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FISCAL THEORY OF THE PRICE LEVEL IN EURO AREA

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Abstract

This paper analyzes empirically the impact of fiscal policy on the price level for the cases of Euro area. We investigate whether the fiscal theory of the price level (FTPL) is able to deliver a reasonable explanation for the different performances of the price level in the different country of Euro area. Also, this paper examines the causal relationship between output gap, public debt, budget deficit, interest rate and inflation rate, and the impact of monetary policy on public debt management, in Euro Area from 1999Q1 to 2013Q4. The evidence does not let hear strong political coordination in Euro Area, and supports the idea that the monetary policy is more stabilizing in its influence on the economic activity than the budget policy. This paper deals with the problems of coordination between monetary and fiscal policies in Euro area. The particular stance of monetary policy affects the capacity of the government to finance the budget deficit by changing the cost of debt service and limiting or expanding the available sources of financing. Lack of coordination between the monetary and fiscal authorities will result in inferior overall economic performance. A weak policy stance in one policy area burdens the other area and is unsustainable in the long term.

Keywords: Monetary policy, Fiscal policy, Euro Area, FTPL, Public debt, budget deficit

INTRODUCTION

The efficient pursuit of the objectives of the authorities overall macroeconomic policy framework requires a close degree of coordination of financial policies. In this paper, the interaction between monetary and fiscal policies is analyzed, stressing the need for policy coordination at two different levels: fulfillment of the overall policy objectives (including financial sector development), and institutional and operational procedures. On the former, the main interactions between monetary and fiscal policies relates to the financing of the budget deficit and its consequences for monetary management.

The monetary policy stance will affect the capacity of the government to finance the budget deficit by affecting the cost of debt service and by limiting or expanding the available sources of financing. At the same time, the financing strategy of the government and its financial needs will place constraints on the operational independence of the monetary authority.

In many countries, monetary policy has been subservient to fiscal policy; central banks have often been required to finance public sector deficits, including those arising from quasi-fiscal activities. Such subordination of monetary policy to fiscal needs introduced an inflationary bias. In recent years, however, there has been a worldwide trend, in the context of the modernization of financial markets, to set up institutional and operational mechanisms that would ensure more efficient overall policy design and implementation. These include the adoption of market-based monetary and debt management instruments, as well as moves to increase central bank independence and in some cases the design of strict rule-based monetary arrangements, such as currency boards.

Two fundamental issues need to be stressed regarding the nature of monetary and fiscal policy coordination. First, the overall policy mix as well as each individual policy must be set on a sustainable course. Second, monetary and fiscal policies operate in different time frames, with monetary policy adjusting almost on a continuous basis and economic agents reacting with much shorter lags to it than in the case of changes to fiscal policy, while fiscal policy takes time to adjust and economic agents react with a lag to such adjustments.

This paper examines the causal relationship between output gap, public debt, budget deficit, interest rate and inflation rate, and the impact of monetary policy on public debt management, in Euro Area from 1999Q1 to 2013Q4. The evidence does not let hear strong political coordination in Euro Area, and supports the idea that the monetary policy is more stabilizing in its influence on the economic activity than the budget policy. This paper deals with the problems of coordination between monetary and fiscal policies in Euro area. The particular stance of monetary policy affects the capacity of the government to finance the budget deficit by changing the cost of debt service and limiting or expanding the available sources of financing.

Lack of coordination between the monetary and fiscal authorities will result in inferior overall economic performance. A weak policy stance in one policy area burdens the other area and is unsustainable in the long term.

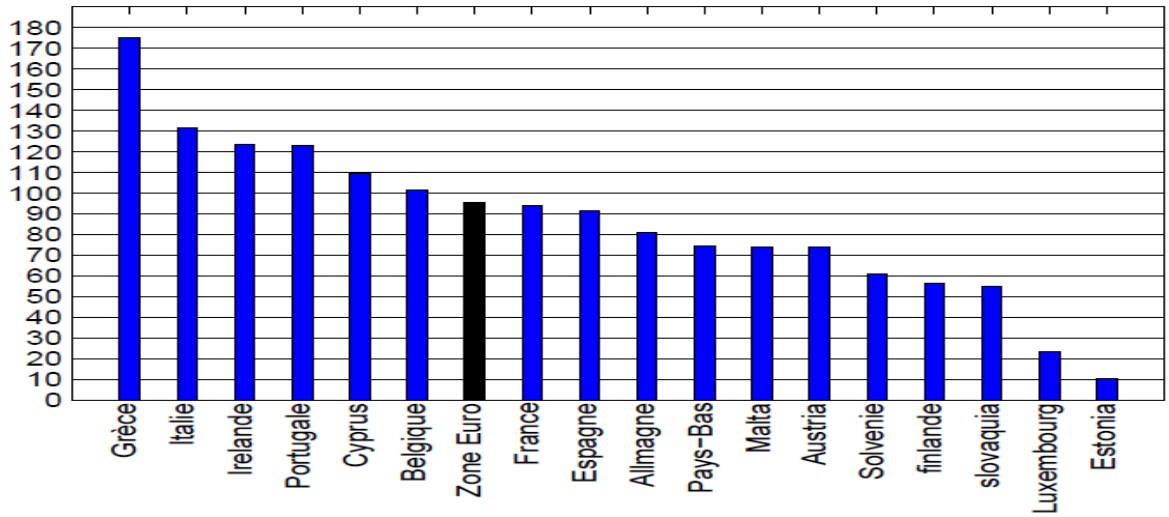
The paper is organized as follows: Section 2 sets out in general Euro Area crisis. Section 3 reviews Methodology and data. Section 4 analyzes Methodology and data. Section 5 presents empirical result and some concluding remarks.

THE EURO AREA CRISIS

Debt crisis in the euro area indicates a succession of financial events which affect, since the beginning of 2010, the savings in 17 Member States of the European Union, whose currency is the euro, in the wake of the financial crisis of 2007-2010. First event is raised in 2010, with the Greek debt crisis as well as its important and constant deficit. It extends to autumn 2010 with public debt crisis of Ireland, caused by the rescue of national banks, made it necessary by previous excessive private debt. During summer 2011 a stock exchange storm occurs caused by the crisis of the Greek debt.

For the first time since 2007 and the whole of public accounts of the euro area debt drops in 2013, announcing a way out of crisis. At the end of the first quarter of 2013, the euro area debt-to-GDP ratio was established to 92.2% in Euro Area (EA17), against 90.6% at the end of the fourth quarter of 2012. In the UE27, the ratio increased passing from 85.2% to 85.9%. Compared to the first quarter of 2012, the debt-to-GDP ratio has increased in both the Euro Area (from 88.2% to 92.2%) than in the EU27 (83.3% to 85.9%). The highest ratios of public debt were recorded in Greece (160.5\%), Italy (130.3%), in Portugal (127.2%) and in the Ireland (125.1%), and lowest in Estonia (10.0%), Bulgaria (18.0%) and in Luxembourg (22.4%).

Figure1: Public debt to GDP ratio in Euro Area



The crisis of public debt is a symptom which must result in searching the main causes which are multiple from one country to another: a very strong government debt related to important structural problems (difficulty in raising the tax and controlling the expenditure), a housing boom in Spain which led private agents to contract risky amounts of private debt, the absence of appreciation by the banks of the risks incurred as well in the granting of the loans as in their refinancing, too modest efforts (since the subprime crisis) for regulating the banking and financial sector, the weakness of the growth which touches the whole of the old industrialized countries since the economic crisis known as of the Great Recession (2008 and afterwards), the cumulative effect caused by expectations of a continued slowdown in growth prospects.

EMPIRICAL LITERATURE REVIEW

Monetary policy analyses remained strongly in favor since the Second World War, analysis of fiscal policy has lost favor with the optimization Keynesian countercyclical policies in the 1970s to the extent that much of monetary indifferent literature considered to the achievement of price stability (Walsh, 2003).

Taylor (2000) gives an overview of increased interest in the development of policies in macroeconomic models during the past twenty years, describing that by «the new normative macroeconomics». This new approach focuses on the evaluation of the various political rules in the context of a particular, micro-founded, the model of the economy.

Leeper (1991) developed the Fiscal Theory of the Price Level (FTPL), he introduced two essential points: the distinction between active and passive political policy, highlighting two stable organizations of economic policies (active monetary policy and passive fiscal policy passive or vice versa).

Leith and Wren-Lewis (2000) defined an active monetary-policy regime which satisfies the Taylor principle. They concluded that monetary and fiscal policies should be either active or passive for stability.

Dixit and Lambertini (2000) consider the interactions between policies in a configuration where the monetary authority controls the inflation. The source of conflict is that the fiscal authority aims to increase output and inflation than the monetary authority. The non-cooperative Nash equilibrium has both a higher inflation and a decline in production. commitment by the monetary authority is not appropriate or sufficient if fiscal policy is active, but the budget commitment hearing would result in a better outcome.

Kirsanova.al (2005) extend the three equations of monetary model to a five equations model of monetary and fiscal policies by adding the government's inter-temporal budget constraint. They suppose that there are a lag period of implementation of fiscal policy that

reflects the legislative and political processes required for important modifications in discretionary fiscal policy, and shift a one period of effect of the monetary policy, which reflects the transmission system. Kuttner (2002) doubts if the budget policy, taking into account these delays, could arrive to an interaction with the monetary policy and a period of effect of the shift monetary policy, which reflects the transmission mechanism. Kuttner doubted whether fiscal policy, given these delays could achieve interaction with monetary policy.

Melitz (1995) analyzes the effect of monetary and fiscal policy on public debt and deficits in 19 OECD countries 1960/78 to 1995 by using the pooled data. He made several interesting results: First, fiscal policy reacts to report of the public debt in a manner of stabilization. Second, the laxist fiscal policy leads to a restrictive monetary policy and vice versa. Third, the automatic stabilization of fiscal policy is much lower than generally perceived.

Melitz (1997) examines the interaction between monetary and fiscal policies in a pooled regression annual data on 19 OECD countries. He notes initially that the monetary and fiscal policies settle in opposed directions, as substitutes, then, that the budget policy plays a stabilizing role of low debt « the taxes behave in a preoccupation with a stabilization, but move the expenditure in a destabilizing way ».

Favero and Monacelli (2003) studies the interactions of policies by using Markov-Switching Vector Autoregressive Models (Krolzig, 1997), they stipulated that although fiscal policy shall be subject to a given regime change in an endogenous way and the regime changes monetarist are imposed in an exogenic way. They note than in the U.S., only between 1987 and 2001 can be described as passive fiscal regime. Thus, Woodford (1998) affirms that since 1980 the passivity would be a good description, and Gali and Perotti (2003) found that fiscal policy more and more passive during this period, after having discussed significant contributions to monetary and fiscal policies and their interactions.

Muscatelli et al. (2004) estimate a New Keynesian model with the generalized method of moments (GMM) in a system with multiple equations. They allow fiscal policy to have two instruments, taxation and expenditure and motivate policy interactions by first the cyclical nature of each policy, and secondly, by the direction of movement of the shocks of production. They find that monetary policy attenuates satisfies the Taylor principle and reacts to produce a stabilizing manner. Thus, they conclude that the interaction depends on the shock. Shocks to the production of fiscal and monetary policy they act as complements whereas inflation shocks, they act as substitutes.

Hughes and Hallett (2005) use individual regressions by instrumental variables to study the interactions between monetary and fiscal policies in the United Kingdom and the euro area.

He notes that monetary and fiscal policies acting as substitutes in the UK, but complement each other in the euro area.

Kirsanova et al. (2006) study the interactions between fiscal and monetary policy when it stabilize a single economy against shocks in a dynamic environment. They suppose that fiscal and monetary policies stabilize the economy by causing changes in aggregate demand. Thus, they find that if policy makers are both volunteers, then the best result is obtained when the tax authority can perform monetary policy.

Reade and J.Sthe (2008) applied the cointegrated VAR method to study the interaction of monetary and fiscal policy and its effect on the sustainability of developments in public debt in the United States in 1960-2005. They conclude that fiscal policy has ensured the sustainability of long-term debt by responding to the increase in debt in a way that the stabilization of the reaction was moderate. However, according to their results, discretionary fiscal policy did not ensure a countercyclical behavior. In addition, monetary policy has followed a Taylor rule type and corrected the imbalance both in the short and long term.

Reade and J.Sthe (2010) using multivariate cointegration methods to study the interactions between monetary and fiscal policies by examining the example of the United States since the early 1980s. They find that the elaboration of the monetary policy is strongly prospective and passive in the sense that it meets the policy rules. In contrast, fiscal policy is found to be active in the sense that it does not respond to rules of fiscal policy. Thus, interactions between the two spheres of politics seem limited so that no policy instrument enters the political rule of the other sphere. But monetary policy is heavily passive is in response to movements of the tax policy. Furthermore, they found that the two policies are complementary, since both policies respond in the same way to revitalize the economy in a downturn and to brake during Boom.

Fragetta and kersanova (2010) studying monetary and fiscal policy interactions in three countries, the United Kingdom, the United States and Sweden. They use a structural general equilibrium model of an open economy and the estimate using Bayesian methods. They assume that the authorities can act in a strategic way in a non-cooperative policy game and compare different leadership regimes. Thus, they characterize monetary and fiscal interactions in the three countries as follows: in each country, monetary authorities and fiscal authorities use their instruments with a substantial smoothing, and there is no evidence debt stabilization in 'any country and finally, the feedback is low to maintain stable economy, but no evidence on the goal of stabilizing the debt was obtained.

METHODOLOGY

The present study is carried out using quarterly time series of Euro Area 1999Q1-2013Q4. The data used include y_t is the output gap, π_t is the inflation rate, r_t is the nominal interest rate, d_t is the public debt and pb_t is the primary government balance defined as government receipts minus spending. The latter two fiscal variables are represented as fractions of GDP. For inflation, we calculate this from the consumer price index (CPI) measure as the most appropriate measure.

Turning to economic activity, it may seem sensible to consider the information provided in a wide range of different measures when considering economic activity, as policymakers surely consider various measures when deciding upon the level of economic activity. Although this might suggest taking the principle component of a number of measures of economic activity, previous Taylor rule studies have generally taken the output gap or some measure of firms' real marginal costs to be the indicator of economic activity. We use the FMI output gap measure.

Following the literature, the interest rate rt is the instrument of monetary policy, while pbt is defined here as the instrument of fiscal policy. There is disagreement whether the fiscal instrument should be taxes or spending or the balance. Kirsanova et al. (2005) take government spending to be the tool, Schmitt-Grohé and Uribe (2004) consider taxation and a number of others take both (for example Muscatelli and Tirelli (2004); Gali and Perotti (2003).

Considering fiscal variables, there is disagreement over whether taxes, government spending or the primary balance ought to be used as the fiscal tool. Primary balance data is defined as:

$$PB_t = T_t - G_t \qquad (1)$$

To isolate automatic stabilisers from discretionary policy, we also consider the cyclically adjusted primary balance measure from the FMI. Hendry (1980) notes that measures of the public debt are readily available and accord to the theoretical variable for gross debt, which can deviate dramatically from net debt.

Debt sustainability is an issue of importance for fiscal policy; a fiscal-policy stance is sustainable if it satisfies the government's intertemporal budget constraint.

We model fiscal policy in a more general setting which allows for data non-stationarity and endogeneity, and we also model fiscal policy in the context of monetary policy, not least to consider the interactions of the two policy spheres. Questions such as the role of monetary policy in debt-sustainability can be investigated in this manner.

Section 4 has emphasised the non-stationarity, of the data series under consideration here. Granger and Newbold (1974) suggested that regression output may be spurious if several of the series modelled are non-stationary. The data series from section 4 can be combined to form a vector autoregression:

$$X_t = \prod_0 + \prod_1 t + \sum_{i=1}^{k} \prod_i X_{t-i} + u_t \,, \quad u_t \sim N(0, \sigma^2) \qquad (2)$$

Here, X_t is a $p \times T$ data matrix, while $\prod 0$ is a $p \times p$ coefficient matrix, where $p = 6$ is the number of variables in the system, and T the number of observations. If the data are non-stationary, so $X_t \sim I(1)$, it must be rearranged into equilibrium-correction form:

$$\Delta X_t = \Pi^* X^*_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-i} + u_t \,, \qquad (3)$$

Where $X^*_{t-1} = (X_{t-1}, 1)$, $\Pi^* = (\Pi, \Pi_0)$, $\Pi = \sum_{i=1}^{k} \Pi_i - I$ and $\Gamma_i = -\sum_{j=i+1}^{k} \Pi_j$. The coefficients for the lagged regressors and the constant term have been banded together, for ease of exposition. Further, if $X_t \sim I(1)$, then given that $u_t \sim I(0)$ and $\Delta X_t \sim I(0)$ then Π must be of reduced rank for equation (3) to be balanced. If Π is of reduced rank then there exist $p \times r$ matrices α and β such that $\alpha\beta'$ and equation (3) becomes:

$$\Delta X_t = \alpha \breve{\beta}' X^*_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta X_{t-k} + u_t \,, \qquad (4)$$

Where $\breve{\beta} = (\beta, \beta_0)'$ and $X^*_{t-1} = (X_{t-1}, 1)$. The $\breve{\beta}' X^*_{t-1}$ terms are cointegrating vectors, the stationary relationships between non-stationary variables, or steady-state relationships. Importantly, $E(\beta' X_t)$ since these cointegrating vectors describe steady state relationships which must be mean zero.

In order to test the direction of causality between different variables, a three-stage procedure is followed. First, we search for the order of integration of the different time series using unit root tests. Generally, a variable is said to be integrated of order (d), written by I(d), if it turns out to be stationary (integrated of order (0), I(0) after differencing d times. Stationarity of a series is an important phenomenon because it can influence its behavior.

In this paper, we conduct unit root tests using the Augmented Dickey-Fuller(ADF) Dickey and Fuller (1979), Phillips-Perron (PP) Phillips-Perron (1988) tests and Kwiatkowski, Phillips, Shmidt and Shin (1992) (KPSS) tests. We use three tests in order to check the robustness of the results. One advantage of the PP test over the ADF test is that the former is robust to general forms of heterodasticity in the error term. Akaike information criterion (AIC) is

used to select the lag length in ADF test, while Newey-West Bartlett kernel is used to select the bandwidth for the PP test.

We study in this paper the stationarity of variables. We use three types of tests. Initially, we apply the Dickey-Fuler Augmented (ADF), then the test of Philips and Perron (PP), which takes into account heteroscedasticity and autocorrelation. These two tests are based on the null hypothesis that the process is non-stationary. We confirm our results by a third test of Kwiatkowski, Phillips, Shmidt and Shin (1992) (KPSS). The latter test, contrary to the two first, is based on the null hypothesis of stationarity of the series. Tables below present the results of three respective tests of unit root. These tests are carried out by the Logiciel E-Views 6.

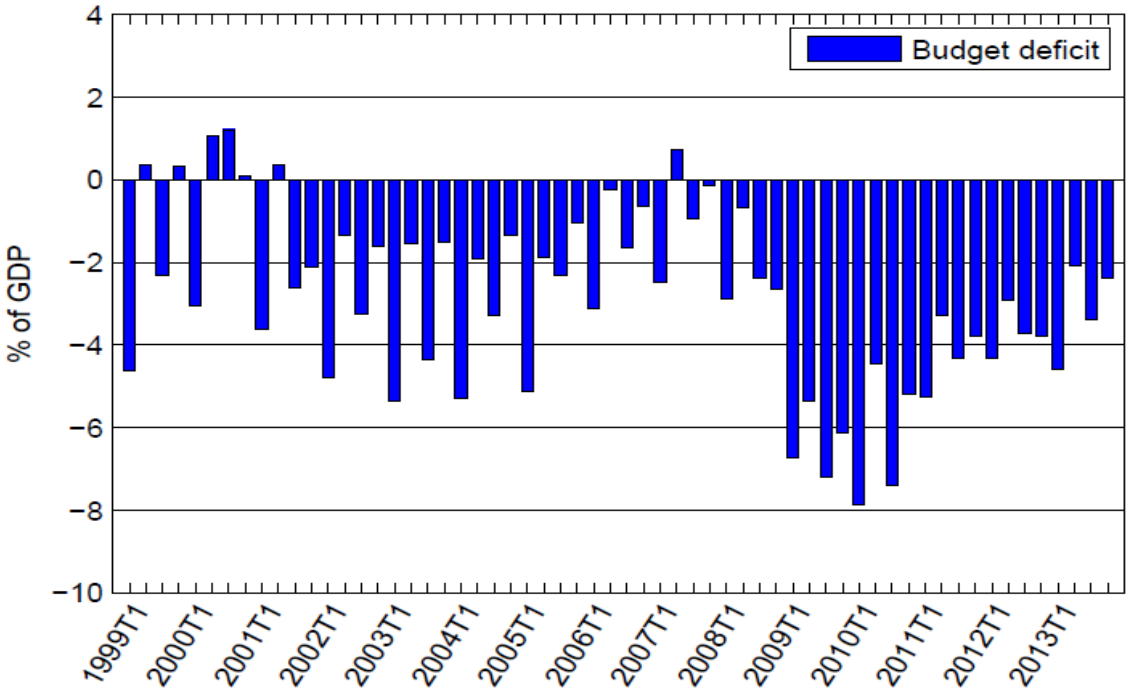
EMPIRICAL RESULTS

Evolution of the main variables

In this section we present the evolution of the main economic variables during the period of our study 1999Q1 to 2013Q4. In order to describe the economic cycle of the Euro Zone, we use the description of data, such as public debt, primary balance, nominal interest rate, inflation and output gap.

a. Government deficit

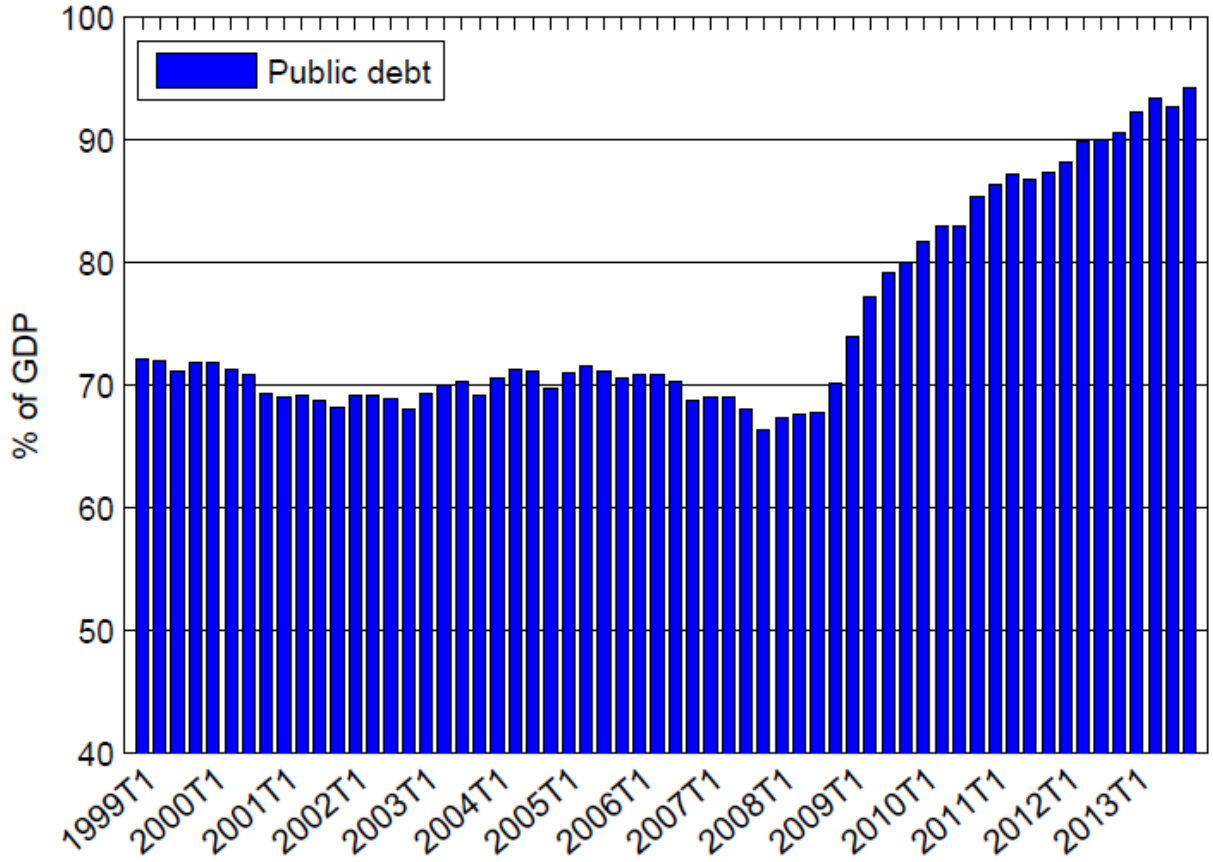
Figure 2: Evolution of the Government deficit in the Euro Area



The figure 2 represents the budget deficit during the period 1999Q1 to 2013Q4. According to this figure we see a decline in the budget deficit between 1999 and 2000, which explains the increase in government revenue over expenditure. Then, it recorded an increase from 2000 to 2004. Also, the budget deficit starts again with advanced during period from 2004 to 2007, and has since gradually increased until 2010, which explains the decrease in revenue, which is explained by the decrease in the share of services exports total by about 4 percentage points from 2008 to 2009, during the recent global crisis. From 2010, there is a slow gradual decrease.

b. Public debt

Figure 3: Evolution of public debt in the Euro area (EA 17)

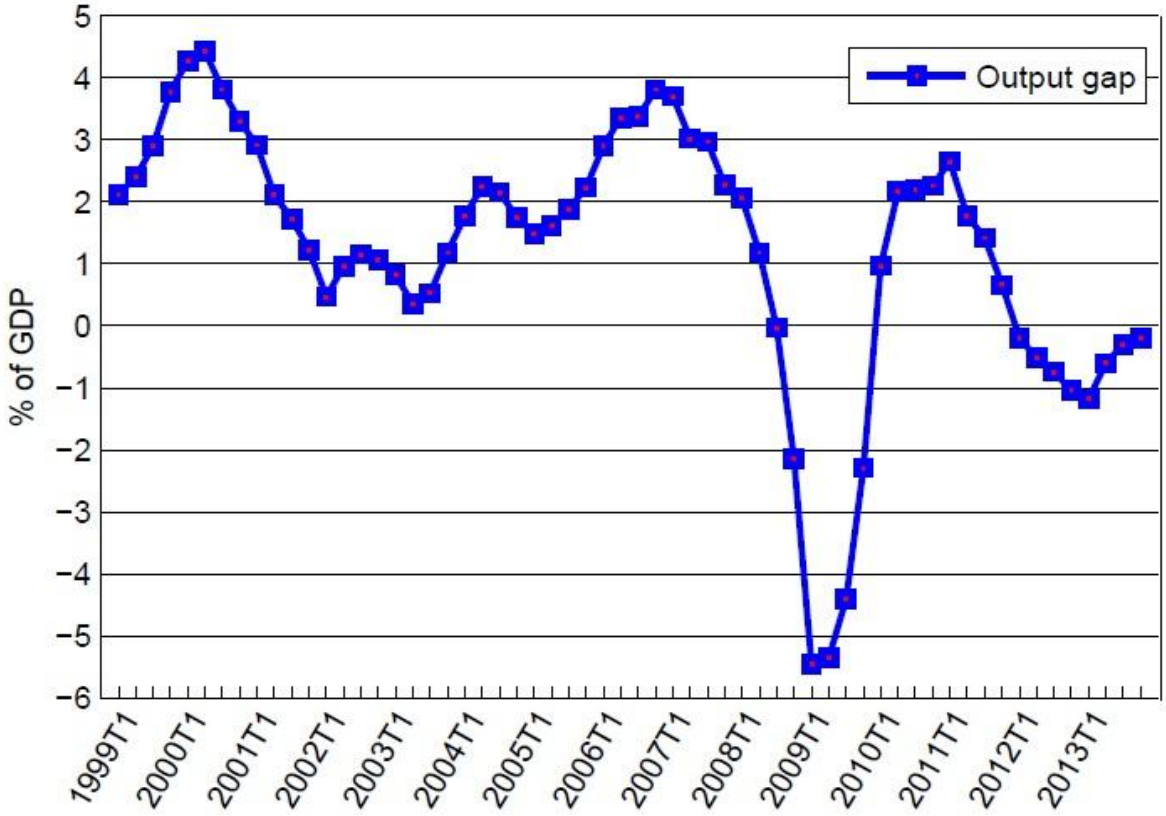


Note that in figure 3, an increase in the debt ratio between the first quarter of 1999 and the end of the third quarter of 2000 and from the fourth quarter of 2000 there was a mean decrease. Thus, from the first quarter of 2001 the public debt increases progressively and admits a steady pace. Thus, there is a remarkable decline in the debt ratio at the end of fourth quarter 2007 and a gradual change in the ratio of public debt to GDP ratio dice late in the fourth quarter of 2008.

Then, from 2008, there is a rapidly changing due to the financial crisis during this period. At the end of the first quarter of 2013, the ratio of public debt to GDP ratio stood at 92.2% in the euro area, against 90.6% at the end of the fourth quarter of 2012

c. Output gap

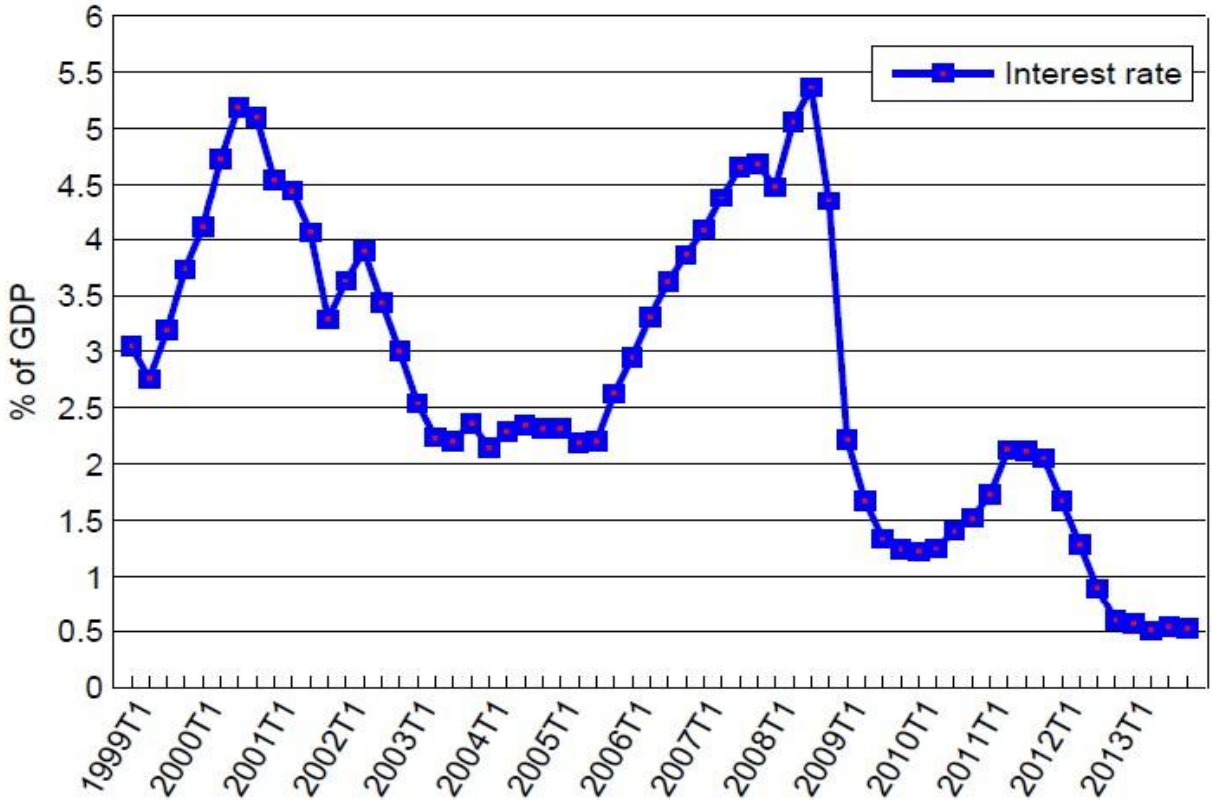
Figure 4: Evolution of the output gap in the Euro Area



The « output gap » refers to the percentage difference between GDP [gross domestic product] and the effective [potential GDP], the latter being defined as the maximum sustainable level (non-inflationary) production that provides the existing stock of labor and capital in the economy, using current technology. Thus, from Figure 4 three step evolution can be seen in the period 2013Q4-199Q1. So 199Q1 between 2002Q1 and show an evolution of 40% hence an increase in the actual GDP relative to potential GDP. Then a slow gradual evolution of 2002Q2 2008Q3 until one notices reflecting a difference of stable production. We notice a negative trend between 2008Q3 and 2010Q1. Finally, a rapid and remarkable from 2010Q2 to 2013Q4 evolution.

d. Interest rate

Figure 5: Evolution of interest rate in the Euro Area

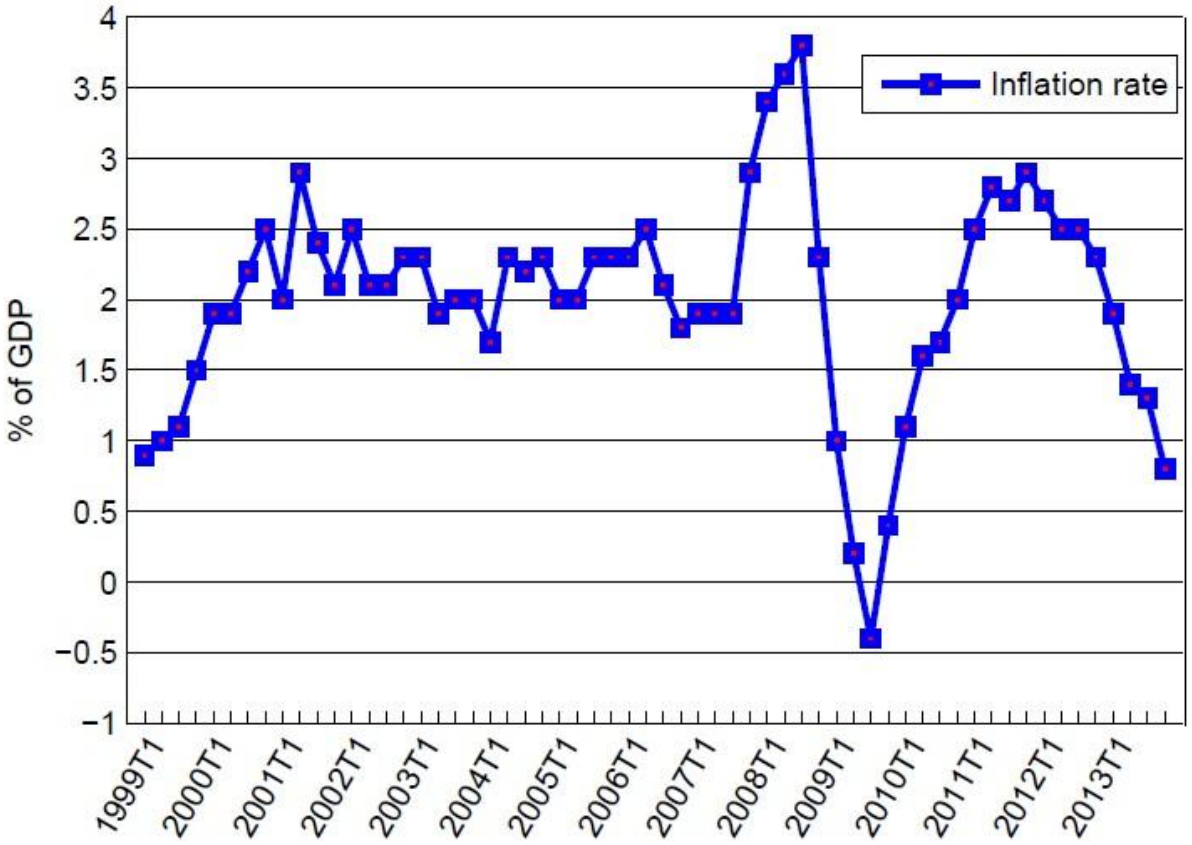


The pace of nominal short-term interest rates for the Euro Zone is characterized by five periods: 1999Q1/2001Q1, 2001Q2/2003Q1, 2003Q2/2005Q3, 2005Q4/2008Q3 and 2008Q4/2013Q4 (Figure 5).

During the period 1999Q1-2001Q1, the nominal interest rate increases and then decreases slightly, it passes from 3% to approximately 5% then it decreases to reach approximately 2% in 2003 Q1, and it remains stable between 2003Q2 / 2005Q3. From the beginning 2005Q4, it rises to a level of 5.5% at the date of 2008Q3. Rising interest rates aims to counteract inflationary pressures which have occurred in this period. In the following period 2008Q4/2013Q4, the nominal interest rate decreases in a dramatic way, it passes from 5.5% to approximately 0.5%. In the end it decreases due to the effect of the crisis, he begins to fall and reached a low of about 0.5 % in 2013.

e. Inflation rate

Figure 6: Evolution of inflation rate in the euro Area



From the figure we see a change in the inflation rate of the Euro Area from one year to another to achieve a period of stability until 2007 Q4. Then, there is a rapid evolution of inflation and reach 4% during 2008 Q3. From the beginning of 2008 Q4 we notice a drop in inflation to about 0.2% and in the end an average growth until 2013Q4.

Stationary tests

Based on the ADF, PP and KPSS unit root tests, we find that all tested series are non-stationary in level, that is, we cannot reject the null hypothesis of non-stationarity. However, the stationarity property is reached after first differencing the series for r_t and $pb_{t,}$ and after second differencing for, dt, and y_t . Unit root testing is carried out and reported in Table 1, 2 and 3. Augmented Dickey-Fuller (ADF) unit root tests are carried out using enough lags for each variable to ensure that no residual autocorrelation remains.

Table 1: Results of KPSS unit root tests

Variables	Statistics «*tc* » with *T* + *C*	Conclusion
d_t	0.220191	Non-stationary I(2)
y_t	0.149442	Non-stationary I(2)
π_t	0.055811	Non-stationary I(1)
pb_t	0.069513	Non-stationary I(2)
r_t	0.101077	Non-stationary I(1)

Table 2: Results of ADF unit root tests

Variables	Trend and constant	Constant	Conclusion
d_t	-1.292041	0.372062	Non-stationary I(2)
y_t	-2.821901	-1.797164	Non-stationary I(2)
π_t	-3.000098	-2.401953	Non-stationary I(1)
pb_t	-2.909461	-2.722499	Non-stationary I(2)
r_t	-3.167218	-1.967961	Non-stationary I(1)

Table 3: Results of PP unit root tests

Variables	Trend and constant	Constant	Conclusion
d_t	-1.054850	1.069137	Non-stationary I(2)
y_t	-2.712947	-2.336540	Non-stationary I(2)
π_t	-1.676087	-1.752210	Non-stationary I(2)
pb_t	-2.909461	-2.722499	Non-stationary I(1)
r_t	-2.189057	-1.321478	Non-stationary I(1)

According to the results of these three tests, we can conclude that the following series: Public debt, inflation, primary balance, output gap and nominal interest rates are non-stationary. The non-stationary character of the series used to search for the presence of a stationary or more linear combinations of these variables. Indeed, the study of the series in first difference for the inflation rate and the nominal interest rate, and the second difference for the remaining variables, ensures the stationary nature of differentiated series.

However, the three tests retain the integration of order 1 of the following series: nominal interest rate and inflation rate and the integration of order 2 of public debt, primary balance and the output gap. This implies the existence of cointegration between the various variables.

Granger, 1981 and Engle and granger, 1987 introduced the concept of integration of a variable in order to examine cointegration. They were placed in the case without deterministic component to achieve a particular concept of cointegration. To test the presence of cointegration of the variables in this study, the approach of Johansen, 1988 and Johansen and Juselius, 1990 is used.

Indeed, the term cointegration was introduced by Granger1981. The cointegration test is used to check the long-term equilibrium relationship between the variables $d_{t,}$ pb_t, r_t, π_t, ${\pi^a}_t$ and y_t.. The presence of an equilibrium relationship among these variables is the most used formally tested using statistical procedures, are those of Engle and Granger, 1987 and Johansen (1988). Johansen cointegration results are reported in Table 4 and 5.

Table 4: Trace test results

Series	Trace statistic	Critical value (0.05)	probability	conclusion
None	55.09319	29.79707	0.0000	H0 rejected
At most 1	16.10871	15.49471	0.0000	H0 rejected
At most 2	0.003144	3.841466	0.9536	H0 rejected

From Table 4, we see that the three variables are cointegrated, where they have a cointegrating relationship long term. Therefore, the null hypothesis of no cointegration is rejected because the trace test indicates two cointegrating equations. Moreover, the existence of cointegration relationship justifies the adoption of a model error correction Engle and Granger (1987).

Table 5: Trace test results -2

Series	Trace statistic	Critical value (0.05)	probability	conclusion
None	17.58206	15.49471	0.0239	H0 rejected
At most 1	2.505959	3.841466	0.1134	H0 accepted

We see from Table 5 that the two variables are cointegrated, where they have a cointegrating relationship long term. Therefore, the null hypothesis of no cointegration is rejected because the trace test indicates one cointegrating equation. Moreover, the existence of cointegration relationship justifies the adoption of a model error correction Engle and Granger1987.

Cointegration between series indicates causality relationships confirmed in the long term, but it does not give the direction of causality. Therefore, the vector error correction model (VECM) is used to examine causality in the short term as well as Granger causality in the long term. The VECM is a template that models adjustments leading to a state of long-term

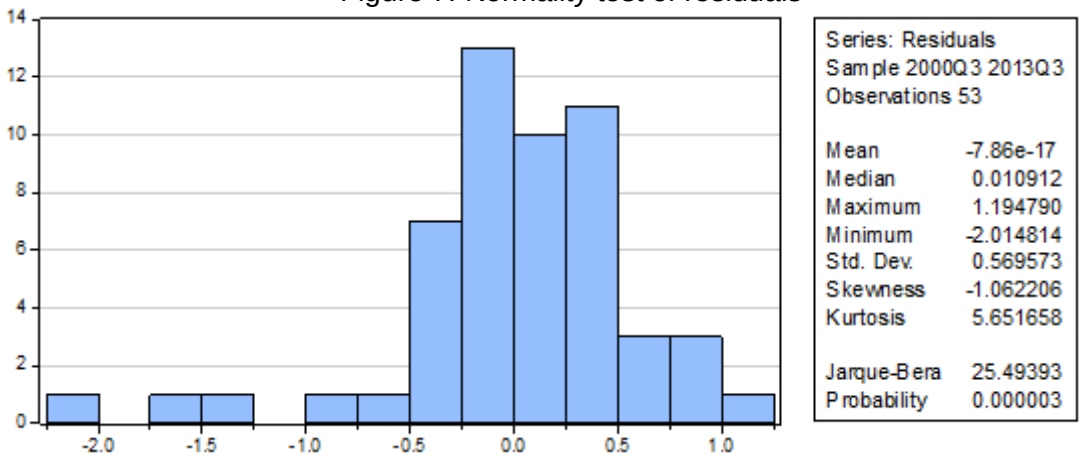
equilibrium. This is a model which incorporates the time, the evolution of short and long term. Thus, the use of error correction model can highlight the common cointegrating relationship (common trend) and deducing the interactions between variables.

Results suggest that there is a causal relationship from long-term public debt and budget deficit to the output gap (the term correction associated with the restoring force x error is negative (-0.266766)., and is significantly different from zero at 5\% statistical level (prob. equal to 0.0347) so there is catching up to the equilibrium value ie, a mechanism error correction: in the long term the imbalances between 3 variables are offset so the series have similar trends.

Nevertheless, in the short term testing and test Wald we find that 'there is not a causal relationship from the budget deficit and public debt to output gap (Chi-square: 0.8686 pro> 0005 therefore we accept the null hypothesis). The value of R2 = 0.61% > 0.60% and the Prob (F-statistic) 0.000647 <0.005 shows an explanatory power of the model.

Concerning tests of residues, we tested serial correlation we have: Prob Chi-Square (2) = 0.1022> 0.005) so the model does not admit a serial correlation. The model errors are heteroscedastic since the value of probability is less than 5 % (prob. Chi-Square 0.0313 we reject the null hypothesis) and normality test presented in the following figure.

Figure 7: Normality test of residuals



From the figure we see that the prob. Jaque-Berra = 0.000003 less than 5%, or the errors of the model are not normally distributed.

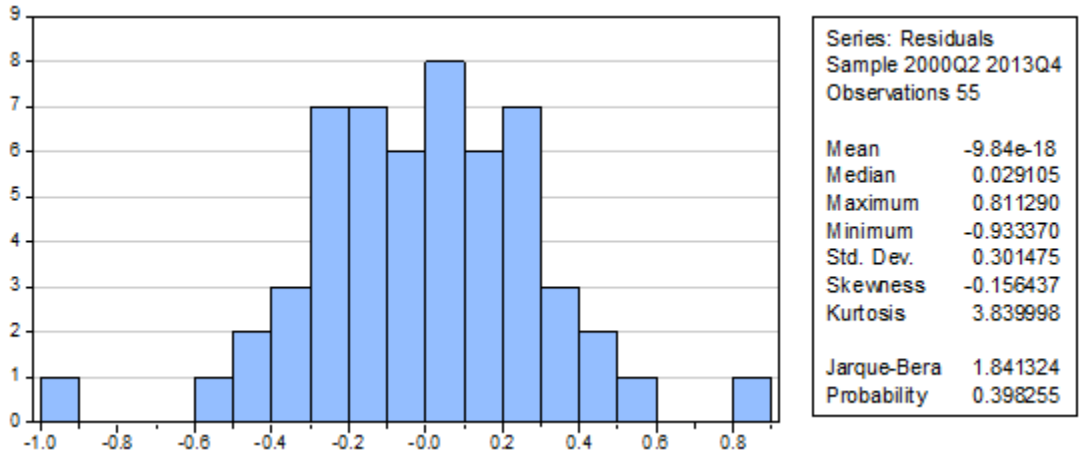
In contrast, the causal relationship between the interest rate and the inflation rate is as follows: at a disaggregated level, the results suggest that there is a causal relationship from long-term inflation rate of interest (the term associated with the restoring force β error correction is negative (-0.007716) and is significantly different from zero at statistical threshold of 5 % (prob. equal to 0.0347). There so much catching up to the equilibrium value ie, an error

correction mechanism: in the long term the imbalances between the interest rate and the inflation rate are offset so the series have similar trends.

Nevertheless, in the short term, testing the Wald test we see that there is a causal relationship from the inflation rate to the interest rate (Chi-square: pro 0.0097 <0.005 so we do not accept hypothesis null). The value of R2 =53% is less than 60% and the Prob (F-statistic) 0.000032 = < 0.005 shows an average explanatory power of the model.

Concerning tests of residues, we tested serial correlation (we have: Prob Chi-Square (2) = 0.7315 is greater than 0.005. So the model does not admit a serial correlation. The model errors are heteroscedastic since the value of probability is less than 5 % (prob. Chi-Square 0.0313 we reject the null hypothesis) and normality test presented in the following figure.

Figure 7: Normality test of residuals -2



From the figure we see that the prob. Jaque-Berra = 0.39 greater than 5%, or errors of the model are normally distributed.

Indeed, Granger (1969) introduced the concept of non-causality, which aims to make the optimal forecast made at the variables. The causality test's objective is to evaluate the temporal order and the ability to forecast variables. Thus, it allows to formalize statistically economic relations between the variables of monetary and fiscal policies for obvious reasons of economic policy but also to study the variables that are likely to predict the evolution of variables monetary and fiscal policies and inflation. The causation analysis will highlight the interactions between the variables of monetary and fiscal policies. Thus, it can also have "information on the temporal relations between variables.

The relationship between debt and instruments of monetary policy will be analyzed from the causality test (Granger1969). This test is to study the relationship between debt and the

different variables of fiscal policy. If the coefficients values of debt are significant, then the primary balance and the output gap is a "cause" of the debt.

The one hand, a bi-directional causality between pairs of variables (debt and deficit) (the output gap and the budget deficit), (debt and the output gap). On the other hand, a uni-directional causality between the couple (the output gap and the budget deficit). On the second hand, a bi-directional causality between pairs of variables (the interest rate and inflation rate). The presence of bi-directional causality denotes variables that influence each other in terms of forecasting ability. On the other hand, a unidirectional causality between the pair of variables (inflation causes interest rates Granger).

CONCLUSIONS

Monetary and fiscal policies appear to be two categories of economic policies that have been the subject of several controversies. The question of their interaction and their influence on economic activity and inflation are acute. Each of the two policies is likely to increase or slow aggregate demand. They can have very different impacts on the economy and a change in one can affect the other.

Based on the approach of Johansen cointegration and Granger causality, we find that, at the aggregate level, there is evidence of unidirectional causality between pairs of variables (the budget deficit because public debt Granger) (the output gap because the budget deficit Granger) (the output gap because public debt Granger). It is observed that the public debt has a direct impact on the budget deficit, and it is observed that the budget deficit and public debt have a direct impact on the output gap. Also, we find a unidirectional causality between the pair of variables (inflation causes interest rates Granger) indeed, we note that the interest rate has a direct impact on the rate inflation.

At the disaggregated level, the results suggest that there is a causal relationship to long-term public debt from dt $and the budget deficit bt to yt as a causal relationship from long-term rate of inflation in interest rates. So there is a catch to the equilibrium value, an error correction mechanism: long-term imbalances between different variables are offset so that the series have similar trends.

Nevertheless, in the short term, we see that there is no causal relationship from the budget deficit and public debt to output gap; however, we see that there is a causal relationship ranging from inflation to interest rates.

From the results found we can conclude that the monetary and fiscal policy are not complementary in the Euro Area and there is a negative effect of policy coordination in the Euro Area, and the advantage of using methods co-integration is that each policy area will have its

own way to steady state, which should be ungovernable in the data, and the responses of policy instruments and target variables can also be set using the cointegrated VAR approach. In addition, our results show that there is no strong interaction between monetary policy and fiscal policy in the euro zone. Without efficient policy coordination, financial instability could ensure, leading to high interest rates, exchange rate pressures, rapid inflation, and an adverse impact on economic growth.

Efficient coordination of monetary and fiscal policies will only be possible if account is taken of the need for policy sustainability and credibility. Both the overall policy framework as well as each policy area considered individually must be set on a sustainable course and be credible. To burden one policy area excessively as a result of a weak stance in the other policy area will sooner or later doom the achievement of the objectives of macroeconomic policy.

Recent research into monetary policy has looked for interest rate rules that ensure price level determinacy independently of the fiscal policy of the government; this has weakened interest in the FTPL. Though no issue as controversial as the FTPL has emerged since, this recent analysis is still open to ambiguous distinctions between policy rules, that should capture government behavior in all possible scenarios, and equilibrium relations across the endogenous variables of an economic system. A more complete analysis awaits the development of new tools that are as simple and powerful as dynamic competitive equilibrium, and yet able to appropriately capture the special role of the government. The new coordination problem is : How do a central bank and its government come to a stable pairing of policies?

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