Effect of Government Expenditure on GDP in the Turkish Economy

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ABSTRACT

The objective of this article is to investigate the effect of government expenditure on GDP in Turkey from 2000Q1-2015Q4 by the superexogeneity test. As a consequence of satisfying both conditions of weak exogeneity and structural invariance, government expenditure is super exogenous to GDP which implies that the policy regime shift for the period of the Global Financial Crisis in Turkey did not cause structural variance in government expenditure. Indeed, the Lucas Critique which indicates that policy regime shifts cause structural breaks, appears to be refuted.

Key words: *Lucas Critique, Government Expenditure, Superexogeneity Test*
JEL Classifications: E52, H5, C22, C52

1. INTRODUCTION

In the literature, although there are plenty of studies that examine the effects of monetary policy shifts (Ball and Mazumder, 2015; Castelnuovo, 2008; Hurn and Muscatelli, 1992; Lindé, 2001; Rudebusch, 2005), there is a lack of empirical support about the impact of fiscal policy which is one of the most interesting and international discussions.

The Global Financial Crisis (GFC) which began in August 2007 in the USA and became stronger by the bankruptcy of Lehman Brothers in September 2008, had an enormous effect on the global economy. The crisis that emerged due to the collapse of the U.S. housing sector rapidly expanded to the banking and other financial markets as well as all branches of the real economy. Both developed and developing economies went into recession and large financial institutions that invested heavily in toxic assets became insolvent.

As opposed to Western banks that suffered heavily from the Global Financial Crisis due to their investment in subprime mortgages, Turkish banks remained relatively strong in this period. The Turkish banking sector was subject to large-scale consolidation after the 2001 economic crisis and many insolvent banks were subject to mergers and acquisitions. After the crisis, regulatory authorities imposed very rigid regulation and supervision of the banking sector and these efforts paid off during the Global Financial Crisis. The balance sheet of the Turkish banking sector did not hold any of the toxic assets that had devastated the balance sheets of large financial institutions all over the world. Therefore, the collapse of global credit markets did not have a direct impact on the banking sector and the industry remained profitable even during the Global Financial Crisis.

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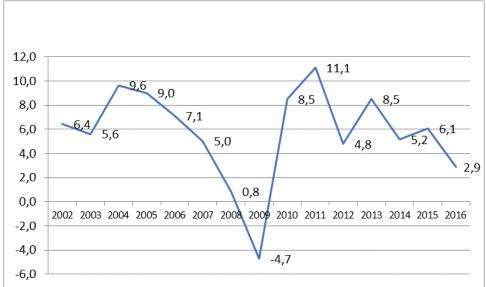M. Orhan, School of Economics and Social Sciences, International Burch University (email: mehmet.orhan@ibu.edu.ba).
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Although the banking sector remained relatively strong during the Global Financial Crisis, the same cannot be said for the real economic activity. The Turkish economy was one of the hardest hit countries in terms of the decline in real GDP. As can be seen in Figure 1.1 the economy went into a recession in the first quarter of 2009 after realizing positive GDP growth for 26 consecutive quarters. Frozen global credit markets and the heavy dependence of the Turkish economy on foreign savings due to the large current account deficit were largely responsible for the rapid decline in economic activity during the Global Financial Crisis. Table 1.1 also shows some major developments in GDP components during this period.

The Turkish economy was one of the hardest hit countries during the Global Financial Crisis but one should also note that the economy experienced a rapid recovery due to the actions taken in the form of monetary and fiscal policies. The Central Bank reduced the policy rate from 19.75% to 8.75% within just a year and this decline in interest rates gave a big stimulus to bank credit volumes. As a result, the economy experienced an average of more than 8% GDP growth in 2010 and 2011 due to the rapid increase in domestic consumption and investment expenditures. Besides monetary policy, the government also used fiscal policy in order to increase the speed of recovery. Tax cuts were introduced in various sectors to increase domestic consumption and government expenditure was increased substantially. As a result, Figure 1.2 demonstrates the expectations changed quickly in Turkey after the outbreak of crisis in the U.S., and Figure 1.3 shows that the ratio of budget deficit to GDP increased to 5.3% which was the highest level seen since 2003.
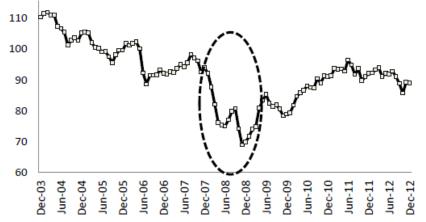
Figure 1.1 Annual GDP Growth Rates

Source: Turkish Statistical Agency.

The Lucas Critique (LC; 1976), which made Prof. Robert E. Lucas a nominee to the Nobel Prize, has been very influential in determination and application of macroeconomic policies and is based on the following notion "Given that the structure of an econometric model consists of optimal decision rules of economic agents, and that optimal decision rules vary systematically with changes in the structure of series relevant to the decision maker, it follows that any change in policy will systematically alter the structure of econometric models" (Lucas, 1976 p. 41). Lucas (1976) maintains that an econometric model is unstable and performs poorly in different time periods since a structural change (expectation-generating mechanism) and/or policy regime change over time. (Habibullah et al., 2001)
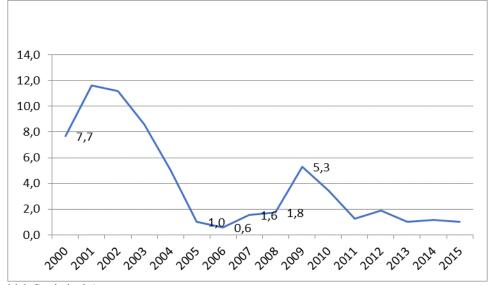
Figure 1.2 Consumer Confidence Index

Source: Central Bank of Republic of Turkey.

	GDP Growth	Consumption Expenditure of Resident Households Growth	Share in GDP	Government Expenditure Growth	Share in GDP	Gross Fixed Capital Formation Growth	Share in GDP	Change in Stocks Growth	Share in GDP	Exports of Goods and Services Growth	Share in GDP	Imports of Goods and Services Growth	Share in GDP
2008Q1	7.01	5.72	71.6	5.52	9.1	7.33	24.9	-95.48	-0.1	12.95	25.5	14.03	30.9
2008Q2	2.63	0.62	68.8	-3.44	9.9	-2.04	25.1	-140.88	0.7	4.26	25.5	2.01	29.9
2008Q3	0.86	-0.35	65.7	2.65	9.0	-8.66	21.1	18.73	5.3	3.85	25.6	-3.84	26.7
2008Q4	-6.97	-6.67	69.9	2.83	12.7	-18.75	23.1	149.50	-6.0	-8.16	25.4	-24.89	25.1
2009Q1	-14.74	-10.23	75.3	5.26	11.2	-27.86	21.0	11790.91	-9.2	-11.06	26.6	-30.99	25.0
2009Q2	-7.77	-1.75	73.3	-0.14	10.7	-24.46	20.5	-517.15	-3.4	-10.78	24.6	-20.60	25.8
2009Q3	-2.77	-1.91	66.3	5.11	9.7	-18.21	17.8	1.76	5.6	-5.22	24.9	-11.66	24.3
2009Q4	5.86	4.98	69.3	18.20	14.2	-4.23	20.9	-32.94	-3.8	7.24	25.8	11.02	26.3
2010Q1	12.59	7.92	72.2	0.52	10.0	17.21	21.9	-94.85	-0.4	-0.85	23.4	21.99	27.1

Table 1.1 Growth of Gross Domestic Product and its Components (%)[1].
Source: Central Bank of Republic of Turkey.

Figure 1.3 Budget Deficit as a Percentage of GDP

Source: Turkish Statistical Agency.

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[1] Growth rates represent percentage changes in real GDP relative to the same quarter in previous year. Share in GDP represents the percentage share of the level of each variable in GDP

The LC analysis became particularly important for the aftermath of the 2008 crisis to assess the effects of consequent policy shifts to stimulate the economy. Although it is difficult to underestimate its importance, the Lucas Critique is limited in practice. Surprisingly, there has been no significant research based on the investigation of these effects through the argument of Lucas for Turkey during the GFC period, which this paper attempts to provide.

The main purpose of this article is to carry out the Superexogeneity test in order to examine the effect of fiscal policy on GDP in the Turkish economy for the Global Financial Crisis period.

This paper is structured as follows: Section II represents the theoretical and methodological framework of this study. Section III demonstrates the test results. Section IV provides the conclusion.

2. A THEORETICAL AND METHODOLOGICAL FRAMEWORK

According to the main argument of the Lucas Critique (Lucas, 1976), any change in economic policy will fundamentally alter the impact of the policy on the economy, because the economic agents form their expectations by considering the future, not the past.

The Lucas Critique is so momentous and influential, as to threaten econometric research unless it takes expectations into consideration, and it claims that when the policy changes, the consequences are not reliable.

Administering policies according to the econometric estimation of reduced form equations based on past data cannot provide useful information about the actual consequences of alternative policies since the parameters that are estimated therein are also subject to change. In order to assess the validity of LC we specify GDP(y_t) as a function of government expenditure (x_t) in our regression framework. The Lucas Critique does not apply if x_t is superexogeneous with respect to y_t.

Superexogeneity testing procedure is used to assess the relevance of the LC (see Engle et al. (1983) for more comprehensive details of the methodology for testing superexogeneity). We define the joint, conditional and marginal distributions for superexogeneity testing following Engle et al. (1983) as:

$$F_k(k_t;\theta_t)=F_{y|x}\left(y_t|x_t;\lambda_{1t}\right).F_x(x_t;\lambda_{2t})$$

where $F_{y|x}$ and F_x are conditional and marginal models.

A variable x_t is said to be *weakly exogenous* for a set of parameters of interest Ψ (some functions of θ) in a conditional model of a variable y_t with parameters λ_1 with $k_t=(y_t, x_t)'$ if:

   i. Ψ is a function of the parameters λ_{1t} alone;

   ii. λ_{1t} and the parameters of the marginal model for x_t and λ_{2t} are variation free, which implies that there is no loss of information about from neglecting the marginal model (Caporale, 1996).

x_t is defined *as superexogenous* for Ψ if:

   i. x_t is weakly exogenous for Ψ,

ii. changes in λ_{2t} do not cause changes in λ_{1t}. Here, a parameter is considered invariant for a class of interventions if it remains constant under these interventions. A model is invariant for such interventions if all its parameters are invariant (Engle et al, 1983, p. 284).

Engle et al. (1983) model the following linear regression equation, which is assumed as the joint distribution of y_t and x_t is conditional normal with the following conditional means:
$$E[y_t|I_t]=\mu_t^y \tag{2.1}$$
$$E[x_t|I_t]=\mu_t^x$$
and covariance matrix
$$\Sigma_t=\begin{bmatrix} \sigma^{yy} & \sigma^{yx} \\ \sigma^{xy} & \sigma^{xx} \end{bmatrix} \tag{2.2}$$

where x_t and y_t are conditional on the information set I_t that contains their past values, and the current and past values of other valid conditioning variables z_t. The conditional expectation of y_t on x_t can be expressed as:
$$E(y_t|x_t)=\lambda_t(x_t-\mu_t^x)+\mu_t^y \tag{2.3}$$
and
$$y_t-E(y_t|x_t)=\omega_t \tag{2.4}$$

Note that, λ_t is the regression coefficient of y_t on x_t which is equal to σ^{yx}/σ^{xx}; and ω_t is the conditional variance which equals to $\sigma^{yy}-(\sigma^{yx})^2/\sigma_t^{xx}$.

The conditional mean of y_t and x_t is considered in the following behavioral relationship as:
$$\mu_t^y=\beta\mu_t^x+z_t'\gamma \tag{2.5}$$

Combining Equations 2.3, 2.4 and 2.5 yields:
$$y_t=\beta x_t+z_t'\gamma+(\lambda_t-\beta)(x_t-\mu_t^x)+\omega_t \tag{2.6}$$

Equation (6) is employed for superexogeneity testing by examining the conditional and the marginal models. The conditional model for Δy_t and the marginal model for Δx_t are as follows:
$$\Delta y_t=\beta_0+\beta_1\Delta x_t+\beta_2\Delta C_t+\beta_3\Delta L_t+\varepsilon_t \tag{2.7}$$
$$\Delta x_t=\beta_0+\beta_1\Delta Tax_t+\beta_1\Delta I_t+\varepsilon_t \tag{2.8}$$

where C_t is the Capital, L_t is the Labour Participation Ratio, Tax_t is the total taxes and I_t is the import.

According to the Equation (2.6), Weak exogeneity of x_t for the parameters of interest requires that μ_t^x, σ_t^{xx}, and σ_t^{yx} do not enter the conditional model, which is satisfied if $\lambda_t=\beta$. This condition simply means that the resulting residuals from the marginal model must be insignificant in the conditional model.

As previously stated, the second condition of superexogeneity is satisfied under the existence of structural invariance which requires the nonsensitivity of the parameters of the conditional model for such interventions that induce structural changes in the marginal model parameters. Empirically, this condition can be tested by inserting a dummy variable in both conditional and marginal models. This dummy represents the structural change or policy shifts. The structural invariance condition is satisfied, if this dummy variable, which captures the

structural change and/or regime shifts, is significant in the marginal model and simultaneously insignificant in the conditional model. This method of testing the structural invariance has been used in many studies such as Hurn and Muscatelli, 1992; Engle and Hendry, 1993; Karunaratne, 1996; and Valadkhani, 1998.

The regime shift or structural change dummy variable in this study is defined as DUM_t, which demonstrates a notable increase in government spending and captures the GFC period for Turkey that takes the value of zero until the last quarter of 2008, and one otherwise.

3. EMPIRICAL RESULTS

All variables that are used in the empirical analysis are real, seasonally adjusted and, excluding Capital data, have been extracted from the Turkish Statistical Institute. Capital data is not available in Turkey. As in Berlemann and Wesselhöft (2014), and Montanaro (2003), we obtain Capital Stock estimates by applying the Perpetual Inventory Method (PIM) to the regional investment series.

According to the augmented Dickey-Fuller (ADF) test results, all the variables are integrated of order one, i.e I(1). The ADF test results are not reported here, but are available upon request.

The estimation results of the parsimonious dynamic conditional and marginal models by the application of the general-to-specific (GTS) methodology (Davidson et al., 1978; and Engle et al., 1983) are below. The short-run dynamics are captured by the cointegrating vector as an error correction mechanism (ECM_{t-1}), which is significant as expected. The models also pass the battery of diagnostic tests, and both the conditional and the marginal models appear to be stable and reveal mainly satisfactory diagnostic test results. We should note that the conditional model of GDP was estimated using HAC errors to account for the heteroscedasticity issue detected while testing. In other tests for both models, there were no signs of misspecification.

Conditional Model of *GDP*:
$$\Delta GDP_t = 97664.2 - 0.089 ECM_{t-1} + 0.194\,\Delta GDP_{t-1} + 0.084\,\Delta GOV_t + 0.012\Delta C_t - 1418.9\Delta L_t$$
$$[97877]\ \ [0.025]\ \ \ \ \ \ [0.195]\ \ \ \ \ \ \ \ [0.073]\ \ \ \ \ \ \ [0.002]\ \ [97254.1]$$
$$+422.05 DUM_t$$
$$[94336.8] \tag{2.9}$$

Sample Period: 2000Q1-2015Q4
$R^2 = 0.232, DW = 1.98$
Prob (*F*-statistic) $= 0.000$
Serial Correlation $F(2,53) = 0.469$
Heteroscedasticity ARCH $F(5,51) = 5.398$

Marginal Model of Government Expenditure:
$$\Delta GOV_t = -231335.3 - 0.705 ECM_{t-1} - 0.079\Delta I_t + 0.052\Delta Tax_t + 667560.0 DUM_t$$
$$[168681.1][0.117]\ \ \ \ \ \ [0.049]\ \ \ \ [0.193]\ \ \ \ \ \ \ [250792.5] \tag{2.10}$$

Sample Period: 2000Q1-2015Q4
$R^2 = 0.387, DW = 2.009$
Prob (*F*-statistic) $= 0.000$

Serial Correlation $F(2,55) = 0.161$
Heteroscedasticity ARCH $F(1,60) = 2.78$
Weak exogeneity and structural invariance test results are reported in Table 3.2. Both conditions of weak exogeneity and structural invariance appear to be satisfied indicating that government expenditure is superexogenous in relation to GDP. This implies that the policy regime shift for the period of the GFC in Turkey did not cause structural variance in government expenditure. The Lucas Critique which indicates that policy regime shifts imply structural breaks, appears to be refuted by these tests.

Test	**Null Hypothesis**	**t-statistic**
Weak exogeneity:	$\varepsilon_t^{GOV} = 0$	1.57
Invariance:		
Marginal model	DUM = 0	2.661[***]
Conditional model	DUM = 0	0.004

Table 3.2 Superexogeneity Test Results.
Notes: [***] indicates rejection of the null hypothesis at the 1% significance level.

4. CONCLUSION

As an emerging economy, Turkey was one of the hardest hit countries by the Global Financial Crisis through different channels. Starting from mid-2008, contraction of the economy affected many of the sectors in Turkey. This study provides an empirical analysis of the applicability of the LC examining the effects of fiscal policy by using the models of GDP and government expenditure for Turkey during the GFC period through the Superexogeneity test. Since the changes induced by the regime shift on the parameters of the marginal model do not alter the parameters of the conditional model, the structural invariance condition is satisfied. As a consequence, we did not find any empirical evidence of the Lucas Critique.

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