

## ON THE TWIN DEFICITS HYPOTHESIS: EVIDENCE FROM TURKEY

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### Abstract

This paper examines the long run relationship between trade deficit and budget deficit in Turkey in the context of fractional cointegration approach. This approach relaxes the assumption in the conventional cointegration analyses that the cointegrating residuals must be integrated of zero and allows it to take any real value. The empirical results of the annual data over the period from 1975 to 2009 show that there is little evidence for the presence of fractional cointegration relationship between trade deficit and budget deficit, hence, for the validity of twin deficits hypothesis in Turkey.

**Keywords:** Budget Deficit, Trade Deficit, Twin Deficits Hypothesis, Fractional Cointegration

**Jel Codes:** C10, E60, F10

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### 1. Introduction

The relationship between trade deficit and budget deficit which is widely known as “twin deficit hypothesis” has become an interesting research area for economists and policy makers in the last few decades. The studies about this phenomenon has mainly centered based on two major economic theories: the Keynesian approach and the Ricardian Equivalence Hypothesis.

The Keynesian approach for twin deficits relationship is associated with the Mundell-Fleming framework. It argues that an increase in budget deficits will cause an increase in domestic interest rate above the world rate, with capital inflows and appreciation of the domestic currency effects. These effects, in turn, result an increase in import expenditures and a decrease in export revenues through the loss of competitiveness in the international area. According to this approach, there exists a positive relationship between two deficits and budget deficit causes an increase in the trade deficit. In contrast, the Ricardian Equivalence Hypothesis claims the absence of any relationship between trade deficit and budget deficit. This hypothesis points out that the shifts between taxes and budget deficits do not matter for real interest rate, the quantity of investment and the trade balance. In other words, the trade balance, interest rates and investment will not be affected by the changes in the budget deficit.

The aim of the paper is to examine the long run relationship between trade deficit and budget deficit in Turkey over the period from 1975 to 2009. The difference of this paper is that we use fractional cointegration method. This method relaxes the assumption in the conventional cointegration analyses that the cointegrating residuals

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must be integrated of zero ( i.e.  $I(0)$  ). Here, the integration order of the cointegrating residuals is allowed to take any real value.

The paper is organized as follows: In Section 2, a simple theoretical framework of the twin deficit hypothesis is provided. The methodology used in this paper is described in Section 3. The data and empirical results are presented in Section 4 while concluding remarks are given in Section 5.

## 2. Theoretical Framework

In order to give a theoretical explanation about twin deficits relationship, the starting point is the well known saving-investment identity which can be derived from the national income identity. The national income identity for an open economy provides the basis of the relationship between budget deficit and trade deficit as follows:

$$Y = C + I + G + (X - M) \quad (1)$$

where  $Y$  is the national income,  $C$  is consumption,  $I$  is investment,  $G$  is government expenditures and  $(X - M)$  is trade balance. The national income can also be identified by the sum of consumption ( $C$ ), saving ( $S$ ) and tax payments ( $T$ ) as follows:

$$Y = C + S + T \quad (2)$$

Substituting Equation(2) in (1); we can rewrite the identity as:

$$(X - M) = (S - I) + (T - G) \quad (3)$$

In this case, It is seen that the trade balance simply equal to the private saving-investment gap ( $S + I$ ) plus the budget balance ( $T - G$ ). Under a stable saving-investment gap assumption, an increase in budget deficit will cause an increase in trade deficit. It means the traditional twin deficits relationship.

There are extensive empirical studies examining the twin deficits relationship. These studies can be classified under two groups: The first group supports twin deficit hypothesis while the second group concludes against twin deficit hypothesis. In the first group, Darrat(1988) examines the relationship between trade deficit and budget deficit for United States by using Granger causality test and finds a bi-directional relationship. The results show that there is evidence of “budget to trade deficit causality”, but also stronger evidence of “trade to budget deficit causality”. Rosenwieg and Tallman(1993) investigates the relationship between fiscal deficits, exchange rates and trade deficit by using vector autoregressive system and provide some evidence that growing government deficits appreciate the dollar and contribute to trade deficits. Vamvoukas(1997) examines the relationship between budget and trade deficits within the framework of cointegration analysis, error correction modeling and Granger causality in order to evaluate the validity of Keynesian proposition and the Ricardian Equivalence Hypothesis. The results support the Keynesian proposition in the short and long run. Khalid and Guan(1999) investigate the casual relationship between trade deficit and budget deficit for selected sample of some developed and developing countries by using cointegration techniques. Their results do not support a long run relationship between twin deficits for developed countries while the results for developing countries show a long run relationship. Piersanti(2000) examines whether current account deficits are linked to expected future budget deficits for OECD countries by using a general equilibrium model and finds that current account deficits

are associated with expected future budget deficits. Akbostancı and Tunç(2002) investigate the linkage between budget deficit and trade deficit in Turkey over the period from 1987 to 2001 and find that the twin deficit hypothesis is valid in Turkey. Leachman and Francis(2002) explore the issue of twin deficits for USA by using cointegration and multicointegration methods and they find weak evidence of cointegration between budget and trade deficits. Baharumshah, Lau and Khalid(2006) examine the twin deficits hypothesis in the ASEAN countries and their results indicate that there is a long run relationship between twin deficits. Funke and Nickel(2006) analyze the empirical relationship between fiscal policy and trade account for G7 countries by using annual panel data and provide empirical evidence that the composition of overall demand has an impact on the magnitude of the trade deficit. Arize and Malindretos(2008) provides new evidence on the long run relationship between trade and budget deficits in ten African countries in the context of conventional and fractional cointegration approaches and find a positive long run relationship between trade deficit and budget deficit.

The studies in the second group can be summarized as follows: Miller and Russek(1989) examine the long run relationship between U.S. twin deficits by using three different but related statistical techniques. The findings based on cointegration analysis indicate no long run equilibrium between the twin deficits. Enders and Lee(1990) develop a two country micro-theoretic model consistent with the Ricardian equivalence hypothesis. Their findings show that budget deficit does not cause the current account deficit. Kim(1995) reports a comment on the statistical findings of Bahmani-Oskooee(1992) for U.S. trade problems. His findings cast doubt on Bahmani-Oskooee's conclusion that only the fiscal policy, reflected by full employment deficit, can solve the U.S trade problems and the terms of trade, and that the exchange rate has no long run relationship with the external account. Kim finds that the trade balance is not cointegrated with the full employment budget and both the current account and trade balance have a long run relationship with the monetary aggregate of M2 and the terms of trade, respectively. Anoruo and Ramchander(1998) analyze the relationship between budget and trade deficits for five Southeast Asian countries: India, Indonesia, Korea, Malaysia and the Philippines and find that trade deficit causes budget deficit but budget deficit does not cause trade deficit. Bilgili and Bilgili(1998) examine the relationship between budget deficit and current account deficit for USA, Singapore and Turkey. Their findings show that the budget deficit has no causal effect on current account deficit for each country. Kuştepe(2001) examines the Feldstein chain which argues that an increase in the government deficit pushes the interest rate up, which in turn attracts foreign capital and strengthens the domestic currency driving the current account balance into deficits. The findings show that there is no evidence of causality from government deficit to current account deficit for Turkey.

### **3. Geweke and Porter-Hudak Test for Fractional Cointegration**

To examine whether there is a long run relationship between trade deficit and budget deficit in Turkey, we employ fractional cointegration approach. Because, the traditional tests have low power when the residuals from a cointegrating regression are mean reverting but not  $I(0)$ . Therefore, a flexibility can be provided by using the fractionally integrated time series process. This process proposed by Granger and

Joyeux(1980) and Hosking(1981) can be described by the following stochastic equation:

$$(1-L)^d X_t = u_t, \quad t = 1, 2, \dots \quad (4)$$

where  $L$  is the lag operator and  $u_t$  is an  $I(0)$  process. Here,  $d$  can take any real value,  $X_t$  is known as a fractionally integrated process. In general  $X_t$  is called an  $I(d)$  process. These processes possess different characteristics according to the value of  $d$  parameter. When  $d=1$ ,  $X_t$  is known as a unit root process. When  $d < 1$ , the process  $X_t$  is said to be a mean reverting process. If  $0 < d < 1$ , the process is a long memory process. If  $0.5 < d < 1$ , the process is nonstationary and exhibits long memory. If  $0 < d < 0.5$ , the process is stationary and exhibits long memory. It is important to note that when  $d < 0.5$  the process is stationary as well as mean reverting and when  $0.5 \leq d$  the process is non-stationary even if the fractional parameter is significantly less than 1.

In the case of fractional cointegration analysis, inference on the fractional differencing parameter ( $d$ ) is crucial. For this purpose, Geweke and Porter-Hudak(1983) (GPH) developed a non-parametric test. Geweke and Porter-Hudak show that differencing parameter  $d$  can be estimated consistently from the least squares regression:

$$\ln(I(w_j)) = \theta - d \ln(4 \sin^2(w_j/2)) + v_j, \quad j = 1, \dots, J \quad (5)$$

where  $\theta$  is a constant,  $w_j = 2\pi j/T$  ( $j = 1, \dots, T-1$ ) denotes the Fourier frequencies of the sample,  $J = f(T^\mu)$  is an increasing function of  $T$  which is the number of observations and  $0 < \mu < 1$ .  $I(w_j)$  is the periodogram of the series at frequency  $w_j$ .

In empirical analysis,  $J = f(T^\mu)$  is used with  $\mu$  ranging from 0.5 to 0.7. Since one can choose different values of  $\mu$ , different estimates of the fractional parameter for the same process can be obtained. The existence of fractional order of integration can be tested by examining the statistical significance of the differencing parameter,  $d$ .

The concept of conventional cointegration analysis requires a linear combination of  $I(1)$  variables to be  $I(0)$ . Granger(1981) introduced the fractional cointegration concept which allows the equilibrium error to possess long memory. Cheung and Lai(1993) define two  $I(1)$  variables to be fractionally cointegrated if a linear combination is  $I(d)$ . Here,  $d$  can be any number less than one. In order to analyse fractional cointegration relationship, two steps are followed: In the first step, the residuals are obtained from the cointegrating regressions. Then, the value of  $d$  is estimated for the residuals from a cointegrating regression and the null hypothesis  $d=1$  tested against the alternative  $d < 1$ . When  $d < 1$ , there is evidence of fractional cointegration. Following Cheung and Lai(1993), the GPH estimator can be used to construct a test for fractional cointegration. Here, the standard normal distribution values cannot be used. Because, the distribution of the test statistic is negatively skewed. To get round this problem, Sephton(2002) computed a set of critical values to use when applying the GPH test for

fractional cointegration. These values are computed for different sample sizes, different numbers of cointegration variables and different  $\mu$  values equal to 0.40, 0.45, 0.50, 0.55 and 0.60.

#### 4. Data and Empirical Results

As noted in the introduction, the main purpose of this paper is to examine the long run relationship between budget deficit and trade deficit in Turkey. For this purpose, we use annual time series data for the period of 1975-2009 obtained from the web site of the Central Bank of Turkey. The trade deficit(TD) is expressed as the ratio of imports to exports and the budget deficit(BD) is expressed as the ratio of budget expenditures to budget revenues. The variables are converted to natural logarithms. The plots of the series can be seen in Figure 1.

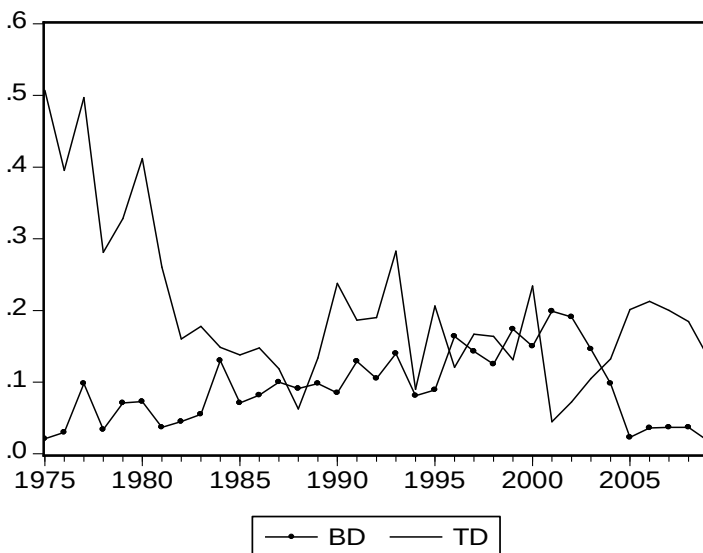


Figure 1: Plots of the BD (Budget Deficit) and TD (Trade Deficit) series.

The plots are only suggestive of the relationship between trade deficit and budget deficit that we will focus on by using statistical analysis methods. In the first step of the analysis, the unit root properties of the data are investigated by using Augmented Dickey Fuller (ADF), Philips and Perron(PP) and Kwiatkowski, Philips, Schmidt and Shin(KPSS) unit root tests. The results with a linear trend can be seen in Table 1.

Table 1: The results of ADF, PP and KPSS unit root tests

| Variables   | ADF                    | PP                     | KPSS                  |
|-------------|------------------------|------------------------|-----------------------|
| TD          | -2.397(1)              | -3.635(3) <sup>b</sup> | 0.153(4) <sup>b</sup> |
| $\Delta$ TD | -9.502(0) <sup>a</sup> | -                      | 0.055(1)              |
| BD          | -1.334(1)              | -1.931(2)              | 0.144(4) <sup>c</sup> |
| $\Delta$ BD | -7.778(0) <sup>a</sup> | -8.325(4) <sup>a</sup> | 0.083(4)              |

<sup>a,b,c</sup> indicate significance at 1%, 5% and 10% levels, respectively. The critical values of ADF and PP unit root tests are -4.252, -3.548 and -3.207 and the critical values for KPSS test are 0.216, 0.146 and 0.119 at 1%, 5% and 10% levels of significance, respectively. The numbers in parenthesis are appropriate lag lengths selected according to AIC.

The results of ADF and PP unit root tests show that budget deficit is stationary after first differencing. But it is found that trade deficit is stationary after first differencing according to ADF test and stationary in the level according to PP test. It is known that standart ADF and PP tests are not very informative on how to distinguish between a unit root and near unit root cases and they have low power in small sample size. Therefore the alternative KPSS test suggested by Kwiatkowski, Philips, Schmidt and Shin (1992) is used to confirm these results. It is important to note that KPSS test differs from other unit root tests in that the series are assumed to be stationary under the null. The results indicate that the null hypothesis is rejected in favour of the unit root hypothesis for budget deficit and trade deficit at levels. These findings confirm that the series are stationary after first differencing. Since these unit root tests do not take account of the possible long memory properties of the data, we also apply Geweke and Porter-Hudak(1983) GPH test. Here, the unit root ( $d = 1$ ) is used as the null hypothesis. However,  $d = 1$  represents a non-stationary process and therefore the usual  $t$ -tests cannot be applied. In order to get round this problem, we estimate following two equations:

$$(1-L)^{d_1} \Delta TD = u_{1t} \quad \text{and} \quad (1-L)^{d_2} \Delta BD = u_{2t} .$$

Thus, the null hypothesis of  $d = 1$  can be tested by the null hypothesis of  $d_1 = 0$ . In Table 2, the estimates of  $d$  from the first differenced series are reported for three different values of  $\mu$  ( $J = T^{0.50}, T^{0.55}, T^{0.60}$ ) to check sensitivity of our results to the choice of  $\mu$ .

Table 2: The results of GPH test

| $\mu$ | <u>TD</u> |                | <u>BD</u> |                |
|-------|-----------|----------------|-----------|----------------|
|       | $d$       | $t$ -statistic | $d$       | $t$ -statistic |
| 0.50  | 0.009     | 0.020          | 0.532     | 0.914          |
| 0.55  | 0.212     | 0.520          | 0.225     | 0.443          |
| 0.60  | 0.185     | 0.570          | 0.073     | 0.209          |

To test the statistical significance, the unit root (i.e.  $d_1=0$ ) is used as the null hypothesis versus  $d_1 < 0$ .

The results show that the GPH test statistics cannot reject the unit root null hypothesis for the TD and BD series. Since both series are found to be non-stationary, our next step is to perform the fractional cointegration test. Fractional cointegration analysis involves two steps: First, the residuals are obtained from the cointegrating regressions. Then, the value of  $d$  is estimated for the residuals from a cointegrating regression and the null hypothesis  $d = 1$  tested against the alternative  $d < 1$ . When  $d < 1$ , there is evidence of fractional cointegration. Cheung and Lai(1993) suggest that the GPH estimator can be used to construct a test for fractional cointegration. But, critical values from the standart normal distribution cannot be used when testing for fractional cointegration because the distribution of the test statistic is negatively skewed. Since there is no specific reason for choosing either TD or BD as the dependent variable for long run relationship, two cointegrating regressions, one with TD as dependent variable and another with BD as the dependent variable, are estimated. Then, the fractional parameter  $d$  of the residuals are examined by using Sephton(2002) critical

values for GPH test. The results of the fractional cointegration test on the residuals for three values of  $\mu$  ( $J = T^{0.50}, T^{0.55}, T^{0.60}$ ) are reported in Table 3.

Table 3: The results of the GPH test on the residuals

| Dependent Variable |       |                     |           |                |
|--------------------|-------|---------------------|-----------|----------------|
| <u>TD</u>          |       |                     | <u>BD</u> |                |
| $\mu$              | $d$   | $t$ -statistic      | $d$       | $t$ -statistic |
| 0.50               | 0.372 | -1.344              | 0.908     | -0.254         |
| 0.55               | 0.474 | -1.584              | 0.901     | -0.460         |
| 0.60               | 0.440 | -2.021 <sup>c</sup> | 0.830     | -0.899         |

<sup>c</sup> indicates significance at 10% level.

The results indicate that the null hypothesis of no fractional cointegration is rejected only for the value of  $\mu = 0.60$  in the case which TD is chosen as dependent variable. In the other case which BD is dependent variable, the null hypothesis cannot be rejected for any values of  $\mu$ . In general, these findings give very little evidence to support the presence of fractional cointegration relationship between TD and BD variables. Hence, there is little evidence for the validity of twin deficits hypothesis in Turkey.

## 5. Conclusion

This paper investigates the relationship between trade deficit and budget deficit in Turkey over the period 1975-2009 by using fractional cointegration approach. It is known that the traditional tests have low power when the residuals from a cointegrating regression are mean reverting but not  $I(0)$ . The fractional cointegration approach relaxes the assumption in the conventional cointegration analyses that the cointegrating residuals must be integrated of zero. Here, the integration order of the cointegrating residuals is allowed to take any real value. There is evidence of fractional cointegration when  $d < 1$ . As a first step of the analysis, the stationarity properties of the variables are examined by using ADF, PP and KPSS unit root tests. Since these unit root tests do not take account of the possible long memory properties, the Geweke and Porter-Hudak(1983) GPH test is also applied. The findings show that both TD and BD series have a unit root. Since the series are non-stationary, our next step is to examine fractional cointegration relationship. To do this, two cointegrating regressions, one with TD as dependent variable and another with BD as the dependent variable, are estimated and the residuals from these regressions are obtained. Then, the  $d$  value for the residuals is estimated by using GPH test. The finding results show that the null hypothesis of no fractional cointegration is rejected for  $\mu = 0.60$  value in the case which TD is dependent variable while it cannot be rejected for another cases. According to these results, it can be concluded that there is little evidence for fractional cointegration relationship between TD and BD variables and for the validity of twin deficits hypothesis in Turkey.

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