Stability and performance of monetary and fiscal policies in the euro euro area

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Abstract

Following the importance of coordination of monetary and fiscal policies, the investigation of the causal relationship between public debt and budget deficit has a fundamental role in implementing suitable policies. This paper examines the fiscal policy sustainability and the impact of monetary policy on public debt management in Euro Area from 1980 to 2014. The analysis is based on error-correction models and cointegrated VAR modelling. 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. An important policy implication resulting from this study is that the fiscal rule generates a divergent dynamic of the public debt. Our results in this paper suggest the Keynesian effects of macroeconomic policies in the eurozone and concludes that there is a sort of complementarity between monetary and fiscal policies in some euro area countries insofar as a restrictive monetary policy (higher interest rates, interest) seems always accompanied by a restrictive fiscal policy (higher taxes or lower public spending) and vice versa. Thus, we consider that the debt has a positive effect on the budget deficit, which translates into behavior that destabilizes the debt. Moreover, fiscal policy is not sustainable in Belgium, Italy, Ireland and Greece. Furthermore, Fiscal policy is sustainable in France and Spain.

Classification JEL: E52, E58, E62, E61.

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1 Introduction

The nature of the interdependence between monetary and fiscal policies is a recurring theme in macroeconomics and has also been a critical issue in a strongly integrated economic area like the European Union. Fiscal policy could affect the chances of success of monetary policy in various ways: through its impact on general confidence in monetary policy, through short-term effects term on demand and by changing long-term conditions for economic growth and lower inflation. Based on the single monetary policy in the euro area since 1999, and the synchronization of monetary policies among the core euro area countries since the early 1990s, the aggregate analysis of fiscal policy for the area as a whole is a relevant undertaking. Although fiscal policy has been a country-specific issue over the past two decades[1], the use of historical data in a model of the aggregate euro area has practical value to policymakers[2].

The 2007-2012 crisis is a deep crisis of financial capitalism, which was calling for a strong policy response from governments to lower the weight of finance and the reliance on public and private debts, to implement a macroeconomic strategy aiming at a return to full employment. Before the crisis, a combination of loose monetary and regulatory policies encouraged excessive credit growth and a housing boom in many countries. This turned out to be a problem when the world economy slowed down Claessens and al. (2009), Crowe and al. (2011). 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 fact, while the response of fiscal indicators such as the level of sovereign debt is of first-order importance in this regard, it generally does not provide a sufficient statistic for assessing the sustainability of debt. The same level of debt may thus have very different implications for debt sustainability in different countries (Bi, 2012). The joint determination of objectives and policies by the monetary and fiscal authorities is a fundamental requirement for efficient policy coordination. A situation where the different policies are made consistent with each other by the passive reaction in one policy area to the commanding position in the other policy area would not achieve the objective of maximizing the effects of policies. For example, setting a very restrictive monetary policy to offset a lax fiscal policy may crowd out and significantly increase the borrowing costs for the government.

The need for coordination raises the question of the appropriate institutional setup. Overall, as a result of the crisis, central banks have been given a larger role in maintaining financial stability

[1] This has also been the case in the operation of the Stability and Growth Pact, the agreement on the coordination of budgetary policies in place in the European Union since 1999.

[2] See, for example, Smets and wouters (2003, 2005); Ratto, 2009; Fagen et al., 2005 and Gunter et al., 2008.

(Bank for International Settlements (BIS, 2012). In the long term, the policy coordination problem rests on how to design a balanced monetary and fiscal policy mix that is conducive to maintaining the economy on its equilibrium growth path-controlling inflation and promoting financial conditions for sustainable growth. This implies limiting the fiscal deficit to a level that can be financed through the operation of the capital markets without creating distortions in the allocation of resources in the economy, without having recourse to direct monetary financing from the central bank, and without relying on an excessive level of external borrowing. 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 analysed, stressing the need for policy coordination at two different levels: fulfilment 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.

This paper examines the fiscal policy sustainability and the impact of monetary policy on public debt management in Euro Area from 1980 to 2014. 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. 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. We show that the fiscal policy rule is such that the more public debt increased in the euro area countries, the more the deficit increased. In other words, we have succeeded in showing, according to our empirical study, that the budgetary rule generates a divergent dynamic of the public debt. On the other hand, the debt is not sustainable within the aggregated euro zone.

The remainder of the paper is organized as follows: Section 2 reviews the empirical literature review. Section 3 analyses Methodology and data. Section 4 presents variables analyse, section 5 presents empirical result and in the end, we have concluding remarks.

2 Empirical literature review

We presented some important studies to motivate our empirical work, these include studies for different countries as well as different time periods. As This paper examines the effect of the interaction between monetary and fiscal policies on the sustainability of developments in public debt and budget deficit, we choose to focus especially on both recent empirical works that adopted the interaction between policies, and on the papers that deal with the effect of monetary and fiscal policy on public debt and deficits.

Taylor (2000) taylor showed that economists have become more and more septic effectiveness of discretionary monetary and fiscal policies and how policy rules have progressively imposed. *Leeper (1991)* developed the Fiscal Theory of the Price Level (FTPL), he introduced two essential points: the distinction between active and passive policies, 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 satisfy 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.

Vines (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 (2000) 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.

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 gets 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 weaker than generally perceived.

Melitz (1997) examine the interaction between monetary and fiscal policies in a pooled regression annual data on 19 OECD countries. He notes 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 the period 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 Jordi and Roberto (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.

Trecroci (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.

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

Vines (2005) 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.

J. James Reade (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.

Tatiana (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.

?sought to analyze the mechanisms of transmission of fiscal policy by estimating the relationship between the primary surplus and the public debt. They also determined whether the public debt was significant and in that it measures it affects the rate of investment, the output gap and the demand for money. They used the Johansen cointegration test and the unit root test (ADF), as well as simultaneous equation models, such as the generalized moments method (GMM) with instrumental variables. The long-term equations resulting from the cointegration tests were analyzed. Thus, they found that public debt affected the real variable in the economy, ie, the ratio of investment to GDP. This empirical evidence suggests the need for a clear prescription of public policy: hence the government should aim to reduce the ratio of debt to GDP. A reduction in the debt ratio translates GDP to an increase in the investment-to-GDP ratio.

Belke and al. (2011)use multivariate cointegration methods to study the interactions of monetary and fiscal policies by studying the example of the United States and the euro area since the beginning of the years 1999-2006. Two models are specified: a partial correction of the error correction models (VECM) and a general VECM. In the partial VECM, they seek a long-term interdependence relationship between the interest rates of the two monetary zones and specify the modalities of the Taylor rule as an exogenous variable. In the general VECM, they consider all endogenous variables, and seek long-run equilibrium relationships between them, which can reveal the monetary interdependence of policies between the two central banks. A weak exogeneity is verified in both models in order to establish a possible relationship between leader-follower. The empirical results of these two models indicate an interdependence between the ECB and the Fed, but only the VECM model demonstrates a leader-follower model between the two central banks.

Reade and Sthe (2011) use multivariate cointegration methods to study the interactions of monetary and fiscal policies by studying the example of the United States since the early 1980s. They find that monetary policy Prospective and passive in the sense that it meets the monetary rules. On the other hand, fiscal policy is active in the sense that it does not respond to the rules of fiscal policy. Thus the interactions between the two spheres of politics seem limited in such a way that no policy instrument enters into the political rule of the other sphere. But monetary policy, which is highly passive, acts as a reaction to the movements in fiscal policy. Moreover, they note that the two policies are complementary, since the two policies respond in the same direction to relaunch the economy in a period of slowdown and the brake during Boom period.

Daly and Smida (2016) analyzes the interaction between monetary and fiscal policies in Greece from 1980 to 2012. 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. The evidence does not let hear strong political interactions in Greece, and supports the idea that the monetary policy is more stabilizing in its influence on the economic activity than the budget policy.

In summary, the above literature review on the interactions between monetary and fiscal policies. These divergences in results seem to generally depend on the country or group of countries considered, econometric techniques, variables incorporated, and time series included in the study. Accordingly, one should be cautious in interpreting empirical results and in delivering policy implications.

3 Methodology and data

The objective of this section is to implement the methodology to analyze our problem. The first step, we will present a theoretical model that allows to account for the interdependencies of monetary and budgetary policies. The second step consists in exposing the empirical strategy and we will explain how to estimate a C-VAR model consistent with the theoretical model and how to interpret the results of the estimation.

3.1 Data

The data used include the output gap y_t, the inflation rate π_t, the nominal interest rate r_t, the public debt d_t and the primary government balance pb_t, 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. Debt, deficit, interest rate and inflation rate variables are downloaded from the Annual Macro-Economic database (AMECO[3]) and the output gap is downloaded from the International Monetary Fund (IMF).

3.2 Theoretical model

We present the theoretical model[4] which are based on three macroeconomic equations: the IS equation, the Philips equation and a representation of the monetary policy rule. This model is

[3]The annual macroeconomic database of the European Commission's Directorate General for Economic and Financial Affairs (DG ECFIN).

[4]Kirsanova et al. (2005).

completed by two additional equations that formalize fiscal policy and public debt dynamics. Monetary policy is described as a generalized Taylor rule, while fiscal policy follows a budget variant of Taylor rule[5] with a feedback effect on other state variables of the system.
The first equation is an IS curve, representing the evolution of the deviation of production y_t, driven in particular by the real interest rate.

$$y_t = \gamma^f E_t y_{t+1} + \gamma^b y_{t-1} - \sigma[r_t - E_t \pi_{t+1}] + \phi d_t + \delta b p_t + \varepsilon_{1,t}, \tag{1}$$

where y_t is the output gap, π_t is the rate of inflation, r_t is the nominal interest rate, d_t is the stock of government debt, and pb_t is the primary deficit. The two budget variables are represented as fractions of GDP. (ε) is a demand shock. The second equation is a Philips accelerator curve. It describes the dynamics of inflation (π_t in terms of past and expected inflation and the output gap.

$$\pi_t = \chi^f \beta E_t \pi_{t+1} + \chi^b \pi_{t-1} + k_1 y_t + k_2 y_{t-1} + \varepsilon_{2,t}, \tag{2}$$

In these equations, the interest rate is considered as the instrument of monetary policy, while pb_t is defined as the tool of the budget maker. There is disagreement on whether the budgetary instrument should be taxes, public expenditure or the primary balance. In our study, we will use the primary deficit as an instrument of fiscal policy. In contrast, insist that public spending be the tool, whereas Schmitt-Grohe and Uribe (2004) consider taxation as such and several other authors take both at the same time, for example Muscatelli and al. (2004) ; Gali and Perotti (2003).

The budget rule and the budget identity: The theoretical equation is an approximation of reality, like the cointegration relation which is interpreted as the budget identity. So the stochastic term of this equation represents the error of this approximation. The government's budgetary identity is:

$$d_t \approx [1 + \rho_{t-1}] d_{t-1} + pb_t. \tag{3}$$

Variables as fractions of GDP, ρ_{t-1} is the real interest rate. Kirsanova et al. (2005) line the budget identity around the reference level of the debt and the levels of the interest rate ρ and d:

[5] Simple rules, especially of the Taylor type, seem to provide ex post a good description of the policies actually followed by central banks in the 1980s and early 1990s.

$$d_t = [1+\hat{\rho}]d_{t-1} + \rho_{t-1}\hat{d} + pb_{t-1} \tag{4}$$

The budget rule

$$pb_t = \psi_y y_t - \psi_\pi \pi_t - \psi_d d_t, \tag{5}$$

where, $\psi_y > 0$, $\psi_\pi > 0$ et $\psi_d > 0$.

The monetary policy rule

Taylor's rule makes the interest rate depend on inflation and the output gap. A general form of this rule is:

$$r_t = \phi_{E\pi} E_t \pi_{t+1} + \phi_\pi \pi_t + \phi_{\pi 1} \pi_{t-1} + \phi_{Ey} E_t y_{t+1} + \phi_y y_t + \phi_{y1} y_{t-1} \tag{6}$$

An "Active" monetary policy (Leith and Wren-Lewis, 2000) would be described by Taylor's principle[6], so $\phi_{E\pi} + \phi_\pi + \phi_{\pi 1} > 1$. Production is generally interpreted as a criterion for inflation (Svensson, 1999), we would therefore expect: $\phi_{Ey} + \phi_y + \phi_{y1} > 0$.

3.3 The empirical strategy

Having presented the theoretical contributions to the interactions between monetary and fiscal policies, we turn now to study our empirical strategy. We use cointegration methods to study the interactions of monetary and fiscal policies.

The present study is carried out using annual time series for six countries in Euro Area (Ireland, Greece, Italy, Spain, Belgium and France) during 1980-2014. Our model allows for non-stationarity data and endogeneity, questions such as the role of monetary policy in debt-sustainability can be investigated in this manner. The empirical strategy used in our study can be combined to the vector autoregressive model (VAR)

$$X_t = \Pi_0 + \sum_{i=1}^{K} \Pi_i X_{t-i} + u_t, u_t \sim N(0, \sigma^2). \tag{7}$$

[6] The Taylor rule (Taylor, 1993b), expressing the interest rate of monetary policy as a linear function of the output gap and the deviations of inflation. of a target level.

X_t is a p vector of data, while Π_0 is a $p \times p$ matrix of coefficients, where $p = 5$ is the number of variables in the system, and T is the number of observations. The matrix Π_0 refers to the constant terms in each equation of the VAR system. If the data are non-stationary, so $X_t \sim I(1)$ and for equation (7) (7) to be equilibrated, it needs to be rewritable into the error-corrected form:

$$\Delta X_t = \Pi^* X^*_{t-1} + \sum_{i=1}^{K-1} \Gamma_i \Delta X_{t-i} + u_t, \tag{8}$$

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 X^*_{t-1} must be of reduced rank for equation (8) to be balanced. If Π^* is of reduced rank then there exist p×r matrices α et β such that $\Pi = \alpha\beta'$ and equation (8) (8) becomes:

$$\Delta X_t = \alpha \tilde{\hat{\beta}}' X^*_{t-1} + \sum_{K=1}^{K-1} \Gamma_i \Delta X_{t-k} + u_t, \tag{9}$$

The $\beta' X^*_{t-1}$ terms are cointegrating vectors, the stationary relationships between non-stationary variables, or steady-state relationships.

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. Stationarily of a series is an important phenomenon because it can influence its behaviour. In this paper, we conduct unit root tests using the Augmented Dickey–Fuller (ADF)[7] and Phillips–Perron (PP)[8] tests. We use both tests in order to check the robustness[9] of the results. 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. Second, once the order of integration of the series is deter- mined, we investigate the potential existence of a long-run equilibrium relationship (or cointegration) between variables. According to Engle and Granger (1987), if two series x_t and y_t are each I(1) or non-stationary, one would expect that a linear combination of x_t andy_t would be a random

[7]Dickey and Fuller, 1979.

[8]Phillips and Perron,1988.

[9]One advantage of the PP test over the ADF test is that the former is robust to general forms of heteroskedasticity in the error term.

walk. To test the presence of cointegration of the variables in this study, Johansen's approach[10] is employed. Finally, if the presence of cointegration is confirmed between different variables, then Engle and Granger, (1987) error correction specification can be used to test for Granger causality and show its direction.

We use two 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 heteroskedasticity 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.

4 Variables trends in economic time series

In order to describe the economic cycle of the countries of the euro area, we will have recourse to the description of main data such as the gross public debt, the budget deficit, the interest rate, inflation and the output gap.

4.1 Gross public deb

Between the end of the third quarter of 2013 and the end of the fourth quarter of 2013, the ratio of public debt to GDP decreased in the euro zone (EA18), from 92.7% to 92, 6% of GDP. In the EU28, the ratio increased from 87.0% to 87.1%. Analyzing the graph of the public debt of the euro zone in the period 1980-2014, we will observe some interesting characteristics. The period of 1999 was marked by a joint effort by the States to reduce the weight of the public debt of the GDP in order to meet the criteria of the Treaty of Maastricht. From the 1980s, the debt ratio increased sharply in almost all the countries of the euro zone. In 25 years it has increased from approximately 35% to 70% of GDP (20 to 70% in France). In the 1990s, the debt ratio continued to increase, particularly in France. In France, between 1992 and 1997, the debt ratio increased by nearly 25 percentage points of GDP. This increase results from the widening of the gap between the interest rate and the growth rate, which in France reached 6 points in 1993, and therefore from the very rapidly increasing share of Cumulative interest in the outstanding capital. From graph (1), we can see a change in the public debt for all countries: France,

Italy, Spain, Belgium, Ireland and Greece from 1980. on the one hand, we note that Belgium,

[10] Johansen, 1988; Johansen and Juselius, 1990.

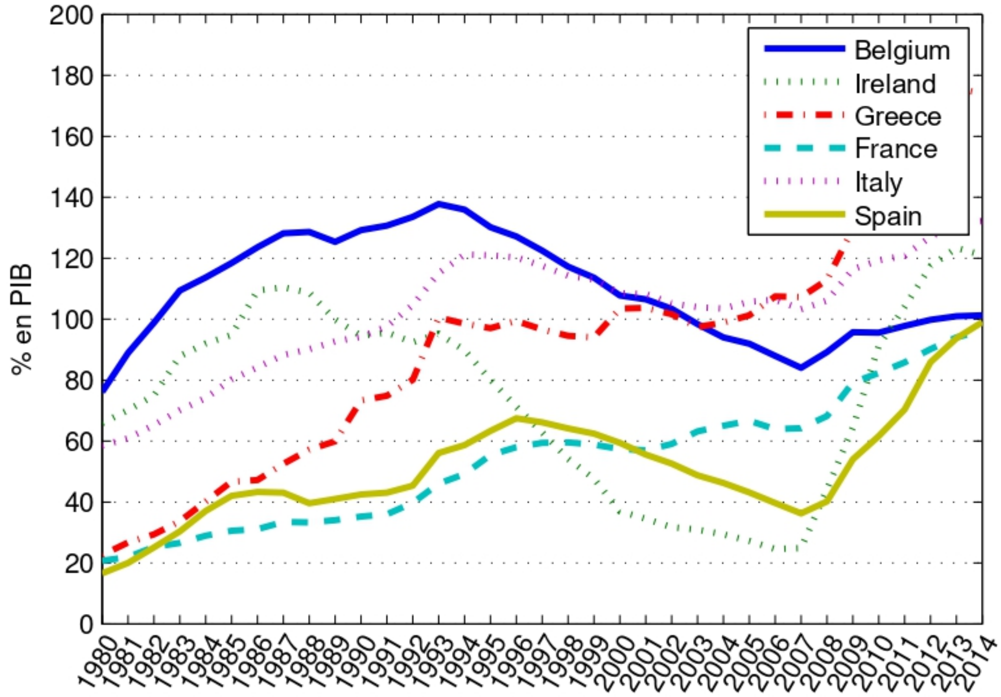

Figure 1: Evolution of public debt in the Euro area (EA 17)

Source: Our own observations.

from 1980 until 1992, had a rate in% of GDP which is the highest of public debt. In contrast, France and Spain have the lowest rate. From 1992 and until 2007, Ireland's public debt gradually declined. Despite all efforts, the ratio of public debt as a % of GDP calculated as an average for the euro area cannot be lowered by 60%, even if it has recorded a downward trend. With the construction of the Monetary Union and the emergence of the Euro the trend begins to reverse. The upward trend in public debt has been continually influenced by government injections to address macroeconomic disruptions. The average public debt of the euro zone reached a minimum point of 66% in 2007 followed by a strong upward trend which still marks the current situation. The first cycle reached maturity starting with 2004 and most of the debt was accumulated in an extended period of time until 2007. The violation of the PSCs in 2002 and 2003 by the Germany and France was to indicate a lower degree of credibility of this mechanism designed to oversee budget developments in member states. Without strong coordination at the level of the euro zone, the situation could not have a favorable end. The downward trend in public debt was reversed after the emergence of the single currency, due to the disappearance of a strong fiscal mechanism.

4.2 Budgetary deficit

In graph 2 we notice that all the countries have a budget de fi cit for the whole period (1980-2014), except Ireland which had a surplus during the period 1997-2008, also Spain between 2004-2008. From 1994 we can see that the six countries have reduced their public deficit in order to join the euro zone to have a threshold above 3%. in France, the economic crisis of 1993 contributed to widening the budget deficit, and the good economy around 2000 mechanically reduced the de fi cit. In 2000, there was talk of a 'budget pot' when the overall deficit was not filled. Between 2010 and 2013, several countries also made a significant effort to reduce their public de fi cit. Thus, the deficit fell by 12.2% in Greece and by 6.8% in Spain. On the other hand, in Ireland we notice that the deficit increased rapidly between 2009-2010, and from 2010 it was reduced by 26.7 percentage points of GDP to reach the same level with all countries in 2014. In 2013, France was still above the 3% threshold, with a public deficit equal to 4.3% of GDP. However, the country reduced it by 35.86% between 2010 and 2013, i.e. a decrease of 2.7 points of GDP.

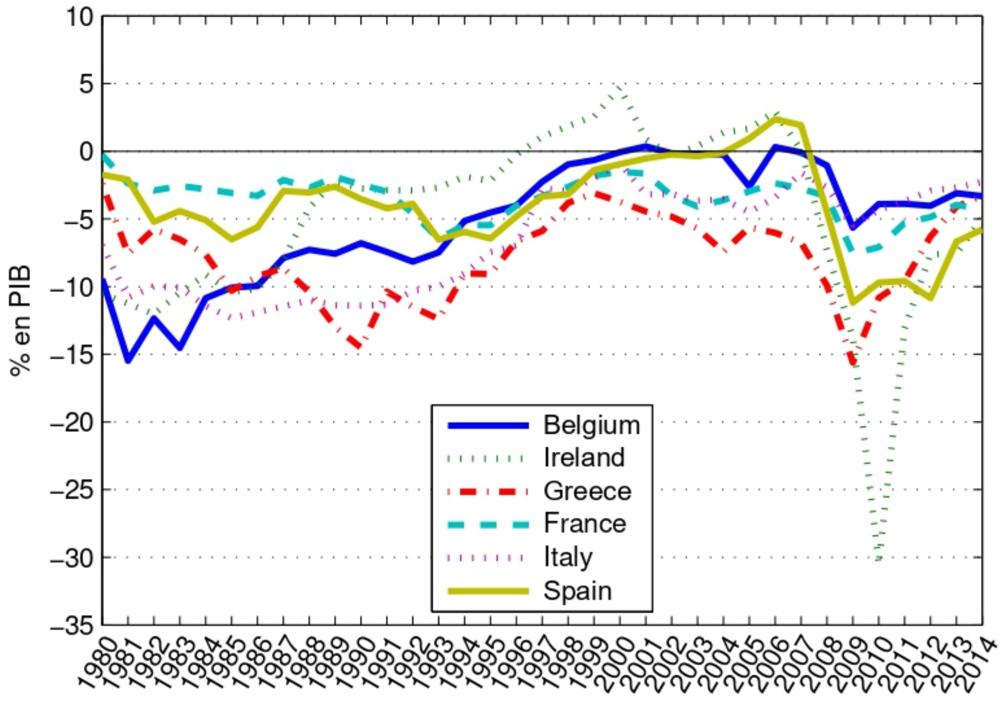

Figure 2: Evolution of deficit in the Euro area (EA 17)

Source: Our own observations.

4.3 Interest rates

From Graph 3 we notice that the interest rate for all countries fell between 1980 until 1999 except in Greece. From 1987 the interest rate in Greece increased and reached 25% in 1994, then it fell gradually from 1994 until 2001 to reach the same rate for all the countries of the euro zone. The single monetary policy interest rate does not always correspond with the good behavior of public finances in many euro area countries, in particular during the economic crisis, Greece, Portugal, Spain and Ireland being among these countries. It is obvious that under such conditions, the budgetary austerity imposed on certain countries was much heavier than that imposed on other States, where financial solidarity was called into question. , at least by the slowness of governments' response to financing needs and budget deficits, compared to the alert speed of the reaction of the ECB and other central banks (Fed, Bank of England , the Bank of Japan) for monetary issues.

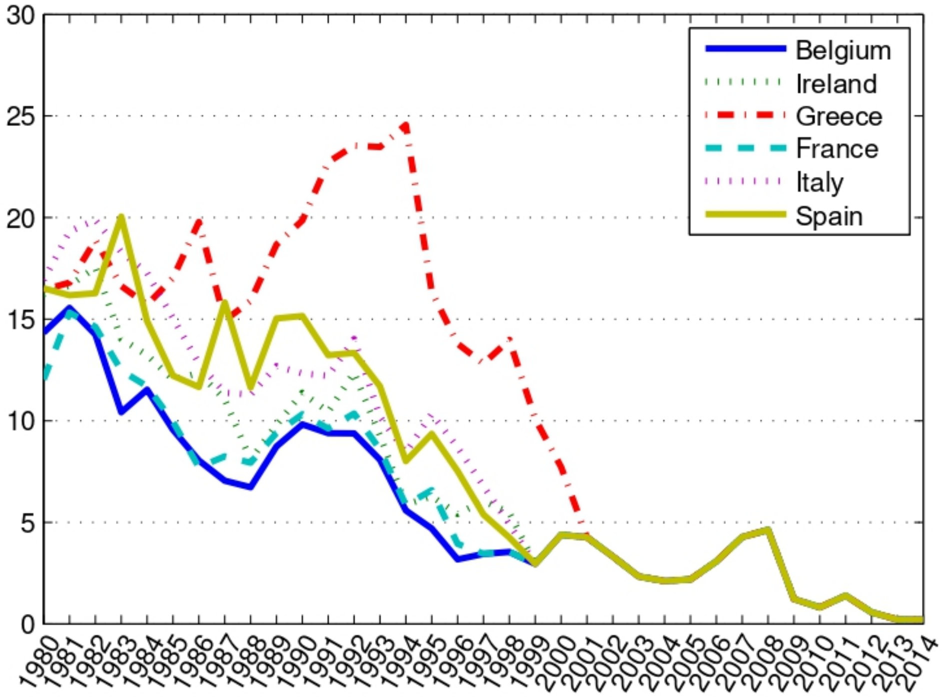

Figure 3: Evolution of interest rate in the Euro area (EA 17)

Source: Our own observations.

4.4 Inflation

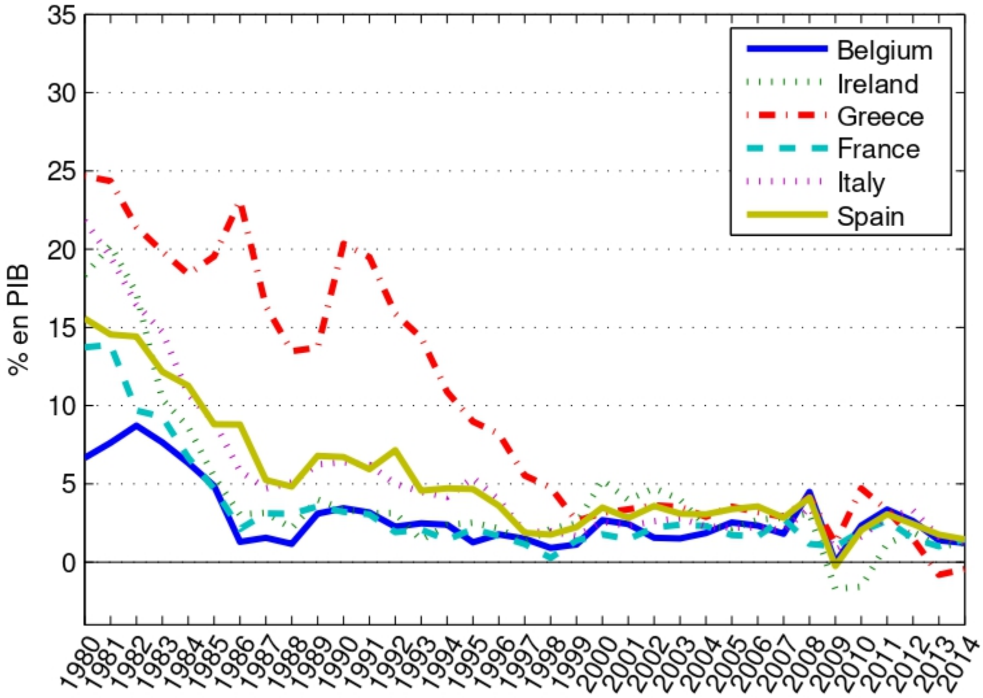

Figure 4: Evolution of inflation in the Euro area (EA 17)

Source: Our own observations.

Graph 4 clearly shows two major trends or behaviors strongly linked to the appearance of the common currency in 2001. Indeed, a sort of contour point (delineating two contrasting zones) is clearly visible in this date. Before, the six countries carried with more or less different values but, all the same, high. These rates have decreased over time with a particular behavior (floating) being however detected at the level of Greece. From 2001, we stailise below 5%

4.5 Output Gap

If we disregard the last years in Greece, we can easily distinguish from Graph 5 a sinusoid around zero and with an almost constant period of 12 years for all six countries. This suggests that a positive trend is expected around 2016-2017. Would this really be the case? Note that this alternative is in bold between -5 and 5.

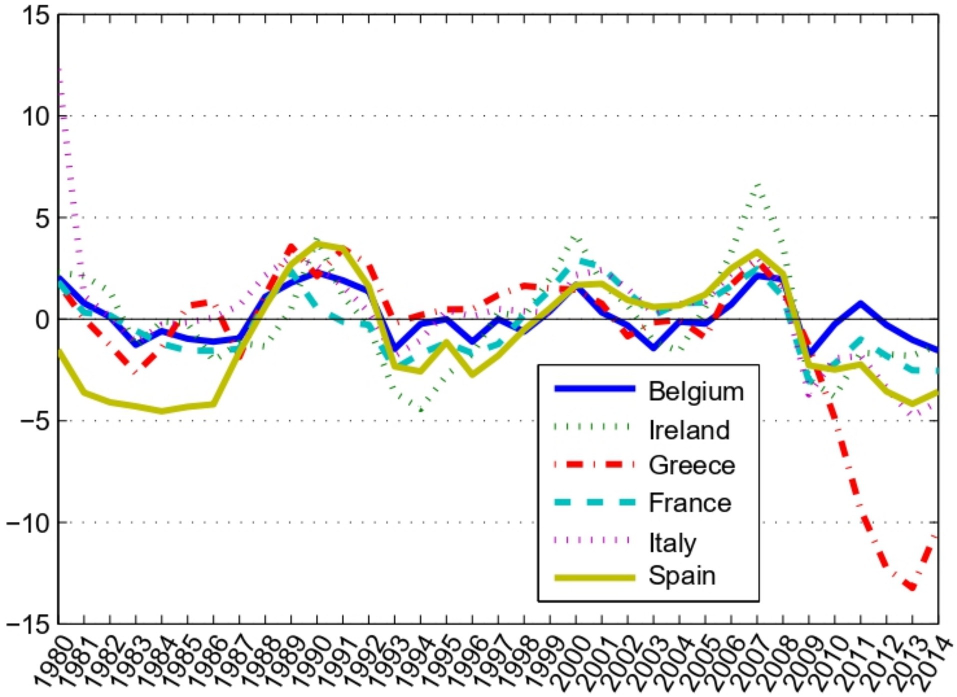

Figure 5: Evolution of output Gap in the Euro area (EA 17)

Source: Our own observations.

5 Empirical results

We present the stationarity and cointegration tests[11]. Finally step consists in explaining how to estimate a C-VAR model consistent with the theoretical model and how to interpret the results of the estimation.

The stationarity of the variables and the eventual cointegration relations are an essential step insofar as they condition the dynamics of the system according to the degree of persistence. In order to test the non-stationarity of the data, each of the variables are tested for unit roots using the traditional ADF-test which tests the null hypothesis of non-stationarity. To ensure robustness the order of integration of the variables, ADF test is supplemented by the Phillips Perron (PP) stationarity test. In constructing the unit root tests, the variables in levels were

[11]The cointegration test is used to discover the number of long-run equilibrium relationships that exist between the variables dt, pbt, rt, t and yt. It is based on the statistical procedure of Johansen (1988, 1991).

tested in the presence of both an intercept and trend. The subsequent tests of first differences included only an intercept given the lack of trending behavior in the first- differences series. Results of the unit root tests of the variables reveal that the majority of the variables have been generated via an integrated of order one I(1) process (see Table 1). First-differences variables are found to be stationarity in at least two of the three tests undertaken for most cases. We can summarize the results of the two unit root tests as follows: According to ADF and PP tests all variables are stationary in first differences. Finally, we find that all variables I(1).

where y_t is the output gap, π_t is the rate of inflation, r_t is the nominal interest rate, d_t is the stock of government debt, and pb_t is the primary deficit. The two budget variables are represented as fractions of GDP.

Since the series are integrated of the same order (I(1)), the Johansen's approach is used to test if the variables are cointegrated. The cointegration test uses an intercept but no trend. Both the Johansen maximum eigenvalue (Max-Eigen) and trace statistics are used to test the null hypothesis of no cointegration. Results, which are reported in Table 2, suggest that in each country the five variables are cointegrated. The number of cointegration vectors is denoted by rank r, which is formally chosen based on a likelihood ratio test known as the trace[12] test . Therefore, we will use additional information to help determine rank, eg, examination of the remaining roots of the system, size of eigenvalues, and correlations between cointegration vectors and different data[13] . The interpretation of these cointegration vectors is important: they are stationary linear combinations and nonstationary static economic variables. Taylor's simple rule relations (1993) are static and stationary relationships between variables; Thus, the persistence of time requires an autoregressive structure in order to provide unbiased estimates of the coefficients. When the number of variables is greater than two, there may be more than one cointegration equation[14] .

Therefore, it is necessary to determine the cointegration rank, ie the number of cointegration relationships among the variables. In the evaluations, we first check the cointegration rank and then use the results of the cointegration rank as a predetermined state for further evaluations in the partial and general framework of VECM. In our empirical analysis, the cointegration test is a prerequisite for applying the empirical framework of VECMs. We will try to identify the equations of the error corrections for all countries which have an economic meaning.

As can be seen, in table 2, the trace and maximum eigenvalue statistics show that both hypotheses, r=0, r=1 and r=2 are rejected at the 5% significance level, which indicates three

[12] Johansen, 1995, 1988.
[13] Juselius, 2007.
[14] Engle and Granger 1987.

Country	Variables	ADF		PP	
		Level	First Difference	Level	First Difference
Ireland	y_t	−1.650266(6)	−4.513585(5)*[a]	−2.343899(8)[b]	−5.259873(19)*
	d_t	−2.268425(1)	−3.147767(3)**	−1.218752(4)	−3.818263(3)*
	pb_t	−2.215896(0)	−5.593849(0)*	−2.288740(1)	−5.706141(5)*
	r_t	−1.658814(4)	−4.518671(3)*	−1.471579(9)	−6.156476(0)*
	π_t	−1.431911(8)	−3.591467(1)*	−3.208339(0)	−4.812077(2)*
Greece	y_t	−0.991447(4)	−3.916231(3)*	−0.845808(2)	−3.781495(1)*
	d_t	−1.486708(0)	−5.995404(0)*	−1.707565(3)	−5.992461(2)*
	pb_t	−2.327539(0)	−5.984786(0)*	−2.468051(1)	−5.984786(1)*
	r_t	−0.569707(1)	−5.049157(0)*	−0.476654(1)	−5.049157(0)*
	π_t	−1.391679(0)	−5.723139(0)*	−1.673252(3)	−5.723139(1)*
France	y_t	−2.884802(1)	−4.981592(1)*	−2.547718(1)	−4.938075(7)*
	d_t	−2.401535(1)	−3.602615(1)**	−1.489287(1)	−3.522231(4)**
	pb_t	−2.829655(1)	−4.942456(0)*	−2.815982(8)	−6.096941(13)*
	r_t	−0.980416(0)	−6.147086(0)*	−0.986410(1)	−6.186770(6)*
	π_t	−1.645639(8)	−3.465251(1)**	−3.333532(3)	−5.355415(3)*
Belgium	y_t	−1.158652(10)	−6.254048(0)*	−3.693538(0)	−6.254048(0)*
	d_t	−0.466953(1)	−3.136067(0)*	−0.167776(4)	−3.134816(2)*
	pb_t	−1.426965(0)	−9.144243(0)*	−1.327444(3)	−8.738098(2)*
	r_t	−1.717078(3)	−4.812906(0)*	−2.526422(1)	−4.812906(1)*
	π_t	−1.630969(6)	−3.971307(5)*	−1.913223(2)	−7.043523(1)*
Spain	y_t	−1.433916(0)	−3.935136(0)*	−1.853914(2)	−3.993998(1)*
	d_t	0.552038(1)	−2.448069(4)**	1.222504(4)	−6.765509(2)*
	pb_t	−1.396868(1)	−4.415325(0)*	−1.168780(2)	−4.415325(1)*
	r_t	−1.781277(0)	−7.005722(0)*	−1.781277(0)	−7.005722(1)*
	π_t	−0.767377(12)	−6.7518300(0)*	−3.960685(3)	−6.751830(0)*
Italy	y_t	−1.294284(5)	−4.722020(1)*	−5.373837(4)	−8.884477(1)*
	d_t	0.978221(1)	−2.434224(0)**	1.700120(4)	−2.315775(5)**
	pb_t	−0.869270(0)	−6.382061(0)*	−0.869270(1)	−6.329224(2)*
	r_t	−2.097755(0)	−4.856566(0)*	−2.179322(3)	−4.838204(2)*
	π_t	−0.516120(12)	−3.790248(0)*	−5.919607(1)	−3.661771(2)*

Table 1: Results of ADF and PP unit root tests

[a]* Seuil de signification à 1%, ** Seuil de signification à 5%, *** Seuil de signification à 10%.

[b]Les valeurs entre parenthèses indiquent le nombre optimal de retards et les largeurs de bande pour les test ADF et PP.

Country	Eigenvalue	Hypothesized	Trace [a]	Max-Eigen	Critical value	at 5%
		$H_0; r$ [a][b]	Statistic	Statistic	Trace	Max-Eigen
Ireland	0.855373	0* [c]	126.7340	59.94147	69.81889	33.87687
	0.660381	1*	66.79256	33.47787	47.85613	27.58434
	0.456331	2*	33.31469	18.89187	29.79707	21.13162
	0.298040	3	14.42282	10.97026	15.49471	14.26460
	0.105395	4	3.452557	3.452557	3.841466	3.841466
Greece	0.955674	0*	178.6544	96.60136	69.81889	33.87687
	0.774599	1*	82.05299	46.18611	47.85613	27.58434
	0.518073	2*	35.86688	22.62883	29.79707	21.13162
	0.310772	3	13.23805	11.53766	15.49471	14.26460
	0.053374	4	1.700389	1.700389	3.841466	3.841466
France	0.992483	0*	246.5350	141.8284	47.85613	27.58434
	0.860037	1*	104.7065	57.02486	29.79707	21.13162
	0.797885	2*	47.68168	46.36866	15.49471	14.26460
	0.044267	3	1.313027	1.313027	3.841466	3.841466
Belgium	0.899060	0*	1151.4194	71.09020	69.81889	33.87687
	0.722125	1*	80.32916	39.69815	47.85613	27.58434
	0.596700	2*	40.63101	28.15029	29.79707	21.13162
	0.2602483	3	12.48072	9.344659	15.49471	14.26460
	0.096215	4	3.136065	3.136065	3.841466	3.841466
Spain	0.831921	0*	135.9372	55.28305	69.81889	33.87687
	0.728971	1*	80.65445	40.39767	47.85613	27.58434
	0.532247	2*	40.25672	23.56715	29.79707	21.13162
	0.397547	3	16.68957	15.72736	15.49471	14.26460
	0.037291	4	0.96178	0.96178	3.841466	3.841466
Ireland	0.860233	0*	140.0845	61.00117	69.81889	33.87687
	0.780826	1*	79.08338	47.05456	47.85613	27.58434
	0.502156	2*	32.02878	21.621715	29.79707	21.13162
	0.266797	3	10.40726	9.626732	15.49471	14.26460
	0.025066	4	0.786949	0.786949	3.841466	3.841466

Table 2: Johansen cointegration results

[a]Trace and Max-eigenvalue tests indicates 3 cointegrating eqn(s) at the 0.05 level
[b]a Indicates the number of cointegration relationships.
[c]*denotes rejection of the hypothesis at the 0.05 level

cointegrating relationships. In our empirical analysis, the cointegration test is a prerequisite for an application of empirical framework of VECM. We will try to identify the equations of the error corrections for France that make economic sense in relation to the economic model studied in the previous section.

We try to explain the three equation of cointegration relation in France.

Résultats économétriques:

$$\alpha\beta X^{*}_{t-1} = \begin{pmatrix} -0.97 & -0.02 & -0.05 \\ -0.14 & 0.12 & 0.46 \\ 0.29 & -0.31 & 0.45 \\ 0.34 & 0.15 & 0.21 \\ -0.24 & 0.35 & 0.04 \end{pmatrix} \begin{pmatrix} y_{t-1} + 2.372\pi_{t-1} - 0.139r_{t-1} + \rho_{1t} \\ d_{t-1} - 18.894\pi_{t-1} + 6.609r_{t-1} + \rho_{2t} \\ bp_{t-1} - 0.627\pi_{t-1} + 0.037r_{t-1} + \rho_{3t} \end{pmatrix} \tag{10}$$

In this case, in the long term, the output gap will be:

$$y_{t-1} = -2.372\pi_{t-1} + 0.139r_{t-1} + \rho_{1t} \tag{11}$$

$$d_{t-1} = 18.894\pi_{t-1} - 6.609r_{t-1} + \rho_{2t} \tag{12}$$

$$bp_{t-1} = 0.627\pi_{t-1} - 0.037r_{t-1} + \rho_{3t} \tag{13}$$

- a. In the first cointegration equation, the coefficient of the interest rate r s negative. In addition, a long-term Philips relation in which $\pi_{t-1} = \frac{1}{-2.372}y_{t-1} + \varepsilon_{1,t-1}$. In this equation, we tested the coefficient of r_{t-1} and found that the coefficient (-0.139) is not significantly different from zero.

  In this case the equation, in the long run, the output gap will be:

  $$\pi_{t-1} = -0.421y_{t-1} \tag{14}$$

  If production increases by 1% of potential output, ie if the output gap increases by 1, the inflation rate decreases by 0.421% per year in the long term. Economic activity has a negative effect in the end but low on the rate of inflation.

- b.Two other cointegration relationships that have an economic meaning.

$$d_{t-1} + 178.621 bp_{t-1} = -5.909 \pi_{t-1} \tag{15}$$

$$bp_{t-1} = 0.0036 d_{t-1} + 0.5212 \pi_{t-1} \tag{16}$$

We find in equation (15) that a debt increase of 1 percentage point of GDP implies a deficit increase of 0.0036 point GDP. This introduces the fact that the fiscal rule generates a convergent dynamics of the public debt. An inflation increase of 1% per year leads in the long term to a primary deficit increase of 0.5212 point of GDP.

- c. For the third cointegration equation instead of eliminating r_{t-1} we eliminate π_{t-1}, in this case we have:

$$d_{t-1} - \frac{18.894}{0.627} bp_{t-1} = (-6.609 - \frac{18.894}{0.627} * 0.037) r_{t-1} \tag{17}$$

$$d_{t-1} = 30.13 bp_{t-1} - 5.49 r_{t-1} \tag{18}$$

$$d_t = (1 + \hat{\rho}) d_{t-1} + \rho_{t-1} \hat{d} + bp_{t-1} \tag{19}$$

In the long term: $d_t = d_{t-1}$, then we have:

$$\hat{\rho} d_t = -\hat{d} \rho_t + pb_t \tag{20}$$

So, we have:

$$d_t = -\frac{\hat{d}}{\hat{\rho}} \rho_t + \frac{pb_t}{\hat{\rho}} \tag{21}$$

We suppose that $\hat{d} = 60\%$ and $\hat{e} = 4\%$, so we obtain:

$$d_t = -\frac{0.6}{0.04} \rho_t + \frac{pb_t}{0.04} \tag{22}$$

$$d_t = -15 \rho_t + 25 pb_t \tag{23}$$

This equation shows that in the end a positive debt must be accompanied by a positive primary deficit, ie a primary deficit, and what we get in equation (22).

In this equation, the budget identity result is a balanced budget in the long term. This is consistent with the previous equation, which suggests that an increase in public debt implies a decrease in the fiscal deficit. This suggests that fiscal policy is sustainable in France.

The results obtained from the estimate show that in the short and long-term monetary and fiscal policies influence economic activity in the case of France. Fiscal policy, captured by revenue, is more effective than monetary policy over the short and long term. The component of the fiscal variable of total expenditure has very little short-term and long-term negative impact on economic activity. Monetary policy, on the other hand, has short-term and long-term positive effects on economic activity. The elasticities of the error-correction model show that in the short and long run, inflation has an adverse effect on economic growth. So far, we have pointed out that the introduction of monetary policy rules must take account of the specificities of countries in the sense that they must integrate differences in terms of growth, inflation and competitiveness. Similarly, we stressed the need to impose budgetary rules in a decentralized or centralized approach. However, each of these rules in isolation has significant limitations when it comes to extract relevant arguments for the policy mix in the monetary union. In the euro area, simply set an inflation target for the ECB and a target of public deficits governments cannot guarantee the effectiveness and overall coherence of the policy mix. This leads to wonder if there is an optimum combination that guarantees the effectiveness and coherence in a heterogeneous monetary union. More specifically, the question we try to answer is whether there is a better combination of monetary and fiscal policy that ensures non-accelerating inflation growth in a European monetary union. We have shown that fiscal policy influences public debt, real interest rates, output gap and primary balance. These variables must be systematically taken into account in the context of a monetary policy geared to price stability. It is also known that in turn, monetary policy has an impact on short-term interest rates, the real value of debt and inflation in long-term yields. Changing these parameters results in a change in the economic environment in which fiscal policy.

It is clear from these interconnections that the implementation of monetary and fiscal policy rules cannot be a solution to the problem of effectiveness of the policy mix that if certain conditions are met. The main one is that the effects induced by a change in the nature of one of these two policies do not affect the credibility of supranational monetary policy or the commitment of national fiscal policies. This suggests that fiscal policy is sustainable in France and Spain but is not sustainable in Belgium, Ireland, Italy and Greece.

6 Conclusion

The study based on six countries of the euro zone is extremely useful because it allows us to see how these policies are appropriate to the objectives assigned to them but also to examine the possibilities of choice and short and long-term analysis of these policies. Since the conduct of fiscal policy is decentralized in the euro area, the government becomes responsible for the economic activity of its own country. Macroeconomic modeling of the influence of monetary and fiscal policy is an approach that in the context of this analysis to study the short, medium and long term which of the two policies is more likely to play a decisive role on the economic activity. To achieve this, we use an analysis of cycles, causal relationships and cointegrated VAR models. An abundant literature on these models tried to explain the credibility of macroeconomic policies because they are deemed appropriate for economic policy studies and macroeconomic variables in general. These analytical methods used to identify the effects of short and long-term imbalances of the different macroeconomic variables. These dynamic models incorporate both short-term and long-term evolution of the variables. The study of this model allow us to identify the conditions of consistency and transmission of monetary and fiscal policies. Under this model, we seek to assess the interaction between the various authorities responsible for the management of monetary and fiscal policies. Our results in this paper suggest the Keynesian effects of macroeconomic policies in the Eurozone and concludes that there is a sort of complementarity between monetary and fiscal policies in some euro area countries insofar as a restrictive monetary policy (higher interest rates, interest) seems always accompanied by a restrictive fiscal policy (higher taxes or lower public spending) and vice versa. This type of behavior appears rather specific to an expansionist period. With a VAR model, we distinguish two regimes: one regime of expansion of the economy and the other of recession, and we introduce a probability of transition from one regime to another that depends on the current regime, supposed exogenous And constant. Moreover, in times of recession, macroeconomic policies are not complementary, but they seem to substitute each other, with a rather expansive response of governments to monetary restriction. These results do not appear to be universally accepted in the literature, Tabellini, (2007) arguing the presence of more expansionary fiscal policy measures in periods of growth, coupled with tight monetary policy and a lack respectively government action in recession when monetary policy seems to become more lax to encourage the resumption of the activity. Some of the studies were carried out in specific countries in the euro area in particular that of Sabate et al. (2006) applied in Spain over the period 1874 to 1935, attest to the dominance vis-à-vis monetary policy fiscal policy.

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Table 3: Results of the Ducky and Fuller increase (ADF) stationarity test of the French series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
d_t	$-2.401535(1)$ $t = 0.48$ $(t_t = 2.49)$ $c = 4.60$ $(t_c = 2.59)$	$0.163927(1)$ $c = 1.16$ $(t_c = 0.96)$	$2.205400(1)$	Non-stationary I(1)
$d(d_t, 1)$	$-3.626586(0)^{**}$ $t = 0.029$ $(t_t = 0.65)$ $c = 0.86$ $(t_c = 0.94)$	$-3.602615(0)^{**}$ $c = 1.33$ $(t_c = 2.436370)$	$-2.471078(0)^{**}$	Non-stationary I(1)
y_t	$-2.836072(1)$ $t = -0.008$ $(t_t = -0.39)$ $c = 0.041$ $(t_c = 0.09)$	$-2.884802(1)$ $c = -0.10$ $(t_c = -0.53)$	$-1.476504(8)$	Non-stationary I(1)
$d(y_t, 1)$	$-4.916761(1)^{*}$ $t = -0.008$ $(t_t = -0.34)$ $c = 0.04$ $(t_c = 0.10)$	$-4.981592(1)^{*}$ $c = -0.10$ $(t_c = -0.47)$	$-5.024148(1)^{*}$	Non-stationary I(1)
π_t	$-1.577675(8)$ $t = 0.007$ $(t_t = 0.27)$ $c = 0.65$ $(t_c = 0.68$	$-1.645639(8)$ $c = 0.85$ $(t_c = 1.44)$	$-0.939775(8)$	Non-stationary I(1)

*Annexe J

Table 4: Results of the Ducky and Fuller increase (ADF) stationarity test of the French series

Variables	Trend and constant	NoTrend	No Trend and constant	Conclusion
$d(pi_t, 1)$	$-3.622535(1)^{**}$ $t = 0.02$ $(t_t = 1.28)$ $c = -0.73$ $(t_c = -1.47)$	$-3.465251(1)^{**}$ $c = -0.13$ $(t_c = -0.73)$	$-3.501857(1)^{*}$	Non-stationary I(1)
bp_t	$-3.204061(1)$ $t = -0.029$ $(t_t = -1.412095$ $c = -1.039$ $(t_c = -2.114)$	$-2.829655(1)$ $c = -1.27$ $(t_c = -2.70)$	$-0.533316(0)$	Non-stationary I(1)
$d(bp_t, 1)$	$-4.826311(0)^{*}$ $t = 0.0002$ $(t_t = 0.013)$ $c = -0.043$ $(t_c = -0.10)$	$-4.942456(0)^{*}$ $c = -0.038$ $(t_c = -0.19)$	$-5.022584(0)^{*}$	Non-stationary I(1)
r_t	$-2.630337(0)$ $t = -0.14$ $t_t = -2.41$ $c = 4.43$ $(t_c = 2.35)$	$-0.980416(0)$ $c = -0.005$ $(t_c = -0.01)$	$-1.791417(0)$	Non Stationnaire I(1)
$d(r_t, 1)$	$-6.137686(0)^{*}$ $t = -0.002$ $(t_t = 0.96)$ $c = -0.85$ $(t_c = -1.79)$	$-6.147086(0)^{*}$ $c = -0.44$ $(t_c = -1.98)$	$-5.585004(0)^{*}$	Non-stationary I(1)

Table 5: Results of the Phillips and Perron (PP) test of stationarity of the French series

Variables	Trend and constant	No Trend	No Trend and constant	Conclusion
	$-1.489287(1)$	$0.926663(0)$	$5.122131(0)$	
	$t = 0.26$			
d_t	$(t_t = 1.31)$			Non Stationnaire
	$c = 3.17$	$c = 1.17$		I(1)
	$(t_c = 1.64)$	$(t_c = 0.97)$		
	$-3.426841(5)^{***}$	$-3.522231(4)^{**}$	$-2.439628(2)^{**}$	
	$t = 0.029$			
$d(d_t, 1)$	$(t_t = 0.65)$			Non-stationary
	$c = 0.86$	$c = 1.33$		I(1)
	$(t_c = 0.94)$	$(t_c = 2.43)$		
	$-2.523557(1)$	$-2.547718(1)$	$-2.520244(1)$	
	$t = -0.004$			
y_t	$(t_t = -0.20)$			Non-stationary
	$c = -0.08$	$c = -0.16$		I(1)
	$(t_c = -0.20)$	$(t_c = -0.79)$		
	$-5.020927(8)^{*}$	$-4.938075(7)^{*}$	$-5.036157(7)^{*}$	
	$t = -0.009$			
$d(y_t, 1)$	$(t_t = -0.40)$			Non-stationary
	$c = 0.10$	$c = -0.06$		I(1)
	$(t_c = 0.21)$	$(t_c = -0.29)$		
	$-3.037644(3)$	$-3.333532(3)$	$-5.677998(3)$	
	$t = -0.002$			
π_t	$(t_t = -0.11)$			Non-stationary
	$c = 0.38$	$c = 0.32$		I(1)
	$(t_c = 0.63$	$(t_c = 1.39)$		

Table 6: Results of the Phillips and Perron (PP) test of stationarity of the French series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-6.335738(3)^{*}$	$-5.355415(3)^{*}$	$-4.976806(3)^{*}$	
	$t = 0.059$			
$d(pi_t, 1)$	$(t_t = 2.74)$			Non-stationary
	$c = -1.49$	$c = -0.35$		I(1)
	$(t_c = -3.24)$	$(t_c = -1.61)$		
	$-2.760054(8)$	$-2.815982(8)$	$-0.376570(9)$	
	$t = -0.012$			
bp_t	$(t_t = -0.61$			Non-stationary
	$c = -1.130$	$c = -1.23$		I(1)
	$(t_c = -2.38)$	$(t_c = -2.81)$		
	$-5.804868(13)^{*}$	$-6.096941(13)^{*}$	$-6.148488(13)^{*}$	
	$t = 0.0002$			
$d(bp_t, 1)$	$(t_t = 0.013)$			Non-stationary
	$c = -0.043$	$c = -0.038$		I(1)
	$(t_c = -0.10)$	$(t_c = -0.19)$		
	$-2.870600(4)$	$-0.986410(1)$	$-1.786355(1)$	
	$t = -0.14$			
r_t	$t_t = -2.41$			Non-stationary
	$c = 4.43$	$c = -0.005$		I(1)
	$(t_c = 2.35)$	$(t_c = -0.01)$		
	$-6.191862(5)^{*}$	$-6.186770(6)^{*}$	$-5.578731(7)^{*}$	
	$t = 0.02$			
$d(r_t, 1)$	$(t_t = 0.96)$			Non Stationnaire
	$c = -0.85$	$c = -0.44$		I(1)
	$(t_c = -1.79)$	$(t_c = -1.98)$		

Table 7: Results of the Ducky and Fuller increase (ADF) stationarity test of the Belguim series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-2.362254(1)$	$-1.557770(1)$	$-0.466953(1)$	
	$t=-0.13$			
d_t	$(t_t=-1.75)$			Non-stationary
	$c=13.28$	$c=5.48$		I(1)
	$(t_c=2.33)$	$(t_c=1.50)$		
	$-2.749834(0)^{*}$	$-3.017548(0)^{**}$	$-3.136067(0)^{*}$	
	$t=-0.017$			
$d(d_t,1)$	$(t_t=-0.26)$			Non-stationary
	$c=0.19$	$c=-0.13$		I(1)
	$(t_c=0.14)$	$(t_c=-0.24)$		
	$-3.030919(8)$	$-2.625691(8)$	$-1.158652(10)$	
	$t=-0.05$			
y_t	$(t_t=-1.57)$			Non-stationary
	$c=1.68$	$c=0.51$		I(1)
	$(t_c=2.10)$	$(t_c=1.63)$		
	$-6.072262(0)^{*}$	$-6.177461(0)^{*}$	$-6.254048(0)^{*}$	
	$t=-0.004$			
$d(y_t,1)$	$(t_t=-0.19)$			Non-stationary
	$c=0.004$	$c=-0.07$		I(1)
	$(t_c=0.009$	$(t_c=-0.35)$		
	$-2.602225(0)$	$-2.392314(0)$	$-1.630969(6)$	
	$t=-0.03$			
π_t	$(t_t=-1.11)$			Non-stationary
	$c=1.40$	$c=0.60$		I(1)
	$(t_c=1.71$	$(t_c=1.53)$		

Table 8: Results of the Ducky and Fuller increase (ADF) stationarity test of the Belguim series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-3.822889(5)^{**}$	$-3.964549(5)^{*}$	$-3.971307(5)^{*}$	
	$t = 0.05$			
$d(pi_t, 1)$	$(t_t = 1.29)$			Non-stationary
	$c = -1.38$	$c = -0.20$		I(1)
	$(t_c = -1.46)$	$(t_c = -0.80)$		
	$-1.851727(0)$	$-1.426965(0)$	$-1.349224(0)$	
	$t = 0.06$			
bp_t	$(t_t = 1.23$			Non-stationary
	$c = -2.162$	$c = -0.37$		I(1)
	$(t_c = -1.40)$	$(t_c = -0.73)$		
	$-10.03280(0)^{*}$	$-9.478032(0)^{*}$	$-9.144243(0)^{*}$	
	$t = -0.05$			
$d(bp_t, 1)$	$(t_t = -2.008)$			Non-stationary
	$c = 1.39$	$c = 0.42$		I(1)
	$(t_c = 2.56)$	$(t_c = 1.60)$		
	$-3.078754(3)$	$-1.136408(3)$	$-1.717078(3)$	
	$t = -0.18$			
r_t	$t_t = -2.81$			Non-stationary
	$c = 6.27$	$c = 0.069$		I(1)
	$(t_c = 2.80)$	$(t_c = 0.16)$		
	$-3.765617(3)^{**}$	$-3.655715(3)^{**}$	$-4.812906(0)^{*}$	
	$t = 0.023$			
$d(r_t, 1)$	$(t_t = 0.93)$			Non-stationary
	$c = -0.97$	$c = -0.47$		I(1)
	$(t_c = -1.66)$	$(t_c = -1.91)$		

Table 9: Results of the Phillips and Perron (PP) stationarity test of the Belguim series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-3.381328(4)$	$-2.125932(4)$	$0.167776(4)$	
	$t=-0.34$			
d_t	$(t_t=-5.08)$			Non-stationary
	$c=25.89$	$c=11.47$		I(1)
	$(t_c=5.27)$	$(t_c=2.14)$		
	$-2.74(0)^{***}$	$-2.998973(1)^{**}$	$-3.134816(2)^{*}$	
	$t=-0.01$			
$d(d_t,1)$	$(t_t=-0.26)$			Non-stationary
	$c=0.19$	$c=-0.13$		I(1)
	$(t_c=0.14)$	$(t_c=-0.24)$		
	$-3.184548(8)$	$-3.696542(1)$	$-3.693538(0)$	
	$t=-0.003$			
y_t	$(t_t=-0.19)$			Non-stationary
	$c=0.053$	$c=-0.010$		I(1)
	$(t_c=0.13)$	$(t_c=-0.057)$		
	$-6.072262(0)^{*}$	$-6.177461(0)^{*}$	$-6.254048(0)^{*}$	
	$t=-0.004$			
$d(y_t,1)$	$(t_t=-0.19)$			Non-stationary
	$c=0.004$	$c=-0.079$		I(1)
	$(t_c=0.009)$	$(t_c=-0.35)$		
	$-2.528993(1)$	$-2.289940(1)$	$-1.913223(2)$	
	$t=-0.031$			
π_t	$(t_t=-1.11)$			Non-stationary
	$c=1.40$	$c=0.60$		I(1)
	$(t_c=1.71$	$(t_c=1.53)$		

Table 10: Results of the Phillips and Perron (PP) stationarity test of the Belguim series

Variables	TTrend and constant	No trend	No trend and constant	Conclusion
	$-7.097437(2)^{*}$	$-7.089396(1)^{*}$	$-7.043523(1)^{*}$	
	$t = 0.02$			
$d(pi_t, 1)$	$(t_t = 0.82)$			Non-stationary
	$c = -0.61$	$c = -0.23$		I(1)
	$(t_c = -1.16)$	$(t_c = -0.93)$		
	$-1.648021(2)$	$-1.316273(3)$	$-1.327444(3)$	
	$t = 0.06$			
bp_t	$(t_t = 1.23$			Non-stationary
	$c = -2.16$	$c = -0.37$		I(1)
	$(t_c = -1.40)$	$(t_c = -0.73)$		
	$-10.03280(1)^{*}$	$-9.128285(2)^{*}$	$-8.738098(2)^{*}$	
	$t = -0.05$			
$d(bp_t, 1)$	$(t_t = -2.008)$			Non-stationary
	$c = 1.39$	$c = 0.42$		I(1)
	$(t_c = 2.56)$	$(t_c = 1.60)$		
	$-2.586392(2)$	$-1.637446(1)$	$-2.526422(1)$	
	$t = -0.10$			
r_t	$t_t = -1.94$			Non-stationary
	$c = 3.18$	$c = 0.09$		I(1)
	$(t_c = 1.95)$	$(t_c = 0.25)$		
	$-5.396905(1)^{*}$	$-5.290859(1)^{*}$	$-4.812906(1)^{*}$	
	$t = 0.026$			
$d(r_t, 1)$	$(t_t = 1.09)$			Non-stationary
	$c = -0.91$	$c = -0.43$		I(1)
	$(t_c = -1.82)$	$(t_c = -1.79)$		

Table 11: Results of the Ducky and Fuller increase (ADF) stationarity test of the Spain series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-3.508697(3)$	$-1.508984(3)$	$0.552038(1)$	
	$t = 0.31$			
d_t	$(t_t = 3.26)$			Non-stationary
	$c = 6.80$	$c = 5.11$		I(1)
	$(t_c = 2.54)$	$(t_c = 1.66)$		
	$-2.629008(4)^{***}$	$-2.739908(4)^{***}$	$-2.448069(4)^{**}$	
	$t = 0.056$			
$d(d_t, 1)$	$(t_t = 0.58)$			Non-stationary
	$c = -0.19$	$c = 0.92$		I(1)
	$(t_c = -0.09)$	$(t_c = 1.19)$		
	$-2.755315(1)$	$-2.008910(8)$	$-1.433916(0)$	
	$t = -0.001$			
y_t	$(t_t = -0.06)$			Non-stationary
	$c = -0.12$	$c = -0.12$		I(1)
	$(t_c = -0.23)$	$(t_c = -0.41)$		
	$-3.804390(5)^{**}$	$-3.862185(0)^{*}$	$-3.935136(0)^{*}$	
	$t = -0.073$			
$d(y_t, 1)$	$(t_t = -1.88)$			Non-stationary
	$c = 1.59$	$c = 0.031$		I(1)
	$(t_c = 1.88$	$(t_c = 0.12)$		
	$-2.613144(0)$	$-1.758880(8)$	$-0.767377(12)$	
	$t = -0.05$			
π_t	$(t_t = -1.37)$			Non-stationary
	$c = 2.065$	$c = 0.57$		I(1)
	$(t_c = 1.63$	$(t_c = 0.81)$		

Table 12: Results of the Ducky and Fuller increase (ADF) stationarity test of the Spain series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-7.772788(0)^{*}$	$-7.312888(0)^{*}$	$-6.7518300(0)^{*}$	
	$t = 0.05$			
$d(pi_t, 1)$	$(t_t = 1.29)$			Non-stationary
	$c = 0.04$	$c = -0.50$		I(1)
	$(t_c = 1.78)$	$(t_c = -1.96)$		
	$-2.538006(1)$	$-2.574320(1)$	$-1.396868(1)$	
	$t = -0.006$			
bp_t	$(t_t = -0.17$			Non-stationary
	$c = -1.02$	$c = -1.13$		I(1)
	$(t_c = -1.24)$	$(t_c = -2.12)$		
	$-4.280298(0)^{*}$	$-4.352223(0)^{*}$	$-4.415325(0)^{*}$	
	$t = 0.001$			
$d(bp_t, 1)$	$(t_t = 0.04)$			Non-stationary
	$c = -0.10$	$c = -0.075$		I(1)
	$(t_c = -0.12)$	$(t_c = -0.20)$		
	$-3.125484(0)$	$-1.102181(0)$	$-1.781277(0)$	
	$t = -0.27$			
r_t	$t_t = -2.88$			Non-stationary
	$c = 8.22$	$c = 0.05$		I(1)
	$(t_c = 2.84)$	$(t_c = 0.08)$		
	$-5.344170(1)^{*}$	$-5.423243(1)^{*}$	$-7.005722(0)^{*}$	
	$t = 0.01$			
$d(r_t, 1)$	$(t_t = 0.31)$			Non-stationary
	$c = -1.01$	$c = -0.78$		I(1)
	$(t_c = -1.21)$	$(t_c = -2.02)$		

Table 13: Results of the Phillips and Perron (PP) stationarity test of the Spain series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-1.609090(4)$	$-0.901903(4)$	$1.222504(4)$	
	$t = 0.10$			
d_t	$(t_t = 0.82)$			Non-stationary
	$c = 2.05$	$c = 1.80$		I(1)
	$(t_c = 0.70)$	$(t_c = 0.62)$		
	$-6.609791(2)^{*}$	$-6.643293(2)^{*}$	$-6.765509(2)^{*}$	
	$t = 0.04$			
$d(d_t, 1)$	$(t_t = 0.51)$			Non-stationary
	$c = -0.73$	$c = 0.030993$		I(1)
	$(t_c = -0.43)$	$(t_c = 0.041)$		
	$-1.768879(1)$	$-1.986684(2)$	$-1.853914(2)$	
	$t = -0.008$			
y_t	$(t_t = -0.31)$			Non-stationary
	$c = -0.02$	$c = -0.18$		I(1)
	$(t_c = -0.04)$	$(t_c = -0.67)$		
	$-3.870175(3)^{**}$	$-3.923997(1)^{*}$	$-3.993998(1)^{*}$	
	$t = -0.02$			
$d(y_t, 1)$	$(t_t = -0.87)$			Non-stationary
	$c = 0.44$	$c = 0.031$		I(1)
	$(t_c = 0.83)$	$(t_c = 0.12)$		
	$-2.613144(0)$	$-2.645075(0)$	$-3.960685(3)$	
	$t = -0.05$			
π_t	$(t_t = -1.37)$			Non-stationary
	$c = 2.06$	$c = 0.40$		I(1)
	$(t_c = 1.63$	$(t_c = 1.06)$		

Table 14: Results of the Phillips and Perron (PP) stationarity test of the Spain series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-7.772788(0)^{*}$	$-7.312888(0)^{*}$	$-6.751830(0)^{*}$	
	$t = 0.04$			
$d(pi_t, 1)$	$(t_t = 1.78)$			Non-stationary
	$c = -1.37$	$c = -0.50$		I(1)
	$(t_c = -2.51)$	$(t_c = -1.96)$		
	$-2.174510(3)$	$-2.191719(3)$	$-1.168780(2)$	
	$t = -0.005$			
bp_t	$(t_t = -0.16$			Non-stationary
	$c = -0.78$	$c = -0.88$		I(1)
	$(t_c = -0.97)$	$(t_c = -1.64)$		
	$-4.280298(1)^{*}$	$-4.352223(1)^{*}$	$-4.415325(1)^{*}$	
	$t = 0.001$			
$d(bp_t, 1)$	$(t_t = 0.04)$			Non-stationary
	$c = -0.10$	$c = -0.07$		I(1)
	$(t_c = -0.12)$	$(t_c = -0.20)$		
	$-3.125484(1)$	$-0.901700(2)$	$-1.781277(0)$	
	$t = -0.27$			
r_t	$t_t = -2.88$			Non-stationary
	$c = 8.22$	$c = 0.05$		I(1)
	$(t_c = 2.84)$	$(t_c = 0.08)$		
	$-7.298295(1)^{*}$	$-7.412529(1)^{*}$	$-7.005722(1)^{*}$	
	$t = 0.007$			
$d(r_t, 1)$	$(t_t = 0.19)$			Non-stationary
	$c = -0.75$	$c = -0.62$		I(1)
	$(t_c = -0.97)$	$(t_c = -1.70)$		

Table 15: Results of the Ducky and Fuller increase (ADF) stationarity test of the Ireland series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-2.238548(1)$	$-2.268425(1)$	$-0.611186(1)$	
	$t=-0.06$			
d_t	$(t_t=-0.51)$			Non-stationary
	$c=8.09$	$c=6.24$		I(1)
	$(t_c=1.75)$	$(t_c=2.18)$		
	$-6.259048(0)^{*}$	$-3.147767(3)^{**}$	$-6.259048(6)^{***}$	
	$t=0.002$			
$d(d_t,1)$	$(t_t=0.02)$			Non-stationary
	$c=-0.26$	$c=0.11$		I(1)
	$(t_c=-0.09)$	$(t_c=0.08)$		
	$-1.626127(6)$	$-1.650266(6)$	$-1.694560(6)$	
	$t=0.024$			
y_t	$(t_t=0.48)$			Non-stationary
	$c=-0.46$	$c=0.02$		I(1)
	$(t_c=-0.43)$	$(t_c=0.07)$		
	$-4.441536(5)^{*}$	$-4.513585(5)^{*}$	$-4.628013(5)^{*}$	
	$t=-0.01$			
$d(y_t,1)$	$(t_t=-0.44)$			Non-stationary
	$c=0.35$	$c=-0.043$		I(1)
	$(t_c=0.36$	$(t_c=-0.12)$		
	$-1.895295(8)$	$-1.431911(8)$	$-0.875545(8)$	
	$t=-0.07$			
π_t	$(t_t=-1.25)$			Non-stationary
	$c=3.52$	$c=1.09$		I(1)
	$(t_c=1.64$	$(t_c=1.18)$		

Table 16: Results of the Ducky and Fuller increase (ADF) stationarity test of the Ireland series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-4.092005(1)^{**}$	$-3.591467(1)^{**}$	$-3.436963(1)^{*}$	
	$t = 0.06$			
$d(pi_t, 1)$	$(t_t = 1.72)$			Non-stationary
	$c = -1.76$	$c = -0.37$		I(1)
	$(t_c = -2.01)$	$(t_c = -1.04)$		
	$1.803434(6)$	$-2.215896(0)$	$-1.917757(0)$	
	$t = -1.10$			
bp_t	$(t_t = -3.01$			Non-stationary
	$c = 24.58$	$c = -1.08$		I(1)
	$(t_c = 2.80)$	$(t_c = -1.11)$		
	$-4.648280(3)^{*}$	$-5.593849(0)^{*}$	$-5.675853(0)^{*}$	
	$t = -0.33$			
$d(bp_t, 1)$	$(t_t = -2.42)$			Non-stationary
	$c = 6.00$	$c = 0.19$		I(1)
	$(t_c = 2.23)$	$(t_c = 0.21)$		
	$-2.863362(0)$	$-1.658814(4)$	$-1.400175(10)$	
	$t = -0.19$			
r_t	$t_t = -2.52$			Non-stationary
	$c = 5.86$	$c = -0.34$		I(1)
	$(t_c = 2.49)$	$(t_c = -0.70)$		
	$-3.604266(8)^{**}$	$-4.518671(3)^{*}$	$-2.125812(4)^{**}$	
	$t = 0.08$			
$d(r_t, 1)$	$(t_t = 1.87)$			Non-stationary
	$c = -3.99$	$c = -0.94$		I(1)
	$(t_c = -2.71)$	$(t_c = -2.75)$		

Table 17: Results of the Phillips and Perron (PP) stationarity test of the Ireland series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-0.959954(4)$	$-1.218752(4)$	$0.061052(4)$	
	$t = 0.21$			
d_t	$(t_t = 1.22)$			Non-stationary
	$c = -2.77$	$c = 2.50$		I(1)
	$(t_c = -0.45)$	$(t_c = 0.58)$		
	$-3.785361(3)^{**}$	$-3.818263(3)^{*}$	$-3.777878(3)^{*}$	
	$t = 0.06$			
$d(d_t, 1)$	$(t_t = 0.48)$			Non-stationary
	$c = -0.81$	$c = 0.26$		I(1)
	$(t_c = -0.32)$	$(t_c = 0.22)$		
	$-2.268734(8)$	$-2.343899(8)$	$-2.409661(8)$	
	$t = 0.001$			
y_t	$(t_t = 0.03)$			Non-stationary
	$c = -0.11$	$c = -0.09$		I(1)
	$(t_c = -0.15)$	$(t_c = -0.27)$		
	$-4.999518(18)^{*}$	$-5.259873(19)^{*}$	$-5.362654(18)^{*}$	
	$t = 0.005$			
$d(y_t, 1)$	$(t_t = 0.13)$			Non-stationary
	$c = -0.16$	$c = -0.07$		I(1)
	$(t_c = -0.20)$	$(t_c = -0.18)$		
	$-2.521352(1)$	$-3.208339(0)$	$-3.547002(0)$	
	$t = -0.01$			
π_t	$(t_t = -0.26)$			Non-stationary
	$c = 0.58$	$c = 0.33$		I(1)
	$(t_c = 0.56$	$(t_c = 0.84)$		

Table 18: Results of the Phillips and Perron (PP) stationarity test of the Ireland series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-5.410899(2)^{*}$	$-4.812077(2)^{*}$	$-4.548554(2)^{*}$	
	$t = 0.07$			
$d(pi_t, 1)$	$(t_t = 2.09)$			Non-stationary
	$c = -1.86$	$c = -0.48$		I(1)
	$(t_c = -2.52)$	$(t_c = -1.38)$		
	$-2.231766(1)$	$-2.288740(1)$	$-1.956442(2)$	
	$t = -0.01$			
bp_t	$(t_t = -0.20$			Non-stationary
	$c = -0.78$	$c = -1.08$		I(1)
	$(t_c = -0.44)$	$(t_c = -1.11)$		
	$-5.824389(6)^{*}$	$-5.706141(5)^{*}$	$-5.810155(5)^{*}$	
	$t = -0.03$			
$d(bp_t, 1)$	$(t_t = -0.41)$			Non-stationary
	$c = 0.89$	$c = 0.19$		I(1)
	$(t_c = 0.46)$	$(t_c = 0.21)$		
	$-2.815029(2)$	$-1.471579(9)$	$-2.769947(3)$	
	$t = -0.19$			
r_t	$t_t = -2.5$			Non-stationary
	$c = 5.86$	$c = 0.02$		I(1)
	$(t_c = 2.49)$	$(t_c = 0.05)$		
	$-6.156107(1)^{*}$	$-6.156476(1)^{*}$	$-5.623074(1)^{*}$	
	$t = 0.02$			
$d(r_t, 1)$	$(t_t = 0.76)$			Non-stationary
	$c = -0.94$	$c = -0.54$		I(1)
	$(t_c = -1.57)$	$(t_c = -1.91)$		

Table 19: Results of the Ducky and Fuller increase (ADF) stationarity test of the Italy series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-2.384859(1)$	$-1.981633(1)$	$0.978221(1)$	
	$t = 0.12$			
d_t	$(t_t = 1.46)$			Non-stationary
	$c = 10.07$	$c = 6.85$		I(1)
	$(t_c = 2.69)$	$(t_c = 2.22)$		
	$-5.913911(0)^{*}$	$-2.829941(0)^{***}$	$-2.434224(0)^{**}$	
	$t = 0.006$			
$d(d_t, 1)$	$(t_t = 0.09)$			Non-stationary
	$c = -0.22$	$c = 0.86$		I(1)
	$(t_c = -0.15)$	$(t_c = 1.38)$		
	$-1.568256(5)$	$-1.830755(1)$	$-1.294284(5)$	
	$t = -0.06$			
y_t	$(t_t = -1.72)$			Non-stationary
	$c = 1.40$	$c = -0.02$		I(1)
	$(t_c = 1.62)$	$(t_c = -0.11)$		
	$-4.678287(1)^{*}$	$-4.671443(1)^{*}$	$-4.722020(1)^{*}$	
	$t = -0.02$			
$d(y_t, 1)$	$(t_t = -0.75)$			Non-stationary
	$c = 0.27$	$c = -0.13$		I(1)
	$(t_c = 0.45$	$(t_c = -0.50)$		
	$-1.276289(8)$	$-2.100397(8)$	$-0.516120(12)$	
	$t = -0.0005$			
π_t	$(t_t = -0.008)$			Non-stationary
	$c = 0.74$	$c = 0.72$		I(1)
	$(t_c = 0.29$	$(t_c = 1.27)$		

Table 20: Results of the Ducky and Fuller increase (ADF) stationarity test of the Italy series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-4.700026(0)^{*}$	$-4.096153(0)^{*}$	$-3.790248(0)^{*}$	
	$t = 0.05$			
$d(pi_t, 1)$	$(t_t = 1.96)$			Non-stationary
	$c = -1.39$	$c = -0.35$		I(1)
	$(t_c = -2.40)$	$(t_c = -1.42)$		
	$-2.692803(0)$	$-0.744252(0)$	$-0.869270(0)$	
	$t = 0.10$			
bp_t	$(t_t = 2.72$			Non Stationnaire
	$c = -3.52$	$c = -0.18$		I(1)
	$(t_c = -2.69)$	$(t_c = -0.36)$		
	$-6.332636(0)^{*}$	$-6.503987(0)^{*}$	$-6.382061(0)^{*}$	
	$t = 0.0001$			
$d(bp_t, 1)$	$(t_t = 0.004)$			Non-stationary
	$c = 0.25$	$c = 0.26$		I(1)
	$(t_c = 0.54)$	$(t_c = 1.18)$		
	$-2.346651(0)$	$-0.876866(0)$	$-2.097755(0)$	
	$t = -0.17$			
r_t	$t_t = -2.16$			Non-stationary
	$c = 5.27$	$c = -0.18$		I(1)
	$(t_c = 2.068737)$	$(t_c = -0.42)$		
	$-5.509465(1)^{*}$	$-5.367450(1)^{*}$	$-4.856566(0)^{*}$	
	$t = 0.03$			
$d(r_t, 1)$	$(t_t = 1.20)$			Non-stationary
	$c = -1.34$	$c = -0.73$		I(1)
	$(t_c = -2.31)$	$(t_c = -2.62)$		

Table 21: Results of the Phillips and Perron (PP) stationarity test of the Italy series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-1.805297(3)$	$-1.719223(3)$	$1.700120(4)$	
	$t = 0.06$			
d_t	$(t_t = 0.62)$			Non-stationary
	$c = 10.06$	$c = 8.36$		I(1)
	$(t_c = 2.33)$	$(t_c = 2.54)$		
	$-4.843585(5)^{*}$	$-3.877496(5)^{*}$	$-2.315775(5)^{**}$	
	$t = -0.038$			
$d(d_t, 1)$	$(t_t = -0.67)$			Non-stationary
	$c = 1.60$	$c = 0.86$		I(1)
	$(t_c = 1.26)$	$(t_c = 1.38)$		
	$-5.282171(4)$	$-5.192164(4)$	$-5.373837(4)$	
	$t = -0.03$			
y_t	$(t_t = -1.13)$			Non-stationary
	$c = 0.55$	$c = -0.11$		I(1)
	$(t_c = 0.83)$	$(t_c = -0.40)$		
	$-8.403880(1)^{*}$	$-8.662754(1)^{*}$	$-8.884477(1)^{*}$	
	$t = -0.02$			
$d(y_t, 1)$	$(t_t = -0.80)$			Non-stationary
	$c = 0.27$	$c = -0.11$		I(1)
	$(t_c = 0.50)$	$(t_c = -0.45)$		
	$-3.732406(1)$	$-5.188642(1)$	$-5.919607(1)$	
	$t = -0.01$			
π_t	$(t_t = -0.65)$			Non-stationary
	$c = 0.87$	$c = 0.38$		I(1)
	$(t_c = 1.10$	$(t_c = 1.48)$		

Table 22: Results of the Phillips and Perron (PP) stationarity test of the Italy series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-4.700026(1)^*$	$-4.010713(2)^*$	$-3.661771(2)^*$	
	$t = 0.05$			
$d(pi_t, 1)$	$(t_t = 1.96)$			Non-stationary
	$c = -1.39$	$c = -0.35$		I(1)
	$(t_c = -2.40)$	$(t_c = -1.42)$		
	$-2.742267(2)$	$-0.744252(1)$	$-0.869270(1)$	
	$t = 0.10$			
bp_t	$(t_t = 2.72$			Non Stationnaire
	$c = -3.52$	$c = -0.18$		I(1)
	$(t_c = -2.69)$	$(t_c = -0.36)$		
	$-6.303423(1)^*$	$-6.469641(1)^*$	$-6.329224(2)^*$	
	$t = 0.0001$			
$d(bp_t, 1)$	$(t_t = 0.004)$			Non-stationary
	$c = 0.25$	$c = 0.26$		I(1)
	$(t_c = 0.54)$	$(t_c = 1.18)$		
	$-2.544340(1)$	$-0.798652(4)$	$-2.179322(3)$	
	$t = -0.17$			
r_t	$t_t = -2.16$			Non-stationary
	$c = 5.27$	$c = -0.18$		I(1)
	$(t_c = 2.06)$	$(t_c = -0.42)$		
	$-5.994299(5)^*$	$-5.560042(3)^*$	$-4.838204(2)^*$	
	$t = 0.02$			
$d(r_t, 1)$	$(t_t = 0.85)$			Non-stationary
	$c = -0.94$	$c = -0.53$		I(1)
	$(t_c = -1.73)$	$(t_c = -2.04)$		

Table 23: Results of the Ducky and Fuller increase (ADF) stationarity test of the Greece series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-1.486708(0)$	$0.003237(0)$	2.981731	
	$t = 0.65$			
d_t	$(t_t = 1.57)$			Non-stationary
	$c = 7.017$	$c = 4.44$		I(1)
	$(t_c = 1.88)$	$(t_c = 1.30)$		
	$-5.951339(0)^{*}$	$-5.995404(0)^{*}$	$-2.350273(1)^{**}$	
	$t = 0.08$			
$d(d_t, 1)$	$(t_t = 0.56)$			Non-stationary
	$c = 3.39$	$c = 4.85$		I(1)
	$(t_c = 1.11)$	$(t_c = 2.98)$		
	$-1.247747(4)$	$-0.991447(4)$	$-1.219812(4)$	
	$t = -0.06$			
y_t	$(t_t = -1.54)$			Non-stationary
	$c = 1.06$	$c = -0.14$		I(1)
	$(t_c = 1.25)$	$(t_c = -0.45)$		
	$-3.464917(5)^{***}$	$-3.916231(3)^{*}$	$-3.861826(3)^{*}$	
	$t = -0.08$			
$d(y_t, 1)$	$(t_t = -1.69)$			Non-stationary
	$c = 1.34$	$c = -0.25$		I(1)
	$(t_c = 1.32$	$(t_c = -0.81)$		
	$-2.389759(0)$	$-1.391679(0)$	$-1.421364(8)$	
	$t = -0.20$			
π_t	$(t_t = -1.99)$			Non-stationary
	$c = 6.10$	$c = -0.02$		I(1)
	$(t_c = 1.94$	$(t_c = -0.03)$		

Table 24: Results of the Ducky and Fuller increase (ADF) stationarity test of the Greece series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-5.702704(0)^*$	$-5.723139(0)^*$	$-5.294255(0)^*$	
	$t = 0.02$			
$d(pi_t, 1)$	$(t_t = 0.64)$			Non-stationary
	$c = -1.30$	$c = -0.77$		I(1)
	$(t_c = -1.38)$	$(t_c = -1.72)$		
	$-2.503663(0)$	$-2.327539(0)$	$-0.773301(0)$	
	$t = 0.06$			
bp_t	$(t_t = 1.58$			Non Stationnaire
	$c = -3.38$	$c = -2.20$		I(1)
	$(t_c = -2.73)$	$(t_c = -2.18)$		
	$-5.944486(0)^*$	$-5.984786(0)^*$	$-6.078621(0)^*$	
	$t = 0.029$			
$d(bp_t, 1)$	$(t_t = 0.68)$			Non-stationary
	$c = -0.39$	$c = 0.13$		I(1)
	$(t_c = -0.46)$	$(t_c = 0.33)$		
	$-2.073277(1)$	$-0.569707(1)$	$-1.203245(0)$	
	$t = -2.07$			
r_t	$t_t = -2.16$			Non-stationary
	$c = 4.83$	$c = -0.09$		I(1)
	$(t_c = 1.94)$	$(t_c = -0.12)$		
	$-5.021835(0^*)$	$-5.049157(0)^*$	$-4.926873(0)^*$	
	$t = -0.02$			
$d(r_t, 1)$	$(t_t = -0.56)$			Non-stationary
	$c = -0.006$	$c = -0.45$		I(1)
	$(t_c = -0.007)$	$(t_c = -1.06)$		

Table 25: Results of the Phillips and Perron (PP) stationarity test of the Greece series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-1.707565(3)$	$0.012265(2)$	$2.999906(2)$	
	$t = 0.65$			
d_t	$(t_t = 1.57)$			Non-stationary
	$c = 7.01$	$c = 4.44$		I(1)
	$(t_c = 1.88)$	$(t_c = 1.30)$		
	$-5.951937(2)^{*}$	$-5.992461(2)^{*}$	$-4.890538(4)^{*}$	
	$t = 0.08$			
$d(d_t, 1)$	$(t_t = 0.56)$			Non-stationary
	$c = 3.39$	$c = 0.86$		I(1)
	$(t_c = 1.11)$	$(t_c = 2.98)$		
	$-1.328877(1)$	$-0.845808(2)$	$-0.740132(2)$	
	$t = -0.05$			
y_t	$(t_t = -1.44)$			Non-stationary
	$c = 0.53$	$c = -0.37$		I(1)
	$(t_c = 0.75)$	$(t_c = -1.12)$		
	$-3.839599(1)^{**}$	$-3.781495(1)^{*}$	$-3.816533(1)^{*}$	
	$t = -0.03$			
$d(y_t, 1)$	$(t_t = -0.85)$			Non-stationary
	$c = 0.36$	$c = -0.15$		I(1)
	$(t_c = 0.52)$	$(t_c = -0.47)$		
	$-2.400709(6)$	$-1.673252(33)$	$-2.341281(0)$	
	$t = -0.20$			
π_t	$(t_t = -1.99)$			Non-stationary
	$c = 6.10$	$c = -0.03$		I(1)
	$(t_c = 1.94$	$(t_c = 1.48)$		

Table 26: Results of the Phillips Perron (PP) stationarity test of the Greece series

Variables	Trend and constant	No trend	No trend and constant	Conclusion
	$-5.702704(1)^{*}$	$-5.723139(1)^{*}$	$-5.294255(0)$	
	$t = 0.05$			
$d(pi_t, 1)$	$(t_t = 1.96)$			Non-stationary
	$c = -1.30$	$c = -0.77$		I(1)
	$(t_c = -1.38)$	$(t_c = -1.72)$		
	$-2.596802(2)$	$-2.468051(2)$	$-0.773301(1)$	
	$t = 0.10$			
bp_t	$(t_t = 2.72$			Non-stationary
	$c = -3.38$	$c = -2.20$		I(1)
	$(t_c = -2.73)$	$(t_c = -2.18)$		
	$-5.944486(1)^{*}$	$-5.984786(1)^{*}$	$-6.078621(1)^{*}$	
	$t = 0.029$			
$d(bp_t, 1)$	$(t_t = 0.68)$			Non-stationary
	$c = -0.39$	$c = 0.13$		I(1)
	$(t_c = -0.46)$	$(t_c = 0.33)$		
	$-2.014135(2)$	$-0.476654(2)$	$-1.189204(2)$	
	$t = -0.14$			
r_t	$t_t = -2.03$			Non-stationary
	$c = 4.11$	$c = -0.24$		I(1)
	$(t_c = 1.83)$	$(t_c = -0.34)$		
	$-5.021835(0)^{*}$	$-5.049157(1)^{*}$	$-4.926873(0)^{*}$	
	$t = -0.02$			
$d(r_t, 1)$	$(t_t = -0.56)$			Non-stationary
	$c = -0.006$	$c = -0.45$		I(1)
	$(t_c = -0.007)$	$(t_c = -1.06)$		

Error Correction	Δy_t	Δbp_t	Δd_t	Δr_t	$\Delta \pi_t$
Italy					
CointEq1	0.728331	1.405092	-1.390887	0.641613	-0.982585
	(0.48622)	(0.35209)	(1.31722)	(0.51725)	(0.30643)
	[1.49795]	[3.99075]	[-1.05592]	[1.24043]	[-3.20658]
CointEq2	0.044497	0.324777	-0.344132	-0.071065	-0.218247
	(0.09701)	(0.07025)	(0.26282)	(0.10320)	(0.06114)
	[0.45867]	[4.62311]	[-1.30938]	[-0.68858]	[-3.56961]
CointEq3	-0.549011	-1.164526	1.049383	-0.562548	0.130673
	(0.32825)	(0.23770)	(0.88928)	(0.34920)	(0.20687)
	[-1.67253]	[-4.89916]	[1.18004]	[-1.61095]	[0.63166]
Irland					
CointEq1	0.088412	-0.557277	-0.956075	0.611791	0.930714
	(0.63862)	(0.92380)	(1.77087)	(0.47296)	(0.38621)
	[0.13844]	[-0.60324]	[-0.53989]	[1.29354]	[2.40986]
CointEq2	-0.317658	-0.414332	0.057909	0.013095	-0.107745
	(0.17632)	(0.25506)	(0.48894)	(0.13058)	(0.10663)
	[-1.80158]	[-1.62443]	[0.11844]	[0.10028]	[-1.01044]
CointEq3	-1.628737	-3.739596	1.391818	-0.080393	-0.904888
	(1.05455)	(1.52548)	(2.92425)	(0.78100)	(0.63775)
	[-1.54448]	[-2.45142]	[0.47596]	[-0.10294]	[-1.41888]
Greece					
CointEq1	-0.620240	-1.180609	-0.175444	-0.014369	-1.123436
	(0.52909)	(0.61088)	(2.64873)	(0.68885)	(0.52217)
	[-1.17228]	[-1.93265]	[-0.06624]	[-0.02086]	[-2.15148]
CointEq2	-0.059997	-0.163713	-0.032855	0.030255	-0.159356
	(0.07072)	(0.08165)	(0.35402)	(0.09207)	(0.06979)
	[-0.84842]	[-2.00510]	[-0.09281]	[0.32862]	[-2.28332]
CointEq3	-0.127018	-1.062523	-0.744664	-0.516486	-0.308760
	(0.25584)	(0.29539)	(1.28080)	(0.33309)	(0.25250)
	[-0.49647]	[-3.59701]	[-0.58141]	[-1.55058]	[-1.22283]

Table 27: Cointegration test results

Error Correction	Δy_t	Δbp_t	Δd_t	Δr_t	$\Delta \pi_t$
France					
CointEq1	−1.497011	−0.608934	1.977098	−1.253260	
	(0.46484)	(0.41191)	(1.04482)	(0.37123)	
	[−3.22049]	[−1.47831]	[1.89229]	[−3.37597]	
CointEq2	0.260741	−0.184679	−2.897919	1.151212	
	(0.96466)	(0.85482)	(2.16827)	(0.77040)	
	[0.27029]	[−0.21604]	[−1.33651]	[1.49431]	
CointEq3	−0.228906	−0.098452	0.279264	−0.183770	
	(0.07104)	(0.06295)	(0.15968)	(0.05673)	
	[−3.22216]	[−1.56391]	[1.74891]	[−3.23910]	
Belguim					
CointEq1	−1.751891	−2.489772	4.100839	−1.382722	−0.837890
	(0.56874)	(0.82962)	(1.08471)	(0.45221)	(0.62809)
	[−3.08029]	[−3.00112]	[3.78058]	[−3.05770]	[−1.33404]
CointEq2	−0.242621	0.467211	−1.178531	0.042591	0.400112
	(0.24636)	(0.35936)	(0.46986)	(0.19588)	(0.27207)
	[−0.98482]	[1.30011]	[−2.50825]	[0.21743]	[1.47064]
CointEq3	0.598747	−0.159420	−0.554749	0.063442	0.638616
	(0.20392)	(0.29746)	(0.38892)	(0.16214)	(0.22520)
	[2.93616]	[−0.53594]	[−1.42637]	[0.39128]	[2.83577]
Spain					
CointEq1	−1.200171	−0.340318	2.701646	0.195087	0.578726
	(0.50021)	(0.88121)	(0.88121)	(0.84136)	(0.59132)
	[−2.39932]	[−0.38620]	[−0.38620]	[0.23187]	[0.97870]
CointEq2	−0.169998	−0.004108	0.020392	−0.255615	−0.001615
	(0.06185)	(0.10896)	(0.15743)	(0.10404)	(0.07312)
	[−2.74842]	[−0.03770]	[0.12953]	[−2.45697]	[−0.02208]
CointEq3	−0.024051	−1.182598	−0.875878	−0.570575	−0.716970
	(0.36596)	(0.64470)	(0.93146)	(0.61555)	(0.43262)
	[−0.06572]	[−1.83433]	[−0.94033]	[−0.92694]	[−1.65728]
CointEq4	0.312057	−0.014227	−0.988094	−0.283061	−0.105615
	(0.18367)	(0.32357)	(0.46749)	(0.30893)	(0.21712)
	[1.69901]	[−0.04397]	[−2.11364]	[−0.91625]	[−0.48643]

Table 28: Cointegration test results