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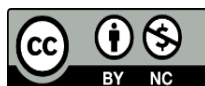
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Exploring The Twin-Deficit Hypothesis by Considering the Energy Prices in Türkiye: The Evidence from the Rolling Window and the Spectral Causality Analyses*

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Abstract

Worsening the budget and current account balance has been one of the government's most urgent issues, especially since the 1980s. Within this context, various studies have been conducted to find the accurate solution and whether there is a connection between the two unpleasant macroeconomic problems. The study aims to address the twin-deficit hypothesis at the full and sub-samples, with different frequencies, by employing the advanced causality test approaches in the case of the Turkish economy by considering energy prices. The Toda-Yamamoto, the Rolling-Window, and Breitung-Candelon Causality analyses are performed on the monthly data spanning from 2009:01 to 2024:08. When examining the evidence on the entire sample, the Ricardian Equivalence hypothesis is verified, and energy prices induce the budget deficit. However, the current account deficit and energy prices affect the budget deficit in the short run due to the outcome of the spectral analysis. The Rolling window discloses the causality relationship among the variables at the varied time intervals. The final testament of the study approves the Ricardian Equaliance in the case of Türkiye and rejects the twin-deficit hypothesis. The policy actions are recommended for the policy-makers based on the evidence obtained in the study.


Keywords

Budget Deficit,
Current Account
Deficit,
Energy Prices,
Macroeconomics,
Twin-Deficit

JEL Classification

O11, Q43, E60

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İkiz Açık Hipotezini Türkiye'deki Enerji Fiyatlarını Dikkate Alarak Araştırmak: Kayan Pencere ve Spektral Nedensellik Analizlerinden Elde Edilen Kanıtlar

Öz

Bütçe ve cari işlemler dengesinin kötüleşmesi, özellikle 1980'lerden beri hükümetlerin en acil konularından biri olmuştur. Bu bağlamda, iki tatsız makroekonomik sorun arasında bir bağlantı olup olmadığı ve doğru çözümü bulmak için çeşitli çalışmalar yapılmıştır. Bu çalışma, ikiz açık hipotezini Türkiye ekonomisi örneğinde enerji fiyatlarını dikkate alarak gelişmiş nedensellik testi yaklaşımlarını kullanarak tam ve alt örneklerde, farklı frekanslara ele almayı amaçlamaktadır. Toda-Yamamoto, Kayan Pencere ve Breitung-Candelon Nedensellik analizleri 2009:01-2024:08 dönemini kapsayan aylık veriler üzerinden gerçekleştirilmiştir. Tüm örneklem üzerinde kanıtlar incelendiğinde, Ricardocu Denklik hipotezi doğrulanmakta ve enerji fiyatları bütçe açığını tetiklemektedir. Ancak, spektral analiz sonucuna göre cari açık ve enerji fiyatları kısa vadede bütçe açığını etkilemektedir. Kayan pencere, değişkenler arasındaki nedensellik ilişkisini farklı zaman aralıklarında ortaya koymaktadır. Çalışmanın nihai sonucu, Türkiye örneğinde Ricardocu Eşitliği onaylamak ve ikiz açık hipotezini reddetmektedir. Çalışmada elde edilen kanıtlara dayanarak politika yapıcılar için politika eylemleri önerilmektedir.

Anahtar Kelimeler

Bütçe Açığı,
Cari İşlemler Açığı,
Enerji Fiyatları,
Makroekonomik,
İkiz Açık

JEL Kodu

O11, Q43, E60

1. Introduction

The budget and current account deficits are among the critical problems of the Turkish economy. The budget deficit occurs when public expenditures exceed public revenues, while the current account deficit emerges when the current account¹ in the balance of payments² is in deficit. In the 1980s, these two deficits were correlated and called the 'twin deficit hypothesis' in the USA. The first view on the twin deficit is the traditional Keynesian theory, which argues that an increase in the budget deficit increases the current account deficit. It is based on the Mundell-Fleming model. According to this theory, the budget balance directly and indirectly affects the current account balance. If there is a dependency on imports for intermediate goods production in a country where public investment is made, the increase in public investments will increase imports. Thus, a current account deficit will occur with a direct effect. The indirect effect occurs when public expenditures increase or tax revenues decrease. As a result, total demand will increase, causing imports to increase and disrupting the current account balance. In addition, if bonds are issued in an economy to finance budget deficits, the national currency will appreciate while interest rates increase, and the demand for imported goods will increase. Thus, a current account deficit will occur.

¹ It comprises foreign trade (export & import), services, and transfer accounts.

² It comprises current, capital, financial, reserve assets, net errors, and omissions accounts.

The second view on the twin deficit is the Ricardian equivalence hypothesis, which suggests no relationship between budget deficits and current account deficits (Mishkin, 2007). It is assumed that individuals are rational and expect that the tax reduction to be implemented by the state will be financed by higher taxes in the future. The savings will not be directed to consumption, so imports will not increase, and as a result, the current account balance will not be disrupted.

Energy imports are among the most critical factors that disrupt the current account balance. As is known, economic growth brings with it an increase in production. Energy is crucial for production in all sectors and for meeting the majority of the physical needs of households in Maslow's hierarchy of needs. In addition, energy is also needed for environmental and social sustainability as well as increasing social and cultural welfare. However, energy prices are affected by the limited energy supply in the world on the one hand and the exchange rate volatility on the other, thereby increasing inflation and profoundly affecting the economy. Since energy resources are limited in Türkiye, there is an import dependency on primary energy resources. Therefore, exchange rate fluctuations are essential. Since 2013, the FED's tight monetary policy, the political developments, and the focus on economic growth have brought exchange rate volatility to the forefront in Türkiye. Hence, any fluctuation in the exchange rate increases costs and is reflected in foreign trade. Even if measures are taken to protect foreign trade, exchange rate volatility may occur and affect energy prices.

First of all, the purpose of this study is to examine the twin deficit in Türkiye and to investigate whether the increase in energy imports has an effect on the current account deficit. For this purpose, Toda-Yamamoto, Rolling-Window, and Breitung and Candelon Frequency-based causality test analyses were conducted in 2009:M01-2024:M08. Employing the econometric approaches on the different frequencies and time intervals is the study's unique contribution because the validity of twin deficits when considering energy prices can be investigated through a sub-sample of the entire sample. Policymakers can learn about the presence of the twin deficit at different time intervals.

The study continues by examining the relationship between energy foreign trade and the current account deficit in Türkiye. Subsequently, the relevant literature review is presented, followed by methodology, analysis, results, and general evaluation.

2. Energy Foreign Trade and Current Account Deficit Relationship in Türkiye

Production is carried out using fossil energy resources in Türkiye. Given the fact that the production of oil and natural gas is limited, it is met through imports. However, fluctuations in exchange rates, legal regulations, taxes, and conflicts or wars in countries of import affect energy foreign trade. Chart 1 presents energy exports and energy imports in Türkiye.

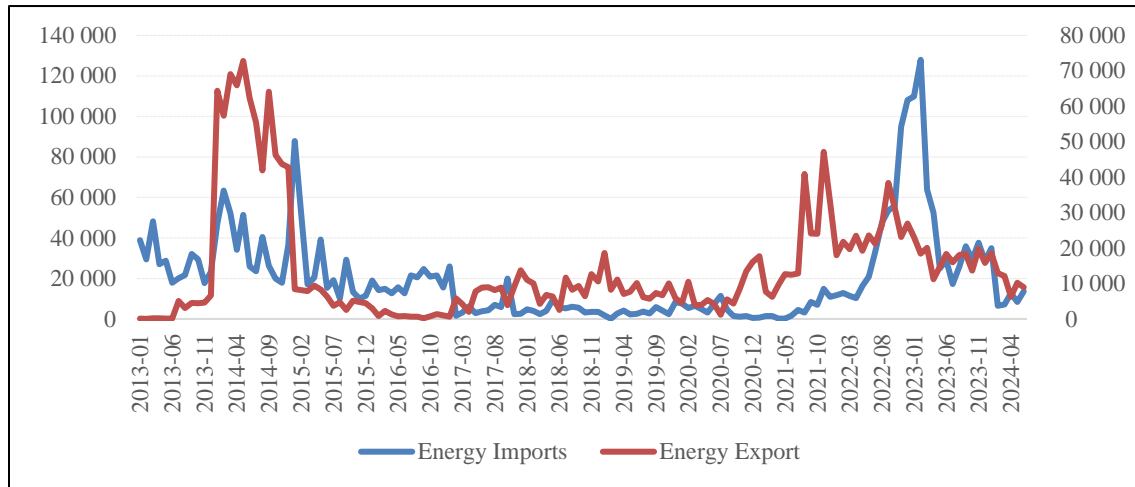


Chart 1. Energy Import – Energy Export (TCMB, 2024)

As seen in Chart 1, since energy supply sources are limited in Türkiye, energy exports cannot meet energy imports.

Energy imports, the most substantial contributor to Türkiye's current account deficit, play a crucial role in the country's economic balance. Chart 2 presents a detailed breakdown of all items in Türkiye's current account.

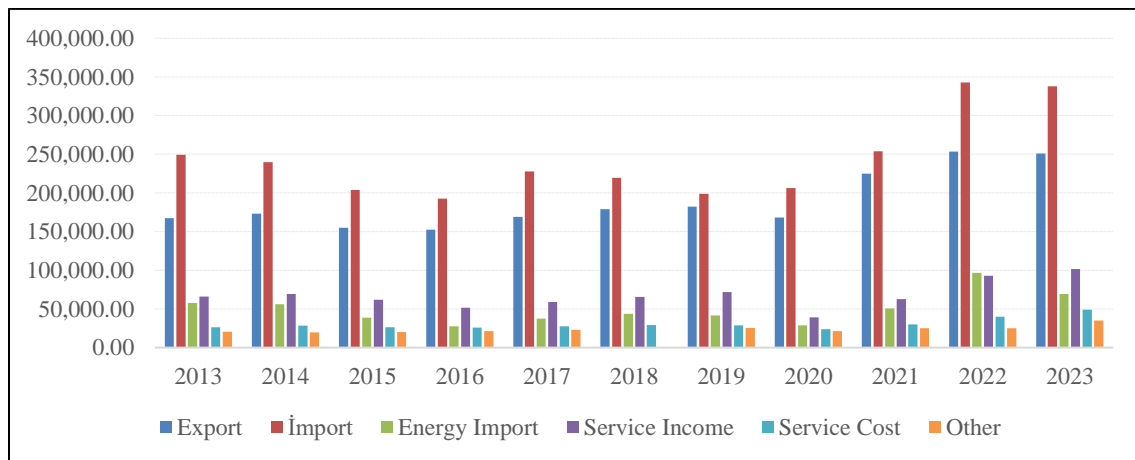


Chart 2. Current Account (TCMB, 2024)

When Chart 2 is evaluated, it is seen that the share of energy imports in the total imports of all sectors has increased in the post-pandemic period. The increase in energy imports has also caused Türkiye to be affected by global energy prices. This situation is among the crucial factors in increasing the headline current account deficit in recent years. The fluctuation in energy prices is shown in Chart 3.

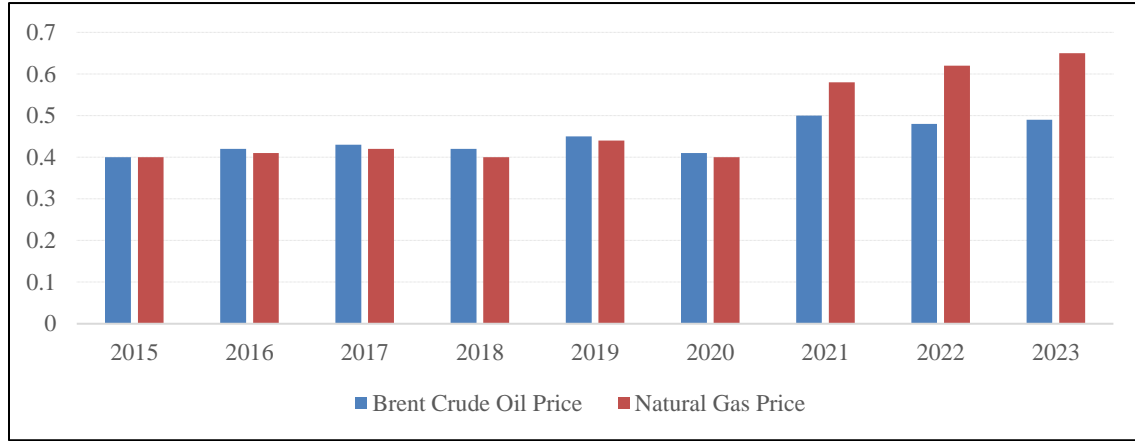


Chart 3. Oil and Natural Gas Prices (Gokcu, 2023; TÜİK, 2024)

As seen in Chart 3, the fluctuations in natural gas and oil prices, especially in 2022-2023, have caused energy prices to increase due to both the increase in demand following the pandemic period and the impact of the war between Russia and Ukraine.

In addition to the heavy burden of our country's dependence on imports of energy resources, when the burden of the carbon border adjustment mechanism (CBAM) is added, it will become more challenging to prevent the current deficit every passing day. This situation will negatively affect the Turkish economy. Considering the economic burden of fossil energy on the one hand and the CO₂ emissions on the other, it is impossible for both the economy and the environment to be sustainable. Therefore, the importance of using renewable energy sources comes to the fore once again.

3. Literature Review

The twin deficit hypothesis has been one of the prominent macroeconomic frameworks and research objectives in the literature. About the volume of the literature, controversial mixed evidence has been encountered. Within this scope, the existing literature can be classified into two categories: the research involved in the first one supports the Keynesian proposition, meaning the

presence of the twin deficit, and the Ricardian Equivalence hypothesis is approved by the research involved in the second. Darrat (1988) managed one of the seminal research for the United States by applying the Granger causality analysis, and a mutual causality connection between the budget and the trade deficit was detected, which confirmed the presence of the twin deficit. Rosenwieg and Tallman (1993) also conducted an investigation performing the VAR models for the United States, and they present the transmission mechanism in which the budget deficit leads to an increase in the dollar, contributing to the trade deficit. Another prominent study was conducted by Vamvoukas (1997) for Greece, and the survey findings approved the validity of the Keynesian proposition. Khalid and Guan (1999) disclosed evidence on whether the twin deficit phenomenon depends on the country's development stage, and they show that the twin deficit holds for developing countries but for developed ones.

Kiran (2011) adopts the fractional cointegration approach for Türkiye, and as a result of the study, it discloses weak evidence supporting the validity of the twin deficit. Miteza (2012) assesses the connection between the budget deficit and the current account deficit for 20 OECD countries. The Arellano-Bond difference GMM estimator and the panel Granger causality analysis are performed, and the estimation finding proves that the budget deficit influences the current account deficit. Hoque et al. (2015) apply the panel fixed, random effects, and OLS regression to test the presence of the twin deficit for 14 developing Asian countries. When performing the panel methods, the study reveals that the budget deficit is the factor causing the current account deficit, confirming the presence of the twin deficit. A 1% increase in budget deficit leads to a widening of the current account deficit, measured as 0.31%. Bölükbaş et al. (2018) perform the panel causality tests on the second generation, including the Dumitrescu-Hurlin (2012) and Emirmahmutoglu-Kose (2011) to examine the twin deficit for the EU-27 countries and Türkiye. The study discloses mixed causality outcomes for the countries considered. For example, the mutual causality relationship holds for 16 out of 28 countries, while a one-way causality link is verified for 5 EU countries. Using panel cointegration analysis, Özçalık and Erataş (2014) investigated the twin deficit hypothesis in emerging market economies. As a result of the analysis, it was concluded that there was no relationship between the current account deficit and the budget deficit. Shastri et al. (2017) endeavor to obtain the result on the presence of the twin deficit for selected 8 Asian countries, and the panel methods with the first and second-generation are executed within this objective. According to the examination, it is concluded that the budget and the current account

deficit have a solid mutual connection in the countries regarded. Bayramoğlu and Öztürk (2018) conducted a study addressing the triple deficit hypothesis in developing countries. The Dumitrescu Hurlin Panel causality analysis is executed. The analysis shows that the budget deficit induces the current account deficit, which poses the validity of the twin deficit. In contrast, a valid interconnection between domestic savings and the current account deficit is confirmed. Still, the non-causality link between the fixed capital investments and the current account deficit is found. This evidence means the partial presence of the triple deficit hypothesis in the considered countries. Okoli et al. (2021) investigated whether the prevalence of the Ricardian Equivalence or the twin-deficit hypothesis matters for BRICS countries. The panel analysis revealing the threshold relationship between the variables is applied within this scope. The study's findings claim that the twin deficit becomes more visible in the BRICS countries, after which both imbalances further increase, and either of the deficits will dramatically increase the other. Dogan and Saykal (2022) try to reach evidence on the presence of the twin deficit by considering the inflation in the case of Türkiye. The VAR models and Granger causality analysis are applied, and the consequence of the investigation proves the absence of the twin deficit. In contrast, the budget and the current account deficit are found to be factors increasing inflation. Asrafuzzaman et al. (2013), who investigated the twin deficit hypothesis in Bangladesh using the same analysis methods, determined a bidirectional causality relationship between the current account deficit and the budget deficit. In Türkiye, İyidoğan and Erkam (2013), Ata and Yücel (2003), Duman and Belke (2011), and Yılmaz and Akıncı (2012), who applied Granger causality analysis at different time intervals, reached similar results in their studies. Liu and Gu (2023) use the bootstrap rolling window approach to analyze whether the causality relationship between the fiscal and trade deficit depends on the time interval between 1901 and 2018 in the USA. As a result of the estimation, it is found that the trade deficit is positively influenced by the fiscal deficit from 1946 to 1956, from 1982 to 1998, in 2002, and from 2002 to 2008. The fiscal deficit had a negative effect on the trade deficit from 1937 to 1945, whereas the trade deficit negatively induced the fiscal deficit from 1940 to 1942, from 1959 to 1975, and from 1981 to 1994. Hussain et al. (2024) apply the augmented ARDL approach to test the twin-deficit hypothesis in Pakistan by focusing on two separate models: the current account balance and the trade balance are used as the dependent variables. When examining the evidence on two different models, the twin-deficit hypothesis holds for Pakistan, and the one-way causality link operating from fiscal deficit to the balance of trade is verified. Moreover, the openness of the

economy and the exchange rate impair and enrich the current account balance, respectively. In Türkiye, Kılavuz and Dumrul (2012) and Altunöz (2014), who applied ARDL analysis for different periods, concluded that there is no relationship between the current account deficit and the budget deficit. Chang et al. (2024) apply the system-equation ADL test for the threshold cointegration test introduced by Li (2017) in the USA. According to the estimation, the twin-deficit hypothesis is confirmed, and a nonlinear long-run connection between trade and budget deficit is found. Lubna and Saha (2024) try to reach evidence on the presence of the twin deficit in Bangladesh by applying the ARDL approach, the Granger causality analysis, and the VAR model. The study's outcome discloses that the current account and fiscal deficit significantly influence each other, while the fiscal deficit causes the current account deficit. Akyol et al. (2023) and Emirmahmutoglu and Köse (2011) tested the twin deficit hypothesis using panel causality, Durbin-h panel cointegration (2008) and panel ARDL bounds tests. As a result of the analysis, while the results supporting the Keynesian approach were reached for Germany, France, Lithuania, Malta, Portugal, and Slovenia, it was determined that the twin deficit hypothesis was not valid in 15 countries in Europe.

Although there are numerous studies in the literature on the twin deficit hypothesis mentioned above, two studies examine the relationship between energy inflation and the twin deficit. Kousar et al. (2022) used the VAR model to examine the relationship between climate change, exchange rate, twin deficit, and energy inflation in Pakistan. When the evidence regarding the model is examined, it is seen that the twin deficit and exchange rate have a significant and positive relationship with energy inflation. In addition, it was found that the effect of the twin deficit on oil prices was more significant than electricity prices. Asif et al. (2023) aimed to analyze the twin deficit's effect on India's energy inflation in a linear and nonlinear framework and used ARDL and NARDL approaches in this direction. The findings show a negative relationship between the twin deficit and energy inflation in the symmetric model. Karaş (2024) applied the ADF unit root test, Zivot-Andrews structural break root test, Gregory-Hanen cointegration test, and Granger causality test to examine the relationship between the current account deficit and budget deficit in Türkiye. As a result of the analysis, a long-term relationship was determined between the budget deficit, current account deficit, and interest. It has been determined that there is a one-way causality relationship between the current account deficit and interest and budget deficit and a two-way causality relationship between the budget deficit and interest.

As a result of the existing studies on the twin deficit, nearly all of the studies investigated the entire sample using different econometric methods. However, the validity of the twin deficit may vary over the time horizon because sub-components of time intervals differ under the various shocks caused by domestic and international markets, varied economic situations, or applied policies. Within this scope, the study investigates the presence of twin deficits by employing the Rolling-Window, Breitung-Candelon Causality, and the conventional Toda-Yamamoto causality analysis. Moreover, as the payments for energy prices are pivotal for the budget and current account balance of Türkiye because of the reliance on imported energy resources, the study also considers the energy prices under the presence of the twin deficit.

4. Data and Methodology

The study has addressed the validity of the twin-deficit hypothesis by considering the role of energy prices in Türkiye. Within this objective, the variables on budget and the current account balance are achieved via the Central Bank of the Republic of Türkiye of Datastream (EVDS). As for the energy prices, the study uses the Brent petrol spot price of Europe via the European Union's website. The budget deficit is calculated by considering the consolidated budget's items, and the current account deficit is also calculated by considering the international balance of payments items. The time interval is based on the monthly time interval spanning from 2009:01-2024:08 with the aim of reaching evidence after the 2008 Global Financial Crisis. All considering series are used in the logarithmic forms to overcome the serial correlation and heteroskedasticity issues. As the budget and the current account are in deficit, they are first converted into the applicable forms for the logarithmic process. The process employed in the budget and current account is shown in the footnote³.

4.1. Toda-Yamamoto Causality Analysis

Granger (1969) causality analysis, which is the pioneering model in causality analysis, is based on a number of limitations. In order for non-stationary series to be subject to analysis, differencing procedures should be applied. Differencing leads to loss of information in the series. In order to prevent information loss, Toda and Yamamoto developed a causality test based on the adjusted VAR model.

³ series logcax2=@recode(ca>0, log(1+ca),-log(1-ca)) series logbudgetx2=@recode(budget>0,log(1+budget),-log(1-budget))

In this test, which is called Toda-Yamamoto causality analysis, the stationarity status of the series is analyzed with the level value regardless of the number of differencing operations. In this test, the degree of stationarity of the series as well as the possible cointegration relationship between the series do not affect the validity of the analysis results (Toda & Yamamoto, 1995:227). Although the model developed by Toda-Yamamoto has fewer restrictions compared to Granger causality analysis, certain steps should be followed in this test phase. The first condition is to determine the appropriate lag length and the lag length is determined by considering the lag length of the VAR model. AIC, SCI and Hannan-Quin (HQ) information criteria are taken into account in determining the optimal lag length in the VAR model. The second case is the determination of the maximum stationarity level of the variables. After determining the lag length and the maximum stationarity level, a VAR model with the sum of these two values is constructed and Toda-Yamamoto causality analysis is performed. In the second stage, the Wald test is applied by ignoring the coefficients with maximum degrees of stationarity added to the appropriate lag. The optimal lag length (p) and the maximum degree of cointegration of the variables (d_{max}) VAR model is constructed with a lag length of $k+d_{max}$. When examining the causality relationship, the MWALD test, which includes only k lag length, is applied. The null hypothesis of the test states that there is no causality relationship results (Toda & Yamamoto, 1995).

4.2. Rolling-Window Causality Analysis

The symmetric or asymmetric causality relationship between series varies over time. Local or global events during the period in which the series are analyzed may affect the causality relationship. At this point, economic, political and social events that take place during the period to be analyzed may cause the causality relations of the variables to differ periodically (Tang, 2008). The fact that periodic structural changes will cause changes in the parameters of the variables has paved the way for time-dependent causality analysis. Moreover, it is emphasized that there will be an interaction between variables under the conditions assumed in the economic literature. Performing time-varying causality analysis not only provides policymakers with periodic policy recommendations but also helps to identify the conditions under which existing theoretical interactions occur. Time-varying causality analysis can be performed from a symmetric or asymmetric perspective over the series considered. Time-varying symmetric and asymmetric causality analysis are time-varying versions of the Hacker and Hatemi (2006) and Hatemi and Irandoust (2012) causality tests. The time-varying asymmetric causality analysis was developed by Yılancı and Bozoklu (2014) based on the model presented by Hatemi and Irandoust (2012). In time-varying causality tests, the entire sample set is not used; instead,

the analysis is performed by determining a sample size smaller than the sample size, i.e. a window width. The sub-periods to be analyzed are defined in equation 5 below.

$$t = \tau - l + 1, \tau - 1, \dots, \tau, \tau = l, l + 1, \dots, T \quad (5)$$

In Equation 5, the term l represents the rolling window size. The most important factor in time-varying causality analysis is the determination of the appropriate sub-period, i.e. the number of windows (Brooks & Hinich, 1998). The equation presented by Caspi (2017) is taken as a basis in the literature. The equation used to determine the number of windows is shown below.

$$l = T(0.01 + 1.8/\sqrt{T}) \quad (6)$$

In the analysis process, causality analysis is performed from the first observation in the first sub-sample to the last observation of the window width. In the next step, the first observation in the first window is deleted and the observations after the last observation of the window width are added and the causality analysis is repeated. This analysis process continues until the last observation of the entire sample set. (Balcılar et al., 2010).

4.3. Breitung –Candelon based on Frequency Causality Analysis

Breitung and Candelon are also applied with the Granger method and the Toda-Yamamoto method with increased lags. Breitung and Candelon (2006) used a bivariate vector autoregressive model. With this model, they proposed a single test procedure by constructing a linear hypothesis on the autoregressive parameters. In this way, the test procedure can be generalized to examine both multidimensional systems and cointegration relationships. The Breitung and Candelon (2006) test allows the data period to be analyzed based on short, medium and long frequencies, thus making it advantageous compared to other causality tests. In order to test in the frequency domain, Geweke (1982) and Hosoya (1991) defined a two-dimensional vector based on the VAR assumption and the vector can be represented as in equation 7;

$$h_t = [d_t, f_t]' ; \odot(L) b_t = \epsilon_t ; \odot(L) = I - \odot_1 L - \dots - \odot_p L^p \quad (7)$$

The lag length and Granger causality analysis over the specified lag length can be expressed in terms of equations 8 and 9, respectively;

$$L^k h_t = h_{t-1} \quad (8)$$

$$S_{d \rightarrow f} = \log \left[\frac{2\pi f_x(\omega)}{|\vartheta_{11}(e^{-i\omega})|^2} \right] = \left[\frac{|\vartheta_{12}(e^{-i\omega})|^2}{|\vartheta_{11}(e^{-i\omega})|^2} \right] \quad (9)$$

$|\vartheta_{12}(e^{-i\omega})|^2 = 0$ is not the Granger cause of a at frequency ω , and if the components of h_t are stationary after first differencing, the autoregressive $\Theta(L)$ contains a unit root and the remaining roots are outside the unit circle. If h_{t-1} in equation 7 is subtracted on all sides, equation 10 is obtained (Breitung & Candelon, 2006).

$$\Delta h_{t-1} = (\Theta_1 - I) h_{t-1} + \Theta_2 h_{t-2} + \dots + \Theta_p h_{t-p} = \widehat{\Theta}(L) h_{t-1} + \epsilon_t \quad (10)$$

5. Results

The study first addresses the stochastic behavior of the considered variables by using the ADF and KPSS unit root tests. The results of the unit root tests are tabulated in Table 1. According to Table 1, *lnCA* does not contain a unit root and is stationary at the 1% significance level. As for *lnBudget*, the null hypothesis of the ADF unit root tests can not be rejected, whereas the null hypothesis of the KPSS unit root tests can not be accepted, which confirms the presence of a unit root at the level. However, the series becomes stationary at the first difference. When considering the outcome of the unit root tests on *lnPetrol*, the results vary with the employed unit root test and its versions. The KPSS unit root test results confirm the null hypothesis at a 5% significance level, and *lnPetrol* involves any unit root at a 10% significance level as a result of the ADF unit root test with constant. At the same time, the series contains a unit root due to the finding of the ADF unit root test with constant and trend while the series becomes stationary at the first differences.

Table 1⁴

The Result of The Unit Root Tests

Variables	The Level				The First Differences			
	ADF		KPSS		ADF		KPSS	
	C	C&T	C	C&T	C	C&T	C	C&T
lnCA	-6.670470*	-7.030039*	0.563932*	0.066890*	-	-	-	-
lnBudget	-2.617253	-2.895752	0.280721	0.246701	-8.781101*	-8.989006*	0.091603*	0.058839*
lnPetrol	-2.787850***	-2.902468	0.283386**	0.184594*	-10.88994*	-10.86996*	-	-

When interpreting the outcome of the stationary analysis, the handling series have different integrated orders, and the presence of the twin deficit hypothesis is investigated under the light of the considered situations. Within this context, the Toda-Yamamoto causality analysis is executed,

⁴ *, **, and *** are significance levels at the 1%, 5%, and 10% level, respectively.

and the optimal lags for the Toda-Yamamoto causality analysis are shown in the Appendix. The outcome of the Toda-Yamamoto causality analysis is presented in Table 2. According to Table 2; it is identified that the twin deficit does not hold for Türkiye because the neutrality causality connection between lnCA and lnbudget is verified. Moreover, lnbudget is induced by lnpetrol. In the study, as the Turkish economy is the price-taker of the petrol price, the one-way causality link from lnpetrol to lnCA and lnbudget is considered.

Table 2

The Result of Toda-Yamamoto Causality Analysis

Models	Chi-sq	k+dmx	Prob.
lnCA-->lnBudget	9.680458	7	0.1388
lnBudget--> lnCA	7.569537	7	0.2714
lnPetrol--> lnBudget	12.94470	7	0.0439
lnPetrol--> lnCA	0.186486	2	0.6659

The evidence obtained from the Toda-Yamamoto causality analysis is based on the entire period, and the causality connection between the variables may be verified at different frequencies or sub-time intervals. Therefore, the Breitung-Candelon frequency-domain causality is performed. The optimal lag must be at least three to perform the Breitung-Candelon frequency-domain causality, and the causality link between lnCA and lnbudget applies to execute. The one-way causality link from lnpetrol to lnbudget is applicable. The outcome of the analysis is disclosed in Figure 1. When a 5% significance level is considered, lnbudget is caused by lncurrent in the short run, and lnpetrol induces lnbudget in the short run.

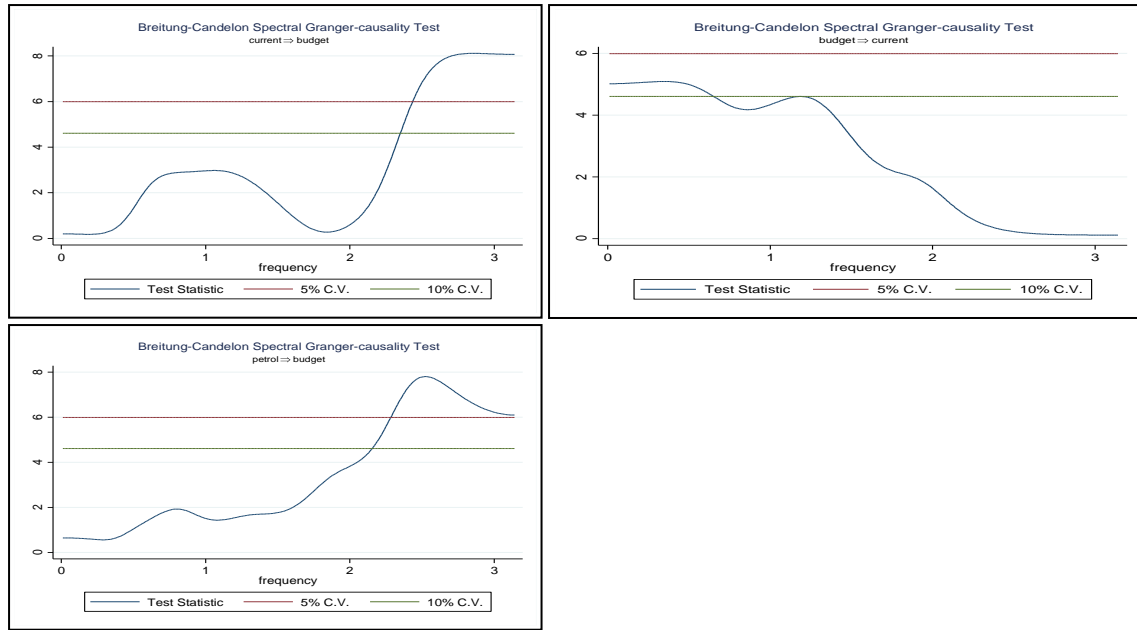
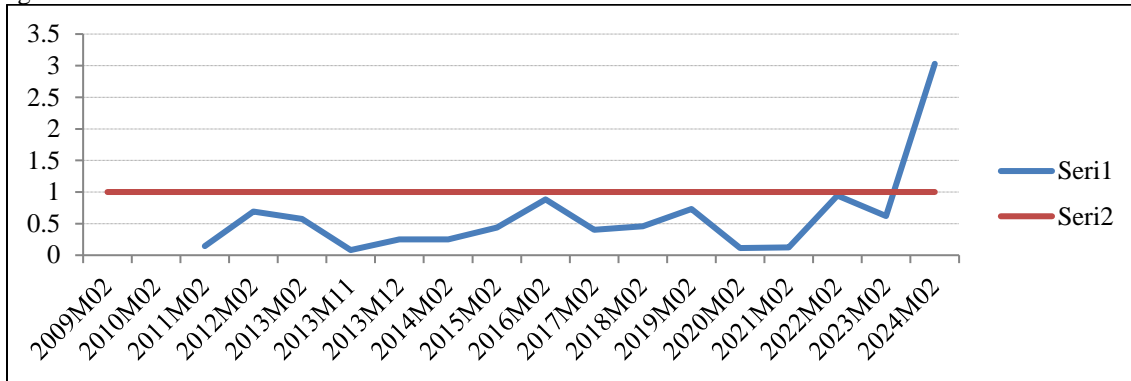


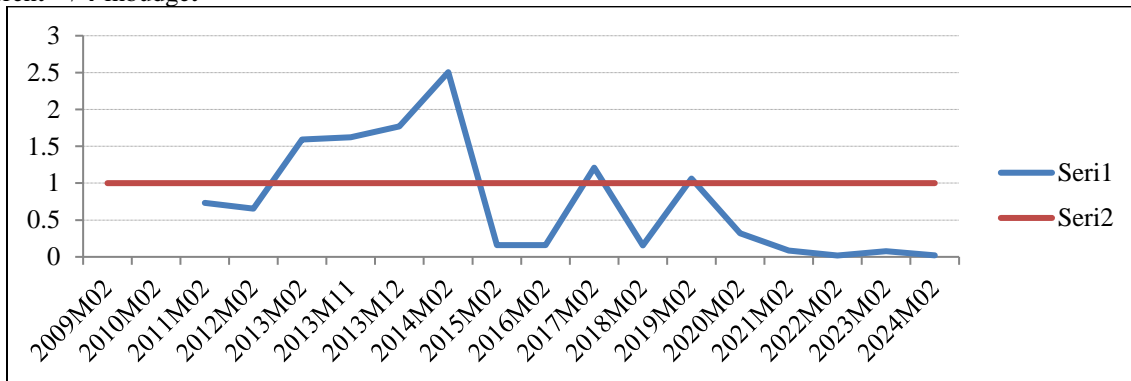
Figure 1. The Result of the Breitung-Candelon Spektural Causality Analysis

The rolling-window causality analysis is the last econometric approach performed, and the analysis's findings are displayed in Figure 2. According to the analysis, Inbudget is the cause of Incurrent in 2011:M11-2011:M12, 2015:M11-2016:M06, 2022:M04- 2022:M09, EXCEPT 2022:M08, 2023:M12-2024:M08. Moreover, Incurrent causes Inbudget in 2012:M07-2014:M03. This evidence implies the rejection of the twin deficit in the case of Türkiye. Moreover, Inpetrol promotes effect on Incurrent over nearly the period between 2011:M09 and 2014:M07. On the other hand, Inpetrol has limited power on Inbudget.

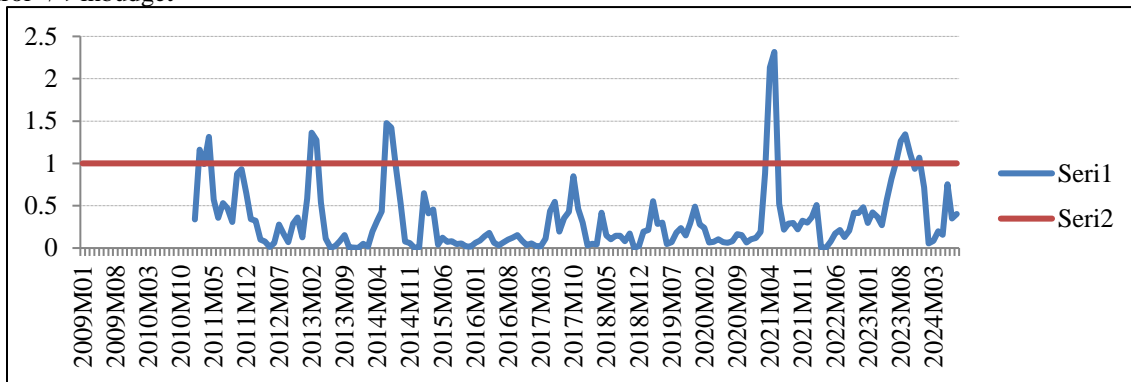
Lnbudget---/→Incurent



Incurent---/→Inbudget



Inpetrol--/→Inbudget



Inpetrol--/→Incurent

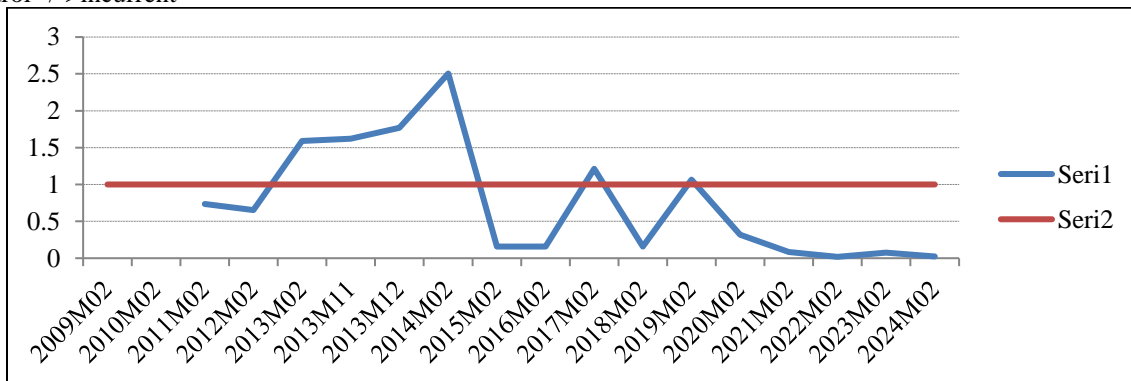


Figure 2. The Result of the Rolling Window Causality Analysis

6. Conclusion

The twin-deficit hypothesis has been one of the most received attention in the literature, and the popular studies on the objective still matter by using novel econometric approaches and control variables. Briefly, the twin-deficit hypothesis discloses that a worsening in the current account balance is associated with an increase in the budget deficit, which is based on the conventional Keynesian theory. However, the Ricardian equivalence hypothesis reveals a controversial framework that shows that the connection between budget deficit and current account deficit is not valid. In addition to the theoretical disputes, empirical evidence has also been varied. Within this scope, the study has been motivated to detect the validity of the twin deficit in varied sub-samples and different frequencies in the case of the Turkish economy over the period between 2009:M01-2024:M08. Along with testing the twin hypothesis, the question of whether the petroleum price matters for the twin-deficit hypothesis is also scrutinized. In order to reveal the evidence on the entire considered period, the Toda-Yamamoto, ignoring the structural breaks, is applied. Besides, the Rolling-Window and Breitung and Candelon causality analysis are also performed to disclose the evidence on the sub-sample and different frequencies. When examining the result of the Toda-Yamamoto causality analysis, the study claims that there is no causal connection between the budget deficit and the current account deficit, which verifies the Ricardian equivalence hypothesis for the Turkish economy for the all-considered entire sample. The outcome achieved is also supported by a number of studies (Özçalık and Erataş,2014; Kılavuz and Dumrul,2012; Altınöz,2014). However, the budget deficit is induced by petrolüem prices. As for the varied frequencies, the Breitung and Candelon causality analysis presents that the budget deficit is caused by the current account deficit in the short run, whereas the current account deficit is not induced by the budget deficit through different frequencies at a 5% significance level. Moreover, petrol prices have an effect on the budget deficit in the short run. As a result, it is understood that the Toda-Yamamoto and Breitung-Candelon causality analyses provide supportive evidence for each other. Finally, the rolling-window causality analysis presents the rejection of the twin deficit but partially the causality link running from the budget deficit to the current account deficit. Moreover, the petroleum prices have an impact on the budget and current account deficit in the last part of the sample. Within this scope, the policymakers of the Turkish economy may address the efforts to improve the budget and current account deficit in terms of varied and dependent policy actions. In order to improve the budget balance, the monetary and fiscal policies should be

determined in the light of the budget discipline, and allocating funds and expenditures should be oriented toward efficiency and productivity. As for the current account balance, efforts are recommended to aim at advanced technology, reducing the imported investment and raw materials, and enriching the international comparative advantages.

Declaration of Research and Publication Ethics

This study which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement

Since the author is the sole author of the article, the contribution rate is 100%.

Declaration of Researcher's Conflict of Interest

There are no potential conflicts of interest in this study.

7. Appendix

varsoc budget current , maxlag(8)								
Selection-order criteria								
Sample: 9 - 188			Number of obs			= 180		
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1318.67				8089.56	14.6741	14.6885	14.7096
1	-1276.17	84.985	4	0.000	5274.51	14.2464	14.2895*	14.3528*
2	-1274.52	3.3104	4	0.507	5413.85	14.2724	14.3444	14.4498
3	-1268.72	11.597	4	0.021	5307.02	14.2525	14.3532	14.5008
4	-1266.19	5.0594	4	0.281	5394.91	14.2688	14.3983	14.5881
5	-1261.06	10.268	4	0.036	5328.09	14.2562	14.4144	14.6464
6	-1244.1	33.925*	4	0.000	4614.33*	14.1122*	14.2992	14.5734
7	-1241.78	4.633	4	0.327	4702.72	14.1309	14.3466	14.663
8	-1239.17	5.2223	4	0.265	4777.55	14.1463	14.3908	14.7494
Endogenous: budget current								
Exogenous: _cons								
varsoc current petrol , maxlag(8)								
Selection-order criteria								
Sample: 9 - 188			Number of obs			= 180		
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-643.019				4.44207	7.16687	7.18126	7.20235
1	-426.868	432.3*	4	0.000	.420588*	4.80965*	4.8528*	4.91608*
2	-424.03	5.6768	4	0.225	.426061	4.82255	4.89447	4.99994
3	-421.369	5.3223	4	0.256	.432468	4.83743	4.93812	5.08577
4	-417.693	7.3507	4	0.118	.434069	4.84104	4.9705	5.16033
5	-414.961	5.4639	4	0.243	.440289	4.85513	5.01336	5.24538
6	-413.255	3.4123	4	0.491	.451745	4.88061	5.06761	5.34182
7	-411.843	2.8252	4	0.587	.465047	4.90936	5.12513	5.44152
8	-407.413	8.8588	4	0.065	.462997	4.90459	5.14913	5.5077
Endogenous: current petrol								
Exogenous: cons								

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