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Debt-Oriented Growth Efforts & the Inevitable End: The Eurozone Sovereign Debt Crisis

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Abstract

This study tries to reveal the unsustainable long-term effects of public expenditures, which are extended based on loan between 2000 and 2015 in 18 Euro zone countries, on economic growth. The countries located in Euro zone chose a way to obtain economic growth by directly lowering taxes on foreign capital investments in the subject period. However, while they could achieve this purpose especially between 2006 and 2007, by 2008 which is subsequent to aforementioned years, they increase their countries' debt loads and thusly public expenditures extremely. Therefore, these countries which applied austerity policies by 2010 to lower the expenses faced sharp declines of their economic growth rates when they achieved their aims. For this reason, even if Euro zone countries continue to apply various policies today, they have difficulty in redressing their macroeconomic balance because of the effects of debt crisis. Since the solution does not lie behind having a debt-growth which is aimed at increasing public expenditures; it lies behind a foreign trade-oriented growth aimed at developing the production.

Keywords

euro zone, economic growth, sovereign debt, government spending

1. Introduction

The common power-seeking of the countries located in Europe came into existence with the foundation of European Union (EU); the subject countries reconciled on the economic and monetary union issues in time and the Union has become sufficient in supplying with its present economic integration. The Maastricht Criteria which was formed in 1991 and become effective in 1993 and usage of Euro as the shared currency since 2002 especially have a different significance in terms of the debt crisis experienced in Europe.

Euro zone consists of 18 European Union countries using Euro which went into general circulation in January 1, 2002. After the new money currency went into general circulation in European Union, there were perceivable increases in consumer prices; besides, the interest rates in EU countries decreased and

the opportunities to reach cheap and much more capital increased. In this process, both public and private sector debts reached extremely high levels. The countries in the spiral of debt's reaching more and cheaper capital resulted in tax deductions and increase in public expenditures in these countries. Applied contractionary fiscal policy revitalized the economy; thus, the tax incomes of most of the countries increased; and this helped the countries to increase the level of public expenditures. However, the investments that were supposed to be applied to the areas rising productivity and competition of economy remained limited. Especially the Euro zone countries which could not provide themselves with a permanent economic growth in these processes got into a jam by becoming highly indebted to the countries also located in EU and they maintained their economic growth by borrowing.

2. Literature Review

Cohen (1993) revealed that the relation between debt and growth is negative. According to him, what comes into question is that a high loan burden narrows down the investments which are the impetus of growth by creating reluctance towards private investments in consequence of future debt crisis and; therefore, while expected interest payments are in a positive relation with outcome, high debt stock slows down the growth by decreasing investments. Also, Cohen expresses that high level of debt does not decrease the investments every time; however, the rate of default of debt dismisses investment. Thereby, by extending the debt-investment relation to growth, external debt accumulation can increase the investment and growth to a certain extent; but when the border is crossed, rest of the debt affects investment and consequently it affects growth in a negative way.

Gregorio and Guidotti (1995) found that there is a relation between long-term growth and finance sector and also proved that there is a particular correlation between GDP and bank loans. They determined that the subject relation is positive in developed countries; however, it has a negative result in developing countries such as Latin America countries.

In the study of Checherita and Rother (2010), the public expenditure effect on the rate of GDP per capita in comparison to GDP in the 12 Euro zone countries is measured for a forty-year-process starting from 1970. Hereunder, the effect of public expenditure of growth is not linear and GDP/debt rate has a bad effect on long-term economic growth. When 70-80% of GDP is obtained, an avoidant growth revealing high public debt starts.

Ayalay and Blazsekz (2011) analyzed the rate of public debt in comparison to GDP in the 17 Euro zone member countries for 2000-2010 period with dynamic latent-factor panel data model. The results show that the contribution of unobservable common factor has been very important for the member countries of Euro zone throughout the global financial crisis and post-2008 debt crisis term.

Pan and Wang (2012) analyzed the relation between public debt and economic growth in 12 Euro zone countries between the years 1970 and 2009 with the Bayesian dynamic factor model. Pan and Wang determined that among these variables there are common variables which affect growth positively and state debts negatively. Prono, Schoder and Semmler (2014) analyzed the relation between the rate of

economic growth of 16 industrialized countries between 1981 and 2013, and the rate of state debt in comparison to GDP. At the times of financial crisis only in the Euro zone countries, the decay in the rate of state debt in comparison to GDP affects the economic growth negatively.

Merilänen (2016) measured how much growth in 18 European countries between 2004-2013 has been affected by 2008-2009 financial crisis and debt crisis with panel data analysis. They found that each analyzed country of 18 European countries has been negatively affected by both of the crisis in nine-year process.

3. Debt Crisis Process in Euro Zone

The needs of a common Economic and Monetary Union were identified inside the union with Maastricht Treaty which became valid in January 1, 1993. In the frame of these needs, the convergence criteria in terms of some macro-quantities are identified in order to remove differences among the economies of the member countries. Among the conditions which are called Maastricht criteria (Council of the European Communities, Treaty on European Union, 1992), the condition which states that the rate of member countries state debts in comparison to GDP should not be over 60% and the condition which states that the rate of member countries fiscal deficit in comparison to GDP should not be over 3% were violated by many European countries. The condition of not being over 3% of fiscal deficit was violated 8 times by Greece, 5 times by Italy, 4 times by Portugal and Germany, three times by France and once by Holland and Austria before the financial crisis. Also, the countries with strong economy such as Germany and France used their political presence in terms of these violations. This situation showed that the countries possess different policies in applying Maastricht criteria. In fact, the member countries embody differences not only in terms of these criteria but also in terms of fiscal policies applied against spiral of debt. However, while an only monetary policy is followed by European Central Bank among the member countries, what brought compliance problem with it is that the countries have different fiscal policies.

In addition to that, Lehman Brothers Inc. in USA and many other banks successively declared bankrupt in 2008 and an outbreak of a financial crisis followed. Later, this crisis reached a global extent and it caused unease especially in Euro zone countries by uniting with debt crisis in Europe. As a consequence of union of these two crisis, the debts of the countries in Euro zone increased day by day and their economies rapidly downsized. So much so that, Euro zone experienced the greatest shrinkage of its history by downsizing 4.1% in 2009 (European Commission, 2009).

Against the financial crisis named as Mortgage crisis in 2008 in the USA, Federal Reserve System of America acted in a manner of reducing the interest rates. The reduced interest rates in real estate sector increased the loan application and they were exported to the international markets by securization; thus, the financial crisis made itself fully evident in Europe.

As the loans possessed by European countries before the financial crisis were consuming and housing oriented and with the effect of financial integration, the banks had too many risky assets during the

crisis. It is even known that there were 300% times more assets than GDP of the Euro zone in the banks assets in the Euro zone (Shambaugh, 2012). The European financial market which was in this situation became more fragile against the crisis and the European countries increased their public debts as a result of their relieves in order to save their banks. Especially Portugal, Ireland, Italy, Greece and Spain (GIIPS countries) in Euro zone had the most difficulties in terms of high public debts during the crisis.

As seen in the Table 1, all seven sample Euro zone countries' rates of debt stock/GDP were on the rise in the post crisis period. While it is seen that Greece and Italy are the countries whose rates of debt are high in the pre-crisis period, it is also seen that Spain and Ireland violate the rule of Maastricht criteria which indicates that state debts should not be more than 60% of GDP. There isn't any unity among the countries in terms of matching the criteria. While the reason why Ireland violated this criterion was that the financial aids given to the banks in order to stabilize the banking sector, which had been collapsed by the financial crisis, increased the debt burden incredibly, the reason of Spain was that Spain held a lot of mortgage loans in her hand during financial crisis. After the financial crisis, the credit rating agencies lowered many countries' credit rating due to their having state debts and this resulted in intensifying the debt crisis more. Notably USA and the credit rating agencies lowered GIIPS countries' credit rates to minus. This situation made it harder for these countries and the countries had to make a series of fiscal policy changes within themselves. As well as the expansionary fiscal policies applied by the countries, public expenditures showed increase because of inefficiency of stabilizators placed into the system and the rise of payments due to unemployment (Volz, 2012).

Table 1. The Ratio of General Government Debt and GDP (Comparison with Selected Countries and the Average of Euro Zone)

	Germany	France	Greece	Ireland	Portugal	Spain	Italy	Euro Zone
2000	59.8	61.9	101.2	28.7	52.0	55.2	108.9	68.0
2001	58.9	61.0	102.9	25.6	53.5	50.6	108.1	67.2
2002	61.3	64.6	101.0	24.1	56.8	49.3	106.9	67.0
2003	63.0	64.2	101.2	29.9	58.7	47.6	100.4	68.2
2004	64.7	65.7	102.7	28.2	62.0	45.3	100.0	68.5
2005	66.9	67.2	107.3	26.1	67.4	42.3	101.9	69.3
2006	66.4	64.4	103.5	23.6	69.2	38.9	102.5	67.4
2007	63.6	64.4	103.1	23.9	68.4	35.5	99.7	65.1
2008	65.0	68.1	109.4	42.4	71.7	39.4	102.3	68.7
2009	72.5	79.0	126.7	61.8	83.6	52.7	112.5	78.5
2010	81.0	81.7	146.2	86.8	96.2	60.1	115.3	84.0
2011	78.4	85.2	172.0	109.3	111.4	69.5	116.4	86.1
2012	79.7	89.6	159.4	120.2	126.2	85.4	123.2	89.5

2013	77.4	92.3	177.0	120.0	129.0	93.7	128.8	91.3
2014	74.9	95.6	178.6	107.5	130.2	99.3	132.3	92.5
2015	71.6	96.2	179.0	98.4	129.0	101.0	133.0	94.0

Source: Eurostat, retrieved February 3, 2016, from http://www.ec.europa.eu/eurostat/data/database traingeconomics, retrieved February 3, 2016, from http://www.tr.tradingeconomics.com/indicators

Table 2 shows that almost every country saw increases in public expenditures after the financial crisis. This situation shows how effective financial crisis is when it is followed by debt crisis. Especially, the increase of government spending/GDP rate of Ireland after the financial crisis is rather remarkable. Likewise, the increase in welfare in Ireland after 1990 was more rapidly when compared to other countries. While Ireland was one of the poorest countries in Europe 30 years ago, it has become one of the rich countries which realized its economic growth in a fast way. The major reasons of this situation are: keeping tax rates low in a way that directly attracts foreign capital investments; operating free market rules well; special importance given to technological advancements; and benefiting from EU in terms of reducing economic dependency to England. Also, unemployment in Ireland regressed significantly. However, the expenses that are channeled to payment/salary increases enhanced public expenditures. This is the reason for Ireland to increase expenses in 65.6% rate in 2010 which is seen in the table. The public expenditures were decreased by taking measures in public sector with the aim of reducing the effect of real estate sector bubble emerged in Ireland with the crisis. In that case, Ireland whose economic growth also regressed proceeded on its way with the borrowings from EU.

Table 2. The Ratio of Government Spending & GDP (Comparison with Selected Countries and the Average of Euro Zone)

	Germany	France	Greece	Ireland	Portugal	Spain	Italy	Euro Zone
2000	44.6	51.1	45.4	30.9	42.6	39.1	45.5	45.7
2001	46.8	51.2	43.7	32.5	44.1	38.5	47.5	46.7
2002	47.2	52.3	43.5	33.0	43.7	38.6	46.8	46.9
2003	47.7	52.8	43.2	32.9	45.3	38.3	47.2	47.3
2004	46.2	52.5	43.7	33.1	46.1	38.7	46.8	46.8
2005	46.0	52.9	43.2	33.3	46.7	38.3	47.1	46.7
2006	44.5	52.5	44.9	33.8	45.2	38.3	47.6	46.1
2007	42.7	52.2	46.9	35.9	44.5	38.9	46.8	45.3
2008	43.4	53.0	50.6	41.8	45.3	41.1	47.8	46.6
2009	47.4	56.8	54.0	47.2	50.2	45.8	51.1	50.7
2010	47.1	56.4	52.2	65.6	51.8	45.6	49.9	50.5
2011	44.5	55.9	54.0	45.4	50.0	45.6	49.1	49.1

2012	44.1	56.8	54.4	41.7	48.8	47.9	50.8	49.8
2013	44.1	57.0	60.1	39.5	50.4	45.1	50.9	49.6
2014	43.9	57.2	49.3	39.0	49.0	43.6	51.1	49.4
2015	44.7	57.0	50.0	45.6	50.1	41.1	51.0	48.6

Source: OECD, retrieved February 3, 2016, from http://www.stats.oecd.org/

HERITAGE, retrieved February 3, 2016, from http://www.heritage.org/index/explore?view=by-region-country-year

quandl, retrieved February 3, 2016, from https://www.quandl.com/

tradingeconomics, retrieved February 3, 2016, from http://tr.tradingeconomics.com/indicators

As well as the effect of global financial crisis and debt crisis that increased the state debts of Euro zone countries via public expenditures, their regressing economic growth effect emerged. Especially, the investments, which can be made with easily obtained loan after the European countries began to use Euro in the pre-financial crisis period, tend to decrease after the crisis. As a result of decreased investments and avoiding risks with expenses after the crisis, there was a sudden fall in demand and decreases in growth rates of the countries was observed.

According to the table in which the numbers of economic growth are involved, the growth rates of all of the countries dropped to minus especially after the year when the global financial crisis occurred (2009) and when the subsequent years are considered, it followed a fluctuating course.

Table 3. Economic Growth Rates (Comparison with Selected Countries and Average of Euro Zone)

	Germany	France	Greece	Ireland	Portugal	Spain	Italy	Euro Zone
2000	3.197	4.04	4.228	10.223	3.787	5.289	3.913	3.8
2001	1.838	1.928	3.61	5.872	1.943	4.001	1.611	2.1
2002	0.019	1.13	3.142	5.946	0.769	2.88	0.251	0.9
2003	-0.73	0.807	6.538	3.853	-0.934	3.188	0.223	0.6
2004	0.7	2,596	4.884	4.435	1.812	3.167	1.407	2.2
2005	0.878	1.637	1.133	6.354	0.767	3.723	1.125	1.7
2006	3.879	2.561	5.745	6.323	1.553	4.174	2.083	3.2
2007	3.833	2.31	3.382	5.534	2.492	3.769	1.356	3.0
2008	0.808	0.091	-0.438	-2.211	0.199	1.116	-1.069	0.5
2009	-5.565	-2.854	-4.36	-5.66	-2.978	-3.574	-0.506	-4.5
2010	3.943	1.878	-5.337	0.379	1.899	0.014	1.683	2.0
2011	3.715	2.095	-8.866	2.589	-1.827	-1	0.705	1.6
2012	0.616	0.215	-6.62	0.148	-4.028	-2.62	-2.865	-0.8

2013	0.406	0.746	-3.981	1.441	-1.13	-1.672	-1.753	-0.5
2014	1.583	0.171	0.69	5.216	0.906	1.361	-0.377	0.9
2015	1.522	1.066	-1.401	5.56	1.689	3.156	0.756	1.4

Source: OECD, retrieved February 3, 2016, from http://www.stats.oecd.org/

In order to be recovered from debt crisis and its effects, Euro zone countries demanded financial aid packages from European Union. However, at first, the economically developed leading countries of European Union criticized GIIPS countries because their economies were unbalanced by ignoring the structural problems of EU during the debt crisis. Nevertheless, the leading countries later agreed to give aid packages to GIIPS countries particularly to Greece, Ireland and Portugal (CURA, 2015). However, the aid packages provided temporary solution; the interventions, which will be done equally only on the numbers to these countries whose financial structures are different from each other, carry the risk of adding another wrong intervention to the interventions that have been done since 2006. More clearly, as it is shown in the analysis below, providing economic growth based on aid/debt brings public expenditures with it and if providing right steps related to production doesn't gain acceleration, sudden fall of economic growth will be faced in the first intervention for reducing debt. The methods of credit facility and indebtment followed in the last ten years in order to get the countries in Euro zone back on their feet in terms of both their banking system and their market economies also have the characteristics of a proof of our analysis.

4. Methodology

4.1 The Concept of Stationary in Time Series and Unit Root Tests

Before analyzing the causal relationships among variables, the stationary degrees of the series must be determined. In the studies which are exercised with non-stationary time series, spurious regressions might develop. Although in spurious regressions, R^2 and significant t statistics value may come into question; the parameter estimations are economically insignificant. Under this circumstance, the stationary of time series that will be used must be tested in order to avoid spurious regressions in the studies exercised with time series analysis (Ümit, 2007).

$$X_t = c_o + j.X_{t-1} + e_t \quad (1)$$

In the equation number (1), if $|j| < l$, X_t series are stationary; and if $|j| = 1$, X_t series are non-stationary. The autoregressive coefficient j's being one or smaller is appropriate for most of the economic time series. When $j > 1$, it is economically not coherent. In the autoregressive equation number (1), $j = 1$ is known as "process with stationary differences" and most of the economic time series are seen as process with stationary differences. In such a process, when $j = 1$, X_t series are said to be integrated in the first degree (Utkulu, 1993). Dickey and Fuller (1987) suggested the easy and proper method of the test X_t's integration degree in the equation number (1) and it is known as Dickey Fuller (DF) Test.

Although DF test is an important step in measuring integration degree, it doesn't take autocorrelation in

error terms in consideration. If the error term e_t is with autocorrelation, DF (Dickey-Fuller) test will be void. As a solution for that situation, Dickey and Fuller suggested that lagged values of dependent variable be added to the model as explanatory variable; so that the autocorrelation will be removed. This test is named as Augmented Dickey-Fuller Test (ADF), and it is considered as the most effective test to determine the integration degree; and it is commonly used in practice (Charemza & Deadmen, 1999).

4.2 Co-Integration Analysis

The importance of the integration degrees of the series in co-integration concept is great. The integration degrees of series are learnt through unit root tests. If obtaining the stationarity of series requires that the difference should be taken for d times, it is said that this series is integrated in the d^{th} degree and it is shown as I (d) (Kadılar, 2000). In order to carry out co-integration analysis, the series are supposed to be integrated in the same degree.

Co-integration is a technique which was developed in order to examine the correlation between two time series that are non-stationary. The concept of co-integration is suggested by Engle and Granger (1987). Co-integration analysis is applied in order to examine the long term relations between series (Göktaş, 2005; Engle & Granger, 1987). Engle and Granger (1987) defined co-integration as:

$x_1 = (x_{1t}, x_{2t}, x_{3t}, \cdots, x_{nt})$ vector's components are defined as integrated in d and b degrees and it is shown as x_t ~ CI (d, b). Conditions;

1. x_t 's all components are integrated in d degree.

2. $\beta = (\beta_1, \beta_2, \cdots, \beta_n)$ vector exists.

3. $\beta x_t = \beta_1 x_{1t} + \beta_2 x_{2t} + \ldots + \beta_n x_{nt}$, is integrated in $(d\text{-}b)^{th}$ degree (b > 0).

β vector, is referred as "co-integration vector" (Engle & Granger, 1987; Charemza, 1992).

4.3 Causality Analysis

The causality test, which was developed in 1969 by Granger, is put through the equations below.

$$Y_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i Y_{t-i} + \sum_{i=1}^{m} \beta_i X_{t-i} + u_t \quad (2)$$

$$X_t = \lambda_0 + \sum_{i=1}^{m} \lambda_i X_{t-i} + \sum_{i=1}^{m} \theta_i Y_{t-i} + v_t \quad (3)$$

Here, m shows the length of lag and it is determined by using information measurements which are in standard VAR that is estimated among the variables (Enders, 1995; Gocer vd., 2012). In the equations with the number (2) and (3), α_0 and λ_0, represent constant terms α, β, λ and θ represent the estimated coefficients of lagged variables. In the models above, it is tested if the coefficients of the lagged values of independent variables equal to zero or not ($\beta_1 = \beta_2 = \cdots = \beta_i = 0$; $\theta_1 = \theta_2 = \cdots \theta_i = 0$). In the equation number (2), in case hypothesis is rejected by using F test, X is the Granger cause of Y; and in the equation number (3), in case hypothesis is rejected, Y is the Granger cause of X (Mishra vd., 2010;

Ekinci, 2011). These tests are used when there are two variables. If there are more than two variables, Block Granger Causality test—Block Exogeneity test- must be used. Block Granger Causality test probes if a lagged variable is the Granger cause of the other variables in the system or not.

4.4 VAR Analysis

The complexity and sophistication of the interaction among economic relations makes it obligatory to use system of simultaneous equations. Also, the difficulties, faced in the phase of establishing dependent and independent variable, which emerge as a natural result of the mutual interaction between economic parameters affects the consistency of the analysis significantly. Therefore, sometimes some restrictions must be imposed on structural model in order to overcome determination problem in system of simultaneous equation. The Vector Autoregressive Models (VAR), which are developed in order to solve this complex table that the system of simultaneous equation contains, solve the subject problem. VAR models are often preferred in terms of time series as they can give dynamic relations without any restrictions on structural models (Keating, 1990; Kumar vd., 1995; Adrian, 1990; Mucuk, 2006). VAR model can be defined as follows (Kibritçioğlu, 1999).

$$X_t = c + b\ (L)\ X_{t-1} + u_t \quad (4)$$

In the equation, *c* stands for constant term, X_{t-1} stands for variables vector of the model, *b(L)* stands for polynomial lag processor, u_t stands for error term (average, variance and covariance of the terms are fixed stationary). Also when one unit shock is applied to one of the variables in the model, the reactions given by both this variable and the other variable to this change are observed with action and reaction analysis. The application of variance decomposing is used in determining in what percentage the variable has its own lag and in what percentage it is explained by other variables of the changes emerging in each variable's variance. Thus, the reactions of the internal variables against shocks are seen via action-reaction function; and variance decomposing shows the relative significance of shocks (Warne, 2004).

5. Results and Discussion

5.1 Data Set and Variables

In this study, in order to analyze the relationship among economic growth rates, annual public expenditures/GDP and annual debt stock/GDP in Euro Zone countries (18 countries) from 2000-2015; time series are used in application and the quantitative results which are found are interpreted. First of all, the logarithms of the variables have been taken in the study in order to ignore the small floatation that can be emerged by time series. Later, Augmented Dickey Fuller Test (ADF) is applied in order to determine if the values of three variables are stationary or non-stationary. As the next step, Co-integration Test is applied to reveal the long term relationship between variables. Then, Granger Causality Test is applied with the aim of detecting the causality relation between variables and finally VAR decomposing is applied in order to determine in what percentage the variable has its own lag and in what percentage it is explained by other variables of the changes emerging in each variable's variance.

The data used in the application are taken from the databases of Eurostat, Tradingeconomics and OECD (Organization for Economic Co-operation and Development).

The changes of these data in time can be seen in Figure 1. The abbreviations used in analysis are GROWTH for Economic Growth; DEPT for Debt Stock and PUBLIC for Public Expenditures.

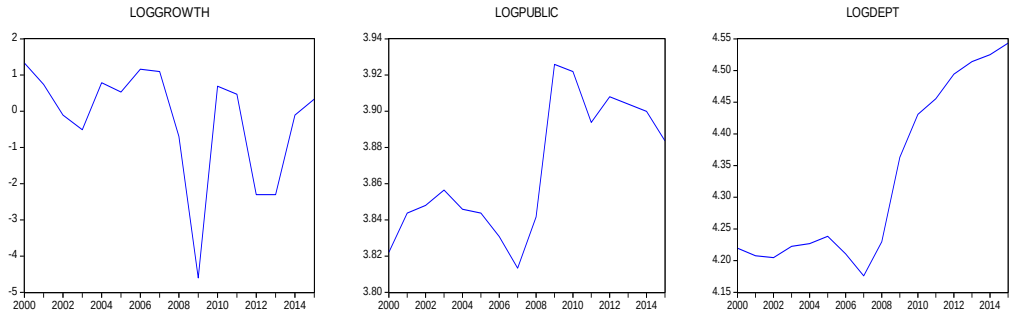

Figure 1. Economic Growth, Public Expenditures and Debt Stock (Euro Zone Countries)

When the series showing data of economic growth, public expenditures and debt stock from 2000 to 2015 are analyzed, the results are as follows: while growth data are seen as almost in the same level and in rise until 2009, it is seen that in 2009 it was in a low level and after that it rose again. In terms of Public Expenditures graphic, it is seen that it bottomed out in 2007 and it topped out in 2009. Finally, when we analyze Debt Stock graphic, it draws attention that it bottomed out in 2007 and in the subsequent years it increased gradually.

5.2 Unit Root Test

Series' having unit root shows that it is non-stationary. When the fixed data of ADF test statistics are analyzed; the things we can say about economic growth, public expenditure and debt stock are as follows: it can be seen that it does not have stationary structure on the level and it does not have a distribution around a particular average.

Table 4. ADF Unit Root Test Results

		ADF—t Statistics	
Variables	MacKinnon Critical Values	Level Values	First Difference
GROWTH	%1 = -3.959 %5 = -3.081 %10 = -2.681	-1.203 (0)	-4.863 (1)***
PUBLIC	%1 = -3.959 %5 = -3.081 %10 = -2.681	-1.677 (0)	-3.343 (1)**

	%1 = -4.057		
DEPT	%5 = -3.119	0.188 (2)	-3.923(1)**
	%10 = -2.701		

Note: The values in brackets give the lag length which are chosen according to SCI criteria. The critical values for ADF were obtained by MacKinnon (1996).

*** p < .01, ** p < .05, * p < .1.

When the first differences are taken, it is seen that the test statistics are bigger than critical values determined by Mackinnon in terms of absolute values. As a result; when the first differences of economic growth, public expenditures and debt stocks series are taken; that is, in I (1), it can be said that they provide with stationary hypothesis (see Figure 1). The graphics of the stationary series the first difference of which are taken is given in Figure2.

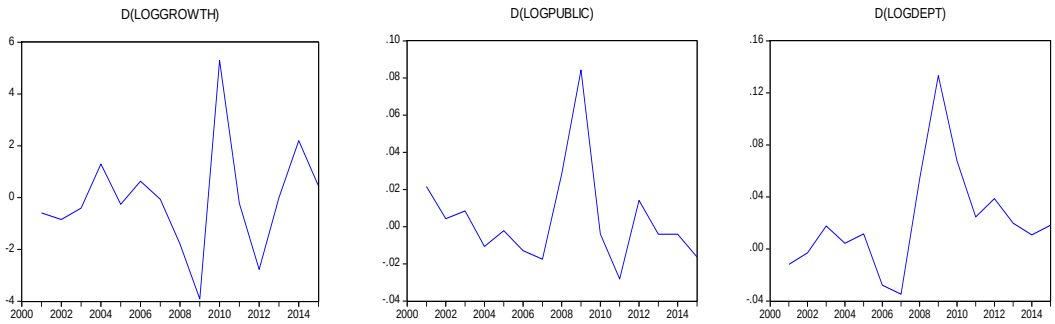

Figure 2. Economic Growth, Public Expenditure and Debt Stock after First Difference (Euro Zone Countries)

5.3 Johansen Co-Integration Test

For all the variables taken in hand, not containing unit root in the first differences; that is, their being co-integrated in the same degree enables the co-integration relationships to be analyzed. In this study, Johansen Co-integration test is used in order to locate whether there is a significant relationship between subject variables in long term or not. The results of this test are presented in the Table 5. When the co-integration analysis results are studied, a long term relationship among economic growth, public expenditure and debt stock series has been found. H_0 hypothesis which declares that there are no co-integrated relationships among variables is dismissed. Max-Eigenvalue and trace statistics show that there are two co-integration equations among these variables.

Table 5. Johansen Co-Integration Test Results

Ho Hypothesis	Eigenvalue Statistics	Trace Statistics	% 5 Critical Value	Prospect**	Max Eigenvalue Statistics	% 5 Critical Value	Prospect**
r = 0*	0.780	37.324	29.797	0.005	21.253	21.131	0.048
r ≤ 1*	0.665	16.071	15.494	0.040	15.322	14.264	0.033
r ≤ 2	0.520	0.749	3.841	0.386	0.749	3.841	0.386

Note: According to maximum eigenvalue and trace statistics, α = 0.05 shows that there are two co-integration equation in level of significance.

* shows that the hypothesis is dismissed in 0.05 level of significance.

** are MacKinnon-Haug-Michelis (1999) p values.

5.4 Block Granger Causality Test

With Block Granger Causality Test, the causality relationship among variables are explained. The obtained results are presented in the Table 6.

Table 6. Block Granger Causality Test Results

Dependent Variable: Economic Growth		
	Chi-square	Prospect
Debt Stock	5.646	0.050**
Public Expenditures	2.771	0.2501
General	7.072	0.1321
Dependent Variable: Debt Stock		
Economic Growth	0.035	0.982
Public Expenditures	4.618	0.090*
General	5.759	0.217
Dependent Variable: Public Expenditures		
Economic Growth	0.471	0.789
Debt Stock	8.363	0.015***
General	10.070	0.039**

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

According to the findings of the Block Granger Causality Test, a unidirectional causality relationship from debt stock to economic growth is found. Also, a bidirectional causality relationship between public expenditures and debt stock is found.

5.5 VAR Analysis

VAR model has been used densely in the applied econometrics and especially in macroeconomics and finance after the pioneer study of Sims (1980). VAR model is a simple multidimensional time series prediction model in which all the variables participating in the model are defined on their lagged values. In this study, the results obtained from VAR model are presented in the Table 7.

Table 7. VAR Model

Variables	D(LOGGROWTH)	D(LOGPUBLIC)	D(LOGDEPT)
D(LOGGROWTH(-1))	-0.135	-0.004	-0.000
	[-0.256]	[-0.645]	[-0.038]
D(LOGGROWTH(-2))	-0.185	-0.000	0.000
	[-0.475]	[-0.037]	[0.036]
D(LOGPUBLIC(-1))	15.567	-2.021	-2.215
	[1.950]	[-2.213]	[-1.375]
D(LOGPUBLIC(-2))	-16.542	0.447	0.511
	[-0.410]	[0.939]	[0.609]
D(LOGDEPT(-1))	-8.579	1.506	2.243
	[-2.011]	[2.859]	[2.414]
D(LOGDEPT(-2))	6.324	-1.202	-1.463
	[2.236]	[-3.427]	[-2.365]
C	0.110	-0.001	0.011
	[0.163]	[-.146]	[0.773]
R^2	0.711	0.745	0.645
F Statistics	2.462	2.923	1.819

Note: The values in brackets give t statistics.

As interpreting VAR model parameters directly will not be significant, the interpretations of these variables will be made by analyzing Action-Reaction and Variance.

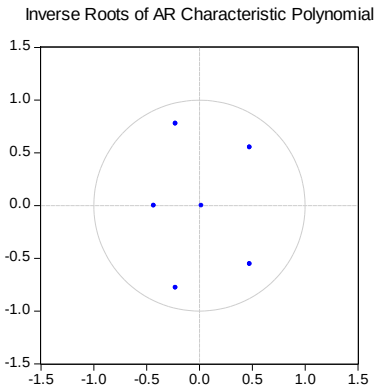

Figure 3. The Location of Inverse Roots of AR Characteristic Polynomial in Unit Circle

The location of inverse roots of AR characteristic Polynomial in unit circle which belongs to appraisal model has revealed that the model does not pose any problem in terms of stationarity (Figure 3).

5.6 Action-Reaction Functions

Each variable's reaction against the errors of its own or of the other variables in the system is named as action-reaction. Action-reaction functions show the effects of the shocks on variables and when and how the effect is (see Figure 4). In the Action-Reaction graphics, the horizontal axis displays the duration of the reaction as trimester and the vertical axis displays the dimension of the reaction. The continuous lines in the graphics indicate the dependent variable's reaction against a standard error shock in the error terms of the model; and the interrupted lines indicate confidence intervals for ±2 standard error.

When the Action-Reaction graphics are analyzed; the reaction of the economic growth in response to one-unit-shock in economic growth reaches the lowest level in the third period and then it gives undulant reactions. In response to the one-unit-shock in public expenditures, the reaction of the economic growth increases in the third period, decreases in the fifth period and then follows a zero level course. When another action-reaction graphic is analyzed; the reaction of public expenditures in response to the debt stock reaches its highest level in the second period and after decreasingly it reaches the lowest level; and then it moves steadily.

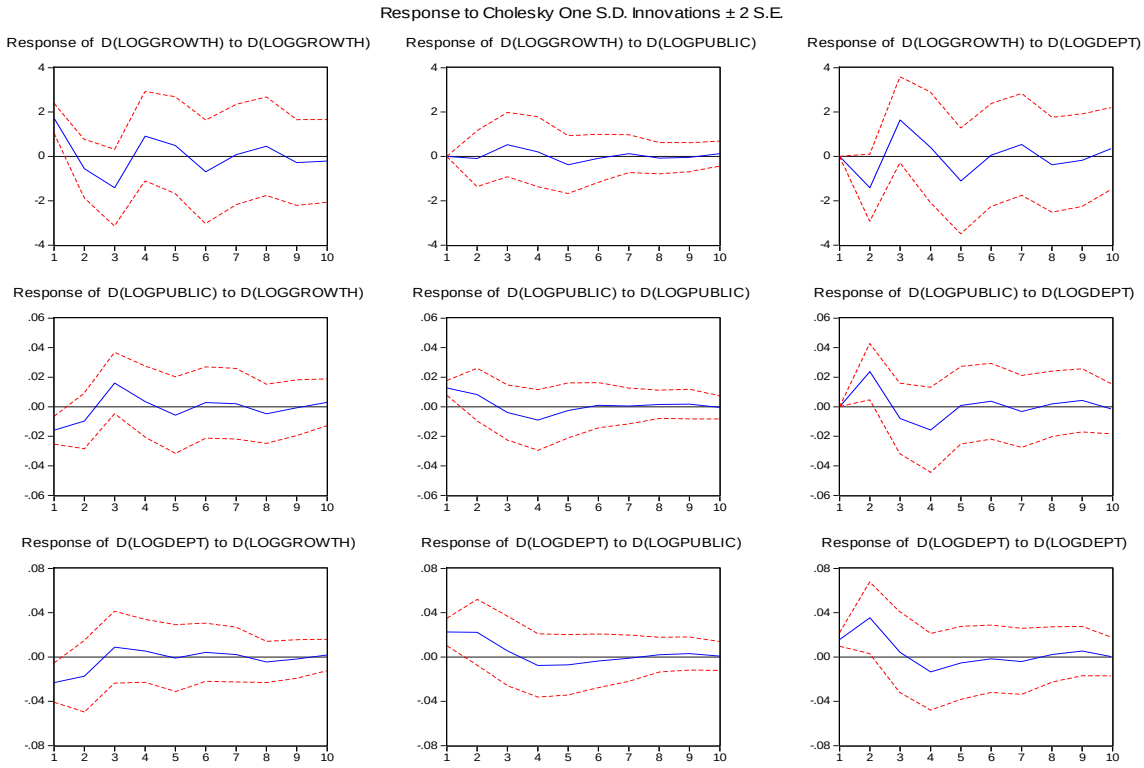

Figure 4. Impulse-Response Graphics

5.7 Variance Decomposition Analysis

Another technique to be used in order to determine the cause of the change in series is VAR decomposition. According to the results of the variance decomposition for economic growth variable in Table 5, 21.6% of the prediction error variance of economic growth is defined by public expenditures, 28.5% of it is defined by debt stock and approximately 50% of it is defined by economic growth itself at the end of the 10th period. According to the results of the variance decomposition for debt stock; 25.2% of the prediction error variance of debt stock is defined by economic growth, 8.12% of it is defined by public expenditures and 66.5% of it is defined by debt stock itself at the end of the 10th period. The results of the variance decomposition for public expenditures show that it is defined by 35.2% economic growth, by 45.4% debt stock and by 19.2% public expenditures itself. These obtained results support the results of Granger Causality Test.

Table 8. Variance Decomposition Analysis Results

	S.E.	D(LOGGROWTH)	D(LOGDEPT)	D(LOGPUBLIC)
Period	Varian	Decomposition	Results for Eco. Growth	Variable
1	1.722	100.000	0.000	0.000
2	2.297	62.061	15.045	22.893
3	3.202	51.340	26.267	22.391
4	3.360	53.964	25.288	20.746
5	3.591	49.127	28.997	21.874
6	3.659	50.934	27.934	21.131
7	3.702	49.826	28.532	21.641
8	3.750	50.040	28.377	21.581
9	3.764	50.206	28.281	21.511
10	3.791	49.798	28.585	21.616
Period	Variance	Decomposition	Results for Debt Stock	Variable
1	0.035	41.537	58.462	0.000
2	0.057	25.127	67.038	7.833
3	0.058	26.471	65.976	7.551
4	0.061	25.344	66.466	8.189
5	0.061	24.837	67.143	8.019
6	0.062	25.080	66.958	7.960
7	0.062	25.053	66.850	8.096
8	0.062	25.388	66.565	8.046
9	0.062	25.214	66.653	8.132
10	0.062	25.273	66.598	8.128
Period	Variance	Decomposition	Results for Pub. Expenditure	Variable
1	0.020	60.989	26.180	12.829
2	0.033	30.417	45.778	23.804
3	0.038	40.796	39.540	19.663
4	0.042	33.783	46.993	19.222
5	0.043	34.812	46.120	19.066
6	0.043	34.817	46.033	19.149
7	0.043	34.759	45.798	19.442
8	0.043	35.419	45.407	19.172
9	0.044	35.041	45.681	19.277
10	0.044	35.278	45.499	19.222

6. Conclusions

European Union's—who represents the common power of the countries in Europe in terms of economy and politics- beginning to use Euro as shared currency with the aim of strengthening especially economic integration of confederation caused Euro zone to emerge in Europe. By means of usage of Euro, forming a more special zone all across European Union caused many problems. One of those problems is the low purchasing power due to increases in customer prices in terms of many European countries.

The countries such as Portugal, Ireland, Italy, Greece and Spain which are located in Euro zone wanted to attract foreign capital investments directly by keeping tax rates low after especially changing their currencies to Euro and they aimed to grow economically by doing so. Particularly the economic growth number of the subject countries in 2006 and 2007 have evidential value. For instance, while growth rate in Ireland was 6.32% and growth rate in Greece was 5.745% in 2006, there was a 2.49% growth in Portugal in 2007. However, keeping tax rates low and reducing unemployment in these countries led to the increase of public expenditures. There was a rapid increase in countries' debt stock/GDP with the effects of the constant increase of public expenditures and the global financial crisis after 2008. Even Germany—which is one of the advanced economies of Europe was able to stop this increase in 2011. And another advanced economy France still has an increase in state debts.

Euro zone countries started to apply austerity policy after especially 2010 in terms of public expenditures in order to reduce the effect of debt spiral. While Ireland had 20.2%, Portugal had 1.8%, Italy had 0.8% decline in public expenditure/GDP in 2011, Spain was able to keep the related data in the same rate in one year process. Germany was one of the countries who had foreseen the situation. As Germany started austerity policy in 2009 and managed to decrease public expenditures/GDP in a 0.3% when compared the year before. But Greece is having hard time in applying this policy even today.

Hence, when the series showing economic growth, public expenditures and debt stock between 2000 and 2015 are analyzed, the following results are seen: growth data are almost at the same level until 2009 and they follow a high course; they are at the lowest level in 2009; and after that, they rise again. The graphic of public expenditures is at the lowest level in 2007 and at the highest level in 2009. When the debt stock graphic is analyzed, it is striking that the lowest level is in 2007 and in the subsequent years it gradually increases. According to the Block Granger Causality Test findings; there is a unidirectional causality relation from debt stock to economic growth. Also, there is a bi-directional causality relation between public expenditures and debt stock. Hereunder, 21.6% of the prediction error variance of economic growth is defined by public expenditures, 28.5% of it is defined by debt stock and 50% of it is defined by economic growth itself at the end of the 10^{th} period in the light of variance decomposition for economic growth variable. Similarly, 25.2% of the prediction error variance of debt stock is defined by economic growth, 8.12% of it is defined by public expenditures and 66.5% of it is defined by debt stock itself at the end of the 10^{th} period according to the result of variance decomposition for debt stock. However, it can be seen in the result of variance decomposition for

public expenditures that 35.2% of it is defined by economic growth; 45.4% of it is defined by debt stock and only 19.2% of it is defined by public expenditures itself. These obtained results support the results of Granger Causality Test.

In that case, when the data of debt/GDP, public expenditures/GDP and economic growth between 2000 and 2015 in Euro zone, which is formed by 18 countries whose development levels and economic structures are different from each other, are examined and analyzed; it is seen that initially Euro zone countries kept tax rates low in order to attract foreign capital; and this resulted in economic growth, yet it increased public expenditures and debt stock. It is also seen that later when the Euro zone countries applied austerity policies in order to reduce debt stock, creditor nations with advanced economy such as Germany could recover faster than others; however, the countries; whose production parts are not as powerful as Germany's and who try to carry out an enterprise with inadequate means, went into bigger crisis and they are still in that spiral of debt today. As a conclusion, for presenting the rescue in the name of aid package, necessary policies must be determined for the Euro zone countries whose development levels and financial structures are closer to each other and then must be applied as a solution to their own financial matters.

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