
Baris Gok, A. Nazif Catik*

Abstract

In this article we analyse the evolution of the relationship between budget and trade deficits in Turkey covering the period 1985:1 to 2013:4. The structural break tests suggest the existence of a regime shift after the severe 2001 crisis. Time-varying responses obtained from the TVP-VAR model up to 2003 support the Keynesian view by providing evidence in favour of twin deficits, whereas the remaining responses suggest the remarkable divergence between fiscal and trade deficits.

Keywords: budget account, current account, TVP-VAR model, Turkey

JEL Classification: C32, H30, F32

1. Introduction

The co-movement of US budget deficits and current account deficit in the 1980s has triggered the debate about the existence of a positive relationship between budget and current account deficits, known as twin deficits. However, empirical studies conducted for various countries covering different periods have produced inconclusive results about the significance and the direction of the relationship. Some papers find the empirical support for the Keynesian view suggesting the existence of twin deficits (*e.g.* Darrat, 1988; Bachman, 1992; Rosenweig and Tallman, 1993; Holmes, 2010 for the USA; Kim and Kim, 2006 for Korea; Magazzino, 2012 for Italy), whilst the others favour the Ricardian Equivalence Hypothesis indicating that fiscal shocks do not have a significant impact on the trade balance of the countries (*e.g.* Enders and Lee, 1990; Rahman and Mishra, 1992 for the USA; Mohammadi and Mosherfi, 2012 for East Asian countries; Papadogonas and Stouraras, 2006 for EU countries). Recent studies, *e.g.* Corsetti and Müller (2006), Kim and Roubini (2008), have even found significant and negative relationship between fiscal and current account balances conflicting with the theoretical prediction of the twin deficits hypothesis.

Some authors have attempted to explain the contradictory findings by introducing structural breaks in the models (*e.g.* Bagnai, 2006; Grier and Ye, 2009). Bagnai (2006) analyses the impact of the change in the government budget balance on the current account in 22 OECD member countries including Turkey using the annual data for the 1960–2005 period. Linear estimates support the twin deficits for Denmark, Germany, Italy, Spain, Sweden, Switzerland and Turkey. A long-run twin deficits relation is found for most of the remaining countries when the structural breaks have been accounted with Gregory and Hansen (1992) cointegration test. Using quarterly US data covering the 1948:1–2005:1

* Baris Gok, Ege University Department of Economics, Bornova, Izmir, Turkey (baris.gok@ege.edu.tr); A. Nazif Catik, Ege University Department of Economics, Bornova, Izmir, Turkey (a.nazif.catik@ege.edu.tr).

period, Grier and Ye (2009) find that the breaking dates of the fiscal and trade deficits are not coincident that may be interpreted as the absence of a long-run relationship. However, VAR analysis supports the validity of the twin deficits in the short run.

The studies on twin deficits hypothesis for Turkey except for Bagnai (2006) and Catik *et al.* (2015) have utilized linear models and their results vary across the methodology and estimation sample similar to other countries.¹ Catik *et al.* (2015) analyse the dynamics between current account and budget account balances based on a multivariate two-regime threshold VAR model covering the period from 1994 to 2012 in Turkey. The results support the twin deficits only in the upper regime when the economy operates above the potential level.

The main limitation of the above studies is that they ignore the possibility of a time-varying relationship between fiscal and trade deficits in Turkey. The behaviour of the budget balance and the current account balance over time makes Turkey a particularly special case to analyse the twin deficits hypothesis with nonlinear models. While the period prior to the 2001 financial crisis is consistent with the twin deficits hypothesis, the huge budget deficits are mostly coincided with large trade deficits. After the crisis, a stabilization package has been introduced based on the implementation of inflation targeting and the tight fiscal policies. By the year of 2004 the government has been successful in declining inflation and taking budget deficits under control. The budget deficit accounting for 11.89 per cent of GDP in 2001 has declined to 2.03 per cent in 2012. However, current account deficits at that time still have a continuously rising pattern, the ratio of current account to GDP increased from 0.27 in 2002 to 9.64 in 2012. The divergence of the variables after 2002 suggests the existence of a possible regime change that should be elaborated with nonlinear models. This study attempts to fill this gap by investigating time-varying relationship among fiscal and trade deficits in Turkey with nonlinear models. To this aim the interaction between the two key variables over time has been investigated with a time-varying parameter VAR (TVP-VAR) model. We also analyse the causality between the budget account balance and the current account balance under the possibility of the structural breaks.

This article is organized as follows. The data are introduced in Section 2. Section 3 explains the TVP-VAR model utilized in the paper. The empirical findings are presented in Section 4. Finally, Section 5 concludes the paper.

2. Data

This paper employs quarterly data covering the period 1985:1 to 2013:4.² The vector of endogenous variables in the VAR model is defined as (Rosensweig and Tallman, 1993; Catik *et al.*, 2015):

$$Y_t' = [GR_t, BAB_t, INT_t, LRER_t, CAB_t] \quad (1)$$

where GR_t is the growth rate of real Gross Domestic Product (GDP). As a measure of fiscal stance the ratio of total public sector revenues to expenditures BAB_t is used.³ The

1 For a detailed survey on the twin deficits hypothesis please see Çatik *et al.* (2015).

2 The estimation sample is determined by the availability of the budget deficit data. All variables are adjusted seasonally using Census X12 method.

3 Budget balance and current account balance variables as a fraction of GDP are not used since the Turkish Ministry of Finance has switched from consolidated budget to central government budget system in 2006 leading to dramatic shifts in the budget figures.

current account balance CAB_t represents the ratio of total export to total import of goods and services. Real interest rate INT_t is computed as $INT_t = (1 + i_t)/(1 + \pi_t)$ using the three month Treasury bill rate i_t and wholesale price inflation π_t . LRR_t is log of the PPI-based real effective exchange rate.⁴ Budget account balance and the treasury bill rate data is collected from the Turkish Treasury. The other data are gathered from the OECD National Accounts and the IMF International Financial Statistics database.

Before the estimation of the VAR models, Kapetanios (2005) unit root test is applied to assess the implications of structural breaks on the unit root properties of the variables.⁵ In contrast to Lumsdaine and Papell (1997) and Lee and Strazicich (2003) this test allows evaluating the stationarity of the time series up to m unknown structural breaks. The results of the tests reported in Table 1 suggest that all variables can be treated as $I(0)$ since the null hypothesis of unit root with breaks is rejected for all variables. Unit root with break test yields different number of breaks for budget account and current account deficits but timing of the breaks are found to be close. There are two structural breaks in BAB_t dated to 2000:4 and 2003:2, but three structural breaks for CAB_t dated to 1989:1, 2000:3 and 2003:3. The common structural break around 2000 may be associated with 2001 crisis, another common break around 2003 corresponds to starting date of the inflation targeting policy after the collapse of fixed exchange rate system in 2001 crisis.

Table 1 | Unit Root Test with Structural Breaks

Series	Breaking Dates	Test Statistic t_{δ}	Result
GR_t	1994:4, 2001:4, 2009:1	6.95826*	$I(0)$
BAB_t	2000:4, 2003:2	9.32506***	$I(0)$
INT_t	1994:2	5.51746**	$I(0)$
LRR_t	2002:3	7.70827***	$I(0)$
CAB_t	1989:1, 2000:3, 2003:3	7.17298**	$I(0)$

Note: *, ** and *** indicate significant at 10%, 5% and 1% respectively. The model allows breaks in the intercept and the slope. Critical values are obtained from Kapetanios (2005).

Source: Own calculation

3. Methodology

We use the following VAR model with time-varying parameter and stochastic volatility by Primiceri (2005) with a state-space form. The measurement equation is,

$$y_t = A_{0,t} + A_{1,t}y_{t-1} + \dots + A_{p,t}y_{t-p} + u_t = X_t'\Theta_t + \varepsilon_t, \quad (2)$$

where $A_{0,t} \dots p,t$ represents the matrix of parameters varying over time written as a matrix form Θ_t . X_t' is the matrix including a constant and the lags of endogenous variables.

4 An increase in the index indicates an appreciation of the domestic currency.

5 ADF and PP tests suggest that the variables are stationary at level at least at the 10% level of significance. The results of those tests are available upon request from the authors.

The disturbance terms u_t are assumed to be heteroskedastic and normally distributed with a zero mean and a time-varying covariance matrix $\Omega_t \cdot \Omega_t$ is decomposed as

$$\Omega_t = B_t^{-1} H_t (B_t^{-1})' \quad (3)$$

Where B_t is a lower triangular matrix illustrating the contemporaneous relationships among the variables and H_t is a matrix including the stochastic volatilities on the diagonal elements

$$B_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ \alpha_{21,t} & 1 & 0 & 0 & 0 \\ \alpha_{31,t} & \alpha_{32,t} & 1 & 0 & 0 \\ \alpha_{41,t} & \alpha_{42,t} & \alpha_{43,t} & 1 & 0 \\ \alpha_{51,t} & \alpha_{52,t} & \alpha_{53,t} & \alpha_{54,t} & 1 \end{bmatrix}, H_t = \begin{bmatrix} h_{1,t} & 0 & 0 & 0 & 0 \\ 0 & h_{2,t} & 0 & 0 & 0 \\ 0 & 0 & h_{3,t} & 0 & 0 \\ 0 & 0 & 0 & h_{4,t} & 0 \\ 0 & 0 & 0 & 0 & h_{5,t} \end{bmatrix} \quad (4)$$

The parameters of the model are allowed to vary with the following equations:

$$\Theta_t = \Theta_{t-1} + v_t \quad v_t \sim N(0, Q) \quad (5)$$

$$\alpha_t = \alpha_{t-1} + \zeta_t \quad \zeta_t \sim N(0, S) \quad (6)$$

$$\ln h_{i,t} = \ln h_{i,t-1} + \sigma_i \eta_{i,t} \quad \eta_{i,t} \sim N(0, 1) \quad (7)$$

The time-varying parameters Θ_t and α_t are assumed to follow random walk without drift process. However, the vector of stochastic volatilities $h_{i,t}$ is assumed to follow geometric random walks as in the financial literature. In this state-space model the disturbances of the measurement equation and three transition equations are assumed to be independent of each other.⁶

4. Empirical Results

Before the estimation of the TVP-VAR model, the causality between the budget and trade deficits under the possibility of structural break is examined. To this aim first a linear VAR model based on the endogenous variables in the Equation 1 is estimated. Second Bai and Perron (1998) *SupF(l+1|l)* test, testing the null of l breaks against the alternative of $l+1$ for $l = 1, \dots, M-1$, is applied to detect the number of structural breaks in the budget and the current account equations.⁷ The results presented in Table 2 are failed to reject one break in favour of two for both BAB_t and CAB_t equations and indicates the existence of one break located in the first and the second quarter of 2001. This result suggests that November 2000–February 2001 financial crises in Turkey leads to a structural break in the relationship between the budget and current accounts. Granger causality test implies bidirectional causality for the whole sample. However, the evidence on the rejection

6 The model adopts the standard assumption regarding the block diagonal structure of the matrix S illustrating the contemporaneous relationship among the variables as in Primiceri (2005).

7 Optimum number of lags is determined by Akaike Information Criterion (AIC). The number of maximum breaks is set to $m = 5$, with a trimming equal to 0.10.

of the null hypothesis of no causality among the variables for the pre-crisis period but not for post-crisis period implies that twin deficits hypothesis may only valid for the pre-crisis period.

Table 2 | Bai-Perron (1998) Structural Break Test

Equation	CAB		BAB	
Break Test	F-statistic	Breaking date	F-statistic	Breaking date
0 vs. 1	2.633108*	2001:2	2.745798*	2001:1
1 vs. 2	2.212685		2.1228	

Note: * denotes significant at the 0.05 level.

Source: Own calculation

Table 3 | Granger Causality Tests

H ₀	CAB does not Granger cause BAB		BAB does not Granger cause CAB	
Sample	1985:4–2013:4		1985:4–2013:4	
F-statistics	2.932502		2.654181	
Prob.	(0.0371)		(0.0526)	
Sample	1985:4–2000:1	2001:2–2013:4	1985:4–2000:4	2001:1–2013:4
F-statistics	3.739260	0.155273	3.272243	0.282267
Prob.	(0.017)	(0.926)	(0.0249)	(0.8381)

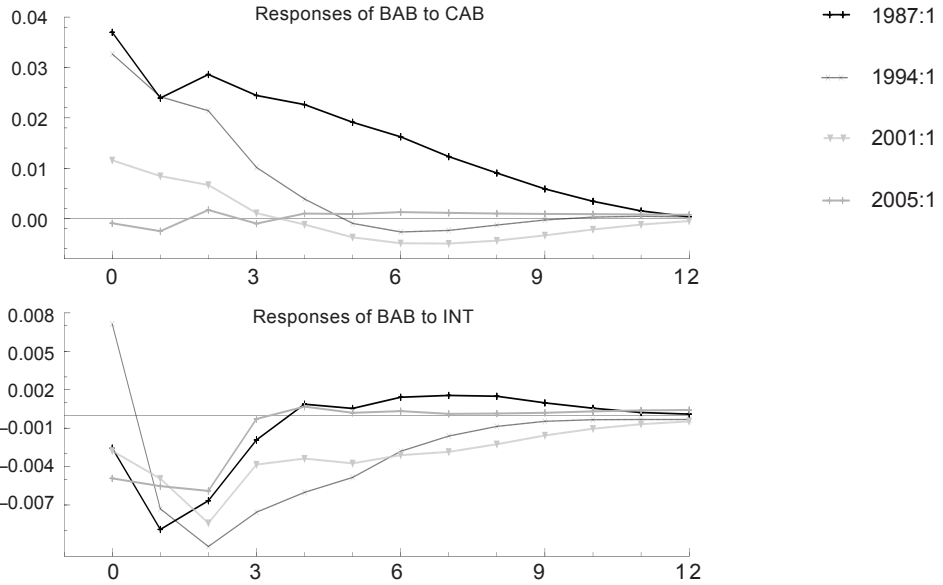
Note: *, ** and *** indicate significant at 10%, 5% and 1%, respectively.

Source: Own calculation

After the investigation of causality, we estimate the TVP-VAR model to analyse the relationship between the current account and the budget account balance in a time-varying framework. Before proceeding, the initial values of the time-varying parameters are determined by the estimation of the linear VAR. Then the model is estimated with Markov Chain Monte Carlo (MCMC) algorithm using the multi-move sampler by Watanabe and Omori (2004).⁸ Impulse responses derived from the variance covariance matrix of the TVP-VAR model are reported in Figures 1 and 2 for the time horizons $t = 0, 1, 2, \dots, 12$. The responses obtained from the linear VAR estimates with different starting points are also presented for comparison purposes.

⁸ We draw 10,000 samples from the posterior distribution, discarding the initial 1,000 as burn-in samples. The sample autocorrelation function, the sample paths and the posterior densities for selected parameters presented in Figure 1 indicate that MCMC results yield stable and uncorrelated samples. See Nakajima *et al.* (2011) for further details about the estimation steps of the TVP-VAR model.

Figure 1a | Responses of BAB to the Positive CAB and INT Shocks (Linear VAR)



Source: Own calculation

Figure 1b | Responses of BAB to the Positive CAB and INT Shocks (TVP - VAR)

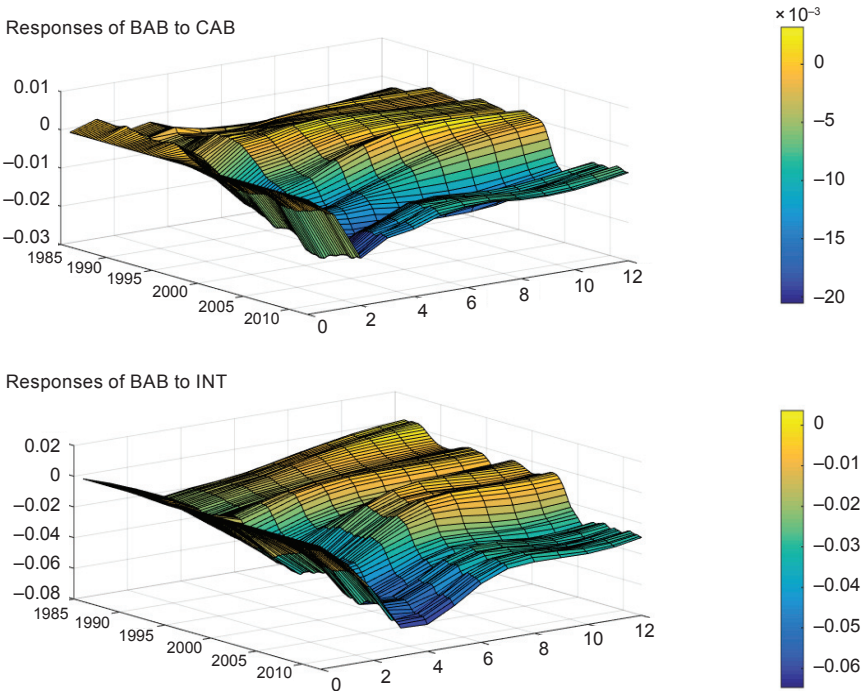


Figure 2a | Responses of CAB to the Positive BAB and LRER Shocks (Linear VAR)

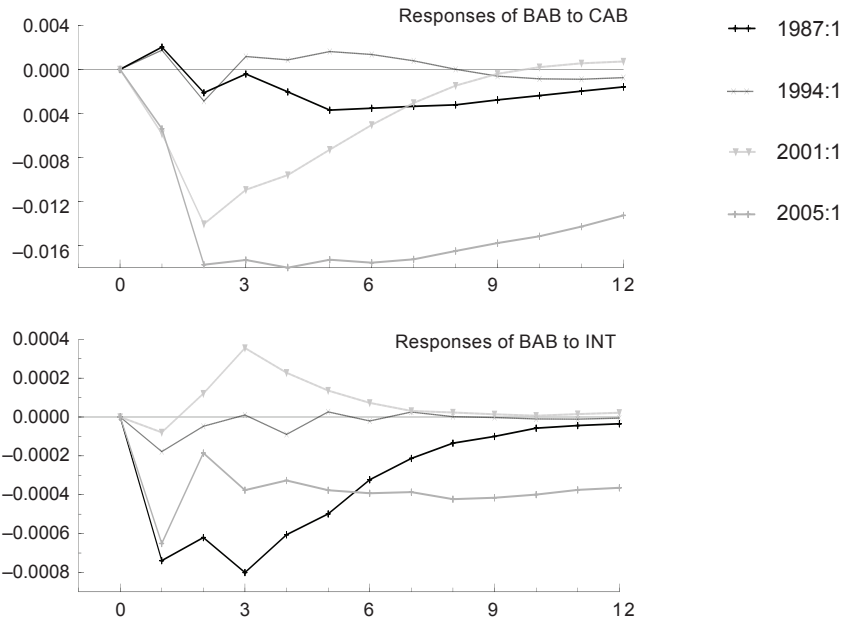
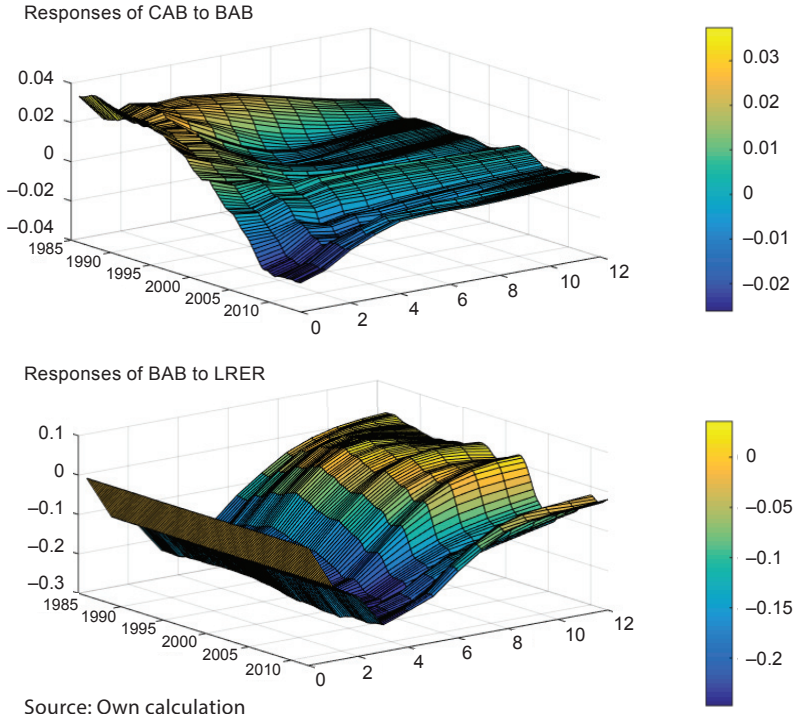


Figure 2b | Responses of CAB to the Positive BAB and LRER Shocks (TVP - VAR)



Source: Own calculation

Figure 1 plots the responses of BAB_t to the positive CAB_t and INT_t shocks. Linear responses suggest that a positive shock to CAB_t , *i.e.* current account surplus, leads to the improvement in the budget balance as implied by twin deficits, however impact of CAB_t shocks has weakened after the 2000s. In contrast to linear estimates, time-varying responses indicate that positive CAB_t shocks do not have a considerable impact on BAB_t . Current account shocks lead to the deterioration of budget account at the earlier period. Then positive responses but with a small magnitude at some time horizons are observed between 1990 and 2002. After 2002 the sign of the all responses turns into negative values interpreted as a clear evidence for the divergence between the variables. The minimum values for the responses are obtained in the second quarter of 2005 with -0.013 possibly connected with the implementation of inflation targeting policy after the financial crisis. The responses to INT_t shocks are obtained as negative as expected. The impact of real interest rate shocks becomes persistent after 2003 similar to the impact of CAB_t shocks. The highest responses are observed in the second quarter of 2005 with -0.03 . By the year of 2013 the long-run impact of positive interest rate shocks on the budget balance has declined to around -0.025 .

The responses of CAB_t to the positive BAB_t and $LRER_t$ shocks are reported in Figure 2. The responses between 1986 and 2005 generally support the twin deficits hypothesis. A positive shock to BAB_t leads to a 3.5% instantaneous rise in the CAB_t in the beginning of the estimation period then falls below 1% by the early 2003. However the responses of CAB_t to the budget account shocks turn into negative values starting with the first quarter of 2005. A positive shock to BAB_t leads to around a 0.025 decline in the CAB_t between 2009 and 2013. This again corroborates the evidence for the divergence between budget and current account balances and the impact of the shock has converged to zero as the time horizon for the responses are raised to 12-quarter. The responses plotted in Figure 2 also suggest that current account responds more aggressively to the real exchange rate shocks than the budget account shocks. The estimates suggest that positive $LRER_t$ shocks, *i.e.* the appreciation of the domestic currency, have negative and time-varying impacts on the current account. One-standard deviation shock to LRER leads to instantaneous worsening of CAB_t with around 11 per cent at the earlier period. The highest impact of exchange rate shocks is observed in 2005 with -0.123 in terms of 12-quarter responses. By the year of 2013 the long-run responses of current account has declined to around -0.025 .

5. Conclusions

In this article we analyse the evolution of the relationship between budget and trade deficits in Turkey for the period 1985:1–2013:4. The nonlinearity and time-varying relationship has been investigated with the application of structural break tests and the estimation of a TVP-VAR model composed of growth, real interest rate, real exchange rate, fiscal and trade deficits. The structural break test indicates the existence of a regime change coincided with the 2001 crisis. The causality test also implies that twin deficits are only the case for the pre-crisis period. Time-varying responses obtained from the TVP-VAR model also reveal the divergence between fiscal and trade deficits especially after 2003. The divergence among the variables after that time suggests that the implementation of tight fiscal policies itself might not be enough to curb current account deficits in Turkey.

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