The Impact of Fiscal Deficit on Inflation Rate – Empirical Evidence Case of Eurozone

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Abstract - The purpose of this working paper is to investigate if determinants have an impact on inflation rate in Eurozone Countries by using times series data for 17 countries from year 1997 to 2017, in yearly basis in total 375 observations. The study used quantitative research approach and secondary data and is analyzed by using linear regression model measures: Inflation rate as a dependent variable, and five independent variables such as: GDP to growth rate, Deficit to GDP rate, Public debt to GDP rate, Government bond interest rate and Unemployment rate. Linear regression model was applied to investigate the impact of GDP to growth rate, deficit to the GDP rate, Public debt to the GDP rate, Government bond interest rate, and Unemployment rate to the dependent variable Inflation rate. From the Linear Regression Model coefficients for inflation rate as a dependent variable shows that three of five variables have a significance one with negative significance and two positive significance. The empirical result shows that the three of five ratios that we mentioned above have a strong influence on the Inflation rate.

General Terms - Macroeconomics and Public Finance.

Keywords - Inflation rate; GDP growth rate; Deficit to GDP; Debt to GDP; Time series analysis.

1. INTRODUCTION

The aim of this paper is to analyze the fiscal deficit report and its impact on the Inflation Rate for Eurozone countries through multiple linear regression analysis. Currently, the term "budget deficit" is a well-known and commonly mentioned expression in news on both television and other written and electronic media as part of government documents and policies. As a concept, it is an expression that economists and policymakers do not like it much, because of its complexity during implementation and impact on the economy Eisner, R (1989)¹⁵. Budget deficit is a very important phenomenon in the fiscal policy of an economy or a particular country. In the period when the economy is in recession, the government usually uses its own economic and fiscal policy mechanisms so that the budget deficit reinforce the economy.

Consequently, the budget deficit is the sum by which the costs of a government such as defense, social security, energy and infrastructure costs and the like exceed its revenues, which mainly come from taxes, customs and collection from other tariffs. Also, the deficit can be measured including interest payments on debt as expenditures (Michael Burda and Charles Wyplosz, 1995). Consequently, the question is whether inflation is affected by perpetual fiscal deficit? In reviewing the literature on the field of public finances, we find that in the analysis and empirical studies of the authors of the difference on this issue has mixed results and as a consequence, these studies and researchers analyzing the relations between the budget deficit and inflation have not reached consensus on the potential impact ratio of the deficit on inflation Darrat, (1985).

According to (Ekanayake, 2012) most of the empirical research suggests that: (i) Budget deficits are not inflationary, (ii) There is only a weak correlation between budget deficits and inflation, and (iii) There is a strong link between fiscal deficits and inflation only during high inflationary periods.

2. LITERATURE REVIEW

During the review of the literature we have underlined that there is a considerable number of theoretical and empirical studies focused on the research of factors that affect the inflation rate. According to the Darrat (1985)⁹, studies the effect of the budget deficit on inflation in the USA economy and on the basis of the evidence derived from this study he came to the conclusion that the budget deficit had a significant impact on inflation. While, (Hondroyiannis and Papapetru, 1994)¹⁹ have studied the impact of budget deficit on inflation in Greece and based on the results of this study they came to the conclusion that there is a long-term relationship between deficit growth as a percentage of GDP and inflation in the Greek economy. Moreover, when we are in Greece, Darrat (1988)¹⁰ in his study found that the high budget deficit has a positive and significant impact on inflation and that this may be the reason for the inflationary effect on the Greek economy. Moreover, in the context of other different studies, (De Haan and Zelhorst, 1990)¹¹ have researched seventeen (17) different countries from 1961 to 1985 and based on...
the research they have found evidence of supporting the "hypothesis of fiscal dominance", that deficits are in correlation with inflation in certain countries during periods when it is also noted that they have high inflation rates. According to Akcay at al, (2011)[3], one of the possible channels that high deficit leads to higher inflation is that government borrowing requirements normally raise net loan requirements in the economy, raising interest rates and pushing private investment. The reduction that results in the growth rate of the economy will lead to a drop in the quantity of available goods for a certain level of cash balances and as a result we have a rise of price levels. Metin (1998) has studied the inflation process in Turkey and found that expansionary fiscal policy has been a key factor that affected inflation. “Excessive demand for money positively influenced inflation, but only in the short run, “while” Imported inflation and excessive demand for capital market assets had some effects on consumer price inflation, while there was no significant impact on excessive demand for goods.

A key policy implication is that inflation could be reduced rapidly by eliminating the fiscal deficit”. Other researchers (Agha and Khan, 2006)[1] found in their research the existence of mutual relations between government deficits and inflation in developing countries. On the same topic, Darrat (1985)[9] empirically examined the relationship between fiscal deficits and inflation in the USA in the post-1960 period and consequently using OLS (Ordinary Least Squares) technique. The same author came to the conclusion that monetary growth and federal deficits significantly affected the US economy's inflation rate during the 1960s and 1970s. In addition, he concluded that federal deficits show a stronger linkage to inflation in comparison to the increase of the monetary amount through the primary money supply by the central bank. The impact on the inflation rate of monetary financing of the fiscal deficit was first observed by (Sargent and Wallace, 1981)[26], according to these studies the analysis were provided to support the hypothesis that fiscal deficits affect inflation.

3. METHODOLOGY AND DATA

3.1 Data Collection

In general, there are a several types of data that are appropriate when we are dealing with a quantitative analysis to solve financial problems, the most important are: time series data, panel data and cross-sectional data. Time series data are those data which are collected in one or more variables for a long period of time. The study uses economic data for seventeen (17) Eurozone countries for public debt, annual government deficit, unemployment rate, and economic growth, GDP growth, inflation rate and the government bond rate. In empirical analysis, the data used are on an annual basis, while the time period included in this study is from 1997 to 2017, with a total of 20 year periods with 357 observations.

Reason of the data panel usage for the period specified above is that during this period the time series are of the format defined by the statistics institutions such as: Eurostat, IMF and the World Bank. The data used from the sources mentioned above have been tested on an annual basis for a period from 1997 to 2017 and this is the reason that three different historical periods of these countries are included: the so-called period of tendencies fulfillment of the Economic Criteria of the Maastricht Treaty, also known as the Convergence Criteria (1995-1999), the period of euro introduction as the single national currency (1999-2002), and the period of global financial crisis, respectively the so-called sovereign debt crisis (post 2008 period).

3.2 Linear Regression Analysis

Our paper uses time series data due to the advantage that it has, and it helps analyze the behavior of each determinant over time (Baltagi, 2005)[4]; (Gurajati, 2003). Linear regression model was issued to determine the relative importance of each independent (explanatory) variable in affecting dependent variable. The general linear regression model is:

\[ Y = \beta_0 + \beta_1 X + \epsilon \]

Starting from the general model and taking into account the selected variables, the empirical model used in our study is:

\[ IR_t = C + \beta_1 GDPgrowth + \beta_2 DR/GDP_t + \beta_3 Debt/GDP_t + \beta_4 GBIR_t + UR_t + \epsilon \]

Where:

- \( IR_t \): inflation rate in period \( t \)
- \( GDP Growth_t \): GDP growth in period \( t \)
- \( DR/GDP_t \): deficit rate to GDP in period \( t \)
- \( Debt/GDP_t \): public debt to GDP in period \( t \)
- \( GBIR_t \): government bond interest rate in period \( t \)
- \( UR_t \): unemployment rate in period \( t \)
- \( \epsilon \): error term of the model

4. DATA ANALYSIS

Descriptive statistics presented in this working papers show the results for number of observation, minimum, maximum, mean value and standard deviation for the total period of data. Consequently, from this table we can see that the explanatory variables the growth rate have an average value of 2.63 percent, with a standard deviation of 3.94 percent and a variance of 15.59 percent. While the minimum value, respectively the maximum ranges from -14.80 percent to 26.30 percent. Dependent variables the inflation rate has an average value of 3.05 percent, with a standard deviation of 4.00 percent and a variance coefficient of 16.02 percent and a minimum value of -4.50 percent and a maximum of 39.70 percent.

The explanatory variable Deficit to GDP ratio has an average -2.87 percent, with standard deviation of 3.87 percent as well as a variance coefficient of 15.00 percent, while the minimum and maximum values range from -32.10 percent to 6.90 percent.

The other explanatory variable used in the model is Debt to GDP ratio which has the highest values and higher
variations, where the average value is 58.51 percent, with a standard deviation of 36.77 percent and that this indicates that the variable has high variations within the econometric model. The minimum debt value in relation to GDP is in the value of 3.70 percent. While the maximum one is 179.70 percent. Explanatory variable government bond interest rate has the lowest values within all the variables used in the econometric model, where its average value is 4.83 percent, with a standard deviation of 2.33 percent and a variance coefficient of 5.45 percent. The minimum value of government bonds in the descriptive statistics is 0.40 percent, while the maximum is 22.50 percent. Finally, other explanatory variables, the unemployment rate is ranked as the second variable with lower values after the government bond rate, where the average value is 8.12 percent, with a standard deviation of 4.13 percent and a variance coefficient of 17.09 percent.

Table 1: Descriptive statistics

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP_G</td>
<td>-14.80</td>
<td>26.30</td>
<td>2.63</td>
<td>3.94</td>
</tr>
<tr>
<td>DR/GDP</td>
<td>-32.10</td>
<td>6.90</td>
<td>-2.82</td>
<td>3.87</td>
</tr>
<tr>
<td>DEBT/GDP</td>
<td>3.70</td>
<td>179.70</td>
<td>58.51</td>
<td>36.77</td>
</tr>
<tr>
<td>IR</td>
<td>-4.50</td>
<td>39.70</td>
<td>3.06</td>
<td>4.00</td>
</tr>
<tr>
<td>GBIR</td>
<td>.40</td>
<td>22.50</td>
<td>4.84</td>
<td>2.33</td>
</tr>
<tr>
<td>UR</td>
<td>1.50</td>
<td>25.40</td>
<td>8.22</td>
<td>4.13</td>
</tr>
</tbody>
</table>

Source: Authors’ calculations

The results for the correlation analysis show that the correlation coefficient between the ratio of the economic growth rate (GDP growth) and the deficit ratio in relation to GDP is from .410 ** with the significance level of 99.9 percent which in fact represents the highest positive correlation compared with other explanatory variables, which means that the Deficit/GDP rate has a high correlation with the rate of economic growth ratio compared to other explanatory variables.

Table 2: Correlations

<table>
<thead>
<tr>
<th></th>
<th>GDP_G</th>
<th>FC/GDP</th>
<th>D/GDP</th>
<th>IR</th>
<th>GBIR</th>
<th>UR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP_G</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FC/GDP</td>
<td>.410</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D/GDP</td>
<td>-.362 **</td>
<td>-.450 **</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IR</td>
<td>.185 **</td>
<td>0.052</td>
<td>-.324 **</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GBIR</td>
<td>-.197 **</td>
<td>-.290 **</td>
<td>0.092</td>
<td>.138 **</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>UR</td>
<td>-.125 **</td>
<td>-.429 **</td>
<td>.218 **</td>
<td>0.044</td>
<td>.321 **</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Source: Authors’ calculations

Meanwhile, the inflation rate is the second variable which has a positive correlation with the economic growth rate in the value of .185 ** with a significance level of 99.9 percent.

The nominal debt in relation to GDP has a higher negative correlation with the economic growth rate of -.362 ** with a significance level of 99.9 percent, followed by the interest rate on government bonds which has a negative correlation with the economic growth rate with a coefficient of -.197 ** with a level of significance of 99.9 percent, and lastly the variable unemployment rate which has the lowest negative correlation value of 125 ** and a mean of 95.0 percent.

4.1. Model Summary

To examine the relationship between dependent variables and explanatory variables we run linear regression model. In the following table coefficients, we present R, R square, Adjusted R square and standard error. The results obtained from our model data show that the dependent variable has a stable correlation with the explanatory variables at .412, respectively 41.2 percent. While, R² in our analysis is .169, which shows that 16.9 percent of the dependent variables are explained by independent variables. The standard error is estimated at 2.99 percent, which show that the model has stability.
R\(^2\) is equal to .158, which shows that 15.8 percent of the variance of the dependent variable is explained by the variation of independent variables. In addition, for verification of the model’s stability the Durbin-Watson test was used. The result of the Durbin-Watson test in our analysis is 1.448 if we compare it with the theories on the explanation of the model’s sustainability, it is seen that the approximate standard interval is between 1.5 and 2.5, indicating that the residual value has no serial correlation or there is no autocorrelation between the residual values. Therefore, based on this interval, the findings in our study show that Durbin-Watson is in the value of 1.448, which is almost within the interval value, which is why we can conclude that the model is stable.

### 4.2. Regression Model Results

In our concrete case the purpose of this study has been to explore how the fiscal deficit and other explanatory variables will affect the inflation rate.

#### Table 4: The results of coefficients

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td></td>
<td></td>
<td>---</td>
<td>------</td>
</tr>
<tr>
<td>(Constant)</td>
<td>2.620</td>
<td>.545</td>
<td>4.809</td>
<td>.000</td>
</tr>
<tr>
<td>GDP GR</td>
<td>.116</td>
<td>.046</td>
<td>.141</td>
<td>2.542</td>
</tr>
<tr>
<td>D/GDP</td>
<td>-.073</td>
<td>.053</td>
<td>-.087</td>
<td>-1.377</td>
</tr>
<tr>
<td>Debt/GDP</td>
<td>-.030</td>
<td>.065</td>
<td>-.034</td>
<td>-.025</td>
</tr>
<tr>
<td>GBRIR</td>
<td>.287</td>
<td>.074</td>
<td>.206</td>
<td>3.893</td>
</tr>
<tr>
<td>UR</td>
<td>.015</td>
<td>.044</td>
<td>.019</td>
<td>.339</td>
</tr>
</tbody>
</table>

a. Dependent Variable: Inflation rate

Source: Authors’ calculations

The results presented in the table above show that the economic growth rate variable is statistically significant with a 90.0 percent positive significance (P = .004). This indicates that the growth of the government bond interest rate ratio has a positive impact on the growth of the inflation rate. Government bond interest rates are positive correlations as in the study and this is in line with the findings of the authors such as Mishkin (1990)[22], (Day and Lange, 1997) and Engsted (1995). The econometric results show that the growth of 1 percent of the government bond interest rate ratio contributes to an increase of 28.7 percent in the inflation rate, provided that all other model factors remain constant.

The empirical findings from our study show that the Inflation Rate and Deficit / GDP ratio have a positive correlation in the Inflation Rate report but are not statistically significant since the P-value is (P = .735), respectively (P = .169) meaning that it has a value greater than 0.10.

### 5. CONCLUSIONS

Regarding the effects of the fiscal deficit at the inflation rate, generally according to Ekanayake (2012)[17], most empirical research suggests that in the first group of opinion there is a view that budget deficits are not inflationary, in the second group of opinion they share the thought that exists only a weak correlation between budget deficits and inflation, and in the third group there are economists who through the study of this relationship...
conclude that there is a strong link between fiscal deficits and inflation only during high inflationary periods. Moreover, on a review of the opinions of (Datta and Chandan, 2011) we see that (Asif Idrees Agha and Muhammad Saleem Khan, 2006), who studied Pakistan's economic variables from 1974 to 2003 conclude that there is dominance in the sector. Whereas (Catão and Terrón, 2005) analyzing both developing and developed countries, and concludes that there is a strong positive relationship between fiscal deficit and inflation in developing countries, but not in developed countries, or Vieira (2000), which studies six European countries and concludes that there is a long-term relationship between inflation and deficit and has been inflation that has contributed to deficit rather than vice versa, or Metin (1998) which studied Turkey's economy and in his statement states that the budget deficit affects a lot of inflation.

However, if we refer to our findings in the econometric model, the results obtained through this model are shown by the economic growth, respectively the GDP growth, which has a positive impact on the inflation rate. So, from the same model according to the results obtained, is shows that the variable of the economic growth rate is statistically significant with a 90.0 percent positive sign (P = .010) significance level and that our findings are similar to the study by (Sargent and Wallace, 1981)[26] where according to these studies, evidence was provided to support the hypothesis that fiscal deficits affect inflation or if we refer to a large part of the studies made by different authors find a strong correlation in the countries with high inflation as (De Haan and Zelhorst, 1990)[11], (Edwards and Tabellini (1991)[14] and (Fischer at al, 2002)[18].

6. REFERENCES


