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Analysis of the Current Account Deficit Sustainability in Turkey

Türkiye'de Cari İşlemler Açığının Sürdürülebilirliğinin Analizi

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ABSTRACT

This paper aims to examine the sustainability of current account deficit in Turkey using both annual and monthly data set covering the periods 1923-2019 and 2008:1-2020:8, respectively. The data set, which is divided into subperiods by considering the turning points of the Turkish economy, is analyzed through the traditional and breakpoint unit root tests, cointegration analysis and error correction models (ECM). The econometric findings reveal that the export and import series are cointegrated for all of subperiods, and that the current account deficit is sustainable in Turkey in a weak form. This study differs from other studies in the current literature on current account deficit in Turkey due to implementing miscellaneous econometric analysis in a comprehensive framework.

Keywords: Current account deficit, Cointegration analysis, Error correction model, Turkish economy.

ÖZ

Bu çalışma 1923-2019 ve 2008:1-2020:8 dönemlerini kapsayan veri setiyle Türkiye'de cari işlemler açığının sürdürülebilirliğini incelemeyi amaçlamaktadır. Türkiye ekonomisinin dönüm noktaları dikkate alınarak alt dönemlere bölünen veri seti çeşitli geleneksel ve yapısal kırılmalı birim kök testleri, eşbütünleşme analizleri ve hata düzeltme modeli ile analiz edilmektedir. Ekonometrik bulgular ihracat ve ithalat serisinin bütün alt dönemlerde eşbütünleşik olduğunu ve Türkiye'de cari işlemler açığının zayıf formda sürdürülebilir olduğunu ortaya koymaktadır. Bu çalışma, çeşitli ekonometrik analizlerin kapsamlı bir çerçevede uygulanması nedeniyle, Türkiye'de cari açığın sürdürülebilirliği ile ilgili mevcut literatürdeki diğer çalışmalardan farklılaşmaktadır.

Anahtar Kelimeler: Cari işlemler açığı, Eşbütünleşme analizi, Hata düzeltme modeli, Türkiye Ekonomisi.

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1. Introduction

Current account balance is the indicator which records a country's international transactions with the rest of the world over certain periods of time. This indicator, with the capital and financial accounts, constitute balance of payments. If the current account balance is negative, this is known as current account deficit (CAD). In other words, current account deficit arises when sum of revenues and current transfers is less than the expenses. The sustainability of the current account deficit is of paramount importance for sustainable economic growth and social welfare (Karunaratne, 2010; Chen, 2011; Insel and Kayikci, 2012).

The concepts of current account deficit sustainability has gained importance since the 1980s together with the domination of neoliberalist economics paradigm. The financial crises of the 1990s ensured that the CAD/GDP ratio was considered as a key indicator for determining economic fragility (Edison, 2003; Zanghieri, 2004). Especially for some developing countries such as Brazil, India, China, Mexico, Argentina, and Turkey CAD/GDP ratio created pressure on the exchange rate. CAD/GDP ratios exceeding 4-6% can be interpreted as a signal of an economic crisis (Dornbusch and Fischer, 1990; Freund, 2000; Karunaratne, 2010). High current account deficits, especially in developing countries, are considered as a leading indicator of a possible economic crises, therefore, it needs to be closely monitored (Milesi-Ferretti and Razin, 1996).

The remarkable increase in the current account deficit worldwide after the 2008 global financial crisis has led to significant concerns about economic stability in many other countries, notably the United States (US). Studies on the US (Cooper, 2001; Roubini, 2006) revealed that the sustainability of the current account deficit in the medium and long term is unlikely. Because, it has reached the extent that it could lead the world into a major financial crisis. It is articulated in different debates that the dollar could collapse if no measures were taken (Edwards, 2005). This view is based on the idea that if the increase in the current account deficit cannot be stopped, the US net international indebtedness will reach 100% of GNP. According to Herrmann and Jochem (2005), by 2007, the US current account deficit would have reached two-thirds of the global net external borrowing. If the deficit continues to remain at this level and grows, significant obstacles will arise for further monetary integration. In the face of the deficit of this magnitude, Roubini (2006) points out that some economists will need a new Bretton Woods regime. In addition, the current account deficit has been growing in recent years in most new European Union (EU) and other Eastern European countries. For example, the current account deficits of Spain and Portugal reached 10% of GNP (Blanchard, 2007).

The CAD/GDP ratio has been increasing since 2001, in parallel with conjectural developments in Turkey. This ratio was 3.5, 5.7 and 8.9 in 2003, 2006 and 2011, respectively. Then, it has been showing a downward trend recently due to rapid increases in the USD/TRY exchange rate. It was 5.9, 3.1 and -1.2 in 2013, 2016 and 2019, respectively. This has led to more intense discussions on the causes of the current account deficit in Turkey. These discussions are mainly focused on the exchange rate.

On the ground that the monetary targeting regime implemented with the transition to a Strong Economy Program, the inflation targeting regime ensured the valuation of the national currency. In such an economic setting where imports are cheaper in terms of residents, the current account deficit has increased. Therefore, in this economic model, deficit financing made it necessary to maintain a high real interest rate policy.

The aim of this study is to analyze the sustainability of Turkey's current account deficit by employing comprehensive econometric analysis with the data set covering 1923-2019 periods and subperiods. The rest of the paper is arranged as follows. Section 2 lays out the theoretical framework in detail. Section 3 describes the literature review. Section 4 specifies data set, methodology and findings, pursued by concluding remarks in last section.

2. Theoretical Framework

Different criteria have been developed to measure the sustainability of the current account deficit. The ratio of the current account deficit to GDP, the ratio of the budget deficit to GDP, the ratio of imports to GDP, the ratio of exports to GDP, the change in reserves, the change in capital flows and the ratio of the trade deficit to GDP are among these criteria (Akdis et al., 2006). Cointegration techniques examined the relationship between export and import variables also occupies an important place in the literature (Husted, 1992; Milesi-Ferretti and Razin, 1996).

Husted (1992) developed a method based on the work of Hakkio and Rush (1991) to test the sustainability of the current account deficit. Husted began its analysis with the following equation under the open economy assumption and budget constraint:

$$C_t = Y_t - I_t - r_t D_t^f \tag{1}$$

where C_t, Y_t, I_t, r_t and D_t^f show the total consumption of the public and private sector, income, investments, international interest rate and the level of the international borrowing at time t, respectively. The budget constraint can be set for all periods by iterating through Equation (1). The resulting intertemporal budget constraint can be written as:

$$D_t^f = \sum_{i=1}^{\infty} \mu_i (Y_{t+i} - C_{t+i} - I_{t+i}) + \lim_{i \to \infty} (\mu_i D_t^f) \tag{2}$$

where $\mu_i = \prod_{i=1}^{j} \frac{1}{1+r_{t+j}}$; i is the discount factor. The income of economic agents minus consumption and investment should be equal to the balance of foreign trade. Foreign trade balance can be expressed as:

$$Y_t - C_t - I_t = X_t - M_t = TB_t \tag{3}$$

where TB_t, X_t and M_t indicate trade balance, exports and imports at time t, respectively. When Equation (2) and Equation (3) are written together, the budget constraint becomes:

$$D_t^f = \sum_{i=1}^{\infty} \mu_i (TB_{t+i}) + \lim_{i\to\infty}(\mu_i D_t^f)$$
(4)

According to Equation (4), when the last period is neglected, the current value of foreign debts must be equal to the present value of the trade balance in the next period. If the current value of foreign debt is greater than the present value of the trade balance in the future, the current account balance cannot be sustained. Hakkio and Rush (1991) and Husted (1992) have arranged the Equation (4) with the assumption that the international interest rate (r) is constant as follows:

$$M_t + r_t D_t^f = X_t + \sum_{i=0}^{\infty}\left(\frac{\Delta X_{t+i} - \Delta Z_{t+i}}{(1+r)^{i-1}}\right) + \lim_{i\to\infty}\left(\frac{D_{t+i}^f}{(1+r)^{i-1}}\right)$$
(5)

where $Z_t = M_t + (r_t - r)D_t^f$. In Equation (5), when X_t is subtracted from both sides of the equation and multiplied by two sides (-1), the equation becomes:

$$CA_t = X_t - M_t - r_t D_{t-1}^f = \sum_{i=0}^{\infty}\left(\frac{\Delta X_{t+i} - \Delta Z_{t+i}}{(1+r)^{i-1}}\right) + \lim_{i\to\infty}\left(\frac{D_{t+i}^f}{(1+r)^{i-1}}\right)$$
(6)

Hakkio and Rush (1991) and Husted (1992) stated that X_t and Z_t can be written as follows with the first order stationary process ($I(1)$) assumption.

$$X_t = a_1 + X_{t-1} + \varepsilon_{1t} \quad (7)$$
$$Z_t = a_2 + Z_{t-1} + \varepsilon_{2t} \quad (8)$$

In this case the equation (6) can be written as:

$$X_t = a + MM_t - \lim_{i\to\infty}\left(\frac{D_{t+i}^f}{(1+r)^{i-1}}\right) + \varepsilon_t$$
(9)

where $MM_t = M_t + r_t D_{t-1}^f$, $a = \frac{1+r}{r}(a_1 - a_2)$ and $\varepsilon_t = \sum_{i=0}^{\infty}\left(\frac{\varepsilon_{1t} - \varepsilon_{2t}}{(1+r)^{i-1}}\right)$. In the long run, this part is negligible because of $\lim_{i\to\infty}\left(\frac{D_{t+i}^f}{(1+r)^{i-1}}\right) = 0$. Finally, the equation (9) can be simply stated as:

$$X_t = a + \beta MM_t + \varepsilon_t \quad (10)$$

The sustainability of the current account deficit becomes conditional on the fact that the correlation coefficient β is equal to one, provided that X_t and MM_t series are cointegrated (Husted, 1992). If β is smaller than one, the sustainability hypothesis is violated. That's to say, if the country's foreign exchange outflows are greater than its foreign exchange revenues, it means the current account deficit is unsustainable. This condition was developed by Quintos (1995). He also stated that current account deficits are sustainable in strong form when β is equal to one, and in weak form when β is between zero and one.

3. Literature Review

Studies on the sustainability of the current account deficit in the literature are classified into two categories: First, studies comparing current account balance and optimality as to intertemporal budget constraint approach; second, works questioning the long term relationship between export and import data. Milesi-Ferreti and Razin (1996) and Edwards (2000) are among the pioneering studies on the sustainability of the current account deficit based on the intertemporal budget constraint. By following the theoretical framework in the pioneering studies, Ghosh and Ostry (1995), Ostry (1997), Callen and Cashin (1999) and Makrydakis (1999), compared the current and optimal current balances by econometric models in order to find out whether the current balance is sustainable.

The second type of study focuses on the long-term relationship of export and import data of countries, or the stationarity of the CAD/GDP ratio. Karunaratne (2010) found that current account deficits in Australia during the period 1959-2007 were sustainable and that the sustainability would be risky if the CAD/GDP ratio exceeded 6% by the help of Engle-Granger (EG) cointegration analysis. With analyses of the Markov Chain and Monte Carlo simulation in the period 1961-2008, Takeuchi (2010) concluded that the current account deficit of US was high and that its sustainability was risky. However, he stated that the current account deficit would become sustainable only if the value of the dollar declines. Holmes et al. (2011) indicated that the sustainability of the current account deficit in India increased in the post-1991 period with generalized least squares (GLS) and vector error correction (VEC) models within 1950-2003 period. Using GLS and Markow switching methods, Chen (2011) failed to reach the sustainability of current account deficit for OECD countries in the period 1970-2009. Greenidge et al. (2011) concluded that the current account deficit for the period 1960-2006 was sustainable in the Barbadian economy, using the Johansen cointegration technique.

There are many studies in Turkey based on the intertemporal budget constraint approach. The International Monetary Fund (lMF) applied a similar method in its 1998 report, and stating that the current balance in Turkey closely followed the optimal current balance in the period 1970-1997. Akcay and Ozler (1998) examined the period 1987-1996 and stated that current account deficits in Turkey were more than normal but would not create a significant problem. Selcuk (1997) argued that this model was insufficient to explain the current balance dynamics due to the lack of full capital mobility, which is one of the main assumptions of the intertemporal budget constraint approach, and concluded that current account deficits in Turkey were unsustainable and that optimal borrowing could not be achieved. In addition, examples of studies questioning the long-term relationship between the data revealing the current account deficit were carried out. While Yucel and Yanar (2005) pointed out the current account deficit is unsustainable, Yamak and Korkmaz (2007), Peker (2009), Gocer and Mercan (2011) concluded that the current account deficit is sustainable in weak form. Insel and Kayikci (2012) stated the income elasticity of imports is 2.24 and that the current account deficit is an inevitable consequence of high economic growth. Apart from the aforementioned works, the detailed literature review on sustainability of CAD in Turkey is as follows.

Table 1. Literature Review on Sustainability of CAD in Turkey

Authors	**Period**	**Methodology**	**Findings**
Kalyoncu (2005)	1987-2002	Johansen	Sustainable
Babaoglu (2005)	1987-2004	VAR	Not Sustainable
Akgul, Koc and Koc (2007)	1992-2006	Markow	Weak Sustainable
Ongan (2008)	1980-2005	Johansen	Not Sustainable
Ozer and Coskun (2011)	2002-2010	Johansen	Weak Sustainable
Sahbaz (2011)	2001-2011	Johansen	Weak Sustainable
Gocer (2013)	1996-2012	Johansen&VECM	Weak Sustainable
Acikgoz and Caglayan (2014)	1992-2011	EG&ARDL	Weak Sustainable
Altunoz (2014)	1994-2013	Johansen	Weak Sustainable
Akcayir and Albeni (2016)	1992-2010	EG&DOLS	Weak Sustainable
Turan et al. (2016)	1987-2014	EG	Not Sustainable
Turk and Sahin (2018)	2000-2016	Johansen	Not Sustainable
Yıldız (2020)	1987-2018	Fourier&FMOLS	Weak Sustainable

Notes: Johansen, VAR, Markov, VECM, EG, ARDL, DOLS, Fourier and FMOLS denotes Johansen cointegration analysis, vector autoregressive models, Markov switching regimes analysis, vector error correction models, Engle-Granger cointegration analysis, dynamic ordinary least squares models, Fourier cointegration analysis and fully modified ordinary least squares analysis, respectively.

4. Data Set, Methodology and Findings

4.1. Dataset

The data set are compiled from TURKSTAT covering 96 annual observations in the period 1923-2019. The import and export data are in US dollars. The movements of export and import data and their logarithms over time are included in Figure 1.

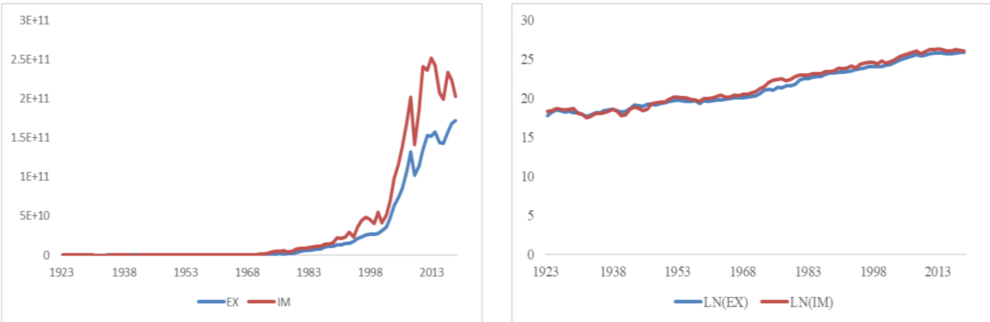

Figure 1. Export and Import Data

Hereafter, logarithmized values of export and import data are used. As seen in Figure 1, export and import data act in harmoniously with each other. Table 1 contains descriptive statistics for the first differences in export and import data. Jarque-Bera Test statistics show that the volatility in import data is higher than the volatility in export data. They are normally distributed at 5% critical value.

Table 2. Descriptive Stats

	LN(EX)	LN(IM)
Mean	21.36	21.68
Standard Deviation	2.661	2.828
Skewness	0.352	0.215
Kurtosis	1.689	1.663
Jarque-Bera	8.951	8.302
Probability	0.011	0.016

As to the correlation between the export and import data, there is a positive and very strong relationship between export and import data when the changes for annual periods are taken into account.

Table 3. Correlation Matrices

	LN(EX)	LN(IM)	ΔLN(EX)	ΔLN(IM)
LN(EX)	1.000	0.994		
LN(IM)	0.994	1.000		
ΔLN(EX)			1.000	0.559
ΔLN(IM)			0.559	1.000

Note: Δ denotes the first difference operator.

4.2. Methodology

In order to analyze the sustainability of the current account deficit in Turkey, it is necessary to question the existence of a long-term relationship between the export and import series. To clarify our analysis, the data must be divided into subperiods which are determined by Boratav (2008). In his book, the economic history of Turkey is divided by subperiods. In this paper, the annual data set which covers the periods 1923-2019 is divided into the periods 1923-1958, 1959-1979 and 1980-2019. In order to make more reliable policy recommendations, the monthly data set which spans the periods from 2008:1 to 2020:8 is also analyzed. Boratav (2008) describes the years 1958 and 1979 as turning points in the Turkish economy.

As to econometric analysis, it is firstly necessary to determine the stationary levels of the series with traditional and breakpoint unit root tests. Stationary means that the mean, variance, and autocovariance of a variable are constant over time. In this regard, the effect of shocks in stationary series disappears in the short term, but shocks in non-stationary series create permanent effects. Cointegration analysis only allows ~~you~~ one to examine the long-term relationships of stationary series of the same order. If two or more time series are not stationary themselves, but a linear combination of them is stationary, it can be said that these series are cointegrated. After the stationary analysis, the cointegration relationship between the series is examined by cointegration tests that take into account single-equation and structural breaks. It should be noted here that although the series is not stationary over a long period, breaks caused by various shocks can affect the stationary levels. Therefore, the analysis needs to be expanded by taking into account the presence of structural breaks. Lastly, with the help of error correction models, the sustainability of current account deficit is analyzed for all subperiods.

4.3. Findings

4.3.1 Stationary and Cointegration Analyses

The stationary levels of the variables used must be determined before conducting cointegration techniques. Therefore, Augmented Dickey-Fuller (ADF) and Ng-Perron

(NP) traditional unit root tests have been referenced[1] . Table 4 shows that the export and import data have a unit root at the level, and they fulfill the condition of stationarity if the first differences are taken.

Table 4. Traditional Unit Root Tests

Periods	Variables	Tests	Level		1^{st} Difference	
			C	C&T	C	C&T
1923-2019	LN(EX)	ADF	0.59 (0)	-1.89 (0)	-9.22 (0)*	-9.37 (0)*
		NP	1.84 (0)	-3.28 (0)	-4.76 (2)*	-21.3 (1)*
	LN(IM)	ADF	0.46 (0)	-2.84 (0)	-8.06 (1)*	-8.13 (1)*
		NP	1.49 (0)	-5.15 (0)	-74.7 (1)*	-73.4 (1)*
1923-1958	LN(EX)	ADF	-1.33 (0)	-1.83 (0)	-4.64 (0)*	-4.57 (0)*
		NP	-0.54 (0)	-6.88 (0)	-11.8 (0)**	-13.6 (0)
	LN(IM)	ADF	-0.54 (2)	-2.05 (2)	-5.54 (1)*	-5.57 (1)*
		NP	-1.10 (2)	-4.55 (2)	-45.3 (1)*	-43.1 (1)*
1959-1979	LN(EX)	ADF	0.83 (1)	-1.19 (1)	-7.89 (0)*	-7.96 (0)*
		NP	-1.82 (3)	-4.87 (0)	-26.0 (3)*	-22.7 (3)*
	LN(IM)	ADF	-0.27 (0)	-1.34 (0)	-4.45 (0)*	-4.30 (0)**
		NP	0.76 (0)	-3.00 (0)	-8.11 (0)**	-19.2 (0)**
1980-2019	LN(EX)	ADF	-2.49 (0)	-2.24 (0)	-5.23 (0)*	-5.71 (0)*
		NP	0.65 (1)	-5.25 (0)	-17.5 (0)*	-17.1 (0)***
	LN(IM)	ADF	-1.64 (0)	-1.99 (0)	-7.16 (0)*	-7.42 (0)*
		NP	0.66 (0)	-8.96 (0)	-28.0 (0)*	-22.6 (0)**
2008:1-2020:8	LN(EX)	ADF	-1.80 (3)	-2.68 (3)	-9.02 (3)*	-8.98 (3)*
		NP	-4.52 (3)	-64.0 (0)*	-18.8 (3)**	-64.6 (0)*
	LN(IM)	ADF	-2.59 (0)***	-2.68 (0)	-17.50 (0)*	-10.50 (1)*
		NP	-11.24 (0)	-13.68 (0)	-66.7 (1)*	-66.4 (1)*

Notes: (1) The critical values are obtained from MacKinnon (1996) for ADF test and from Ng and Perron (2001) for NP test. The critical values of 1% and 5% significance levels in ADF test are -3.503 and -2.893 for models with only intercept, while -4.060

[1] The ADF test (Dickey and Fuller, 1979, 1981) is $\Delta x_t = \delta + \beta t + a x_{t-1} + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + u_t$, where $\Delta, x_t, \delta, \beta$ and u_t represent the first difference operator, the dependant variable, the constant term, the coefficient of trend (t) and the white noise error term. The rejection of the null hypothesis $(a = 0)$ means the x_t series is stationary. The NP test (Ng and Perron, 2001) is performed by taking into account the x_t series, extracting of trend, and the MZ_a statistic which is obtained by PP test developed by Phillips and Perron (1988).

and -3.459 for models with intercept and trend, respectively. These critical values are, respectively, -13.80 and -8.10, -23.80 and -17.30 for NP test. (2) The values in parenthesis represent the optimal lag length. (3) *, ** and *** indicate the null hypothesis is rejected at 1, 5 and 10 % significance levels.

Engle-Granger (EG), Phillips-Ouliaris (PO), Park and Hansen tests are implemented whether there is a long-term relationship between non-stationarity variables at the level, primarily based on the estimation of a single equation. According to the EG and PO test results put forth at Table 5, the null hypothesis that there is no cointegrated relationship between export and import data is rejected at the different significance levels. Also, Park and Hansen tests supports the aforementioned relationship between the variables in case of deterministic cointegration and stochastic trend.

Table 5. Single Equation Cointegration Tests

Periods	Tests		Value	Tests		Value
1923-2019	**EG**	***t***	-3.46**	**Park**	$\boldsymbol{H(0,1)}$	0.092
		z	-21.43**		$\boldsymbol{H(1,2)}$	24.34*
	PO	***t***	-3.28***	**Hansen**	***Lc***	0.910*
		z	-18.79***			
1923-1958	**EG**	***t***	-3.21***	**Park**	$\boldsymbol{H(0,1)}$	29.97*
		z	-22.17**		$\boldsymbol{H(1,2)}$	33.30*
	PO	***t***	-3.25***	**Hansen**	***Lc***	0.40***
		z	-21.69**			
1959-1979	**EG**	***t***	-3.725**	**Park**	$\boldsymbol{H(0,1)}$	7.19*
		z	-17.44**		$\boldsymbol{H(1,2)}$	17.80*
	PO	***t***	-3.81**	**Hansen**	***Lc***	0.22
		z	-17.14**			
1980-2019	**EG**	***t***	-5.57*	**Park**	$\boldsymbol{H(0,1)}$	7.43*
		z	-29.03*		$\boldsymbol{H(1,2)}$	7.65**
	PO	***t***	-5.62*	**Hansen**	***Lc***	0.18
		z	-30.48*			
2008:1-2020:8	**EG**	***t***	-7.17*	**Park**	$\boldsymbol{H(0,1)}$	0.09
		z	-78.76*		$\boldsymbol{H(1,2)}$	1.04
	PO	***t***	-7.29*	**Hansen**	***Lc***	0.33
		z	-82.06*			

Notes: (1) In all four tests, the relationship between export and import data is estimated by the fully adjusted least squares (FMOLS) method. (2) In the EG test, the optimal lag length is determined with the help of the Schwarz Information Criterion. In the PO test, the Bartlett Kernel Spectral estimation method is used. The bandwidth is determined by the Newey-West method. (3) The tables developed by MacKinnon (1996) for the EG and PO cointegration tests and Hansen (1992) for the Hansen cointegration test is taken into account. (4) *, ** and *** indicate the null hypothesis is rejected at 1, 5 and 10 % significance levels.

4.3.2 Stationary and Cointegration Analyses with Structural Break(s)

The results of the unit root tests and cointegration tests in Table 3, 4 and 5 are obtained under the assumption that there is no structural breakpoints in the Turkish economy during the subperiods covered. However, as shown in Figure 1, many of economic turbulences such as economic and political crisis of 1958, 1980 and 2008 have significantly affected export and import data through the exchange rate shocks. Therefore, the possible effects of these developments on the unit root and cointegration analyses should be made clear, in case they may change the results obtained. In this context, Zivot-Andrews (ZA) and Lumsdaine-Papell (LP) unit root tests are implemented where structural breakpoints could be determined exogenously[2]. The results of the ZA and LP unit root tests, which allows one and two structural breaks, respectively, are given in Table 6. Although this two unit root tests reveal that the export and import data are stationary at first difference. Furthermore, it is remarkable that the break periods are in line with the political and economic problems in Turkey.

[2] In the LP test (Lumsdaine and Papell, 1997), the models allowing two structural breaks in the constant $\Delta x_t = \delta + \beta t + a x_{t-1} + \theta DU1_t + \omega DU2_t + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + u_t$; allowing two structural breaks in the constant and one structural break in the time trend $\Delta x_t = \delta + \beta t + a x_{t-1} + \theta DU1_t + \mu DT1_t + \omega DU2_t + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + u_t$; and which allows two structural breaks both constant and time trend $\Delta x_t = \delta + \beta t + a x_{t-1} + \theta DU1_t + \mu DT1_t + \omega DU2_t + \varphi DT2_t + \sum_{i=1}^{k} \gamma_i \Delta x_{t-i} + u_t$ is estimated, which $\Delta, x_t, DU1, DU2, DT1, DT2, \delta, \beta, \theta, \mu, \omega, \varphi$ and u_t represent the first difference operator, the dependant variable, the dummy variables indicating structural breaks in constant and trend, the intercept, the time trend coefficient, the coefficient of dummy variables and white noise error term, respectively. $t = 1,2,\ldots,T$ shows the time and TB_1 and TB_2 $(1 < TB_1, TB_2 < T)$ indicate structural break periods. When $t > TB_1, TB_2$; $DU1_t, DU2_t = 1$, in the oher cases $DU1_t, DU2_t = 0$; when $t > TB_1, TB_2$; $DT1_t = t - TB_1$ and $DT2_t = t - TB_2$, otherwise $DT1_t, DT2_t = 0$. The rejection of the null hypothesis of $a = 0$ in the ZA and LP tests mean the x_t series is stationary with structural breaks.

Table 6. ZA and LP Tests

Periods	Tests		C		T		C&T	
			t-stats	Date(s)	t-stats	Date(s)	t-stats	Date(s)
1923-2019	**LN(EX)**	**ZA**	-3.22	1980	-2.93	1959	-3.26	1954
		LP	-3.94	1953 1979	-3.82	1968 1982	-4.48	1941 1971
	LN(IM)	**ZA**	-4.35	1973	-3.05	1959	-3.74	1972
		LP	-4.32	1971 2001	-3.48	1965 1977	-5.06	1941 1971
1923-1958	**LN(EX)**	**ZA**	-3.51	1942	-3.26	1932	-3.86	1941
		LP	-3.25	1942 1945	-3.52	1941 1944	-3.48	1941 1954
	LN(IM)	**ZA**	-4.22	1941	-3.03	1952	-3.36	1937
		LP	-3.60	1941 1946	-4.21	1937 1952	-4.46	1937 1952
1959-1979	**LN(EX)**	**ZA**	-2.06	1971	-2.43	1974	-2.24	1971
		LP	-2.94	1971 1974	-3.32	1968 1974	-3.28	1968 1971
	LN(IM)	**ZA**	-1.84	1966	-3.94	1971	-3.46	1971
		LP	-2.02	1964 1971	-4.06	1966 1971	-3.60	1966 1974
1980-2019	**LN(EX)**	**ZA**	-2.23	1984	-2.49	2009	-3.96	2002
		LP	-3.64	1999 2012	-3.97	1988 2011	-4.74	2002 2009
	LN(IM)	**ZA**	-2.23	2014	-4.47	2004	-3.57	2002
		LP	-4.27	1989 2002	-3.58	1989 2004	-4.22	1984 2012
2008:1-2020:8	**LN(EX)**	**ZA**	-3.93	2011:3	-3.61	2013:3	-3.78	2010:10
		LP	-3.94	2010:11 2019:5	-4.52	2009:4 2012:1	-3.48	2010:9 2017:6
	LN(IM)	**ZA**	-4.17	2010:3	-3.58	2012:4	-4.50	2010:3
		LP	-4.29	2009:7 2019:3	-3.98	2011:5 2017:4	-4.13	2010:7 2017:8

***Notes*:** (1) Critical values are taken from tables developed by Zivot and Andrews (1992) for the ZA test, Lumsdaine and Papell (1997) for the LP test. The critical values at 1% and 5% significance levels in the ZA test are -5.34 and -5.80 for the model with break in the constant (C), -5.93 and -4.42 for the model with break in the trend (T), -5.57 and -5.08 for the model with break in the trend with the constant (C&T), respectively. The critical values for the LP test are -7.34 and -6.82; -7.24 and -6.65, -7.34 and -6.82, respectively. (2) The values in parentheses indicate the optimal lag length determined by Schwarz Information Criterion.

ZA and LP test results show that the series are stationary at first difference, not at the level in case of one or two breaks. This justifies that the single equation cointegration models are sufficient. However, comparing results by adding system-based (VAR) models ~~next~~ to single equation models is not the right approach. Because single equation models and VAR models use different estimation methods and are based on different assumptions, they cannot be compared directly. For this reason, there is no need to use the Johansen and Saikkonen-Lütkepohl methods to determine the cointegration rank, because there is already no more than one cointegrated vector between two variables, and the rank cannot be greater than one.

In case of structural breaks, the results of the EG, PO, Park and Hansen tests are suspicious. Therefore, the Gregory-Hansen (GH) cointegration test, in which the breaks are determined endogenously, is applied[3]. As stated at Table 7, a long-term relationship between export and import data is found only the model with regime change.

[3] GH cointegration test (Gregory and Hansen, 1996) is based on estimation of models, allowing break in constant $x_{1t} = \delta_1 + \delta_2\varphi_{t\tau} + ax_{2t} + u_t$; containing the time trend and allowing break in constant $x_{1t} = \delta_1 + \delta_2\varphi_{t\tau} + \beta t + ax_{2t} + u_t$ and allowing scrutiny of regime change $x_{1t} = \delta_1 + \delta_2\varphi_{t\tau} + \beta t + a_1x_{2t} + a_2x_{2t}\varphi_{t\tau} + u_t$, where $x_{1t}, x_{2t}, \delta_1, \delta_2, a,\ a_1, a_2, \beta$ and u_t represent the variables, the constant term before structural break and the change made by structural break in constant term, the coefficient vector of explanatory variables, the cointegration vector before regime change and the change made by regime change in the cointegration vector, the coefficient of trend (t) and white noise error term. $\varphi_{t\tau}$ is a dummy variable that takes a value of one while $t > \gamma\tau$ and zero in other cases, while the coefficient τ between 0 and 1 represents the period during which the structural break occurred. In the GH cointegration test, three models are estimated for each τ value and the ADF unit root test is applied to the error terms. Accordingly, the minimum value of the test statistic is accepted as the structural break. If the absolute value of test statistic is greater than the critical value, the null hypothesis is rejected that is no cointegrated relationship between the variables.

Table 7. GH Tests

Periods	C		C&T		RC	
	t-stats	Date	t-stats	Date	t-stats	Date
1923-2019	-4.87 (0)	1948	-3.71 (0)	1948	-6.26 (0)*	1979
1923-1958	-4.27 (0)	1950	-5.36 (0)**	1947	-9.27 (0)*	1939
1959-1979	-3.86 (0)	1969	-5.15(0)	1971	-8.26 (0)*	1971
1980-2019	-4.41 (0)	2004	-3.25(0)	2002	-9.92 (1)*	1984
2008:1-2020:8	-5.11 (1)**	2013:5	-4.63 (1)	2011:7	-11.8 (0)*	2009:11

Notes: (1) Critical values are taken from tables developed by Gregory and Hansen (1996). The critical values of GH test at 1% and 5% significance levels are -5.44 and -4.92 for break in constant (C); -5.80 and -5.29 for break in constant and trend (C&T); -5.97 and -5.50 for regime change model (RC). (2) The values in parentheses indicate the optimal lag length determined by Schwarz Information Criterion. (3) * and ** display the null hypothesis is rejected at 1 and 5 % significance levels.

4.3.3. Error Correction Model

Both Table 5 and 7 show that the export and import data are cointegrated. The relationship between these two series is estimated by error correction model by taking break periods displayed by the GH regime change model shown in Table 7 into account. Table 8 displays that all of long term coefficients of independent variable and error correction term are significant both economically and statistically.

Table 8. Error Correction Model

Periods	Dependent Variable: LN(EX)		
	LN(IM)	C	ECT_{-1}
1923-2019	0.95 (0.12)*	0.91 (0.45)**	-0.25 (0.02)*
1923-1958	0.74 (0.19)*	4.74 (1.69)*	-0.40 (0.09)*
1959-1979	0.76 (0.18)*	4.69 (1.60)*	-47.8 (0.26)*
1980-2019	0.98 (0.22)*	0.13 (0.57)	-0.51 (0.07)*
2008:1-2020:8	0.85 (0.10)*	3.17 (2.24)	-0.46 (0.06)*

Notes: (1) ECT_{-1} denotes error correction term. (2) The values in parentheses indicate the standard errors. (3) * and ** show the null hypothesis is rejected at 1, 5 and 10 % significance levels.

Table 8 exhibits that the current account deficit in Turkey is sustainable in weak form. In the period 1923-2019, the export/import coverage ratio is close to one. From 1980 to present, an implicit export-led growth model has been applied in Turkey. Liberalization of foreign trade, transition to floating exchange regime, positive impact on international competitiveness of serious devaluations after the crises of 1994, 1997, 2001 contribute to the current account balance after 1980. In the post-2008 period, when the global financial crisis broke out, the USD/TL exchange rate fell until FED's tapering decision in 2013. Its negative impact on the foreign trade balance has been evident. The impact of serious exchange rate fluctuations in 2018 and 2020 on the foreign trade balance will only be seen in the following periods.

5. Conclusion

The current account deficit ranks first among the main macroeconomic problems not only in Turkey but also in many developed and developing countries. Especially with the recent global financial crisis, the CAD/GDP ratio has started to be followed more seriously by policymakers and academics. Today, the most important reason underlying trade and exchange rate wars are the desire of countries to become advantageous in foreign trade and the idea of closing their current account deficits.

In this study, the sustainability of the current account deficit, which is one of the chronic problems of the Turkish economy, is investigated using unit root tests, cointegration analysis and error correction model using annual data for the period 1923-2019 and monthly data for the period 2008:1-2020:8. Applying the intertemporal budget constraint model developed by Husted (1992), a strong relationship between export and import data is found. The fact that the export/import coverage ratio is smaller than one indicates the current account deficit in Turkey is sustainable in weak form and the results is in line with Gocer (2013) and Yildiz (2020) studies. In order to sustain it in strong form or close, reducing the share of imported inputs in the production, granting incentives to exporting firms, the implementation of policies of export promotion and import substituted production should be supported and encouraged.

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