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Budget Deficits and Inflation: Evidence from Turkey

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Abstract

This study attempts to investigate the presence of causality between budget deficits and inflation rate. For this purpose, Granger-causality tests are employed on monthly budget deficit and inflation data of Turkey which covers two sub-periods namely, (1987:M1-2003:M6) and (2005:M1-2013:M6). The results indicate a positive significant causality running from budget deficits to inflation rate during the high inflation period (1987:M1-2003:M6). This causal link disappears during the low inflation period (2005:M1-2013:M6).

Keywords: Inflation, Budget deficits, Granger-Causality tests.

1. Introduction

The relationship between the inflation rate and the budget deficit level is one of the most examined issues in macroeconomics since these two are generally regarded as conventional indicators of macroeconomic performance. Researchers encounter a vast theoretical and empirical literature related to the linkage between the dynamics of the budget deficits and the inflation rate. Hence, the causality running from budget deficits to inflation is easily found throughout the literature.

This paper aims to evaluate the validity of this causal link by using Turkish data. For this purpose, the next section reviews the related theoretical and empirical literature. Afterwards, empirical framework and estimation results are summarized respectively. Finally, the last section concludes.

2. Theoretical Framework

The classical explanation of inflation essentially refers to the classical view of quantity theory of money which suggests two basic propositions. According to the first proposition which is also known as classical dichotomy, a permanent increase in the money stock does not change the level of output and the velocity of money in the long run. On the other hand, the second proposition reveals a proportional relation between the rate of inflation and the growth rate of money, which implies that a permanent increase in money growth leads to an equal increase in the rate of inflation in the long run.

Following classical economists, Milton Friedman the founder of monetarism presents a similar description relying on the modern version of quantity theory and states that “Inflation is always

and everywhere a monetary phenomenon" (Friedman 1970:24). Thus, according to the monetarist framework, budget deficits are considered to be a source of inflation only to the extent that they are monetized.

Later on mainstream theoretical studies started to emphasize the role of fiscal variables, especially the budget deficits, on price level determination. This part of the literature begins with the well-recognized work of Sargent and Wallace (1981), which highlights the importance of fiscal and monetary policy coordination while ensuring price stability. According to Sargent and Wallace (1981), the monetary authority's control over inflation might be much more limited than anticipated due to the inter-temporal budget constraint of the government. In other words, the sustainability of budget deficits may require money growth which in turn converts inflation to a fiscally-driven monetary phenomenon.

Finally, more recent studies such as Woodford (1994, 1995, 1996) and Sims (1994, 1997) lead to a new theory of price determination which is also known as fiscal theory of price level (FTPL). They argue that money creation may not be the single channel through which the budget deficits cause inflation. According to FTPL, in a non-Ricardian world where fiscal policy is the dominant regime, the nexus between the budget deficits and inflation mainly stems from the wealth effects of bond financed budget deficits. Thereby, monetary authority's purpose of debt monetization is likely to be in charge in a monetary dominant Ricardian regime which is a norm for the quantity theory of money.

As a result, theoretical framework indicates that budget deficit-inflation causality is consistent with FTPL while deficit-money-inflation causal sequence is checking for Sargent-Wallace hypothesis.

3. Overview of the Empirical Literature

Despite the enormous number of studies that focus on the causal relationship between budget deficits and inflation, it is possible to briefly clarify them by using some salient aspects[1].

First of all, most of these studies use time series data and employ procedures like OLS, cointegration, causality tests, ECMs and VAR. Among these studies Hamburger and Zwick (1981), Ahking and Miller (1985) and Darrat (1985) utilize US data and find that government deficit, money growth and inflation are causally related only for certain sub-periods. Only, Dwyer (1982) finds no impact between these variables for US data.

Not only Dwyer (1982) but also King and Plosser (1985), Giannaros and Kolluri (1985), Karras (1994), Abizadeh and Yousefi (1998), Komulainen and Pirtilla (2002), *Tekin-Koru and Ozmen (2003)*, Grauwe and Polan (2005), *Altintas et al. (2008)*, Rubio et al. (2009), Mukhtar and Zakaria (2010) Mehdi and Reza (2011) and Georgantopoulus and Tsamis (2011) clearly find no connection between the variables in question for different samples including both developed and developing countries.

De Haan and Zelhorst (1990) collect data from 17 developing countries over the period of 1961–1985, and use VAR estimation to reveal the correlation between budget deficits and inflation. Researchers emphasize that budget deficits inflation causality is majorly valid in high inflation periods. Later on, this benchmark finding is supported by several studies like Fischer et al. (2002), Loungani and Swagel (2001), Catao and Terrones (2005), Domac and Yucel (2005) and

[1] The studies sampling just Turkey are shown in italics.

Lin and Chu (2013) which have definite differences both in methodology and sample selection. Apart from these studies, Neyapti (2003) attributes this causality largely to low degrees of central bank independence and financial market development, while Kwon et al. (2009) refers to the role of public indebtedness.

Furthermore, Chaudhary and Ahmad (1995), Hondroyiannis and Papapetrou (1997), *Metin (1998)*, Vieira (2000), Alavirad (2003), Solomon & Wet (2004), *Kesbic et al. (2004)*, Narayan et al. (2006), Patience and Augustine (2008), *Davarcioglu-Ozaktas (2008)*, Lozano (2009), Chimobi & Igwe (2010) and Makochekanwa (2011) find a strong link between budget deficits and inflation wholly due to the massive monetization which is in line with Sargent and Wallace Hypothesis. Also, this finding is confirmed by *Akcay et al. (1996)*, *Ozgun (2000)* and Dogru and Senturk (2013) only in the long run.

Finally, Choudhary and Parai (1991), Hondroyiannis and Papapetrou (1994), Shabbir and Ahmed (1994), *Metin (1995)*, *Insel (1995)*, *Lim and Papi (1997)*, Cotarelli et al. (1998), Favero and Spinelli (1999), Onwioduokit (1999), Darrat (2000), Fratianni and Spinelli (2001), Piontkivsky et al. (2001), *Telatar (2002)*, *Gunaydin (2004)*, *Barisik and Kesikoglu (2006)*, *Cetintas (2005)*, Agha and Khan (2006), Wolde-Rufael (2008), *Oktayer (2010)*, Habibullah et al. (2011), Nawaz et al. (2012), *Dogru (2014)* and Jalil et al. (2014) find that an increase in budget deficit would lead to a rise in inflation rate directly as FTPL asserts.

4. Econometric Framework, Data and Results

The causal link between the budget deficit and inflation in Turkish economy is investigated for the sub-periods (1987M1-2004M12) and (2005M1-2013M6) within the frame of Granger-causality methodology[2]. The inflation rate series (inf) used in this study are computed from the monthly CPI indices (1987=100) obtained from the CBRT (Central Bank of the Republic of Turkey) Electronic Data Distribution System. As a proxy for the budget deficit, we use the ratio of budget revenues to the budget expenditures (bb) which are obtained from the monthly public account bulletin of the Ministry of Finance General Directorate of Accounting. Both of the series are seasonally adjusted by applying Census X12 procedure.

Table 1. Descriptive Statistics of Variables

	bb (1987:M01 - 2004:M12)	bb (2005:M01 - 2013:M06)	inf (1987:M01 - 2004:M12)	inf (2005:M01 - 2013:M06)
Mean	0.769266	0.922872	0.040299	0.006697
Median	0.780733	0.928582	0.040724	0.006724
Maximum	1.041420	1.238718	0.231754	0.028190
Minimum	0.482634	0.705457	-0.014393	-0.004357
Std. Dev.	0.109043	0.096183	0.023992	0.005287
Skewness	-0.088661	0.114518	2.633116	0.632098
Kurtosis	2.540165	3.724937	22.14993	4.727507
JB	2.186026	2.456462	3550.076	19.47551
# of Obs.	216	102	216	102

[2] The selection of sub-periods majorly influenced by three factors. First of all, the context of consumer price index has changed by the end of 2004. Secondly, Turkish government started to secure primary budget surpluses by the year 2005. Lastly, the first sub-period reflects high and chronic inflation episode while the second one represents vice versa. Last two factors could be verified by the descriptive statistics shown in Table 1.

Prior to causality analysis a couple of stationarity tests (ADF and PP) are carried out in order to eliminate the need of long run relationship. Also, the possibility of utilizing dummy variables for the structural break points in VAR models requires to perform Zivot Andrews stationarity test.

The results of the stationarity analysis with regard to the Augmented Dickey Fuller and Philips-Perron unit root tests are reported in Table 2. As shown in Table 2, both series are found to be stationary at 1% significance level in either sub-periods with one exception[3].

Table 2. Unit root test results

VARIABLES	ADF		PP
bb (1987:M01 - 2004:M12)	-3.936700[a] (0)		-3.874155[a](3)
bb (2005:M01 - 2013:M06)	-3.209455[b] (2)		-8.526192[a](6)
inf (1987:M01 - 2004:M12)	-8.079847[a] (0)		-7.978866[a](2)
inf (2005:M01 - 2013:M06)	-9.117654[a] (0)		-9.081638[a](7)
	Critical value 1% : -3.46	Critical value 5% : -2.87	Critical value 10% : -2.57

Notes: (i) The parentheses indicate the appropriate lag lengths for the ADF regressions and the appropriate bandwidths for the PP regressions. The lags are determined by Schwarz information criteria (SIC) **(ii)** [a], [b] and [c] denote 1, 5 and 10 % levels of statistical significance, respectively.

Since the period of analysis covers 1994, 2001 and 2008 crisis together with the stability programs, the stationarity analysis should be performed by using an appropriate methodology that takes into consideration the possible structural breaks. Accordingly, beside ADF and PP unit root tests, Zivot Andrews (1992) method is applied to test the null of unit root against the alternative hypothesis asserting the stationarity of the series with an endogenously determined one-time break. Within three models of ZA methodology, Model A and Model B allow for a change in intercept and trend respectively, while Model C permits a shift both in intercept and trend. The models have the following forms,

(Model A) $y_t = \mu^A + \alpha^A y_{t-1} + \beta^A t + \theta^A DU_t(\lambda) + \sum_{j=1}^{k} d_j^A \Delta y_{t-j} + \varepsilon_t$ (1)

(Model B) $y_t = \mu^B + \alpha^B y_{t-1} + \beta^B t + \theta^B DU_t(\lambda) + \sum_{j=1}^{k} d_j^B \Delta y_{t-j} + \varepsilon_t$ (2)

(Model C) $y_t = \mu^C + \alpha^C y_{t-1} + \beta^C t + \theta^C DU_t(\lambda) + \gamma^C DT_t(\lambda) + \sum_{j=1}^{k} d_j^C \Delta y_{t-j} + \varepsilon_t$ (3)

where the $DU_t(\lambda)$ is a dummy variable that defines a mean shift in intercept at time TB, while $DT_t(\lambda)$ is the corresponding trend shift dummy variable. $DU_t(\lambda) = 1$ if t>TB and zero otherwise. On the other hand, $DT_t(\lambda) = T\text{-}TB$ if t>TB and zero otherwise. The null of unit root is rejected if α is statistically significant. The results of the ZA unit root test is presented in Table 3.

[3] The budget deficit series are stationary at 5% significance level for the second sub-period (2005M1-2013M6).

Table 3. Zivot Andrews Test Results

(1987:M01 - 2004:M12)						
Variables	**Model A**		**Model B**		**Model C**	
	t-stat	TB	t-stat	TB	t-stat	TB
bb	-5.945[a]	2000:M08	-6.041[a]	2002:M04	-6.234[a]	1999:M01
inf	-9.891[a]	2002:M02	-10.120[a]	1997:M05	-10.311[a]	1994:M05
(2005:M01 - 2013M6)						
Variables	**Model A**		**Model B**		**Model C**	
	t-stat	TB	t-stat	TB	t-stat	TB
bb	-10.284[a]	2010:M07	-9.691[a]	2012:M02	-11.037[a]	2011:M01
inf	-6.172[a]	2008:M11	-5.685[a]	2010:M12	-6.100[a]	2008:M11
	Critical value %1 : -5.43		Critical value %1 : -4.93		Critical value %1 : -5.57	

Notes: (i) [a], [b] and [c] denote 1, 5 and 10 % levels of statistical significance, respectively.

Table 3 indicates that either budget balance and inflation rate series are stationary at 1% significance level with regard to Model A, B and C in both sub-periods. Furthermore, it could be seen that the structural breaks for the series coincide to the crisis periods as expected pre-analysis.

The final step of the estimation methodology used in this study is to investigate the relationship between the budget deficits and inflation through a Granger non-causality analysis as both of these variables are stationary at level. Accordingly, inflation and budget deficit series are subsequently exploited within the p-th order vector autoregressive [VAR (p)] framework for the Granger non-causality analysis which is proposed by Granger (1969).

$$inf_t = \theta + \sum_{i=1}^{p} \alpha_i \, inf_{t-i} + \sum_{i=1}^{q} \beta_i \, bb_{t-i} + \varepsilon_t \quad (4)$$

$$bb_t = \phi + \sum_{i=1}^{p} \sigma_i \, bb_{t-i} + \sum_{i=1}^{q} \delta_i \, inf_{t-i} + \varepsilon_t \quad (5)$$

In the single equations of the above [VAR (p)] model which are estimated by ordinary least squares separately, Granger non-causality hypotheses are tested at lags 1 to 12. Granger non-causality tests are based on the null hypotheses of H_0: $\beta_1=\beta_2=\ldots..=\beta_i=0$ in equation (4) and H_0: $\delta_1= \delta_2=\ldots..= \delta_i=0$ in equation (5). The rejection of the null hypothesis in equation (4) means that budget deficits does not Granger-cause inflation, which is accepted as an evidence for the causal link running from budget deficits to inflation.

Optimal lag length (p) for the VAR model and Granger-causality analysis is determined by means of Akaike Information Criteria (AIC), Schwarz Criteria (SC), Hannan-Quinn Criteria (HQ) and LM serial correlation tests which are presented in Table 4 and 5.

Table 4. Optimal Lag Length Determination (1987:M01 - 2004:M12)

Lag	AIC	SC	HQ	LM
1	-8.618545	**-8.455892**	**-8.552749**	**19.39095**
2	-8.595007	-8.367293	-8.502892	39.91677
3	-8.571672	-8.278897	-8.453240	1.684725
4	-8.539398	-8.181561	-8.394646	10.28118
5	**-8.619580**	-8.196682	-8.448510	**5.764107**
6	-8.617069	-8.129110	-8.419681	5.488672
7	-8.616490	-8.063470	-8.392783	1.487000
8	-8.597031	-7.978950	-8.347006	3.549042
9	-8.563798	-7.880656	-8.287455	10.00255
10	-8.536625	-7.788422	-8.233963	5.238732
11	-8.510365	-7.697100	-8.181384	24.98200
12	-8.494128	-7.615802	-8.138829	9.086380

Notes: **i)** Bold figures in AIC, SC and HQ columns stand for the optimal length. **ii)** Bold figures in LM columns stands for no serial correlation.

Table 5. Optimal Lag Length Determination (2005:M01 - 2013:M06)

Lag	AIC	SC	HQ	LM
1	-9.492386	**-9.270181***	**-9.402780***	**5.914820**
2	-9.528890	-9.195582	-9.394481	0.643042
3	**-9.531008***	-9.086597	-9.351796	9.687413
4	-9.493179	-8.937666	-9.269163	1.731778
5	-9.495145	-8.828529	-9.226326	2.816304
6	-9.431178	-8.653459	-9.117556	2.958331
7	-9.361267	-8.472446	-9.002842	1.443653
8	-9.300600	-8.300676	-8.897372	4.285704
9	-9.253134	-8.142108	-8.805103	0.678944
10	-9.322969	-8.100840	-8.830135	4.350174
11	-9.275573	-7.942341	-8.737936	2.511196
12	-9.368967	-7.924632	-8.786526	5.520092

Notes: **i)** Bold figures in AIC, SC and HQ columns stand for the optimal length. **ii)** Bold figures in LM columns stands for no serial correlation.

In addition to the selection criteria, LM test has to indicate no serial correlation at the determined lag length. Accordingly, for the first sub-period (1987M1-2004M12) optimal lag lengths are 1 and 5. On the other hand, for the second period (2005M1-2013M6) there is only one optimal lag length which is equal to 1, as the lag length indicated by AIC fails from serial correlation test.

Estimates of the [VAR (p)] inflation models for two sub-periods are presented in Table 6. The estimates for the first sub-period (1987M1-2004M12) are quite better. Impulse dummies for crisis periods (1994 and 2001) are significant at 1% significance level. Also models are overall significant with relatively high F test values (86.25941 and 34.14294) and adjusted R^2 (0.614441 and 0.654443). The estimates for the second sub-period are quite weak, as the inertia in the inflation dynamics of Turkey is eliminated because of the significant increase in credibility and decline in inflationary expectations. Nevertheless, the VAR model we used for this period is overall significant at 1% level as the F test value is equal to (6.937408).

Table 6. Estimates of [VAR (p)] Inflation Models

	(1987:M01 - 2004:M12)		(2005:M01 - 2013:M06)
	Model 1 (lag = 1)	Model 1 (lag = 5)	Model 1 (lag = 1)
Dependent Variable	inf	inf	inf
c	-0.004818	-0.010227	0.001475
inf (-1)	0.499156[a]	0.442611[a]	0.046436
inf (-2)		0.029766	
inf (-3)		0.014409	
inf (-4)		-0.058822	
inf (-5)		0.231912[a]	
bb (-1)	0.031321[a]	0.024562	0.005111
bb (-2)		0.011846	
bb (-3)		-0.005849	
bb (-4)		-0.021556	
bb (-5)		0.021035	
D94	0.190241[a]	0.186582[a]	
D01	0.042260[a]	0.045235[a]	
D11			0.021949[a]
R^2	0.621647	0.674190	0.176656
Adj. R^2	0.614441	0.654443	0.151192
F-stat.	86.25941[a]	34.14294[a]	6.937408[a]

Notes: **i)** [a], [b] and [c] denote 1, 5 and 10 % levels of statistical significance, respectively. **ii)** D94, D01 and D11 dummies stand for eliminating outlier effects stem from crisis periods.

Finally results for Granger-causality tests are presented in Table 7. Although the Granger-causality analysis is performed for 1 to 12 lags, Table 7 just reports the results at the lags which are chosen by appropriate selection criteria.

Table 7. Granger Causality Test Results

H_0: Budget Deficits Does Not Granger-Cause Inflation (1987:M01 - 2004:M12)	
Lag 1	11.08080[a]
Lag 5	11.73915[b]
H_0: Budget Deficits Does Not Granger-Cause Inflation (2005:M01 - 2013:M06)	
Lag 1	0.997359

Notes: **i)** [a], [b] and [c] denote 1, 5 and 10 % levels of statistical significance, respectively. **ii)** The above statistics are obtained from the Granger causality block exogeneity Wald tests. iv) Two different lags are provided for the first period since AIC, SC, HQ and LM values do not indicate one lag.

The results indicate a significant causality running from budget deficits to inflation rate during the high inflation period (1987:M1-2003:M6). This causal link disappears during the low inflation period (2005:M1-2013:M6). This finding is in line with several studies like De Haan and Zelhorst (1990), Fischer et al. (2002), Loungani and Swagel (2001), Catao and Terrones (2005), Domac and Yucel (2005) and Lin and Chu (2013). Correspondingly, the decline in budget deficits during the second sub-period underpin reaching and sustaining a disinflationary economic environment. This fact affirms the fiscal policy implications proposed by former studies like Metin (1995) and Günaydın (2004).

5. Conclusion

This study re-examines a well-known causal relationship between budget deficits and inflation for Turkey in two different sub-periods. Following the justification of sub-period choice the causal link in question was tested by using VAR methodology and Granger non-causality procedures. Non-causality tests confirmed the causality running from budget deficits to inflation for the first sub-period in which the average inflation is relatively high. This finding disappeared when the second sub-period with low average inflation is analyzed. These results could be attributed to the strong fiscal stabilization policies pursued in the Turkish economy aftermath of 2001 crisis.

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