1. TESTING TWIN DEFICITS HYPOTHESIS FOR EU-27 AND TURKEY: A PANEL GRANGER CAUSALITY APPROACH UNDER CROSS-SECTIONAL DEPENDENCE

Mehmet BÖLÜKBAŞ[1]
Mehmet Hanefi TOPAL[2]
Hakan HOTUNLUOĞLU[3]

Abstract

Twin deficits hypothesis has been one of the most widely-applied phenomenon in the economics literature. In this study, the twin deficits hypothesis was tested for the EU-27 member states and Turkey with the data covering the 2002:Q1-2014:Q1 period. Unlike other studies, the twin deficits hypothesis was tested by using second generation panel causality tests that considered the cross-sectional dependence. According to the findings of this study, which used panel Granger causality tests suggested by Dumitrescu-Hurlin (2012) and Emirmahmutoğlu-Kose (2011), there is statistically significant bidirectional causality between budget deficit (BD) and current account deficit (CAD) in the relevant period. It was found out a bidirectional causality between BD and CAD in sixteen of the twenty-eight countries (Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Netherlands, Romania, Spain, Turkey and the UK) and a unidirectional causality from BD to CAD was also noticed in five EU countries (Cyprus, Latvia, Lithuania, Poland and Slovakia). Nevertheless, the findings indicated that there is a unidirectional causality from CAD to BD in Hungary, Luxembourg and Malta but there is no causality between BD and CAD in Ireland, Portugal, Slovenia, and Sweden.

Keywords: budget deficit, current account deficit, twin deficits hypothesis, cross-sectional dependence, panel Granger causality.

JEL Classification: C33, F32, H62, 052

[1]. *Department of Economics, Aydin Adnan Menderes University, Turkey. E-mail: mbolukbas@adu.edu.tr*
[2]*Department of Public Finance, Gümüşhane University, Turkey. E-mail:mhanefitopal@gmail.com.*
[3] *Department of Public Finance, Aydin Adnan Menderes University, Turkey. E-mail: hakanhotunlu@gmail.com*

1. Introduction

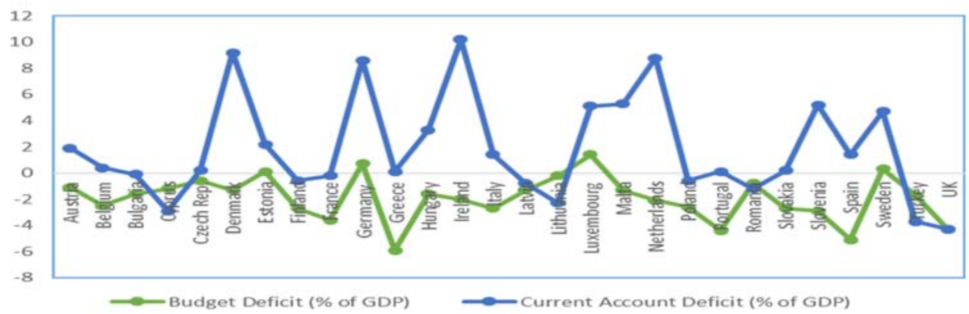
Recently, it was obvious that many developed and developing countries suffered deterioration in their budget deficits *(BD)* and current account deficits *(CAD).* Especially, the developments after global financial crisis have contributed to the linkage between BD and CAD. All these developments are important to show us that the “twin deficits hypothesis” is still popular in the economics literature.

What does “twin deficits hypothesis” mean? As it is widely acknowledged, the twin deficits hypothesis states that an increase in the BD causes an increase in the CAD (Constantinos and Emmanouil, 2011, p.45). Hence, the twin deficit problem refers to a state of an economy running both BD and CAD. The term twin deficits, also called as twin deficit anomaly or the double deficit hypothesis, was coined to describe the relationship between BD and CAD in the United States during the 1980s (Miller and Russek, 1989, Abell, 1990, Dewald and Ulan, 1990, Salvatore, 2006 and Deltoro, 2015). The linkage between BD and CAD, however, has been experienced not only by the USA but also by many European countries, as well as developing countries, emerging as a fundamental economic challenge.

When the twin deficits hypothesis is considered theoretically, it looks like an important macroeconomic problem. High budget deficits are seen as the main reason for the twin deficits hypothesis in the literature. The increase in the BD leads to CAD, which again leads to the creation of a new budget deficits. This is a good evident for understanding why twin deficits problem is like a spiral. Twin deficits problem which concerns both the domestic and external balance of countries, is still known as one of the important and current debates in the economics literature. The twin deficits hypothesis is explained under the traditional Keynesian approach in literature. According to the this approach, increases in BD lead to CAD and, consequently, twin deficits occur. On the other hand, the Ricardian approach states that there is no relationship between BD and CAD. This theoretical debates are discussed in the next chapter of the study. We think that it would be useful to look at the rates of BD and CAD for the EU-27 and Turkey because the study focuses on the twin deficits hypothesis. Figure 1 below shows BD and CAD data for the year 2015 in the selected sample country group.

Figure 1

BD and CAD Indicators for EU-27 and Turkey in 2015



Source: *CBRT (2017), Eurostat (2017), and World Bank (2017).*

As shown in Figure 1, Greece, Spain, Portugal and the UK, in sequence, had the highest budget deficit. On the other hand, beginning from the top, Luxembourg, Germany, Sweden and Estonia ran the highest budget surplus. When we look at the countries in terms of CAD, Ireland, Denmark, Netherlands and Germany are the countries that have the highest current account surplus, but the UK, Turkey, Cyprus and Lithuania are the countries that have the highest current account deficits, respectively, in the relevant period. As can be understood from figure, the relationship between BD and CAD is striking. In this regard, the aim of the study is to investigate empirically whether there is an actual relationship between BD and CAD in the selected countries and - if the relationship indeed exists - to examine the direction of relationship in terms of countries.

There are many studies (*e.g.* Fleming, 1962, Mundell, 1963, Abell, 1990, Normandin, 1999, Salvatore, 2006, Corsetti and Müller, 2006, Kim and Roubini, 2008, Forte and Magazzinno, 2013, Oktar and Yuksel, 2016) focusing on the linkage between BD and CAD and, hence, so many different results and interpretation have followed. Basically, conventional approaches (such as Keynesian and Mundell-Fleming Approaches) argue that there is a unidirectional causality from BD to CAD; on the other hand, as we mentioned above, the Ricardian approach does not accept any relationship between BD and CAD. Empirical studies on twin deficits hypothesis support both the conventional approaches and the Ricardian approach.

Within this context, the aim of this study is to test the twin deficits hypothesis for the EU-27 countries (Austria, Belgium, Bulgaria, Cyprus, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom) and Turkey. Unlike the other studies, the twin deficits hypothesis was tested by using the second generation panel causality tests that consider cross-sectional dependence. If we do not take into account the cross-sectional dependence, we know that there will be biased and inconsistent empirical results. At the same time, we also checked the countries in terms of heterogeneity situation to make comments for each country. In this regard, it may be said that the study includes empirical findings which were predicted with new econometric methods. This situation can be considered both as a modest contribution to the literature and also as a significant difference in the study. However, the majority of the studies addressing the twin deficits hypothesis usually deal wtih a particular group of countries (*e.g.* the EU countries, the Emerging Countries, the Asian Countries, the Sub-Saharan countries, etc.). However, in this study we included Turkey in addition to the EU-27 countries and we performed analysis by taking into consideration 28 countries. We also aim to test the validity of twin deficits hypothesis for individual EU-27 countries and Turkey. Thereby, we will have the chance to classify the countries whether they have the twin deficits problem in their economies.

The study is organized as follows: Section 2, “Literature Review” provides the theoretical and empirical literature on the linkage between BD and CAD. Section 3 contains the “Empirical Analysis”. Lastly, the interpretations and recommendations are included in the conclusions chapter.

2. Literature Review

From the theoretical and empirical point of view, many studies focus on the twin deficits hypothesis. This has contributed to the enrichment of the field and to the formation of different studies in the literature on this subject. According to Pelinescu and Caraiani (2010, p.76); the economic literature mentions that in the large countries, with open economies, the twin deficits may appear as a result of expansionary fiscal policies, the current account deficit being of 50% from the reduction of the budgetary revenues in GDP. In this part of the study, firstly the theoretical background about twin deficits hypothesis is briefed, and then the empirical studies on twin deficits hypothesis and their results are discussed. Table 1 shows the basics of the twin deficits hypothesis.

Table 1

Basics of Twin Deficits Hypothesis

Twin Deficits Hypothesis	**Unidirectional Causality** Traditional Approaches • Keynesian Approach • Mundell-Fleming Approach	$\mathrm{BD} \rightarrow \mathrm{CAD}$
Current account targeting	**Unidirectional Causality**	$\mathrm{CAD} \rightarrow \mathrm{BD}$
Feedback Linkage	**Bidirectional Causality**	$\mathrm{BD} \leftrightarrow \mathrm{CAD}$
No linkage	**Non-Causality** Ricardian Approach	$\mathrm{BD} \nleftrightarrow \mathrm{CAD}$

Source: *Sinicakova et al. (2017).*

As one may see in Table 1, the Keynesian and the Mundell-Fleming approaches support the twin deficits hypothesis. Both of these approaches argue that there is a unidirectional relationship from BD to CAD and the direction of the causality is from BD to CAD. According to the Keynesian approach, an increase in BD will cause an increase in domestic income. When domestic income increases, it will encourage more imports and, eventually, will worsen the trade balance. That is how budget deficit and current account deficit become twins (Puah *et al*., 2006, p.1).

Beside that, according to the Mundell-Fleming approach, under the assumption of floating exchange rates, an increase in BD causes an upward pressure on interest rates, thereby leading to more capital inputs and exchange rate appreciation, which results in a CAD increase (Chowdhury and Saleh, 2007, p.4, Asrafuzzaman and Gupta, 2013, p.2 and Chang and Hsu, 2009, p.4). Thus, this approach also accepts that there is a unidirectional causality from BD to CAD. In contrast to these approaches, the Ricardian approach states that no causality exists between BD and CAD and does not accept any effect of BD on CAD. According to the Ricardian approach, a taxcut or a reduction in public savings by the government do not influence the current account deficit, ruling out a potential relationship between BD and CAD. According to Albu and Pelinescu (2000, p.13), New Cambridge Group (Fetherston and Godley, 1978) has also an extreme view about twin defcits. This approach determines that private disposal income is equal to private consumption and investment expenditure. Therefore, the national income identity implies that a government budget deficit must be matched by an equal current account deficit. This view is consistent with the Mundell-Fleming model under perfect capital mobility and floating exchange rates.

In addition to these theoretical approaches, “current account targeting” and “feedback linkage” in the literature accept that there is a rational linkage between BD and CAD under unidirectional causality and bidirectional causality, respectively. Current account targeting hypothesis acknowledges that a positive and significant relationship between BD and CAD leads to current account balance and defends in contrast to twin deficits hypothesis that the direction of the relationship is from CAD to BD. Another hypothesis about twin deficits is “feedback linkage”, which proposes that there is bidirectional causality between BD and CAD. Beside these theoretical approaches on the twin deficits hypothesis, the empirical literature is also extensive. Table 2 below displays a few of the conducted empirical studies.

Table 2

Empirical Literature on Twin Deficits Hypothesis

		Study	**Country & Period**	**Method**	**Results**
Unidirectional Causality	**Twin deficits hypothesis**	Abell (1990)	United States 1979-1985	VAR	$BD \rightarrow CAD$
		Kearney and Monadjemi (1990)	8 countries 1972-1987	Panel VAR	$BD \rightarrow CAD$
		Zietz and Pemberton (1990)	United States 1972-1987	Semi-reduced Form Models	$BD \rightarrow CAD$
		Dibooğlu (1997)	United States 1960-1994	VAR, Cointegration	$BD \rightarrow CAD$
		Salvatore (2006)	G7 1973-2005	Panel OLS	$BD \rightarrow CAD$
		Uysal and Topallı (2007)	Turkey 1974-2004	Johansen Cointegration, Granger Causality	$BD \rightarrow CAD$
		Bayrak and Esen (2012)	Turkey 1975-2010	Johansen Cointegration	$BD \rightarrow CAD$
		Forte and Magazzino (2013)	33 European Countries 1970-2010	GLS and GMM Analysis	$BD \rightarrow CAD$
		Akdoğan and Geldi (2013)	7 EU countries 2000-2011	Panel Cointegration	$BD \rightarrow CAD$
		Tosun *et al.* (2014)	Selected CEE Economies 1990-2013	Bounds Testing, Granger Causality	$BD \rightarrow CAD$
		Koçbulut and Altıntaş (2016)	OECD-20 1987-2012	Panel Cointegration	$BD \rightarrow CAD$
		Sinicakova *et al.* (2017)	EU-28 2000-2014	Panel Granger Analysis	$BD \rightarrow CAD$
	Current accoun	Anoruo and Ramchander (1998)	5 Developing Southeast Asian Economies 1957-1993	Panel VAR, Granger Causality	$CAD \rightarrow BD$

		Puah *et al.* (2006)	Malaysia 1970-2015	Toda-Yamamoto Causality	CAD → BD
		Çavdar (2011)	Turkey 1994-2008	Johansen Cointegration, Granger Causality	CAD → BD
		Magazzino (2012)	Italy 1970-2010	Johansen Cointegration, Granger Causality	CAD → BD
Bidirectional Causality	**Feedback linkage**	Darrat (1988)	United States 1960-1984	Granger Causality	BD ↔ CAD
		Islam (1998)	Brazil 1973-1991	Granger Causality	BD ↔ CAD
		Baharumshah *et al.* (2006)	9 Seacen Countries 1980-2001	Panel VAR, Granger Causality	BD ↔ CAD
		Mukhtar *et al.* (2007)	Pakistan 1975-2005	Johansen Cointegration,Granger Causality	BD ↔ CAD
		Pahlavani and Saleh (2009)	Philippines 1970-2005	Toda-Yamamoto Causality	BD ↔ CAD
		Asrafuzzaman and Gupta (2013)	Bangladesh 1972-2012	VAR, Granger Causality	BD ↔ CAD
		Bolat *et al.* (2014) (results for 8 countries)	EU-27 2002Q1-2013Q4	Panel Granger Causality	BD ↔ CAD
Non-Causality	**No linkage**	Dewaldand Ulan (1990)	United States 1954-1987	OLS	BD ↮ CAD
		Kim and Roubini (2008)	United States 1972-2004	VAR	BD ↮ CAD
		Corsettiand Müller (2006)	US, UK, Australia, Canada 1979-2005	Panel VAR	BD ↮ CAD
		Aristovnik and Djuric (2010)	EU Members & Candidates 1995-2008	Panel OLS	BD ↮ CAD
		Üzümcü and Kanca (2013)	Turkey 1980-2012	OLS, Johansen Cointegration, Granger Causality	BD ↮ CAD
		Bolat *et al.* (2014) (results for 9 countries)	EU-27 2002Q1-2013Q4	Panel Granger Causality	BD ↮ CAD
		Deltoro (2015)	10 European Countries 1970-2011	Panel Granger Causality	BD ↮ CAD

As apparent in Table 2, there are many studies supporting the twin deficits hypothesis with findings showing a unidirectional causality from BD to CAD. Some of these studies (*e.g.* Abell, 1990, Dibooğlu, 1997, Bayrakand Esen, 2012) test the twin deficits hypothesis by using time series analysis such as VAR analysis or Johansen co-integration method, while others (*e.g.* Kearney and Monadjemi, 1990, Salvatore, 2006, Forte and Magazzino, 2013, Sinicakova *et al.,* 2017) employed panel data methods to test twin deficits hypothesis and many of them confirmed the validity of twin deficits hypothesis.

Contrary to these empirical studies, it is possible to come across studies which suggest that the direction of causal relationship is from CAD to BD rather than from BD to CAD. Studies of Anoruo and Ramchander (1998), Puah *et al.* (2006), Çavdar (2011), Magazzino (2012) are only a few.

When we look at the studies that suggest bidirectional causality between BD and CAD, we may see that time series analysis were usually applied. The results of these country-based studies (*e.g.,* Darrat, 1988, Islam, 1998, Baharrumshah *et al.,* 2006, Mukhtar *et al.,* 2007, Pahlavaniand Saleh, 2009 and Asrafuzzaman and Gupta, 2013) are significant to elaborate on the bidirectional relationship of BD and CAD.

Apart from all these studies, there are also many empirical studies showing no significant causality between BD and CAD. In this regard, Dewaldand Ulan (1990), Kim and Roubini (2003), Corsetti and Müller (2006), Aristovnik and Djuric (2010), Üzümcü and Kanca (2013) and Deltoro (2015) used time series and panel data analysis to test twin deficits hypothesis, but the results indicate that there is no causal relationship between BD and CAD. In addition to all these studies, Bolat *et al.* (2014) used bootstrap panel Granger causality test and found bidirectional causality relationship in 8 EU countries and no causality in 9 EU countries.

As we see in the literature review, there are not so many studies that consider cross-sectional dependence during empirical analysis for the EU and Turkey. On the other hand, it is also rare to find studies which take into account the heterogeneity of countries. When viewed from this aspect, it can be thought that our work is a new contribution to the literature for debating these considerations.

3. Empirical Analysis

In this section of the study, the relationship between BD and CAD was empirically analyzed. In this context, firstly data and model specification were defined and then the empirical methodology was introduced and the empirical findings of analysis were evaluated.

3.1. Data Set and Model Specification

In this study, budget deficit and current account deficit data for the period of 2002:Q1-2014:Q1 belonging to the EU-27 member states and Turkey were used. The data set was compiled from Eurostat, World Bank and Central Bank of Turkish Republic (CBRT) and the tests were conducted by Gauss and Matlab programs. We wanted to keep the period of the study longer, but we faced a problen with the data sets of some countries. Thus, we had to consider the 2002:Q1-2014:Q1 period due to such reasons. However, when determining the data set, we looked at the many sources and the reliability of the series was researched. Models used in the study are constructed as in the equations (1) and (2) below;

$$CAD = \beta_{0it} + \beta_{1it}BD + \varepsilon_{it} \quad (1)$$

$$BD = \beta_{0it} + \beta_{1it}CAD + \varepsilon_{it} \quad (2)$$

In equations (1) and (2), i stands for countries (i=1,2, …, 28), t denotes time period (t=2002:Q1, 2002:Q2,…., 2014:Q1), CAD is current account deficits of countries, BD is budget deficits of countries, β_0 is constant term and ε_{it} is the error term. In the study, second generation panel Granger causality tests were used as the econometric method. Empirical methodology and findings are elaborated in the following section.

3.2. Empirical Methodology

In the empirical analysis of the study, firstly cross-sectional dependence was tested then panel unit root tests followed. Moon-Perron (2004) and Hadri-Kurozumi (2012) unit root tests were used to examine unit root of the series. Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011) panel Granger causality tests were employed to investigate the causality relationship between BD and CAD in the course of causality analysis of the series that seem to be stationary. In this part of the study, we discussed the empirical methodology.

Testing Cross-sectional Dependence

In order to investigate the causal relationship between the variables in the research models, it is vital to examine the integration levels of the variables with the panel unit root tests. However, in order to determine the panel unit root test to be used, first of all cross-sectional dependence of the series or models should be tested. If the cross-sectional dependence in the panel is not taken into consideration, the estimation results will be biased and inconsistent (Pesaran, 2004). Cross-sectional dependence refers to the assumed linkage between cross-sections and indicates whether cross-sections are affected to the same extent by the shocks in the relevant series.Gradual expansion of globalization, high foreign trade volumes and levels of financial integration among countries have naturally contributed to a greater amount of interdependence between nations. So, this interdependence creates a chain reaction for an economic shock in one country to affect others. Therefore, second generation panel unit root tests should be chosen to have robust results under cross-sectional dependence as first generation panel unit root tests may lead to spurious results due to size distortion in the case of cross-sectional dependence. Breusch and Pagan (1980) suggest the Lagrange Multiplier (LM) test, which is expressed by CD_{LM1} in the equation (3);

$$CD_{LM1} = T\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}^2 \quad (3)$$

In the CD_{LM1} test, the null hypothesis of no-cross sectional dependence ($H_o: Cov(u_{it}, u_{jt}) = 0$ for all t and $i \neq j$) is tested against the alternative hypothesis of the existence of cross-sectional dependence ($H_1: Cov(u_{it}, u_{jt}) \neq 0$ for at least one pair of $i \neq j$). In the LM test, $\hat{\rho}_{ij}$, is the sample estimate of the pair-wise correlation of the residuals from Ordinary Least Squares (OLS) estimation for each *i*[1] (Bolat *et al.,* 2014). The LM statistics is used to test cross-sectional dependence in the case of *T→∞* and *N* is constant or in the case of *T>N*. The statistics has the asymptotic chi-square distribution feature in *N(N-1)/2* degrees of freedom. It is important to note that if *N* increases, the effect of LM statistics will decrease. Pesaran (2004) suggests two separate tests with asymptotic standard normal distribution, such *as* CD_{LM2} for the case of *T>N* and CD test for the case of *N>T* to solve this problem. These tests are expressed as in theequations (4) and (5), respectively:

[1] $\rho_{ij} = \rho_{ji} = \sum_{t=1}^{T}\varepsilon_{ij}\varepsilon_{jt} \Big/ \left(\sum_{t=1}^{T}\varepsilon_{ij}^2\right)^{1/2}\left(\sum_{t=1}^{T}\varepsilon_{jt}^2\right)^{1/2}$

$$CD_{LM2} = \left(\frac{1}{N(N-1)}\right)^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T\hat{\rho}_{ij}^2 - 1 \quad (4)$$

$$CD = \left(\frac{2T}{N(N-1)}\right)^{1/2} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \quad (5)$$

However, in stationary dynamic panel data models, CD_{LM2} ve CD tests fail to reject the null hypothesis when the group average is zero but individual averages are different from zero. Pesaran and Yamagata (2008) proposed a bias-adjusted and modified LM statistic by using mean and variance of the LM statistic to avoid this problem. The bias-adjusted LM statistics is calculated as in the equation (6) below;

$$LM_{adj} = \sqrt{\left(\frac{2T}{N(N-1)}\right) \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \frac{(T-k)\hat{\rho}_{ij}^2 - \mu_{Tij}}{\sqrt{\nu_{Tij}^2}}} \quad (6)$$

In this equation, μ_{Tij} and ν_{Tij}^2 are the mean and the variance of $(T-k)\hat{\rho}_{ij}^2$, respectively, proposed by Pesaran and Yamagata (2008). When $T \rightarrow \infty$ and $N \rightarrow \infty$, LM_{adj} has the asymptotic standard normal distribution feature under the the null hypothesis of no-cross sectional dependence.

Testing Non-stationarity

Moon-Perron (2004) and Hadri-Kurozumi (2012) panel unit root tests were used to test stationarity in this study. Moon-Perron (2004) use an AR (1) model that takes into account common factors in error terms. The model can be simply expressed as follows in the equations (7) and (8);

$$y_{i,t} = (1-\lambda_i)\mu_i + \lambda_i y_{i,t} + u_{i,t} \quad (7)$$

$$u_{i,t} = \delta_i' F_t + \varepsilon_{i,t} \quad (8)$$

where: F_t and δ_i' indicate (kx1) number of common factor vectors and the coefficients of the vector of common factors respectively for i=1, 2,…N and t=1, 2,…T. $\varepsilon_{i,t}$ is a cross-sectionally uncorrelated and idiosyncratic error term and it has infinite Moving Average (MA) process. The null hypothesis of unit root (H_0: λ_i=1 for i=1, 2,…, N) is tested against the alternative hypothesis of non-existence of unit root (H_1: λ_i<1 for some i). The dataset is not defactored and panel unit root test is applied by this proposed defactored dataset. Moon-Perron (2004) consider common factors as a deviation and develop two separate t-statistics that have standard normal distribution and is based on pooled defactored dataset. These statistics are calculated as in the equations (9) and (10) below;

$$t_a^* = \frac{\sqrt{NT}(\hat{\lambda}^* - 1)}{\sqrt{\frac{2\hat{\varphi}_e^4}{\hat{\omega}_e^4}}}, \quad N,T \rightarrow \infty, N(0,1) \quad (9)$$

$$t_b^* = \sqrt{NT}(\hat{\lambda}^* - 1)\sqrt{\frac{1}{NT^2} tr(Y_{t-1} Q_{\hat{\Delta}} Y_{t-1}')}\left(\frac{\hat{\omega}_e}{\hat{\varphi}_e^2}\right), \quad N,T \rightarrow \infty, N(0,1) \quad (10)$$

where: λ_I^* expresses the value of λ_i calculated with pooled OLS out of the defactored dataset. $\hat{\Phi}_e^4$ is the average of cross-section of $\hat{\omega}_e^4$. t_a^* and t_b^* statistics are based on the estimator of the projection matrix and the estimators of long-run variances of $\hat{\varphi}_e^2$. The test assumes the application of common factor model in which k-unobserved number of idiosyncratic shock is added to error term. The number of common factors is estimated by the criteria of Bai and Ng (2004), in particular by the modified Bayesian Info Criteria (BIC3). This info criterion was choosen in the selection of common factor in this study as this info criterion performs better than the other info criterions according to Moon-Perron (2007). In addition to this, stationarity of the series are examined by Hadri-Kurozumi (2012) panel unit root test which considers cross-sectional dependence. This test allows autocorrelation problem and is applicable for both T>N and N>T cases. Hadri-Krozumi (2012) unit root test is the panel version of KPSS test. In the test, the null hypothesis -series are stationary (H_0: $\emptyset_i(1) \neq 0$ for all i) - is tested against the alternative hypothesis - series are not stationary (H_1: $\emptyset_i(1) = 0$). Two separate test statistics, named Z_A^{SPC} and Z_A^{LA} are used for that. To calculate Z_A^{SPC} statistic, Monte Carlo simulations are employed as the statistic follows the seemingly unrelated regression calculation procedure. Besides that, this statistic is also taken into account in the case of cross-sectional dependence. The data generation process described in the equations (11) and (12) is followed to do the test.

$$y_{i,t} = z_t' \delta_i + F_t \gamma_i + \varepsilon_{i,t} \quad (11)$$

$$\varepsilon_{i,t} = \emptyset_{i1} \varepsilon_{i,t-1} + \ldots + \emptyset_{ip} \varepsilon_{i,t-p} + v_{i,t} \quad (12)$$

In this equation, $z_t'\delta_i$ and F_t represent the deterministic unit effects and common factor vector, respectively. When the Z_A^{SPC} statistic is calculated, the autocorrelation problem can be solved with AR(p) process proposed by Sul *et al.* (2005). Likewise, for the calculation of Z_A^{LA} statistic, the autocorrelation problem can be solved using AR (p+1) processes proposed by Choi (1993) and Toda-Yamamoto (1995) and adding a lag to the model (Hadri-Kurozumi, 2012, p.32). First, the long-term variance is calculated; then, the calculations of the variances of SPC and LA follow. Thus, the statistics Z_A^{SPC} and Z_A^{LA} in the equations (13) and (14) are obtained;

$$Z_A^{SPC} = \frac{1}{\hat{\sigma}_{iSPC}^2 T^2} \sum_{t=1}^{T} \left(S_{i,t}^w\right)^2 \quad (13)$$

$$Z_A^{LA} = \frac{1}{\hat{\sigma}_{iLA}^2 T^2} \sum_{t=1}^{T} \left(S_{i,t}^w\right)^2 \quad (14)$$

Within the equations, $\hat{\sigma}_i^2$ is long-term variance estimator and $S_{it}^w = \sum_{s=1}^{t} \hat{\varepsilon}_{is}$ is error term of AR regressions derived from the estimation of by OLS and used to calculate the variance of SPC and LA. Both statistics have asymptotic standard normal distribution.

Testing Non-Granger Causality

The causality between variables was examined at both panel and country level by Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011) panel causality tests in the study. Dumitrescu-Hurlin (2012) panel causality test is an advanced Granger (1969) causality test that can be applied to balanced and heterogeneous panels with or without cross-sectional dependence and may be used when T>N or N>T. The test uses two separate HNC distributions: asymptotic and semi-asymptotic. The asymptotic distribution is used when T>N and semi-asymptotic distribution is used in the case where N>T. In the causality test, three separate statistics are calculated considering the following panel data model;

$$y_{i,t} = \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \tag{15}$$

In the equation, K, $\gamma_i^{(k)}$ and $\beta_i^{(k)}$ indicate lag length, autoregressive parameter and regression coefficient, respectively. It is assumed that these parameters are constant over time, but they may vary with reference to units. The null hypothesis of the test is that "there is no Granger causality from X to Y in all cross-sections", while the alternative hypothesis is that "there is a Granger causality from X to Y in at least one cross-section". Test hypotheses can be expressed as follows.

$$\begin{gathered} H_0: \beta_i = 0; \quad \forall_i := 1,2,\ldots.,N with \beta_i = \beta_i^{(1)},\ldots..,\beta_i^{(k)} \\ H_1: \beta_i \neq 0; \quad \forall_i := 1,2,\ldots.,N \\ \beta_i \neq 0; \quad \forall_i := N_1+1, N_1+2,\ldots..,N \end{gathered} \tag{16}$$

Mean $W_{N,T}^{HNC}$ statistic used for testing the hypotheses is calculated as in the following equation;

$$\begin{gathered} W_{N,T}^{HNC} = \frac{1}{N}\sum_{i=1}^{N} W_{i,T} \\ W_{i,T} = (T-2K-1)\left(\frac{\tilde{\varepsilon}_i \emptyset_i \tilde{\varepsilon}_i}{\tilde{\varepsilon}_i M_i \tilde{\varepsilon}_i}\right), \quad i = 1,2,\ldots,N \end{gathered} \tag{17}$$

In the equation, $W_{i,T}$is the mean Wald statistics calculated for the time dimension *t* of the cross-sections. Although individual Wald statistics approximate towards chi-square distribution in K-degrees of freedom, authors state that the mean Wald statistics converge to standard normal distribution when $T \rightarrow \infty$ or when $N \rightarrow \infty$. Asymptotic $Z_{N,T}^{HNC}$ and semi-aymptoticZ_N^{HNC} statistics generated by $W_{N,T}^{HNC}$ are shown as in equations (18) and (19);

$$Z_{N,T}^{HNC} = \sqrt{\frac{N}{2K}}(W_{N,T}^{HNC} - K); \quad T,N \rightarrow \infty N(0,1) \tag{18}$$

$$Z_N^{HNC} = \frac{\sqrt{N}\left[W_{N,T}^{HNC} - N^{-1}\sum_{i=1}^{N} E(W_{i,T})\right]}{\sqrt{N^{-1}\sum_{i=1}^{N} var(W_{i,T})}}; \quad N \rightarrow \infty N(0,1) \tag{19}$$

Emirmahmutoğlu-Kose (2011) panel Granger causality test is the panel version of Toda-Yamamoto's Granger causality approach in time series. In this approach, it is possible to test panel causality under cross-sectional heterogeneity without having to check whether the series of units in the panel are co-integrated or non-stationary. As the critical values of panel statistics are obtained by Monte Carlo simulations, cross-sectional dependence is also taken into account in this test. First of all, a LA-VAR model - as stated in equation (20) - is estimated for each cross-section;

$$y_{i,t} = \mu_i + A_{1i} y_{i(t-1)} + \cdots + A_{pi} y_{i(t-pi)} + \cdots + A_{(p+d)i} y_{i(t-pi-di)} + \varepsilon_{i,t} \tag{20}$$

In equation (20), $y_{I,t}$, μ_i, pi and di are the vector of endogenous variables, p-dimensional unit effects vector, optimum lag and maximum cointegretion level of variables, respectively. The null hypothesis of no Granger causality from X to Y is tested against the alternative hypothesis of a Granger causality from X to Y. The individual Wald statistics have an asymptotic chi-square distribution in p-degrees of freedom. The significance level of individual Wald statistics (ρ_i) is combined as in equation (21) by using Fisher (1932)'s meta analysis and heterogeneous panel group test statistics (panel Fisher statistics) are obtained.

$$\lambda = -2\sum_{i=1}^{N} ln(\rho_i) \quad (21)$$

Fisher's statistic has asymptotic chi-square distribution at 2N degrees of freedom. But this distribution loses its validity in the case of cross-sectional dependence. Hence, Emirmahmutoglu-Kose (2011) proposes that critical values should be found by Monte Carlo simulations. If the calculated statistics are greater than critical values obtained with simulations, the null hypothesis of no Granger causality will be rejected.

3.3 Empirical Findings and Discussions

Cross-sectional dependence test results are reported in Table 3. According to the findings, null hypothesis is rejected in both all series and also the two models at 1% significance level. That is to say, a shock to the budget deficit or current account deficit of any country in the panel affects other countries as expected. This result also signifies that stationarity of the series should be examined with the help of second generation panel unit root tests which take into consideration cross-sectional dependence and second generation panel causality tests - also regarding cross-sectional dependence - should be conducted to avoid biased and inconsistent results.

Table 3

Cross-sectional Dependence Tests Results

Test	CD_{LM1}	CD_{LM2}	CD	LM_{adj}
BD	2266.7*	68.6*	68.4*	26.7*
CAD	2695.0*	84.2*	83.9*	16.7*
$\langle \boldsymbol{CAD}\vert\boldsymbol{BD}\rangle$	2437.3*	74.8*	18.5*	94.3*
$\langle \boldsymbol{BD}\vert\boldsymbol{CAD}\rangle$	2021.6*	59.7*	24.6*	83.4*

Note: ** indicates signifacence at 1% level.*

Table 4 shows the Moon-Perron (2004), Hadri-Kurozumi (2012) panel unit root test results. According to the findings of t_a^* ve t_b^* test statistics in the Moon-Perron (2004) unit root test, the null hypothesis is rejected for BD and CAD series at 1% significance level. The results indicate that the series are stationary. Nevertheless, according to Hadri-Kurozumi (2012) panel unit root test results, the null hypothesis cannot be rejected for both series and it is concluded that the series (BD and CAD) are stationary.

Table 4

Moon-Perron and Hadri-Kurozumi Panel Unit Root Test Results for BD and CAD

	Moon-Perron (2004)				Hadri-Kurozumi (2012)			
	$\boldsymbol{t_a^*}$	Prob.	$\boldsymbol{t_b^*}$	Prob.	$\boldsymbol{Z_A^{SPC}}$	Prob.	$\boldsymbol{Z_A^{LA}}$	Prob.
BD	-15.772*	0.000	-9.927*	0.000	0.976	0.164	1.407	0.074
CAD	-7.808*	0.000	-4.982*	0.000	-0.322	0.122	1.070	0.142

Note: ** indicates significance at the 1% level. In Moon-Perron panel unit root test, maximum common factor is five (5) and common factor number is calculated with BIC_3 info criterion of Bai-Ng (2004).*

Based on these results, it may be said that BD and CAD in the EU-27 and Turkey display a stable fluctuation and the economic shocks experienced are weak. Following this phase, the causality between variables is to be directly examined without co-integration analysis since the series are integrated at the level.

The panel findings of Dumitrescu-Hurlin (2012) panel Granger causality test are displayed in Table 5. In this study, only $Z_{N,T}^{HNC}$ test statistic results of Dumitrescu-Hurlin (2012) panel causality test findings are reported, because the time period is larger than the units (T=49, N=28). According to the test results, the null hypothesis of no Granger causality between variables is rejected at 1% significance level. Even if common lag length is increased, the result and level of statistical significance does not change. This finding shows that there is a bidirectional causality between BD and CAD in the relevant period for the panel of countries.

Similarly, in Table 5, Emirmahmutoglu-Kose (2011) panel Granger causality test results also support that there is a bidirectional causality between BD and CAD. The Fisher test statistics calculated for panel is greater than the critical values obtained by Monte Carlo simulations in different statistical significance levels. Accordingly, these test results also indicate that the null hypothesis of no Granger causality between variables is rejected at 1% significance level.

As we see in Table 5, there is a bidrectional causality relation in the majority of countries. This situation shows that the twin deficits problem was valid in many EU countries and Turkey for the period of 2002-2014.

Table 5

Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011)

Panel Granger Causality Test Results

Null Hypothesis	Dumitrescu-Hurlin (2012)					
	Lag=1		Lag =2		Lag =3	
	$W_{N,T}^{HNC}$	$Z_{N,T}^{HNC}$	$W_{N,T}^{HNC}$	$Z_{N,T}^{HNC}$	$W_{N,T}^{HNC}$	$Z_{N,T}^{HNC}$
$BD \nrightarrow CAD$	14.15*	12.90*	21.98*	19.68*	26.78*	23.46*
$CAD \nrightarrow BD$	11.13*	10.10*	19.67*	17.59*	23.84*	20.84*

Null Hypothesis	Emirmahmutoglu-Kose (2011)			
	Fisher Stats	Critical Values		
		1%	**5%**	**10%**
$BD \nrightarrow CAD$	339.62*	105.694	92.071	85.376
$CAD \nrightarrow BD$	374.68*	107.049	93.540	86.319

Note: ** indicates significance at the 1% level. Critical values in the Emirmahmutoglu-Kose panel causality test were obtained with 10,000 iterations.*

In parallel with the proposition that bidirectional causality between BD and CAD was supported for the panel of countries, country-specific Wald statistics were calculated and the significance levels of the statistics were examined by Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011) panel Granger causality tests to determine which hypothesis is valid in EU-27 and Turkey. The sum of the test results is shown in Table 6. As may be inferred, the results of both tests are correlative.This result can be regarded as an important criterion for the reliability of the obtained findings.

Table 6

Individual Statistics of Panel Granger Causality

Country	Emirmahmutoglu-Kose (2011)					Dumitrescu-Hurlin (2012)			
	pi	$BD \nrightarrow CAD$		$CAD \nrightarrow BD$		$BD \nrightarrow CAD$		$CAD \nrightarrow BD$	
		W-Stat	Prob.	W-Stat	Prob.	W-Stat	Prob.	W-Stat	Prob.
Austria	3	13.91**	0.003	15.96*	0.001	14.98**	0.002	17.18*	0.001
Belgium	2	43.22*	0.000	24.43*	0.000	48.07*	0.000	24.08*	0.000
Bulgaria	3	67.83*	0.000	44.40*	0.000	73.05*	0.000	44.81*	0.000
Cyprus	3	14.19**	0.003	3.51	0.319	15.28**	0.002	3.78	0.286
Czech Rep.	3	6.26***	0.100	15.11**	0.002	6.74***	0.080	16.28*	0.001
Denmark	3	19.77*	0.000	6.72***	0.081	21.29*	0.000	7.24***	0.064
Estonia	3	15.60*	0.000	18.82*	0.000	16.80*	0.000	20.26*	0.000
Finland	3	19.27*	0.000	8.38**	0.039	20.75*	0.000	9.03**	0.028
France	3	13.77**	0.003	19.21*	0.000	14.83**	0.002	20.69*	0.000
Germany	3	32.15*	0.000	41.73*	0.000	34.62*	0.000	44.94*	0.000
Greece	3	13.69**	0.003	12.34**	0.006	14.74**	0.002	13.29**	0.004
Hungary	1	0.032	0.857	2.02	0.155	0.488	0.921	7.29***	0.062
Ireland	3	1.82	0.609	4.03	0.258	1.96	0.579	4.34	0.226
Italy	3	8.03**	0.045	10.01**	0.019	8.65**	0.035	10.77**	0.002
Latvia	1	6.83**	0.009	0.499	0.480	11.73**	0.002	3.53	0.316
Lithuania	3	6.06	0.108	9.66**	0.022	6.53***	0.088	10.41**	0.002
Luxembourg	1	0.61	0.435	6.46**	0.011	1.57	0.666	9.09**	0.028
Malta	3	3.77	0.286	8.65**	0.034	4.06	0.254	9.32**	0.025
Netherlands	3	11.79**	0.008	8.32**	0.040	12.70**	0.005	8.96**	0.029
Poland	1	4.22**	0.040	1.81	0.178	9.90**	0.019	4.49	0.213
Portugal	2	1.52	0.467	1.06	0.586	2.28	0.514	4.37	0.224
Romania	3	22.14*	0.000	25.44*	0.000	23.84*	0.000	27.39*	0.000
Slovakia	2	8.05**	0.018	0.82	0.664	13.37**	0.003	3.00	0.390
Slovenia	3	4.68	0.196	2.76	0.430	5.04	0.168	2.97	0.385
Spain	3	44.73*	0.000	61.42*	0.000	48.17*	0.000	66.14*	0.000
Sweden	3	1.51	0.679	1.98	0.575	1.63	0.652	2.13	0.544
Turkey	3	20.08*	0.000	15.97*	0.001	21.63*	0.000	17.19*	0.000
UK	3	8.85**	0.031	6.67***	0.084	9.53**	0.022	7.15***	0.067

Note: **, **, and *** indicate significance at the 1%, 5%, and 10% levels, respectively. In the Emirmahmutoglu-Kose panel causality test, critical values were obtained with 10,000 iterations and lag length was determinbed by Akaike İnfo Criterion (p_i).*

Table 7 summarizes the findings on whether there is a causal relationship between BD and CAD and if the answer is positive, on what is the direction of causality in the countries subject to analysis.

The results indicate that there is a bidirectional causality between BD and CAD in sixteen countries (Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Romania, Spain, Turkey and the UK); whereas, it is observed that twin deficits hypothesis is valid in Cyprus, Latvia, Lithuania, Poland and Slovakia and the direction of causality is from BD to CAD.

Table 7

Summary for Direction of Granger Causality

Countries	Direction $BD \sim CAD$		Results	Countries	Direction $BD \sim CAD$		Results
Austria	→	←	↔	**Latvia**	→		→
Belgium	→	←	↔	**Lithuania**	→		→
Bulgaria	→	←	↔	Luxembourg		←	←
Cyprus	→		→	Malta		←	←
Czech R.	→	←	↔	Netherlands	→	←	↔
Denmark	→	←	↔	**Poland**	→		→
Estonia	→	←	↔	Portugal			↮
Finland	→	←	↔	Romania	→	←	↔
France	→	←	↔	**Slovakia**	→		→
Germany	→	←	↔	Slovenia			↮
Greece	→	←	↔	Spain	→	←	↔
Hungary		←	←	Sweden			↮
Ireland			↮	Turkey	→	←	↔
Italy	→	←	↔	UK	→	←	↔

Note: ↮*; no linkage,* ↔*; feedback linkage,* →*, twin deficits and,* ←*; current account targeting*

In contrast, the direction of causality is from CAD to BD in Hungary, Luxembourg and Malta. Lastly, there is no causality between BD and CAD in Ireland, Portugal, Slovenia, and Sweden, unlike the above-mentioned countries.

4. Conclusions

This study examined whether the twin deficits hypothesis is still valid in the EU-27 member states and Turkey within the period of 2002:Q1-2014:Q1. We know that there are many studies in the literature which focus on the twin deficits problem. Unlike the others, in this study, second generation panel Granger causality analysis that takes into consideration cross-sectional dependence was used for the empirical analysis. This method, which is one of the most popular panel econometric methods of recent periods, has many features. For example, it is possible to have results for both individual countries and also for panel. In this regard, our results show that there is a statistically significant bidirectional causality between BD and CAD for many countries. The findings obtained from the empirical analysis are also confirmed by the causality tests proposed by both Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011). It may be considered as an important finding of the study that there is bidirectional causality between BD and CAD in sixteen of the twenty-eight countries subject to analysis (Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Romania, Spain, Turkey and the UK).This result is consistent with the study of Bolat *et al.* (2014), which analysed almost the same period. In addition, it is significant to conclude that twin deficits hypothesis is also valid in Cyprus, Latvia, Lithuania, Poland, and Slovakia. The direction of causality is from BD to CAD and this result is also consistent with the studies of Forte and Magazzino (2013), Akdoğan and Geldi (2013), Sinicakova *et al.* (2017). It is quite interesting that five countries (Cyprus, Latvia, Lithuania, Poland, and Slovakia) that accessed to the EU in 2004 have results of unidirectional causality from BD to CAD. It may be useful to examine this issue in detail.

Contrary to this linkage, it may be stated that the direction of causality is from CAD to BD in Hungary, Luxembourg and Malta. If the factors determining the current account deficits are confirmed, it will be easy to understand the reason of the twin deficits problem in these three countries. At the same time, it could be better to research the foreign trade structure of these countries. Lastly, Ireland, Portugal, Slovenia, and Sweden have emerged as countries with no causality between BD and CAD. This result is also similar with the study of Aristovnik and Djuric (2010) and the Ricardian approach is supported by this result. All the empirical findings are summarized in Table 8 below.

Table 8

Sum of Empirical Findings

Twin Deficits Hypothesis	Cyprus, Latvia, Lithuania, Poland Slovakia	$BD \rightarrow CAD$
Current account targeting	Hungary, Luxembourg, Malta	$CAD \rightarrow BD$
Feedback Linkage	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Netherlands, Romania, Spain, Turkey, UK	$BD \leftrightarrow CAD$
No linkage	Ireland, Portugal, Slovenia, Sweden	$BD \nleftrightarrow CAD$

Consequently, the validity of the twin deficits hypothesis was proven, although not valid in all the countries. However, there is enough evidence to assume a relationship between budget deficits and current account deficits in some countries. This result is consistent with the expectations of our study.The results of the study are also in parallel with the studies of Darrat (1988), Abell (1990), Dibooglu (1997), Islam (1998),Baharumshah *et al.* (2006), Mukhtar *et al.* (2007), Pahlavani and Saleh (2009), Bayrak and Esen (2012), Asrafuzzaman and Gupta (2013), which have reached the same results for different countries. Based on these findings, it can be stated that twin deficits problem should still be regarded as an important macroeconomic problem in many EU countries and in Turkey. Therefore, it is vital that the twin deficit problem should not be overlooked by states while formulating their economic policies.

Empirical findings show that high budget deficits bring other macroeconomic problems in their wake. Therefore, we suggest that contractionary fiscal policy is useful to prevent high budget deficits for many EU countries and Turkey. Of course, contractionary fiscal policy is not enough on its own, beside that central banks should provide compatible monetary policy. On the other hand, policy makers do not focus on budget deficit only; they also concentrate on the current account deficits and take measures to minimize them. In addition to all these, the Maastricht criteria should be revised and it should be kept in mind that the source of the twin deficits problem may be the failure to comply with these criteria. We also think that the relationship between BD and CAD should be analysed by considering the period before and after the global financial crisis, so that the effect of the crisis on the twin deficits might be determined. Additionally, it could be better to perform symmetric and asymmetric analysis of the relationship between BD and CAD for the same sample.

References

Abell, J.D., 1990. Twin Deficits during the 1980s: An Empirical Investigation. *Journal of Macroeconomics,* 12 (1), pp.81-96.

Akdoğan, U.İ. and Geldi, K.H., 2013. Revisiting the Twin Deficit Hypothesis for the Economies of Europe. *The Journal of European Theoretical and Applied Studies,* 1(1), pp.53-65.

Albu, L.L. and Pelinescu, E., 2000. Sustainability of Public Debt and Budget Deficit. *RPEC/WP, No:4,* pp.1-26. Available at: <http://pdc.ceu.hu/archive/00001028/01/1.pdf> [Accessed on May 2017].

Aristovnik, A. and Djuric, S., 2010. Twin Deficits and The Feldstein-Horioka Puzzle: A Comparison of the EU Member States and Candidate Countries. *Munich Personal RePEc Archive* Paper No. 24149.

Anoruo, E. and Ramchander, S., 1998. Current Account and Fiscal Deficits: Evidence from Five Developing Economies of Asia. *Journal of Asian Economics* 9(3), pp.487-501.

Asrafuzzaman, R.A. and Gupta, S.D., 2013. An Empirical Investigation of Budget and Trade Deficits: The Case of Bangladesh. *International Journal of Economics and Financial Issues*, 3(3), pp.570-579.

Baharumshah, A.Z. Lau, E. and Khalid, A.M., 2006. Testing Twin Deficits Hypothesis Using VARs and Variance Decomposition. *Bond University Bond Business School Publications*, 8(1), pp.2-30.

Bai, J. and Ng, S., 2004. A Panic Attack on Unit Roots and Cointegration. *Econometrica,* 72(4), pp.1127-1177.

Bayrak, M. and Esen, Ö., 2012. Bütçe Açıklarının Cari İşlemler Dengesi Üzerine Etkileri: İkiz Açıklar Hipotezinin Türkiye Açısından Değerlendirilmesi. *Ekonomik Yaklaşım*, 23(82), pp.23-49.

Breusch, T.S. and Pagan, A.R., 1980. The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, 47(1), pp.239-253.

Bolat, S. Emirmahmutoglu, F. and Belke, M. 2014. The Dynamic Linkages of Budget Deficits and Current Account Deficits Nexus in EU Countries: Bootstrap Panel Granger Causality Test. *International Journal of Economic Perspectives*, 8(2), pp.16-26.

CBRT, 2017. Electronic Data Delivery System. [online] Available at: <http://evds.tcmb.gov.tr/ [Accessed on May 2017].

Chang, J.C. and Hsu Z.Z., 2009. Causality Relationships Between the Twin Deficits in the Regional Economy. Department of Economics, National Chi Nan University Available at: <http://econ.ccu.edu.tw/2009/conference/2B3.pdf> [Accessed on December 2016].

Chowdhury K. and Saleh, A.S., 2007. Testing the Keynesian Proposition of Twin Deficits in the Presence of Trade Liberalisation: Evidence from Sri Lanka, *Faculty of Business - Economics Working Papers, 07-09*

Choi, I., 1993. Asymptotic Normality of the Least-Squares Estimates for Higher Order Autoregressive Integrated Processes with Some Applications. *Econometric Theory*, 9(2), pp.263-282.

Constantinos, K. and Emmanouil, T., 2011. Has the Accession of Greece in the EU Influenced the Dynamics of the Country's "Twin Deficits"? An Empirical Investigation. *European Research Studies,* XIV(1), pp.45-54.

Corsetti, G. and Müller, G. J., 2006. Twin Deficits: Squaring Theory, Evidence and Common Sense. *Economic Policy*, 21(48), pp.597-638.

Çavdar, Ç.Ş., 2011. Türkiye İçin İkiz Açık Hipotezinin Testi. *e-Journal of New World Sicences Academy*, 6(4), 422-431. Available at: <http://dergipark.gov.tr/download/article-file/187087> [Accessed on April 2017].

Darrat, A.F., 1988. Have Large Budget Deficits Caused Rising Trade Deficits? *Southern Economic Journal*, 54, pp.879-887.

Deltoro, S.L., 2015. Twin Deficits Hypothesis For European Countries. Universitat Jaume Economics Degree Thesis. Available at: <http://repositori.uji.es/xmlui/bitstream/handle/10234/131408/TFG_Laborda_Deltoro_Sandra.pdf?sequence=1> [Accessed on April 2017].

Dewald, W.G., and Ulan, M., 1990. Twin-Deficit Illusion. *Cato Journal,* 9(3), pp.689-707.

Dibooğlu, S., 1997. Accounting for US Current Account Deficits: An Empirical Investigation. *Applied Economics*, 29(6), pp.787-793.

Dumitrescu, E.I., and Hurlin, C., 2012. Testing for Granger Non-causality in Heterogeneous Panels. *Economic Modelling*, 29(4), pp.1450-1460.

Emirmahmutoglu, F. and Köse, N., 2011. Testing for Granger Causality in Heterogeneous Mixed Panels. *Economic Modelling*, 28(3), pp.870-876.

Eurostat, 2017. Statistics A – Z. [online] Available at: <http://ec.europa.eu/eurostat/data/statistics-a-z/abc?> [Accessed on May 2017].

Fetherston, M.J. and Godley, W.A.H., 1978. New Cambridge Macroeconomics and Global Monetarism: Some Issues in the Contact of U.K. Economic Policy. *Carnegie-Rochester Conference Series on Public Policy*, 9, pp.33-65

Fisher, R.A., 1932. Statistical Methods for Research Workers, 4th Edition. Edinburgh: Oliver and Boyd.

Fleming, J.M., 1962, Domestic Financial Policies Under Fixed and Under Floating Exchange Rates. *International Monetary Fund Staff Papers,* 9(3), pp.369-380.

Forte, F. and Magazzino, C., 2013. Twin Deficits in the European Countries, *International Advances in Economic Research*, 19(3), pp.289-310.

Hadri, K. and Kurozumi, E., 2012. A Simple Panel Stationarity Test in the Presence of Serial Correlation and a Common Factor. *Economics Letters*, 115(1), pp.31-34.

Islam, M.F., 1998. Brazil's Twin Deficits: An Empirical Examination. *Atlantic Economic Journal,* 26(2), pp.121-128.

Kearney, C. and Monadjemi, M., 1990. Fiscal Policy and Current Account Performance: International Evidence on the Twin Deficits. *Journal of Macroeconomics,* 12(2), pp.197-219.

Kim, S. and Roubini N., 2008. Twin Deficit or Twin Divergence? Fiscal Policy, Current Account, and Real Exchange Rate in the U.S. *Journal of International Economics,* 74(2), pp.362-383.

Koçbulut, Ö. and Altıntaş, H., 2016. İkiz Açıklar ve Feldstein-Horioka Hipotezi: OECD Ülkeleri Üzerine Yatay Kesit Bağımlılığı Altında Yapısal Kırılmalı Panel Eşbütünleşme Analizi. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 48, pp.145-174.

Magazzino, C., 2012. Fiscal Policy, Consumption and Current Account in the European Countries. *Economics Bulletin*, 32(2), pp.1330-1344.

Miller, S.M. and Russek, F.S., 1989. Are the Twin Deficits Really Related? *Contemporary Economic Policy*, 7(4), pp.91–115.

Moon, H.R., and Perron, B., 2004. Testing for a unit root in Panels with Dynamic Factors. *Journal of Econometrics*, 122, pp.81-126.

Moon, H.R., and Perron, B., 2007. An Empirical Analysis of Nonstationarity in a Panel of Interest Rates with Factors. *Journal of Applied Econometrics*, 22(2), pp.383-400.

Mukhtar, T., Zakaria, M. and Ahmed, M., 2007. An Empirical Investigation for the Twin Deficits Hypothesis in Pakistan. *Journal of Economic Cooperation*, 28(4), pp.63-80.

Mundell, R., 1963. Capital Mobility and Stabilization Policy Under Fixed and Flexible Exchange Rates. *The Canadian Journal of Economics and Political Science*, 29(4), pp.475-485.

Normandin, M., 1999. Budget Deficit Persistence and The Twin Deficits Hypothesis. *Journal of International Economics*, 49(1), pp.171-193.

Oktar, S. and Yuksel, S., 2016. Avrupa Birliği Ülkelerinde İkiz Açık Hipotezinin Geçerliliği. *Kastamonu Üniversitesi İİBF Dergisi*, 11, pp.46-61.

Pahlavani, M. and Saleh, A. S., 2009. Budget Deficits and Current Account Deficits in Philippines: A Causal Relationship? *American Journal of Applied Sciences*, 6(8), pp. 1515-1520.

Pelinescu, E. and Caraiani, P., 2010. Econometric Analysis of the Relationship between the Two Deficits in Romania. *Hyperion International Journal of Econophysics & New Economy*, 3(1), pp.75-88.

Pesaran, M. H., 2004. General Diagnostic Tests for Cross Section Dependence inPanels. Cambridge Working Papers in Economics (CWP*E),* 0435.

Pesaran, M.H., and Yamagata, T., 2008. Testing Slope Homogeneity in Large Panels. *Journal of Econometrics*, 142(1), pp.50-93.

Puah, C. Lau, E. and Tan, K.L., 2006. Budget-Current Account Deficits Nexus in Malaysia. *The Journal of Global Business Management*, 2(2), pp.126-135.

Salvatore, D., 2006. Twin Deficits in the G-7 Countries and Global Structural Imbalances. *Journal of Policy Modeling*, 28(6), pp.701-712.

Sinicakova, M., Sulikova, V. and Gavurova, B., 2017. Twin Deficits Threat in the European Union. *E*&M Economics and Management, 20(1), pp.144-156.

Toda, H.Y. and Yamamoto, T., 1995. Statistical Inference in Vector Autoregressions with Possibly Integrated Processes. *Journal of Econometrics*, 66(1-2), pp.225-250

Tosun, M.U. İyidoğan P.V. and Telatar, E., 2014. The Twin Deficits in Selected Central and Eastern European Economies: Bounds Testing Approach With Causality Analysis. *Romanian Journal of Economic Forecasting*, 17(2), pp.141-160.

Uysal, D. and Topallı, N., 2007. İkiz Açık Hipotezi: Türkiye. *Selçuk Üniversitesi Sosyal Bilimler Meslek Yüksekokulu Dergisi*, 10(1-2), pp.201-214.

Üzümcü, A. and Kanca, O.C., 2013. İkiz Açık Hipotezi: Türkiye Üzerine Bir Uygulama (1980-2012). *İnönü Üniversitesi Uluslararası Sosyal Bilimler Dergisi*, 2(1), pp.17-42.

World Bank, 2017. World Bank Open Data. [online] Available at: <http://data.worldbank.org/> [Accessed on May 2017].

Zietz, J. and Pemberton, D.K., 1990. The U.S. Budget and Trade Deficits: A Simultaneous Equation Model. *Southern Economic Journal*, 57(1), pp.23–34.