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To Visualize Relationship Between Economic Growth, Government Spending and Money Supply: Evidence from Turkey

Zahoor Hussain Javed and Ahmet Sahinoz
Department of Economics, University of Hacettepe, Beytepe Campus, Ankara, Turkey

Abstract: This study investigate relationships between economic growth, government spending and money supply over the period 1992:1 to 2003:3. Present findings investigate the directional and undirectional causality between economic growth and government spending in a bivariate system. On other hand, Engle-Granger and Phillips-Ouliaris tests shows no cointegration between economic growth and government spending. However, by the introduction of a third variable, money supply; in multivariate system the investigation indicates a directional causality from economic growth, government spending and money supply in the long run, with existence of undirectional causality from expenditure to money supply in the same period. Therefore, with exception to Johansen test, the Engle-Granger test and Phillips-Ouliaris show weak evidence for cointegration between economic growth, government spending and money supply. Nevertheless, present results show that economic growth is more volatile than the government spending and money supply, over the period under consideration, which is particularly important for policy-maker in that it is the macroeconomic policy of government that affects growth and influences the money supply and government spending.

Key words: Economic growth, government spending, money supply, Turkey

INTRODUCTION

The purpose of the present study was to the examine relationship among economic growth (GNP) and government spending by introducing money supply as a third economic variable which may have significant effect on the causality and long-run relationship of economic growth and government spending in the Turkish economy by using causality tests of Granger[1], Engel-Granger[2], Phillips-Ouliaris[3] and Johansen's[4] cointegration method. At first glance, we note the relationship between economic growth and government spending, then evaluate the relationship between economic growth, government spending and money supply. It is possible that expansion of government spending is proceeded by an increase in economic growth, with the initial effect felt largely within the national sector and only subsequently on the aggregate economy. If markets are interdependent, disturbances in one market will be transmitted to other markets. However, there have been few empirical studies of relationships between the government spending and the economic growth. The issue of concern herewith is whether the expenditure, money supply and the economic growth are segmented or interdependent and whether relationship between economic growth, government spending and money supply does exist.

Recent empirical investigation of the relationship between economic growth and government spending has been conducted using the bivariate causality tests of Granger[1] and Sims[5]. Keran[6] suggested that monetary influences had stronger, more predictable and faster impact on economic growth than expenditure influences. Keran[7] again argued in empirical evidence that monetary influences had a stronger, more predictable and faster impact on economic activity than expenditure influences in United State. Andersen and Jorden[8] suggested that changes in government spending financed by monetary expansion are reflected in changes in the monetary base and in the money stock and money that influence monetary actions on economic activity is more certain than fiscal actions (expenditures). Henrekson[9] and Murthy[10] have argued that the economic growth-government spending link is a long term behaviourial relationship that should be tested on the basis of their co-movement over time. In this context, a number of empirical studies examine the long run equilibrium condition between economic development and public spending using the cointegration techniques developed by Engle and Granger[2], Johansen[4]. Recently, Levine and Renelt[11] using extreme bound analysis, demonstrate that the relationship between economic growth and some of its determinants was found

Corresponding Author: Zahoor Hussain Javed, Department of Economics, University of Hacettepe, Beytepe Campus, Ankara, Turkey Tel: +90 555 2584096 E-mail: zahoorhj@yahoo.com

to be fragile when using cross-sectional country data. Dacy[12] find evidence for the existence of a long run link between national income and government spending while Ashworth[13] and Hayo[14] find little or no support for relationship between income and expenditure. Ashworth[13] has suggested that differences in the time series properties of the underlying data and the choice of the estimation procedure used may help explain diversity in cointegration results. Oxley[15] find evidence that long run relationship exist between economic growth and government spending in Britain. On the whole, impact studies using time series support our hypothesis, while causality investigations generate mixed results which range from no causal relationship to bi-directional causality. Ahsan *et al.*[16-19] have pointed out that the use of an additional fiscal or monetary variable can change the causal relationship between public expenditure and national income. More recently, Kennedy[20] has suggested that cointegration tests should fail to find cointegration among the variables under consideration if a relevant variable is omitted from the analysis. This analysis of the long run equilibrium condition between economic growth, government spending and money supply involves three steps. This study attempts to fill this gap in the literature, with special attention being paid to the how the long run relationship between economic growth, government spending and money supply existence. Not withstanding, our empirical analysis attempts to shed light on the channels through which how economic growth, government spendings and money supply accelerate in Turkish economy. Comparing present results with the earlier studies we then try to examine in more detail the potential channels through which, how, economic growth, government spendings and money supply work for Turkish economy with tools of Granger's[1] causality, Engle-Granger , Phillips-Ouliaris[3] and Jhonsen's[4] cointegration tests.

MATERIALS AND METHODS

We employ Granger's[1] causality, Engle-Granger[2], Phillips-Ouliaris[3] and Jhonsen's[4] cointegration tests to find the interrelationship between economic growth, government spending and money supply. Firstly, we employ Granger's[1] causality test to analyse the interrelationship between economic growth and government spending. We use two sets of test to investigate relationship between the said variables. First, following Hashemzadeh *et al.*[21], we test the bivariate causality relationship between every pair of variables using the standerd two-variable approach, as described below:

$$GNP_t = \alpha + \Sigma \alpha_i GNP_{t--1} + \Sigma c_t EXP_{t-1} + v_t \quad (1)$$

$$EXP_t = \beta + \Sigma \beta_t EXP_{t-1} + \Sigma d_t GNP_{t--1} + \eta_t \quad (2)$$

Where, GNP is economic growth measured as percentage change in the same quarter of the pervious year and EXP is government spending measured as percentage change in the same quarter of the pervious year. Bivariate causality implies that EXP is Granger-causing GNP growth provided that v_t is assumed as uncorrelated disturbances in Eq. 1. Similarly, GNP is Granger-causing EXP if η_t is assumed as uncorrelated disturbances in Eq. 2. If both of the above events occur, then feedback effects exist. The hypothesis that government spending causes economic growth, if supported by the data, should imply that the null hypothesis $\sum_t^4 b_t = o$ of should be rejected by the calculated F-value when X is excluded in the restricted form of Eq. 1. If there is bidirectional causality then $\sum_t^4 c_t \neq o$ and $\sum_t^4 d \neq o$. For the bivariate analysis the F-value is calculated as:

$$F_{(4, n-2m-1)} = \frac{(ESS_R - ESS_U)/4}{ESS_U/(n-3m-1)} \quad (3)$$

Where, ESS_R and ESS_U are the sum of squared residuals for the constrained and unconstrained , Where ESS_R and ESS_U are sum of the squared residuals for the constrained and unconstrained causality regressions, respectively. n is the total number of observations and m is the number of lags per variable.

The second test examines the joint effect of two variables on the third variable. The joint trivariate causality model is described as under:

$$GNP_t = \alpha_0 + \sum_{t=1}^4 \alpha i\, GNP_{t--1} + \sum_{t=1}^4 b_i\, EXP_{t-1} + \sum_{t=1}^4 c_i M_{t-1} + \varphi_t \quad (4)$$

$$EXP_t = \Psi_0 + \sum_{t=1}^4 \beta_t EXP_{t-1} + \sum_{t=1}^4 g_i GNP_{t--1} + \sum_{t=1}^4 e_t M_{t-1} + \varepsilon_t \quad (5)$$

Table 1: Unit root and stationarily tests

	Sample range 1992:1-2003:3				Subsample range 1992:1-1997:4	
	ADF		PP		ADF	PP
Variable	level	1st difference	level	1st difference	level	level
GNP	2.45	8.99[a]	2.43	8.79[a]	2.82[c]	2.85[c]
EXP	-0.33	-12.71[a]	0.72	-12.27[a]	4.678[a]	10.39[a]
M	0.24	-9.75[a]	2.33	-10.72[a]	4.25[a]	5.47[a]

	Subsample 1998:1-2003:3			
	ADF		PP	
	Level	1st difference	Level	1st difference
GNP	1.03	9.30[a]	0.82	9.71[a]
EXP	2.01	5.41[a]	1.97	5.43[a]
M	1.73	10.72[a]	1.29	8.99[a]

Critical values for the ADF statistics from Fuller Table 8.5.2. p:373.1976. [a] denotes 1% (-3.58), [b] denotes 5% (-2.93), [c] denotes 10% (-2.60)

$$M_t = \xi_0 + \sum_{t=1}^{4} h_i M_{t-1} + \sum_{t=1}^{4} d_i GNP_{t--1} + \sum_{t=1}^{4} f_i EXP_{t-1} + \delta_t \quad (6)$$

In the trivariate causality system, we introduced a third variable M_t money supply measured as percentage change in the same quarter of the pervious year. The hypothesis being tested with Eq. 4-6 are, Whether EXP and M jointly cause GNP after controlling GNP's own lags; Whether GNP and M jointly cause EXP after controlling EXP's own lags; Whether EXP and GNP jointly cause M after controlling M's own lags. Though questions about optimal lags are raised in the literature. Jones[22] demonstrates that ad hoc methods for determining the lags to use in Granger's causality test performed better than some of statistical methods used to search for optimal lags. Earlier, Thornton and Batten[23] also found the final prediction method to be a better technique for determining the optimal lags. Thus, the issue of the best statistical method to use in determining the optimal lag is unresolved. We, therefor, estimated Eq. 1, 2 and 4-6 assuming four lags for each variable. The F-value for the trivariate causality test is calculated as:

$$F_{(4, n-2m-1)} = \frac{(ESS_R - ESS_U)}{ESS_U/(n-3m-1)} \quad (7)$$

Where the variables are as defined in Eq. 3.

Unit root tests: The casual tests of Granger[1] and Sims[5] are essentially tests of the predictive ability of time-series models. However, Granger causality tests require the use of stationary time-series data[24,25]. Bhamani-Oskooee *et al.*[26] also use the bivariate causality tests of Granger to investigate relationship between export revenue and economic growth. Under current practice, developing such data requires testing of the observed data series for unit roots called Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF)[27] tests. Consequently, before testing the cointegrating regressions as given above, we need to examine the stationarily of respective time series. For this purpose, we test each series by well known Augmented Dickey-Fuller unit root test.

$$\Delta Y_t = \beta_1 + \delta Y_{t-1} + \alpha \Sigma\Delta Y_{t-1} + \varepsilon_t \quad (8)$$

Where, $\Delta Y_t = Y_t - Y_{t-1}$, ϵ_t is the error term and δ is chosen to ensure serially uncorrelated residuals. The variables containing in Table 1 are examined for stationary.

Data: Quarterly data on GNP growth, government spending (EXP) and money supply (M) of Turkish economy for the 1992:1 to 2003:3 period were taken from the various issues on Economic and Social Indicators of State Planning Organization and International Financial Statistics.

RESULTS AND DISCUSSION

Table 2 reports the results of the bivariate analysis which suggests that the undirectional positive causality is from GNP to EXP since the estimated F value is statistically significant. Table 3 is based on three samples. Each sample is analysed for the total sample period 1992:1-2003:3 and two subperiods, 1992: 1997:4 and 1998: 2003:3. Under the consideration period 1992:1-2003:3 trivariate analysis which finds undirectional and positive causality between money supply and economic growth after excluding government

Table 2: Total sample: Bivariate analysis of causal relationship among GNP growth and expenditure (EXP) for the 1992:1-2003:3

Direction of causality	F value	p value of F
EXP → GNP	0.65	0.62
GNP→ EXP	2.45**	0.06

Critical F-values 1%= 3.32, 5%= 2.37, 10%= 1.94, df (2, 138)

Table 3: Total sample: Trivariate analysis of causal relationship among GNP growth, spending (EXP) and money supply(M) for the 1992:1-2003:3

EXP(M) → GNP[a]	GNP(M1) →EXP	GNP(EX) → M
M(EXP) → GNP[b]	M(GNP) → EXP	EX(GNP)→ M
0.62	0.76	0.00
(0.65)	(0.45)	(88.02)*
0.06	0.37	0.00
(2.45)**	(1.10)	(5.44)*
Subsample 1992:1-1997:4		
0.94	0.98	0.01
(0.18)	(0.10)	(0.41)
(0.84)	0.595	0.011
(0.34)	(0.72)	(5.39)*
Subsample 1998:1-2003:3		
0.55	0.00	0.14
(0.80)	(7.54)*	2.24 ***
0.32	0.00	0.06
(1.34)	(7.13)*	(3.25)**

Critical F-values 1%= 3.32, 5%= 2.37, 10%= 1.94, df (2, 138). * Significant at the 1% level, indicating that there is a significant causal relationship. ** significant at the 5% level, indicating that there is a significant causal relationship.*** significant at the 10% level, indicating that there is a significant causal relationship. EXP(M) → GNP [a] is interpreted as EXP and M jointly cause GNP after excluding M. M(EXP) → GNP [b] is interpreted as M and EXP jointly cause GNP after excluding EXP. Figures on top are the p values, while those in parentheses below are the F-values represented

Table 4: Test for co-integration in the Model (GNP, EXP)

Test-type		Observed statistic	5% critical value	10% critical value
Engle-Granger	ADF[a]	-0.31	-3.37	-2.59
	ADF[b]	2.58	-	-
Phillips-Ouliaris	PP[a]	0.74	-	-
	PP[b]	0.36	-	-
Johansen	Trace			
	r = 0	25.88	20.04	15.41
	r≤0	8.32	6.65	3.76
	λ-Max			
	r = 0	17.55	14.07	13.54
	r≤0	8.32	6.65	3.76

[a]Regression of EXP on GNP with a lag length of 0 chosen for unit root test. [b]Regression of GNP on EXP with a lag length of 0 chosen for unit root test. Johsen statistics computed from a VAR model in level specified with 3 lags and a constant term

Table 5: Test for co-integration in the model (GNP, EXP, M)

Test-type		Observed statistic	5% critical value	10% critical value
Engle-Granger	ADF[a]	4.16	-3.93	-3.59
	ADF[b]	2.18	-	-
	ADF[c]	-2.46	-	-
Phillips-Ouliaris	PP[a]	3.09	-	-
	PP[b]	-2.24	-	-
	PP[c]	-2.21	-	-
Johansen	Trace			
	r = 0	56.91	29.68	26.79
	r≤0	33.04	15.41	13.33
	r≤2	14.66	3.76	2.69
	λ-Max			
	r = 0	23.87	20.97	18.76
	r≤0	18.37	14.07	12.07
	r≤2	14.66	3.76	2.69

The results of Johansen's[4] trac statistics are reported in Table 4 and 5. The first row of numbers in parentheses gives the asymptotic significance level (p values) estimated in MacKinnon *et al.*[28]. The second row in parentheses gives the significance level estimated with the bootstrapped simulations. [a]Regression of GNP on EXP and M with a lag length of 2 chosen as for unit root test. [b]Regression of EXP on GNP and M with a lag length of 2 chosen as for unit root test. [c]Regression of M on GNP and EXP with a lag length of 2 chosen as for unit root test. Johsen statistics computed from a VAR model in level specified with 3 lags and a constant term

expenditure. In the same period empirical evidence suggests that bidirectional and positive relationship between economic growth and money supply after excluding government spendings. On the other hand during this period analysis shows undirectional and positive relationship between government spendings and money supply after excluding economic growth. Nevertheless, we look into subperiod 1992:1 to 1997:4, which provide evidence of undirectional and positive causality between government expenditures and money supply afer excluding economic growth. Not withstanding, over the subperiod 1998:1 to 2003:3

empirical analysis addresses evidence of bidirectional and positive causality from economic growth and government expenditure after excluding money supply and undirectional and positive causality from money supply and government expenditure after excluding economic growth. Table 4 suggest the absence of cointegration between economic growth and government spendings. The Engle-Granger and Phillips-Ouliaris tests accept the null hypothesis of no cointegration. Nevertheless, the Johansen test results are inconsistent. The λ–Max test statistic accepts the null hypothesis of cointegration and trace statistic suggests that each of the variable is stationary. Lastly, tests for the existence of cointegrating relationship among economic growth, spendings and money supply are shown in Table 5. The Engle-Granger test shows weak evidence for cointegration, with test statistic results of the regressions showing only one regression is significant at the 5% level, while Phillips-Ouliaris test also show weak cointegration which shows only one regression is significant at 10% level. Lastly, Jhonsen's[4] cointegration test results emphasis that economic growth, government spending and money supply accelerate in the same direction and shows robust relationship between the parameters.

CONCLUSIONS

The main object of the research reported on here to provide some assessment relationship of economic growth, government spending and money supply. Empirical studies of economic growth and government spending analysis which reports that the undirectional positive causality is from economic growth to expenditure. The main shortcoming of the bivariate causality analysis is omission of other relevant variables. The empirical evidence emphasis that there is joint feedback effect between economic growth and government spendings. However, The Engle-Granger and Phillips-Ouliaris tests accept the null hypothesis of no cointegration, while the Johansen test results are inconsistent with these results At the introduction of a third variable money supply; within trivariate causality analysis of economic growth and government spending for Turkish economy. The multivariate causality empirical evidence shows that bidirectional and positive causality between economic growth and money supply after excludings government spendings, while undirectional and positive causality between government spendings and money supply after excludings economic growth in the same period. However, in the 1998:1-2003:3, the structural adjustment programmes which removed some of the economic distortions and increased economic growth, government spending and money supply in same direction with slightly having different magnitude. Engle-Granger and Phillips-Ouliaris empirical shows weak cointegration between these variables, while Johonsen's cointegration test investigate, robust cointegration relationship between economic growth, government spending and money supply. To round out the discussion, Turkish economy can gain more economic growth and can remove economic distortions with tools of constant growth rate of money supply, reduction of unproductive expenditures and implementation of structural adjustment programmes.

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