definition of Variables

This paper uses quarterly data for the 1990:1-2012:2 periods. Data related to external debt (million \$), export (million \$), import (million \$), budget deficit (thousand TL), and foreign direct investment (million \$) are obtained from the Central Bank of the Republic of Turkey (CBRT). Data on Consumer Price Index (base year 2005), export prices, import prices, GDP (million \$), and foreign exchange reserves (million SDR) are taken from International Financial Statistics (IFS). Budget deficit is calculated as the difference between central budget revenue and central budget expenditure. The data, which is monthly, is transformed into quarterly data by averaging and then converted to million dollars using exchange rate data that is taken from CBRT. And lastly, the generated data is proportioned to GDP.

The reasons for the inclusion of each independent variable into the model can be explained as follows:

- Trade openness can affect external debt both positively and negatively. If earnings from exports exceed import bills after trade liberalization, trade openness affects external debt negatively, while the effect is positive in the opposite situation. Since the increase in imports is faster than the increase in exports in developing countries that underwent trade liberalization, the coefficient of trade openness is expected to have a positive sign (Zakaria, 2012:165).
- The terms of trade is the ratio of exported goods price index to imported goods price index. A decrease in terms of trade expresses a decrease in the competitiveness of the country and leads to reduction in exports and hence an increase in external debt burden. Since empirical evidence from previous studies shows that developing countries have had deteriorated terms of trade for so many years, this variable's effect

on external debt is assumed to be positive (Gürbüz and Çekerol, 2002:32; Zakaria, 2012:165).

- If a country's public revenues do not compensate its spending, a budget deficit occurs, and this deficit is financed by incurring increased external debt when increasing revenues or decreasing expenditures are not possible through other means. Budget deficits are generally financed by internal borrowing in developed countries, while the developing countries resort to both external and internal borrowing (Demir and Sever; 2009:12). As a result, increasing deficits cause external debt to rise gradually (Gül and Ünlü, 2006:235). Thus this variable is expected to affect external debt positively.
- Increasing foreign exchange reserves cause external borrowing demand to decrease. For this reason reserves are considered to affect external debt negatively.
- Foreign direct investment affects balance of payment and capital stocks positively, and by providing foreign exchange, foreign direct investment contributes to a decrease in the external debt of the host country.
- An increase in inflation causes exports to decrease and, consequently, the trade deficit to increase. Moreover, inflation decreases the real value of public revenue and exacerbates the budget deficit. As a result, government turns to external borrowing in order to close the trade and budget deficits. On the other hand, national currency depreciates if there is inflation, increasing the nominal value of external debt, expressed in national currency. Hence, inflations' impact on external debt is expected to be positive.

## **5. EMPIRICAL RESULTS**

### **5.1. Estimation Results from ARDL Model**

The stationarity of the variables is examined by four unit root tests, namely Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiatkowski-Phillips-Schmidt-Shin (KPSS), and Ng-Perron tests. Table 5.4 contains the results from these unit root tests. In bound test procedure, unlike the traditional cointegration analysis, variables are allowed to be stationary in levels or integrated in different levels. However, variables cannot be I(2), which will hinder the reliability of results. There are no obstacles in applying the bound test to the related variables in this study as results from unit root tests indicate that none of the variables are I(2). In the UECM, external debt is estimated with four explanatory variables, namely trade openness, reserves, foreign direct investment, and inflation. In the first step of the bound test, optimum lag length is selected for UECM. In this stage, Akaike Information Criteria (AIC) is considered, and "8 lag" is selected as optimal since it minimizes AIC and does not include an autocorrelation problem. The results related to optimal lag selection are represented in Table 5.5. The UECM is estimated with 8 lag and Wald test is employed to one lagged dependent and independent variables. The calculated F statistics from Wald test is "6.0319". Since this statistics exceeds the lower and upper critical values that are calculated by Pesaran et al. (2001), the null hypothesis of no cointegration relationship is rejected. Results from bound test support a cointegration relationship between the variables in question.

	ED	TO	TT	BD	R	FDI	INF	
<b>ADF</b>	Level	-3.346(8) <sup>c</sup>	-3.889(8) <sup>b</sup>	-4.536(8) <sup>b</sup>	-2.216(3) <sup>c</sup>	2.869(0) <sup>a</sup>	-2.169(3) <sup>c</sup>	-4.713(1) <sup>b</sup>
		[-3.513]	[-4.075]	[-4.075]	[-3.508]	[-2.591]	[-3.508]	[-4.067]
		[-2.898]	[-3.466]	[-3.466]	[-2.896]	[-1.944]	[-2.896]	[-3.462]
		[-2.586]	[-3.160]	[-3.160]	[-2.585]	[-1.614]	[-2.585]	[-3.157]
1st Difference				-8.031(3) <sup>a</sup>		-10.817(2) <sup>a</sup>		
				-2.592		-2.592		
				-1.945		-1.945		
				-1.614		-1.614		
<b>PP</b>	Level	-4.717(7) <sup>c</sup>	-5.614(3) <sup>b</sup>	-4.042(2) <sup>b</sup>	-6.337(3) <sup>c</sup>	2.734(1) <sup>a</sup>	-6.942(1) <sup>c</sup>	-7.987(4) <sup>b</sup>
		[-3.506]	[-4.064]	[-4.064]	[-3.506]	[-2.591]	[-3.506]	[-4.066]
		[-2.894]	[-3.461]	[-3.461]	[-2.894]	[-1.944]	[-2.894]	[-3.462]
		[-2.584]	[-3.157]	[-3.157]	[-2.584]	[-1.614]	[-2.584]	[-3.157]
<b>KPSS</b>	Level	0.117(6) <sup>c</sup>	0.059(5) <sup>b</sup>	0.053(6) <sup>b</sup>	0.239(5) <sup>b</sup>	0.214(7) <sup>b</sup>	1.185(4) <sup>c</sup>	0.174(5) <sup>b</sup>
		[0.739]	[0.216]	[0.216]	[0.216]	[0.216]	[0.739]	[0.216]
		[0.463]	[0.146]	[0.146]	[0.146]	[0.146]	[0.463]	[0.146]
		[0.347]	[0.119]	[0.119]	[0.119]	[0.119]	[0.347]	[0.119]
1st Difference				0.111(8) <sup>c</sup>		0.074(8) <sup>c</sup>		
				[0.739]		[0.739]		
				[0.463]		[0.463]		
				[0.347]		[0.347]		
<b>NG-PERRON</b>	$MZ_t$	Level	Level	Level	Level	Level	Level	
		-29.591*(7) <sup>c</sup>	-30.893*(3) <sup>b</sup>	-19.271**(2) <sup>b</sup>	-33.263*(3) <sup>c</sup>	-3.978(1) <sup>b</sup>	-30.071*(1) <sup>c</sup>	-52.251*(4) <sup>b</sup>
	$MZ_{it}$	Level	Level	Level	Level	Level	Level	Level
		-3.846*(7) <sup>c</sup>	-3.903*(3) <sup>b</sup>	-3.089**(2) <sup>b</sup>	-4.064*(3) <sup>c</sup>	-1.325(1) <sup>b</sup>	-3.876*(1) <sup>c</sup>	-5.111*(4) <sup>b</sup>
	MSB	Level	Level	Level	Level	Level	Level	Level
		0.130*(7) <sup>c</sup>	0.126*(3) <sup>b</sup>	0.160**(2) <sup>b</sup>	0.122*(3) <sup>c</sup>	0.333(1) <sup>b</sup>	0.129*(1) <sup>c</sup>	0.098*(4) <sup>b</sup>
	MPT	Level	Level	Level	Level	Level	Level	Level
		0.829*(7) <sup>c</sup>	3.109*(3) <sup>b</sup>	4.823**(2) <sup>b</sup>	0.778*(3) <sup>c</sup>	21.907(1) <sup>b</sup>	0.819*(1) <sup>c</sup>	1.745*(4) <sup>b</sup>
					1st Difference			
					-43.258*(1) <sup>b</sup>			
					1st Difference			
					-4.619*(1) <sup>b</sup>			
				1st Difference				
				0.107*(1) <sup>b</sup>				
				1st Difference				
				2.274*(1) <sup>b</sup>				
<b>Decision</b>	I (0)	I (0)	I (0)	I (1)	I (0)	I (1)	I (0)	

**Table 5.4** Unit Root Test Results

Notes: The numbers in parentheses "(.)" are the lag lengths that are determined by AIC in ADF test. Bartlett Kernell estimation method is used in PP, KPSS ve NG-Perron tests, bandwidth is determined as Newey-West. The numbers in parentheses "[.]" are critical values. a:denotes that regression does not involve constant term or trend; b: denotes regression involves both constant term and trend; c: denotes regression involves constant term. \*, \*\*, indicates 1% and 5% significance level.

Lag Length	Akaike	Schwarz	$\chi^2_{BREUSCH-GODFREY}$ (4)
1	-0.7107	-0.2855*	5.5965 (0.23)
2	-0.8001	-0.2293	3.7535 (0.44)
3	-0.6948	0.0236	6.4443 (0.16)
4	-0.5905	0.2776	16.6203 (0.00)
5	-0.6315	0.3885	14.0285 (0.01)
6	-0.7398	0.4342	20.0173 (0.00)
7	-0.8071	0.5231	11.7544 (0.02)
8	-1.0586*	0.4302	2.4042 (0.66)

**Table 5.5** Optimal Lag Selection for Bound Test

Note:  $\chi^2_{BREUSCH-GODFREY}$  is autocorrelation test statistics. The numbers in parentheses are probability values. \* denotes the selected lag length.

Critical Values ( 5% Significance Level)			
k	F Statistic	Lower Level	Upper Level
4	6.0319	2.86	4.01

**Table 5.6** Bound Test Results

Notes: k denotes the number of independent variables in the model. Critical values are taken from Table C1(iii) in Pesaran et al. (2001:300).

Variables	Coefficients	t- statistics
ED (-1)	0.8165	8.2114*
ED (-2)	-0.2843	-2.2562**
ED(-3)	0.2574	3.3970*
TO	3.3619	7.6728*
TO (-1)	-1.8588	-3.1349*
TO(-2)	-0.9478	-1.6397***
R	-0.1104	-1.0931
R (-1)	-0.6885	-0.4721
R (-2)	0.3981	0.2747
R (-3)	0.1410	1.3762
FDI	-15.1246	-0.5795
FDI(-1)	22.4573	0.8359
FDI(-2)	-40.6461	-1.2801
FDI(-3)	-58.5243	-1.8401***
INF	1.2076	3.6380*
Diagnostic Test Results		
$R^2=0.86$ $\bar{R}^2=0.83$ $\chi^2_{BG}=2.98(0.56)$ $(0.28)$ $\chi^2_{WHITE}=0.92$ $(0.34)$		

Variables	Long Run Coefficients	Coefficient	t- statistics
TO		2.6389	1.9667**
R		0.7486	0.057151
FDI		-436.4600	-1.5375
INF		5.7390	2.6887*

**Table 5.7** Estimation Results from ARDL (3,2,3,3,0).

Notes: \*, \*\*, \*\*\* indicates respectively 1% significance level, 5% significance level and 10% significance level.  $\chi^2_{BG}$  and  $\chi^2_{WHITE}$  are autocorrelation and heteroscedasticity statistics. The numbers in parentheses are probability values.

The following stage is ARDL analysis. For optimal lag selection AIC is taken into account again, and the optimal lag length is determined as 3 for external debt, 2 for trade openness, 3

for reserves, 3 for foreign direct investment, and 0 for inflation. Thus the estimated model is ARDL(3,2,3,3,0). The results related to estimated ARDL model is represented in Table 5.7. Long run coefficients from the estimation of ARDL(3,2,3,3,0) show that trade openness and inflation have significant and positive long run effects on external debt. The long run effects of other variables are insignificant. The error correction model obtained from ARDL(3,2,3,3,0) model provides knowledge about the short run effects of variables on external debt. Table 5.8 contains the estimation results from the error correction model. The results demonstrate that the short run effects of trade openness and inflation on external debt is significantly positive, in parallel to the long run effects. Moreover, the results indicate that an increase in reserves causes a decrease in external debt, while an increase in foreign direct investment causes an increase in external debt. Additionally, it is detected that the error correction term's coefficient is significantly negative; this evidence both gives support to the cointegration relationship between variables and shows that 21% of the bias from the long run path is removed in a quarter.

Variables	Coefficients	t- statistics
DED (-1)	0.0269	0.3078
DED (-2)	-0.2574	-3.3970*
DTO	3.3619	7.6728*
DTO (-1)	0.9478	1.6397***
DR	-0.1104	-1.0931
DR (-1)	-0.1808	-1.8283***
DR (-2)	-0.1410	-1.3762
DFDI	-15.1246	-0.5795
DFDI(-1)	99.1704	2.3791**
DFDI(-2)	58.5243	1.8401***
DINF	1.2076	3.6380*
ECT(-1)	-0.2104	-3.2002*

**Table 5.8** Estimation Results from Error Correction Model.

Notes: Dependent variable is "external debt". \*, \*\*, \*\*\* indicates respectively 1% significance level, 5% significance level and 10% significance level.

## 5.2. Estimation Results from GMM

To estimate our model we cannot apply least square method as the potential endogeneity of the variables can render the least square estimators biased and inconsistent. Therefore, we have applied the GMM estimation technique to estimate the foreign debt equation. The GMM estimators control for the potential endogeneity of the lagged dependent variable and for the potential endogeneity of other explanatory variables in the model. In this stage, nine different models are estimated by GMM. The results derived from GMM analysis are reported in Table 5.9. The instrumental variables in the models are the lagged values of the variables. In the first model, the effect of trade openness, terms of trade, budget deficit, reserves, foreign direct investment, and inflation on external debt is examined. Other models are for being able to see the effects of variables in question more clearly. These models, in which trade openness is always included as an independent variable, are formed by different combinations of explanatory variables. Trade openness has a significantly positive effect on external debt in all models. Furthermore, the coefficients of trade openness are significant at 1% level. In the first model, which includes all independent variables, demonstrates that a one unit increase in trade openness increases external debt by 3.73 units. The effect of terms of trade is also positive and significant at 1% level. In the first model, a one unit increase in terms of trade increases external debt by 5.22 units. The coefficients of budget deficit are not found to be significant. Foreign exchange reserves' effect on external debt is insignificant in the first and

the last model, while in the fifth and eighth model its effect on external debt is significantly negative. Empirical results depict an inverse relationship between foreign exchange reserves and external debt. The coefficient of foreign direct investment is negative and significant in all models other than the eighth model. In the first model, a one unit increase in foreign direct investment results in a decrease in external debt by 52.19 units. The coefficient of inflation is significant in the models other than the first one. Results denote the decreasing effect of inflation on external debt, but the expected sign of this variable is positive. The estimation results related to the inflation variable do not meet expectations. Autoregressive process AR(1) is included in the models in order to eliminate the autocorrelation problem (Adewuyi and Akpokodje, 2010:429). According to the Durbin-Watson test there is no autocorrelation in the estimated models.

	1	2	3	4	5	6	7	8	9
<b>Constant</b>	-5.388 (-2.773)*	0.486 (2.664)*	-5.194 (-5.257)*	0.191 (0.703)	0.956 (4.472)*	0.557 (3.097)*	-0.573 (-1.172)	1.009 (5.252)*	-5.782 (-4.226)*
<b>TO</b>	3.730 (4.512)*	3.022 (7.116)*	4.053 (7.991)*	3.842 (5.372)*	2.889 (5.213)*	2.713 (6.260)*	5.715 (5.943)*	3.698 (4.111)*	3.811 (6.357)*
<b>TT</b>	5.220 (3.226)*		5.240 (5.269)*						5.562 (4.641)*
<b>BD</b>	1.208 (0.374)			3.822 (1.448)					
<b>R</b>	8.49E-06 (0.652)				-1.40E- (-3.586)*			-2.32E-05 (-4.400)*	9.30E-06 (1.219)
<b>FDI</b>	-52.189 (-1.934)**					-52.399 (-1.997)**		-38.942 (-0.914)	-49.626 (-1.714)**
<b>INF</b>	0.192 (0.283)						-2.266 (-2.458)**	-1.502 (-1.968)**	
<b>AR(1)</b>	0.839 (11.904)*	0.869 (15.448)*	0.896 (20.829)*	0.901 (18.325)	0.733 (9.144)*	0.859 (15.312)*	0.964 (36.211)*	0.693 (8.297)*	0.841 (17.904)*
<b>R<sup>2</sup></b>	0.627	0.644	0.638	0.639	0.685	0.636	0.504	0.630	0.604
<b>D</b>	1.674	1.895	1.784	1.935	1.873	1.859	2.303	1.963	1.702

**Table 5.9** GMM Estimation Results

Notes: The values in parentheses are t-statistics. \*, \*\*, \*\*\* indicates respectively 1% significance level, 5% significance level and 10% significance level. d: is Durbin-Watson test statistic.

## 6. CONCLUSION

External debt has been an essential component of the Turkish economy as it is for developing countries. In the past, the planned growth and development targets could not be reached due to various reasons, some of which include low levels of domestic saving, capital, technology and qualified labor force. As a result, Turkey has resorted to external borrowing for realizing its economic development targets. There are positive effects of external borrowing on economic growth. Similarly, it is thought that trade openness affects external debt positively. Developing countries applying outward economic policies often need external borrowing for supporting restructuring.

The aim of this paper is to analyze the impacts of trade openness on external debt for the Turkish economy. Empirical analyses are performed using the bound test procedure, ARDL analysis and GMM method for quarterly data for 1990:1-2012:2 periods. Results from bound test indicate a long run cointegration relationship between the variables. According to ARDL

results, trade openness and inflation have significantly positive effects on external debt both in the short run and long run. Estimation results from GMM indicate that trade openness and terms of trade increases external debt, while reserves and foreign direct investment decrease external debt.

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