

Estimation of a fiscal policy rule for EMU countries (1984-2005)

García, Agustin; Arroyo, Maria J.; Minguez, Roman; Uxó González, Jorge

Postprint / Postprint

Zeitschriftenartikel / journal article

Zur Verfügung gestellt in Kooperation mit / provided in cooperation with:

www.peerproject.eu

Empfohlene Zitierung / Suggested Citation:

García, A., Arroyo, M. J., Minguez, R., & Uxó González, J. (2009). Estimation of a fiscal policy rule for EMU countries (1984-2005). *Applied Economics*, 41(7), 869-884. <https://doi.org/10.1080/00036840701720739>

Nutzungsbedingungen:

Dieser Text wird unter dem "PEER Licence Agreement zur Verfügung" gestellt. Nähere Auskünfte zum PEER-Projekt finden Sie hier: <http://www.peerproject.eu> Gewährt wird ein nicht exklusives, nicht übertragbares, persönliches und beschränktes Recht auf Nutzung dieses Dokuments. Dieses Dokument ist ausschließlich für den persönlichen, nicht-kommerziellen Gebrauch bestimmt. Auf sämtlichen Kopien dieses Dokuments müssen alle Urheberrechtshinweise und sonstigen Hinweise auf gesetzlichen Schutz beibehalten werden. Sie dürfen dieses Dokument nicht in irgendeiner Weise abändern, noch dürfen Sie dieses Dokument für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen.

Mit der Verwendung dieses Dokuments erkennen Sie die Nutzungsbedingungen an.

Terms of use:

This document is made available under the "PEER Licence Agreement". For more information regarding the PEER-project see: <http://www.peerproject.eu> This document is solely intended for your personal, non-commercial use. All of the copies of this documents must retain all copyright information and other information regarding legal protection. You are not allowed to alter this document in any way, to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public.

By using this particular document, you accept the above-stated conditions of use.



ESTIMATION OF A FISCAL POLICY RULE FOR EMU COUNTRIES (1984-2005)

Journal:	<i>Applied Economics</i>
Manuscript ID:	APE-05-0417.R1
Journal Selection:	Applied Economics
Date Submitted by the Author:	24-Oct-2006
Complete List of Authors:	GARCÍA, AGUSTIN; SAN PABLO-CEU UNIVERSITY, ECONOMICS ARROYO, MARIA J.; San Pablo-CEU University, Economics MINGUEZ, ROMAN; San Pablo-CEU University, Economics UXÓ, JORGE; San Pablo-CEU University, Economics
JEL Code:	E62 - Fiscal Policy Public Expenditures, Investment, and Finance Taxation < , E32 - Business Fluctuations Cycles <
Keywords:	Fiscal Policy, Policy Rule, European Monetary Union, SURE Models, Stability and Growth Pact

SCHOLARONE™
Manuscripts

ESTIMATION OF A FISCAL POLICY RULE FOR EMU COUNTRIES (1984-2005)

Abstract

The primary objective of this paper is to estimate a fiscal policy rule for each of the EMU member States from 1984 to 2005 in order to know if there has been a systematic response of the cyclically adjusted primary balance to output gap and debt level variations. Also, we aim to discover whether the change in the fiscal framework which took place after 1992 has had a substantial impact on the fiscal policy applied. The principal novelty is that the estimation is performed simultaneously by means of a SURE (Seemingly Unrelated Regression Estimator) model. We are thus able to obtain different coefficients for each country, while developing possible correlations between national fiscal policies which would reveal the existence of common factors. The results provide clear evidence of a structural break in the rule after the introduction of the new fiscal regulations and, as the hypothesis of equality in the national coefficients of the rule is clearly rejected, reveal a need to consider specific national factors.

1. Introduction:

The primary objective of this paper is to estimate a policy rule for the fiscal authorities of each of the EMU member States from 1984 to 2005 in order to know if there has been a systematic response of the cyclically adjusted primary balance to output gap and debt level variations.

The overall approach, therefore, lies within the framework of what is known as New Normative Macroeconomics (Taylor (2000a and 2000b)), the principal characteristic of which is the formulation of economic policy in the form of activist rules. These rules are expressed by more or less simple equations in which the instrument used by the authorities depends on a reduced number of variables indicating the state of the economy.

The use of policy rules has spread in academic literature as a useful tool for analysing economic policy from both a positive and normative perspective. The best known example is the Taylor Rule¹. The estimation of the Taylor Rule enables us to know if a central bank actively responds or not to changes in the inflation rate or income, and make comparisons between countries over time.

One paper of reference in the application of this method to fiscal policy in EMU countries is Galí and Perotti (2003). Their primary objective was to analyse the changes occurred in European fiscal policy as a result of the introduction of new fiscal rules in 1992 (Maastricht Treaty, MT) and 1997 (Stability and Growth Pact, SGP). In particular, from our perspective, the most important results obtained from estimating the rule are that the new fiscal policy framework have reduced the previously procyclical nature of the discretionary policies applied by

¹ Taylor (1993).

1
2
3 European governments, and that nonetheless, there has been no reduction in the
4 application of corrective fiscal policies when public debt has increased.
5
6
7

8
9 Although a different rule is also estimated for each country separately,
10 Galí and Perotti focus on common European trends, and obtain their main results
11 from estimating a data panel in which the coefficients of the rule are the same for
12 all EMU countries. Consequently, they are unable to appropriately distinguish the
13 different fiscal policies applied by each European country.
14
15
16
17
18

19
20 This “common European factor”, and in particular the introduction of new
21 fiscal rules, has probably been of great importance for the development of the
22 fiscal policies applied by the different governments. However, we cannot rule out
23 the existence of “specific national factors” which have generated significant
24 differences in the coefficients of the rule for each country. We have therefore
25 simultaneously estimated all the national equations with a SURE² model, enabling
26 us to use the information derived from both common and specific factors.
27
28
29
30
31
32
33
34
35
36
37

38 Indeed, the simultaneous estimation of all the equations makes use of the
39 correlation between the errors terms of each national equation, including all
40 factors with a common origin. But, at the same time, there is no initial constraint
41 to the value of the national coefficients, which are not necessarily the same,
42 enabling us to consider national differences. In fact, the results obtained clearly
43 show that such differences are significant.
44
45
46
47
48
49
50
51

52 This paper is therefore supplementary to the work of Galí y Perotti, and its
53 primary objective is to re-estimate the impact of the change in the European fiscal
54 policy framework on the discretionary policies applied by European governments
55
56
57
58
59
60

² Seemingly Unrelated Regression Estimator.

1
2
3 while paying more attention to the differences between countries. In the second
4
5 section, then, we define the fiscal policy rule to be estimated while, in the third,
6
7 we justify the choice of method and approach some issues related to the data
8
9 employed. The fourth section includes a brief summary of the coefficients
10
11 estimation, together with the principal tests used to diagnose the model. Section
12
13 five contains a more detailed interpretation of the results and the paper ends with
14
15 our conclusions.
16
17
18
19

20 21 22 **2. Identification of the fiscal policy rule:**

23
24
25
26 In this section, we present the fiscal policy to be estimated, requiring us to
27
28 define both the variable to be used to represent the authorities' decisions and the
29
30 variables whose evolution in turn determined fiscal policy changes. For
31
32 comparison purposes, these variables are as used by Galí and Perotti (2003).
33
34
35
36
37

38 **2.1. Variable representing fiscal policy:**

39
40
41 The variable used in this paper to represent fiscal policy orientation is the
42
43 cyclically adjusted primary balance (CAPB), the dependent variable of the
44
45 regression. This variable represents the discretionary component of fiscal policy,
46
47 that is, the part of the budgetary balance which directly depends on governmental
48
49 decisions. In particular:
50
51
52

- 53
54 • We use the primary and not the total balance because the authorities have no
55
56 short term impact on debt interest payments, since they depend on the
57
58 evolution of the interest rate and accumulated debt. Furthermore, as Bohn
59
60 (1998) shows, a condition sufficient to ensure the long-term sustainability of

1
2
3 public finance is that the authorities increase the primary balance whenever
4
5 the public debt-GDP ratio grows. One of our objectives is precisely to
6
7 determine the degree to which the authorities take sufficient action to ensure
8
9 this.

- 10
11
12
13 • We have also discounted the effects of the economic cycle from this primary
14
15 balance, for two reasons. Firstly, the CAPB (or its increase) is the variable
16
17 most often used in fiscal policy literature to measure the orientation
18
19 (expansive or contractive) of discretionary fiscal policy, distinguishing it from
20
21 the effect of automatic stabilisers which would be mixed into the total primary
22
23 balance³. Secondly, as Galí and Perotti (2003) point out, given the more
24
25 structural nature of the factors influencing the action of automatic stabilisers
26
27 (for instance, the labour market or welfare state institutions of each country)
28
29 are unlikely to have been significantly affected in the short term by the
30
31 Maastricht Treaty or the Stability and Growth Pact. Therefore, since another
32
33 of our objectives is precisely to analyse the effect of introducing these rules
34
35 into the behaviour of fiscal authorities, the CAPB appears to be a more
36
37 appropriate variable.
38
39
40
41
42
43
44
45

46 2.2. Variables determining fiscal policy:

47
48
49

50 The variables used as regressors in this paper are the output gap, the debt-GDP
51
52 ratio, a binary variable and the cyclically adjusted balance delayed one period:
53
54

- 55 • The choice of these variables is related to the objectives expected of the
56
57 authorities when making their budgetary decisions. According to Favero and
58
59

60 ³ This analytical procedure is followed by the European Commission (2006) and in all the previous editions of *Public Finances in EMU*. Larch and Salto (2003) offer a discussion of the utility of this indicator to measure the sign of discretionary fiscal policy.

1
2
3 Monacelli (2003), these decisions largely obey a short-term objective (the
4
5 cyclical stabilisation of the economy, which these authors qualify as the
6
7 “active” component of fiscal policy) and another longer-term objective (the
8
9 sustainability of public finance, or “passive” component of fiscal policy).
10
11

12
13 From a short-term perspective, the authorities may attempt to alter
14
15 public revenue and expenditure in order to compensate for cyclical income
16
17 fluctuations by means of their effect on aggregate demand. Some doubts have
18
19 recently been expressed concerning the efficacy of fiscal policy in influencing
20
21 income and employment levels, fundamentally based on the hypothesis of
22
23 Ricardian Equivalence. However, neither the theoretical arguments⁴ nor the
24
25 empirical evidence appear to be sufficient to reject the use of fiscal policy to
26
27 stabilise the economy. Indeed, numerous recent studies provide strong support
28
29 for the idea that fiscal stimuli can have positive effects on the economy during
30
31 periods of low growth⁵. In fact, the creation of the EMU itself, by centralising
32
33 monetary policy decisions, is an additional argument for national authorities to
34
35 operate in this way, further adapting the global sign of the single monetary
36
37 policy to the specific cyclical conditions in each country. Therefore, one of the
38
39 regression variables is the output gap (OG), to verify whether EMU countries
40
41
42
43
44
45
46

47
48 ⁴ Calmfors (2003) says that “the Ricardian equivalence results require very restrictive theoretical
49 assumptions which are not likely to apply in reality”. Blinder (2004) summarises the most
50 common criticisms of this hypothesis.

51
52 ⁵ Burnside, Eichenbaum and Fisher (1999) and Fatás and Mihov (2000) point out that in the United
53 States fiscal shocks also produce changes in output, consumption, investment and employment.
54 Furthermore, Fatás and Mihov (2002), based on time and cross-section data pertaining to 51
55 countries, find that the relation between the magnitude of output changes and the use of
56 discretionary fiscal policy is statistically significant, in the sense that countries with larger
57 governments suffer less economic cycle volatility. On the other hand, Perotti (2002) studies
58 the effects of fiscal measures on GDP, price and interest rate growth in five OECD countries (United
59 States, Germany, United Kingdom, Canada and Australia) using autoregressive vectors. Firstly,
60 the analysis reveals that the estimated effects of fiscal policy on the GDP tend to be positive,
although minor, and that public expenditure multipliers (positive and mostly less than one) are
usually larger in absolute values than those obtained as tax multipliers (negative). Hemming, Kell
and Mahfouz (2002) present a selection of this empirical literature, showing that the estimated
mean tax multiplier is 0.5.

1
2
3 have indeed worked in this way, systematically changing the CAPB to
4 stabilise their economies. This would be confirmed by a positive regression
5 coefficient.
6
7
8
9

10
11 With a more long-term perspective, another of the objectives at which
12 countries should aim when making primary balance decisions is, as we have
13 mentioned, to guarantee the long-term sustainability of public finance. This
14 requires corrective measures when debt increases, and the second regressor
15 variable is therefore the debt/GDP ratio (PD) at the end of the previous period.
16
17 This variable's coefficient should also be positive if the authorities
18 systematically apply policies which are sustainable in the long term.
19
20
21
22
23
24
25
26
27

- 28 • A second criterion for the choice of variables included in the regression is
29 derived from the fact that the framework in which fiscal policy is applied in
30 the European Union has changed substantially since the nineties with the
31 introduction of the rules established first in the Maastricht Treaty and, later,
32 with the Stability and Growth Pact. This suggests the possibility of a structural
33 break in the value of the parameters⁶ so, to account for this possible effect, we
34 have included a binary variable (AM_{92it}) with zero value for the years before
35 1992 and a value of 1 from then on, accompanying both the output gap and
36 public debt as the constant of the regression.
37
38
39
40
41
42
43
44
45
46
47
48
49
50 • Finally, we have included the value of the CAPB delayed one period, in so far
51 as fiscal decisions are affected by a high level of inertia. Indeed, the results of
52 the estimation show that this variable is significant in the fiscal policy of all
53 EMU countries.
54
55
56
57
58
59
60

⁶ A Chow test and other statistics have confirmed us such a structural rupture in 1992. See section 4.1.

2.3. Estimated equation and meaning of the coefficients:

In conclusion, once the independent and dependent variables have been defined, the estimated equation is as follows:

$$CAPB_{it} = \alpha_{0i} + \alpha_{1i}AM_{92it} + \beta_{1i}OG_{it} + \beta_{2i}AM_{92it}OG_{it} + \beta_{3i}PD_{it-1} + \beta_{4i}AM_{92it}PD_{it-1} + \beta_{5i}CAPB_{it-1} + u_{it} \quad (1)$$

As we will see later, this equation was estimated simultaneously for each of the 11 EMU countries for which data is available from 1984 (all of them except Luxembourg) taken from OECD (2006). An equation is also estimated for the mean EMU data.

As we mentioned earlier, CAPB is the cyclically adjusted primary balance, OG is the output gap, PD represents public debt, AM is the variable representing the effect of the introduction of new fiscal rules in the EU from 1992 on, and Table 1 shows the economic meaning of the coefficients. Sub-index i represents the ith country, whereas sub-index t represents the period to which the variables correspond.

Insert Table 1 here

3. Method of estimation and data used:

One of the main issues we have approached in this paper is the choice of a method of estimation meeting two important conditions.

In the first place, we are working with 11 countries which form part of a strongly integrated economic area, the fiscal policies of which have been conditioned by a highly significant institutional change, represented by the new

1
2
3 fiscal discipline rules included in the Maastricht Treaty and the Stability and
4
5 Growth Pact. Their fiscal policies can therefore be expected to have some
6
7 common features.
8
9

10
11 Secondly, however, we are also interested in determining whether the
12
13 systematic behaviour of the different national fiscal authorities – shown in the
14
15 coefficients of the rule – reveals differences, and whether the effects of
16
17 introducing the new fiscal framework have been homogeneous across EMU
18
19 countries. This seems particularly important as, throughout the integration
20
21 process, economic policy coordination did not include the centralisation of fiscal
22
23 policies which, although subject to a multilateral supervision process, remain
24
25 under the authority of the national governments. Furthermore, after the creation
26
27 of the EMU, fiscal policy is now the only macroeconomic instrument available to
28
29 these governments for stabilising their economies, so each country can be
30
31 expected to adapt it to its own specific situation.
32
33
34
35
36

37 In other words, the method of estimation has to contemplate the interrelation
38
39 between fiscal policies, while distinguishing different national behaviours.
40
41

42
43 Taking the work of Galí and Perotti (2003) and IMF (2004) as representative
44
45 of recent literature concerning the estimation of fiscal policy rules in EMU
46
47 countries, we see that they have used a similar modelling strategy. Each national
48
49 equation is first estimated separately, subsequently estimating a panel with data
50
51 from all the countries, permitting the existence of fixed national effects but taking
52
53 the other coefficients between the fiscal rules of different countries as equal.
54
55
56

57 Galí and Perotti (2003) justify this second step by referring to a problem of
58
59 insufficient degrees of freedom in the estimation of each national equation
60

1
2
3 separately, whereas IMF (2004) underlines the possibility of changes in the
4
5 coefficients derived from processes common to the entire euro area, such as the
6
7 introduction of a new fiscal framework. This global effect could be insufficiently
8
9 contemplated in the individual national estimations.
10
11

12
13 The principal innovation in our work is the use of a SURE (Seemingly
14
15 Unrelated Regression Estimator) model⁷, which will enable simultaneous
16
17 estimation by generalised least squares of the 11 national equations considered. In
18
19 our opinion, there are two primary reasons for preferring this choice to the
20
21 alternative used in the two aforementioned publications:
22
23
24
25
26
27

- 28 1. On the one hand, this estimation procedure enables the use of the correlation
29
30 matrix of the error terms of each equation to gain efficiency. The growing
31
32 interdependence of these economies, the convergence of their economic
33
34 policies⁸ or the existence of common shocks will give the error terms of the
35
36 equations of the different countries a common component, representing a far
37
38 from negligible contemporaneous correlation⁹. It is therefore not efficient to
39
40 estimate the 11 fiscal policy equations separately for each country.
41
42
43
44
- 45 2. Furthermore, our model does not initially limit the behaviour of the different
46
47 countries because they belong to the EMU, but tests the values of the
48
49 coefficients to determine whether behaviour is homogeneous or varies among
50
51 the different national authorities. In other words, it considers the possible
52
53 importance of specific national factors (political, economic or institutional)
54
55
56

57
58 ⁷ See Green (1999), Chap. 15.

59 ⁸ European Commission (2004).

60 ⁹ The data used in the study are annual and, due to their low frequency, there are unlikely to be important non-contemporaneous correlations. The cross correlation functions calculated from the GLS residuals of the different countries have confirmed this.

1
2
3 for explaining the fiscal authorities' different reactions to changes in the
4 cyclic situation or levels of debt. Indeed, as we shall see later, the hypotheses
5 of homogeneous behaviour by countries have always been rejected.
6
7
8
9

10
11
12
13
14 This type of estimation, therefore, by enabling us to simultaneously obtain
15 different coefficients for each country, is more efficient for distinguishing
16 national behaviours than the fixed effects of the data panel.
17
18
19

20
21
22
23
24 Taking this into account, the estimation is by generalised least squares (GLS)
25 to gain efficiency, contemplating the contemporaneous correlations between
26 countries. To justify this, we start by specifying the covariance matrix of the
27 enlarged vector formed with the error terms of all the simultaneous equations. A
28 simple and realistic assumption concerning the structure of this covariance matrix
29 comprises the following hypotheses¹⁰:
30
31
32
33
34
35
36
37

- 38
39 1. In each equation, the error term presents neither autocorrelation nor
40 heteroscedasticity¹¹:
41
42

$$43 \quad E(u_i u_i) = \sigma_i^2 I_T; i = 1, 2, \dots, m^{12}$$

44
45
46
47 The fact that the lagged dependent variable itself appears as the regressor
48 also shows that, with this assumption, the error term does not present
49 correlation.
50
51
52
53

- 54
55 2. The only non null correlation between the errors of the different equations
56 is contemporaneous:
57
58

59
60 ¹⁰ Novales (1993), page 274.

¹¹ Although there can be heteroscedasticity between the different countries.

¹² m is the number of equations in the model.

$$E(u_i u_j) = \sigma_{ij} I_T; i \neq j; i, j = 1, 2, \dots, m$$

That is, it is assumed that the covariance is independent from the moment in time considered [$E(u_{it} u'_{jt}) = \sigma_{ij}$, for all $t = 1, 2, \dots, T$] and it is also admitted that $E(u_{it} u'_{js}) = 0$ for all $t \neq s, t, s = 1, 2, \dots, T$.

With the above assumptions, the general covariance matrix of the shocks can be written using the Kronecker product: $\Omega = \Sigma \otimes I_T$, where Σ is the contemporaneous variance-covariance matrix of the residuals. Matrix Ω is not scalar and, therefore, if our assumptions are true, the usual ordinary least squares (OLS) estimator will not be efficient, since it ignores the information contained in the covariances between contemporaneous observations of different equations. The efficient estimation, considering the covariance matrix between the error terms of different equations, can be performed by generalised least squares (GLS) by means of the following expression:

$$\hat{\beta}^{MCG} = (X^T \Omega^{-1} X)^{-1} (X^T \Omega^{-1} Y)$$

And the covariance matrix of the estimation is given by:

$$\text{var } \hat{\beta}^{MCG} = (X^T \Omega^{-1} X)^{-1}$$

Our analysis of the residuals of the estimated national equations has confirmed our assumptions about the covariance matrix and, therefore, the convenience of simultaneous estimation by GLS.

1
2
3 This is shown, for instance in the heteroscedasticity test between groups
4 and cross-section correlation¹³ (Table 2). This tests the hypothesis that the
5
6 elements outside the diagonal of the covariance matrix estimated from the OLS
7
8 residuals are zero, that is, that there is no correlation between EMU countries. If
9
10 the null hypothesis is rejected, as it is here, it is more efficient to estimate a SURE
11
12 model by GLS, as the model is not restricted by a single parameter vector and the
13
14 correlation matrix of the error terms is used in the estimation to gain efficiency.
15
16
17
18
19
20
21
22

23 **Insert Table 2 here**
24
25
26
27

28 Furthermore, the contemporaneous correlation matrix of the residuals
29
30 estimated by GLS (Table 3) contains significant values, confirming the need to
31
32 take these correlations into account when estimating the model.
33
34
35
36
37

38 **Insert Table 3 here**
39
40
41
42

43 Finally, Graph 1 shows the autocorrelation functions of the residuals
44
45 estimated by GLS. As we can see, the error term of each equation does not
46
47 present autocorrelation, which is one of the other assumptions established
48
49 concerning the covariance matrix of the error terms.
50
51
52
53
54

55 **Insert Graph 1 here**
56
57
58
59
60

¹³ Green (1999), page. 571.

1
2
3 One final issue that has to be considered in relation to the method of
4 estimation employed refers to the data available. We have used the annual data
5 provided in the Statistical Annex of *OECD Economic Outlook* (No. 79, May
6 2006), which includes both fiscal variables and the estimation of the output gap
7 and the separation between the discretionary component of fiscal policy and the
8 use of automatic stabilisers.
9
10

11
12 The estimated period includes every year for which data is available for the
13 11 countries for which the fiscal policy rule has been estimated: from 1984 to
14 2005. This period is particularly interesting, because it includes enough years
15 before and after the approval of the fiscal rules currently applicable in the EMU,
16 enabling us to analyse a possible structural change.
17
18

19
20 One problem with our method of estimation is that, since the sample is
21 relatively short, the number of observations is small in relation to the number of
22 parameters to be estimated. To reduce this possible over-parameterisation
23 problem, it may be a good idea to increase the data frequency or increase the
24 period backwards in time. We have ruled out both these options, however, for the
25 following reasons:
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

- 48 • In the first place, most of the tests we have used for diagnosing the model,
49 analysing the fit of the estimation with the original series or testing the
50 existence of a structural break, have rejected the null hypothesis
51 considered. And, although the tests are not very powerful because of the
52 short sample used, if the null hypothesis considered is rejected, as it is
53 here, there will be very clear evidence in favour of this rejection.
54
55
56
57
58
59
60

- Although there are some quarterly fiscal data interpolated from annual figures, they are not homogeneous and, furthermore, budgetary decision-making takes place on an annual basis. This, for instance, is the frequency with which the budgets of EMU countries are approved and compliance with the requirements of the Stability and Growth Pact is analysed.
- We would also prefer not to go much further back than the contemplated period, as the seventies are characterised by important supply shocks (rising oil prices) which conditioned the application of economic policy. We would probably have to consider the special nature of the data pertaining to those years by including new parameters, which would certainly do nothing to improve the over-parameterisation problem observed with our model. Indeed, the empirical literature about the recent evolution of fiscal policy in the EMU compared with previous years usually focuses on the period starting in the eighties.
- There is also an important practical reason. We have used all the data provided by the OECD *Economic Outlook* as Galí and Perotti (2003). The two options proposed could reduce our comparability and force us to use a different source.

4. Estimated values of the coefficients and principal tests performed:

Table 4 shows the values of the estimated coefficients of the fiscal policy rule for each country and for the EMU overall, together with the t-statistic.

1
2
3 Although we will later be analysing our results and their possible significance in
4
5 more detail, we are now in a position to advance some results:
6
7
8
9

- 10
11 • Before 1992, the coefficients estimated for the output gap are 10%
12 significant in 5 of the 11 countries; after 1992, they are significantly
13 different from zero in 6 countries. It is clearly significant in both periods
14 for the EMU overall.
15
16
17
18
19
- 20
21 • The only case in which the estimated coefficient is positive and
22 significant both before and after 1992 is Finland,. In the rest, it is either
23 negative or not significantly different from zero. This appears to
24 indicate that, in the past, discretionary fiscal policy did not
25 systematically play a stabilising role.
26
27
28
29
30
31
32
- 33
34 • The estimated debt coefficients are significant for 5 EMU countries
35 before 1992 and for 3 afterwards. For the EMU overall, its mean value
36 is very close to zero in both periods.
37
38
39
40
- 41
42 • Unlike the case of the output gap, when these coefficients are
43 significant, they take on positive values, with the only exception of
44 Belgium before Maastricht.
45
46
47
48
- 49
50 • Finally, the coefficient of the cyclically-adjusted primary balance
51 lagged one period is clearly significant for all the countries, showing
52 that budgetary decisions are affected by a certain degree of inertia.
53
54
55
56
57
58

59 **Insert Table 4 here**
60

Besides these tests of the individual significance of the parameters, below are the results of the principal statistical tests performed to analyse the evidence available concerning the existence of a structural change in the sample, in order to check whether the estimation obtained meets the required conditions.

4.1. *Evidence of structural change:*

One of our primary objectives is to test whether the change occurred in the regulatory framework applicable to fiscal policy from 1992 on has altered the systematic behaviour of the fiscal authorities, both in their response to the output gap and in their reaction to changes in indebtedness, and whether this change has been heterogeneous in the different countries.

In order to verify whether there is a structural break in the data in 1992 and, therefore, whether the introduction of a binary variable¹⁴ with which to represent the effects of the Maastricht Treaty was correct, we have performed a series of tests on our model, the results of which are shown in Table 5.

Insert Table 5 here

The first row shows the result of the Chow test, which clearly detects a change in the value of the parameters from 1992 on, so we have estimated the model including a binary variable (AM92t) representing the effect of the change in the fiscal framework on the behaviour of each country's authorities.

¹⁴ With a value of one from 1992 on and zero beforehand.

This change can be included both in the equation's constant and in the response of discretionary policy to the output gap and debt. The model including the structural change would be represented by the equation:

$$CAPB_{it} = \alpha_{0i} + \alpha_{1i}AM_{92it} + \beta_{1i}OG_{it} + \beta_{2i}AM_{92it}OG_{it} + \beta_{3i}PD_{it-1} + \beta_{4i}AM_{92it}PD_{it-1} + \beta_{5i}CAPB_{it-1} + u_{it}$$

We have also compared the estimation resulting from this model with that derived from the same model without structural change, using Akaike and Schwarz information criteria. As the Table shows, this analysis confirms that, although there is an over-parameterisation problem, the model with structural break fits the data better than a model estimated by the same procedure but without contemplating such a break.

Thirdly, to measure the overall goodness of fit of the system, we present a McElroy generalised R2 (1977)¹⁵. The use of this statistic instead of the traditional R2 is justified, firstly, by the need for a single overall measurement of the system's goodness of fit; and secondly, because in a SURE model like ours the cross-section correlation is used in the method of estimation to gain efficiency in the estimations obtained. The value of this measurement from the data used here is 0.925.

On the fourth row of the Table, we go from a global analysis of the model's fit to a more detailed analysis of each of the parameters showing the effects of the structural change in discretionary fiscal policy (α_{1i} , β_{2i} and β_{4i}). We have therefore tested whether $H_0 : \alpha_{1i} = 0$ or $H_0 : \beta_{2i} = 0$ or $H_0 : \beta_{4i} = 0$, which

¹⁵The McElroy R2 corresponds to the following expression (see Green (1999), page 585):

$$R_*^2 = 1 - \frac{\hat{\varepsilon}' \hat{V}^{-1} \hat{\varepsilon}}{\sum_{i=1}^M \sum_{j=1}^M \hat{\sigma}^{ij} \left[\sum_{t=1}^T (y_{it} - \bar{y}_i)(y_{jt} - \bar{y}_j) \right]}$$

1
2
3 is more clearly rejected for the constant and the debt coefficient, but also for the
4
5 output gap.
6
7

8
9 There is therefore very strong evidence of a structural change. The second
10 part of Table 5 shows other tests performed to verify whether there are significant
11 national differences in the effects of this structural change.
12
13

14
15 Row 5 presents the results of a test to rule out the effect derived from the
16 application of new fiscal rules from 1992 on being the same for all EMU
17 countries, that is, whether $H_0 : \alpha_{1i} = \alpha_1$ or $H_0 : \beta_{2i} = \beta_2$ or $H_0 : \beta_{4i} = \beta_4$. Once
18 again, the null hypothesis is rejected, which seems to reinforce the need to
19 estimate the model allowing for national differences in the parameters.
20
21
22
23
24
25
26
27

28
29 And this result is even stronger when we test the equality of the
30 parameters, both in the model with structural change (row 6) and in the model
31 without (row 7). The null hypothesis in the model with structural change is:
32
33 $H_0 : \alpha_{0i} + \alpha_{1i} = \alpha$ or $H_0 : \beta_{1i} + \beta_{2i} = \beta_1$ or $H_0 : \beta_{3i} + \beta_{4i} = \beta_3$, and: $H_0 : \alpha_{0i} = \alpha$
34 or $H_0 : \beta_{1i} = \beta_1$ or $H_0 : \beta_{3i} = \beta_3$ in the model without structural change. It is
35 rejected in both models.
36
37
38
39
40
41
42
43

44 Therefore, this seems to confirm the two initial hypotheses described at the
45 start of this paper: from 1992 on, coinciding with the change in European fiscal
46 rules¹⁶, there is a change in the effects of both the output gap and debt on
47 discretionary fiscal measures; furthermore, these effects are different for each
48 EMU country.
49
50
51
52
53
54
55
56
57

58
59 ¹⁶ The fact of this coincidence does not imply that the new rules are the only explanation for the
60 different behaviour observed in the fiscal authorities. This institutional change probably encouraged more budgetary discipline in Europe, reducing the weight of the public sector, which has a broader territorial dimension.

1
2
3 4.2. Diagnosis of the estimated model:
4
5
6
7

8 The evidence derived from the above statistical tests has led us to finally
9 select a model with structural change in which each country's fiscal policy
10 coefficients can be different, but which also considers the interrelation between
11 each of the national equations (simultaneous estimation).
12
13
14
15
16

17 To diagnose our final estimation, we now analyse the existence of
18 autocorrelation in the residuals, their normality and goodness of fit with the
19 original series. As Table 6 shows, the p-values of the Ljung-Box and Breusch-
20 Godfrey tests only show slight evidence of autocorrelation for 1, 2 and 5 lags in
21 some cases, whereas the Jarque Bera test confirms the normality of the residuals.
22
23
24
25
26
27
28
29

30 Finally, we have also calculated the values of the goodness of fit
31 measurements which would have been obtained working individually with each
32 regression and, as we can see, they are lower than that obtained with the global
33 system, which is very high. There is high variability in the fit of each country
34 although, except for Portugal, Holland and Austria, the R2 is relatively high.
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53

54 **Insert Table 6 here**
55
56
57
58
59
60

59 **5. Interpretation of the results:**
60

61 Returning to the values of the estimated fiscal policy rule coefficients for
62 each country and for the EMU as a whole, we can analyse the results of the
63 estimation in more detail. We have centred our analysis on four principal issues:
64 (i) the stabilising role of discretionary fiscal policy, as given by the effect of the
65
66
67
68
69
70

1
2
3 output gap on discretionary decisions, (ii) the effect on these discretionary
4
5 decisions of the aim of guaranteeing the sustainability of public finance, (iii) the
6
7 consequences of adopting the new fiscal policy normative framework (Maastricht
8
9 Treaty and, later, the Stability and Growth Pact) on the two types of behaviour,
10
11 and (iv) the differences in the coefficients estimated for each country. Following
12
13 are the results of the joint analysis of these four issues:
14
15
16
17
18
19

- 20 1. Before application of the Maastricht Treaty, most EMU countries were
21 characterised by a procyclical discretionary fiscal policy, as can be seen in
22 the negative sign of the β_{1i} parameter (Table 4 and Graph 2). The only
23
24 exceptions are Finland and Ireland, whereas the countries in which the
25
26 negative value of the coefficient is greatest are Greece, Germany, Italy,
27
28 France and Holland.
29
30
31
32
33

34 **Insert Graph 2 here**
35
36
37
38

39 Indeed, the activity, deficit and debt data shows that in an initial
40
41 phase, from 1984 to 1987, the output gap was negative and contractive
42
43 discretionary fiscal policies were, nonetheless, applied (there was an
44
45 increase in the adjusted primary balance in the period, as seen on Graph 3).
46
47 This behaviour can be justified by the difficult situation of public finances
48
49 in early eighties, reducing the scope for using fiscal policy as a way of
50
51 stabilising the economy.
52
53
54
55

56 On the other hand, from 1988 to 1991 the European economies
57
58 experienced an expansive phase, which favoured reduction of the deficit
59
60 during the period. But this reduction occurred as a result of the application

1
2
3 of automatic stabilisers, since the discretionary fiscal policy was
4 expansive. This can be seen in Graph 3. As you can observe, the output
5 gap increased and the cyclical component of fiscal policy (the effect
6 derived from the automatic stabilisers) therefore generated an
7 improvement in the total budgetary balance. However, since the adjusted
8 balance was diminishing (procyclical) the net effect was only a slight
9 improvement in deficit figures.

20 **Insert Graph 3 here**

- 21
22
23
24 2. From 1992 on, most countries have experienced a important change in
25 their discretionary fiscal policy; although most of the parameters continue
26 to be negative (procyclical), their absolute values have decreased. We can
27 therefore confirm the result obtained by Galí and Perotti (2003) that
28 discretionary fiscal policy since 1992 has not been more, but less,
29 procyclical. Furthermore, as Graph 2 shows, this change is greatest in
30 precisely those countries in which procyclical behaviour had been more
31 evident up to 1992: Germany, Greece and Italy. On the other hand, the
32 discretionary fiscal policy of Finland remains anti-cyclical.

33
34
35
36
37
38
39
40
41
42
43
44
45 Here again, however, there are two exceptions. In Belgium and
46 Ireland the change in this coefficient was in the other direction, with its
47 negative value increasing in the former and a positive value becoming
48 negative in the latter.

49
50
51
52
53
54
55
56 From 1994 to 1997, the euro-zone economies experienced, in
57 average, a period of negative output gaps in which, nonetheless, restrictive
58 discretionary fiscal measures were applied. This is probably justified by
59
60

1
2
3 the budgetary adjustments required in most European countries to comply
4 with the nominal convergence criteria established in the Stability and
5 Growth Pact. Likewise, the high value of the debt-GDP ratio was also
6 significant¹⁷, with the sustainability of public finance objective given
7 priority over stabilisation of the economy, and leaving the latter to the
8 automatic stabilisers. Also, as occurred in the previous expansionary
9 phase, the recovery of growth rates in the late 90's again gave rise to less
10 strict discretionary fiscal policies.
11
12
13
14
15
16
17
18
19
20
21

22
23 But, finally, if we consider the deceleration period starting in 2001,
24 European countries have reduced the cyclically adjusted primary balance.
25 In other words, unlike the two restrictive phases considered so far (early
26 eighties and early nineties), anti-cyclical policies were applied on this
27 occasion, as shown by the positive ratio between the change in the CABB
28 and the change in the OG in the 2001-2005 period. As Graph 4 shows, this
29 ratio is only negative – procyclical – in Austria, Spain and, particularly,
30 Greece.
31
32
33
34
35
36
37
38
39
40
41

42 This change in fiscal policy was probably enabled by the improved
43 budgetary situation of European countries, which had more room to
44 manoeuvre in 2001 than at the start of the two previous periods of
45 deceleration. To a large extent, this results from the budgetary discipline
46 imposed by the fiscal rules. It is also true, however, that these
47 expansionary policies were applied even though they meant that six
48 countries failed to comply with the SGP in some of these years, leading to
49
50
51
52
53
54
55
56
57
58
59
60

¹⁷ The highest in the period analysed.

1
2
3 it being reformed in 2005 in order to increase its flexibility so that it could
4
5 accommodate, for instance, unfavourable cyclical situations.
6
7

8
9 **Insert Graph 4 here**

- 10
11
12 3. In most countries, both before and after application of the Maastricht
13 Treaty, public debt levels helped to generate positive adjusted primary
14 balances. These coefficients are shown on Graph 5, and the only
15
16 exceptions are Austria, Belgium and Holland (before 1992) and Germany
17
18 after 1992.
19
20
21
22
23

24 On the other hand, it is important to note that the change towards a
25
26 more anti-cyclical discretionary fiscal policy did not represent an
27
28 important change in reaction to debt in most European countries. This
29
30 result is consistent with that obtained by Galí and Perotti (2003).
31
32
33
34
35

36 **Insert Graph 5 here**

- 37
38
39 4. From the estimated rule, a test can also be applied to weight the long-term
40
41 sustainability of public finance¹⁸. The sufficient condition to guarantee
42
43 solvency is for the estimation of the parameter representing the effect of
44
45 the debt-GDP ratio on the adjusted primary balance (β_{3i} before application
46
47 of the Maastricht Treaty and $\beta_{3i} + \beta_{4i}$, afterwards) to be positive. As Table 3
48
49 and Graph 6 shows, this condition is met in most cases so that, except for
50
51 Belgium¹⁹, the public finance of EMU countries is sustainable after
52
53 application of the Maastricht Treaty.
54
55
56
57
58

59
60

¹⁸ See Bohn (1998) and Ballabriga and Martínez-Mongay (2005).

¹⁹ However, since this is only a sufficient condition, we cannot confirm with this test that it is unsustainable in Belgium.

1
2
3
4
5 5. With regards to the role established by the Stability and Growth Pact for
6 discretionary measures and automatic stabilisers in the fiscal policy
7 stabilising function²⁰, we can affirm the following. During its first few
8 years of application, the need to adapt to stricter budgetary discipline
9 requirements led to discretionary fiscal measures partly compensating for
10 the effect induced by automatic stabilisers. However, in more recent years,
11 economic stagnation and previous fiscal adjustment led the fiscal
12 authorities to adopt expansive discretionary measures to stabilise their
13 economies, failing to strictly comply with the Pact's philosophy, with
14 some countries even failing to comply with the Pact itself. However, as we
15 saw in the previous point, a small adjustment (positive) to the adjusted
16 primary balance in response to accumulated debt is sufficient for public
17 accounts to be sustainable, so SGP requirements would appear to be too
18 strict, and the introduction of greater flexibility in the 2005 reform would
19 be justified.
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42

43 Finally, by introducing the cyclically adjusted primary balance delayed one
44 period as one of the regressors of the fiscal policy rule, we have estimated a
45 dynamic model. One of the most significant features of these models is that they
46
47
48
49
50
51
52
53

54 ²⁰The SGP does not literally establish that discretionary measures cannot be applied to stabilise the
55 economy, but it is implicit in its philosophy when it states that governments must maintain
56 equilibrium or a superavit position in the medium term. This approach is defended, for example, in
57 European Central Bank (2004), and in relation to the relative role of discretionary measures and
58 automatic stabilisers, Buti and Van der Noord (2004) say that: "While the potential usefulness of
59 fiscal stabilisation is being re-considered, the "heritage" of the debate in the 1980s casts a strong
60 scepticism over the use of discretionary fiscal action to fine tune the economy. (...) The use of
discretionary fiscal policy for stabilising purposes should be confined only to exceptional
situations".

enable us to distinguish between the short and long-term response of the dependent variable to variations in one of the explanatory variables.

The short-term effects are given by the coefficients estimated in the model, which we have analysed in the above section. With regards to the long-term effects, they are obtained by considering that the impact of each explanatory variable on discretionary fiscal policy at time t is not only due to the contemporary value of the variable (*at time t*) but also to the effect of the evolution of the same variable in previous periods ($t-1, t-2\dots$). This long-term effect can be identified in the response functions to the output gap and debt level, also considering the possible changes to the effects of the two variables from 1992 on.

Table 7 shows the short-term effects of the output gap and debt (*before Maastricht, β_{1i}, β_{3i} and after Maastricht, $\beta_{1i}+\beta_{2i}, \beta_{3i}+\beta_{4i}$, respectively*), and the accumulated effects from their impact²¹. The long-term effect is evidently greater, so we should consider that the response of the authorities is more active than initially assumed given the short-term expect, since the β_{5i} parameter is always positive. Our conclusions concerning the procyclical or anticyclical nature of discretionary fiscal action, however, remain unaltered.

Insert Table 7 here

²¹These effects will be significantly different from zero whenever the coefficients are. Since the accumulated effect is $\beta_{ji}/(1-\beta_{5i})$, when the test is performed, the null hypothesis (the estimated coefficient is zero) will only be accepted when the same hypothesis, but considered with the numerator coefficient, is not rejected.

6. Conclusions:

In this paper, we have used a SURE model to simultaneously estimate the rule characterising the behaviour of the fiscal authorities in each EMU country in the 1983-2005 period. This estimation procedure has enabled us to identify the impact of common factors such as the new fiscal framework, but also to obtain the differences in the national values of the coefficients of the rule, contemplating other aspects (institutional, political or economic) specific to each country. In our opinion, this is an important contribution to the empirical literature related to fiscal policy in the EMU.

Our estimated fiscal policy rule pays special attention to the reaction of the discretionary component of fiscal policy versus variations in the economy's cyclical conditions – measured by the output gap- and in the level of public debt. We also analyse whether there was a change in this reaction after the Maastricht Treaty came into force in 1992.

In this respect, one of the most solid results obtained from the estimation is that there is clear evidence of a structural break after the introduction of a new fiscal framework. This change is seen in a reduction in the procyclical nature of previous fiscal policies, even though there was no significant reduction in the authorities' reactions to increased debt in the form of increases in the cyclically adjusted primary balance. On the other hand, this reaction appears to be sufficient to guarantee the long-term sustainability of public debt.

These results support those previously obtained in the literature and, in particular, are generally consistent with those obtained by Galí and Perotti (2003), our reference for this paper. However, we have also obtained clear evidence in

1
2
3 favour of the need to distinguish between the fiscal rules for each country,
4
5
6 estimating them with a SURE model to collect all the cross correlations, because
7
8
9 all our tests have rejected the hypothesis of equality in the national coefficients, a
10
11
12 constraint which was applied to prior studies. There is, for example, a large
13
14
15 difference between Finland – the only country in which discretionary policy was
16
17
18 clearly anti-cyclical during the two periods considered – and Greece – the country
19
20
21 with the clearest procyclical activity in both periods. We believe that this result
22
23
24 shows a need to continue our analysis with a specific study of the national factors
25
26
27 behind these differences.
28

References:

- 29
30
31 Ballabriga, F.C.; Martínez-Mongay, C. (2005): “Sustainability of EU public
32
33 finances”, *European Economy Economic Papers n.º 225*, April, Brussels.
34
35 Blinder, A. (2004): “The case against the case against discretionary fiscal policy”,
36
37 *CEPS Working Papers n.º 100*.
38
39 Bohn, H (1998): “The Behaviour of U.S. Public Debt and Deficits”, *Quarterly*
40
41 *Journal of Economics vol. 113*, 949-963.
42
43 Burnside, C., M. Eichenbaum; J.D.M. Fisher (1999): “Assessing the Effects of
44
45 Fiscal Shocks”, *NBER Working Papers*, 7459.
46
47 Buti, M.; P. Van Den Noord (2004): “Fiscal policy in EMU: rules, discretion and
48
49 political incentives”, *European Commission Economic Papers*, 206.
50
51 Calmfors, L. (2003): “Fiscal Policy to Stabilise the Domestic Economy in the
52
53 EMU: What Can We Learn from Monetary Policy?”, *CESifo Economics*
54
55 *Studies vol. 4*, 319-353.
56
57 European Central Bank (2004): “Fiscal policy influences on macroeconomic
58
59 stability and prices”, *Monthly Bulletin*, April.
60
European Commission (2004): *Public Finances in EMU*.
European Commission (2006): *Public Finances in EMU*.
Fatàs, A.; I. Mihov (2000): “The Effects of Fiscal Policy on Consumption and
Employment: Theory and Evidence”, *INSEAD Working Papers*.
Fatàs, A.; Mihov, I. (2002): “Fiscal Policy and EMU”, *INSEAD*.

- 1
2
3 Favero, C.; T. Monacelli (2003): “Monetary-Fiscal mix and inflation
4 performance: evidence from the U.S.”, *IGIER Working Papers*, No. 234,
5 April.
6
- 7 Galí, J.; Perotti, R. (2003): “Fiscal Policy and Monetary Integration in Europe”,
8 *Economic Policy*, vol. 37, 533-572.
9
- 10 Green, W.H. (1999): *Análisis Económico*, 3rd ed, Prentice Hall.
11
- 12 Hemming, R., M. Kell; S. Mahfouz (2002): “The Effectiveness of Fiscal Policy in
13 Stimulating Economic Activity – A Review of the Literature”, *IMF Working*
14 *Papers*, 02208.
15
- 16 IMF (2004): “Has Fiscal Behavior Changed under the European Economic and
17 Monetary Union?”, *World Economic Outlook*, September, 103-124.
18
- 19 Larch, M.; M. Salto (2003): “Fiscal rules, inertia and discretionary fiscal policy”,
20 *European Economy Economic Papers n.º 194*.
21
- 22 Novales, A. (1993): *Econometría*, McGraw Hill.
23
- 24 OECD (2006): *OECD Economic Outlook*, May.
25
- 26 Perotti, R. (2002): “Estimating the effects of fiscal policy in OECD countries”,
27 *ISOM Conference*, Frankfurt.
28
- 29 Taylor, J. (1993): “Discretion versus Policy Rules in Practice”, *Carnegie-*
30 *Rochester Conference Series on Public Policy*, 39.
31
- 32 Taylor, R.J. (2000a): “How the Rational Expectations Revolution Has Changed
33 Macroeconomic Policy Research?” *Stanford University*,
34 <http://www.stanford.edu/~johntayl/Papers/IEALecture.pdf>
35
- 36 Taylor, R.J. (2000b): “Reassessing Discretionary Fiscal Policy”, *Stanford*
37 *University*,
38 <http://www.stanford.edu/~johntayl/Papers/Reassessing+Revised.pdf>
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Tables and Graphs:**TABLE 1: REGRESSION COEFFICIENTES FOR EACH COUNTRY:**

α_{0i} : Constant before 1992.

$\alpha_{0i} + \alpha_{1i}$: Constant from 1992 on.

β_{1i} : Effect of economic evolution on the discretionary nature of fiscal policy before 1992. For each percentage point that the output gap changes, a structural primary balance of β_{1i} percentage points is generated in the same period.

$\beta_{1i} + \beta_{2i}$: Effect of economic evolution on the discretionary nature of fiscal policy from 1992 on. For each percentage point that the output gap changes, a structural primary balance of $\beta_{1i} + \beta_{2i}$ percentage points is generated in the same period.

β_{3i} : Effect that the level of debt in the previous period has on the discretionary nature of fiscal policy before 1992. For each percentage point of debt in the previous period, a structural primary balance of β_{3i} percentage points is generated in the same period.

$\beta_{3i} + \beta_{4i}$: Effect that the level of debt in the previous period has on the discretionary nature of fiscal policy from 1992 on. For each percentage point of debt accumulated up to the previous period, a structural primary balance of $\beta_{3i} + \beta_{4i}$ percentage points is generated in the same period.

β_{5i} : It represents the inertia of the structural primary balance, determining how the past of the dependent variable influences its future evolution.

TABLE 2: HETEROSCEDASTICITY TEST BETWEEN GROUPS AND CROSS-SECTION CORRELATION:

STATISTIC*	P-VALUE
$\lambda_{LR} = (n * T) * \left(\log\left(\frac{e' * e}{n * T}\right) - T * \log(\Sigma) \right) = 1629,3$	0.0000

*The asymptotic distribution is χ^2 with $\frac{n * (n + 1)}{2} - 1$ degrees of freedom.

Source: the authors, from the results of the estimations.

TABLE 3: CONTEMPORANEOUS RESIDUAL CORRELATIONS ESTIMATED BY GLS:

	AU	BE	FI	FR	GE	GR	IR	IT	HO	PO	SP
AU	1.0000	0.0811	-0.0222	0.1337	0.1667	-0.1961	-0.1543	0.4784	-0.2417	0.1671	0.1657
BE	0.0811	1.0000	-0.0165	0.3240	-0.0011	-0.0943	0.0043	-0.1399	-0.2390	-0.3701	-0.0575
FI	-0.0222	-0.0165	1.0000	-0.1607	0.3831	0.2619	0.0392	0.1449	-0.0103	-0.0785	-0.6381
FR	0.1337	0.3240	-0.1607	1.0000	0.3587	0.4203	0.2852	0.0401	0.2764	-0.3333	0.4673
GE	0.1667	-0.0011	0.3831	0.3587	1.0000	0.4855	0.5886	0.3026	0.3142	-0.0198	-0.1539
GR	-0.1961	-0.0943	0.2619	0.4203	0.4855	1.0000	0.4273	-0.2819	0.3522	-0.1859	0.1422
IR	-0.543	0.0043	0.0392	0.2852	0.5886	0.4273	1.0000	0.2056	0.4808	0.1493	-0.0221
IT	0.4784	-0.1399	0.1449	0.0401	0.3026	-0.2819	0.2056	1.0000	-0.2127	0.6027	0.0342
HO	-0.2417	-0.2390	-0.0103	0.2764	0.3142	0.3522	0.4808	-0.2127	1.0000	-0.5234	-0.1187
PO	0.1671	-0.3701	-0.0785	-0.3333	-0.0198	-0.1859	0.1493	0.6027	-0.5234	1.0000	0.2139
SP	0.1657	-0.0575	-0.6381	0.4673	-0.1539	0.1422	-0.0221	0.0342	-0.1187	0.2139	1.0000

Source: the authors, from the results of the estimations.

TABLE 4: ESTIMATION OF DISCRETIONARY FISCAL POLICY IN EMU-11:

COUNTRY	CONSTANT		OUTPUT GAP		DEBT		CABB ₁	TOTAL AFTER MAASTRICHT		
	α_0	α_1	β_1	β_2	β_3	β_4	β_5	$\alpha_0+\alpha_1$	$\beta_1+\beta_2$	$\beta_3+\beta_4$
AUSTRIA	3.44	-12.58	-0.04	0.04	-0.06	0.21	0.47	-9.14	0.00	0.14
	(0.75)	(-2.17)	(-0.18)	(0.13)	(-0.79)	(2.13)	(2.90)	(-2.56)	(-0.02)	(2.64)
BELGIUM	12.36	-14.09	-0.03	-0.50	-0.10	0.11	0.83	-1.73	-0.52	0.02
	(1.94)	(-1.96)	(-0.18)	(-2.26)	(-1.78)	(2.00)	(7.90)	(-1.00)	(-3.33)	(1.55)
FINLAND	-10.23	8.70	0.21	0.07	0.61	-0.53	0.34	-1.54	0.27	0.08
	(-1.37)	(1.15)	(1.28)	(0.35)	(1.48)	(-1.28)	(1.78)	(-0.70)	(2.07)	(2.21)
FRANCE	-1.07	-1.78	-0.26	-0.07	0.02	0.01	0.59	-2.84	-0.33	0.04
	(-0.19)	(-0.33)	(-1.77)	(-0.32)	(0.17)	(0.10)	(4.42)	(-2.73)	(-2.19)	(2.19)
GERMANY	-42.91	43.85	-0.80	0.36	1.05	-1.07	0.54	0.94	-0.44	-0.02
	(-3.37)	(3.43)	(-6.05)	(1.91)	(3.38)	(-3.43)	(5.05)	(0.83)	(-3.48)	(-0.93)
GREECE	-8.88	5.75	-1.46	0.55	0.09	-0.06	0.27	-3.13	-0.91	0.03
	(-4.82)	(1.20)	(-4.75)	(1.42)	(3.07)	(-1.31)	(2.17)	(-0.69)	(-3.83)	(0.79)
IRELAND	-15.87	16.75	0.21	-0.48	0.17	-0.16	0.42	0.88	-0.27	0.01
	(-3.16)	(3.33)	(0.94)	(-1.95)	(3.30)	(-3.12)	(2.66)	(0.58)	(-1.62)	(0.26)
ITALY	-17.90	9.47	-0.76	0.36	0.18	-0.10	0.58	-8.43	-0.40	0.08
	(-3.49)	(1.07)	(-2.61)	(1.10)	(3.34)	(-1.21)	(2.95)	(-1.09)	(-2.72)	(1.15)
HOLLAND	10.02	-11.24	-0.32	0.14	-0.12	0.15	0.42	-1.22	-0.18	0.03
	(0.65)	(-0.72)	(-1.10)	(0.38)	(-0.66)	(0.81)	(2.49)	(-0.65)	(-0.98)	(1.23)
PORTUGAL	-0.68	-0.95	-0.12	0.09	0.03	0.00	0.34	-1.63	-0.03	0.03
	(-0.11)	(-0.13)	(-1.43)	(0.58)	(0.24)	(0.02)	(2.05)	(-0.50)	(-0.26)	(0.54)
SPAIN	-4.51	4.96	-0.20	0.21	0.09	-0.09	0.74	0.45	0.01	0.00
	(-1.38)	(1.39)	(-1.79)	(1.13)	(1.26)	(-1.14)	(6.13)	(0.31)	(0.07)	(0.14)
EMU	-0.72	0.09	-0.15	-0.01	0.01	0.00	0.82	-0.63	-0.17	0.01
	(-3.24)	(0.26)	(-5.50)	(-0.32)	(4.11)	(0.38)	(31.09)	(-2.61)	(-4.68)	(4.25)

The brackets contain the value of the t-statistic of the parameter significance test.

Source: the authors, from the results of the estimations.

TABLE 5: EVIDENCE OF A STRUCTURAL CHANGE FROM 1992 ON:

No.	TEST	MODEL		α_1	β_2	β_4
1	CHOW TEST	0.02348				
2	INFORMATION CRITERIA	MODEL WITH BREAK	MODEL WITHOUT BREAK			
	- AIC	-172.638	-113.61			
	- SC	-171.528	-112.976			
3	R2 (McElroy)	0.925				
4	STRUCTURAL CHANGE BY PARAMETER			4.24E-06	6.41E-02	8.16E-06
5	EQUAL MAASTRICHT EFFECT ACROSS COUNTRIES			2.79E-06	4.72E-02	4.40E-06
6	EQUAL PARAMETERS ACROSS COUNTRIES (WITH STRUCTURAL CHANGE)			3.53E-07	5.19E-11	3.06E-06
7	EQUAL PARAMETERS ACROSS COUNTRIES (WITHOUT STRUCTURAL CHANGE)			0.000000	0.,000000	1.78E-15

The information provided about test results refers to *p*-value.

Source: the authors, from the results of the estimations.

TABLE 6: MODEL DIAGNOSIS STATISTICS:

COUNTRY	AUTOCORRELATION*			R2	NORMALITY
	1 lag	2 lags	5 lags		Jarque Bera
Austria	0.93	0.65	0.80	0.517	0.84
	0.51	0.08	0.02		
Belgium	0.50	0.83	0.75	0.908	0.38
	0.15	0.07	0.17		
Finland	0.74	1.00	0.77	0.686	0.67
	0.05	0.12	0.08		
France	0.81	0.77	0.47	0.806	0.51
	0.04	0.09	0.12		
Germany	0.52	0.99	0.56	0.768	0.57
	0.10	0.07	0.02		
Greece	0.89	0.85	0.55	0.897	0.65
	0.04	0.11	0.15		
Ireland	0.83	0.73	0.65	0.763	0.93
	0.04	0.05	0.04		
Italy	0.91	1.00	0.49	0.924	0.41
	0.10	0.23	0.38		
Holland	0.73	0.48	0.58	0.598	0.62
	0.04	0.03	0.00		
Portugal	0.74	0.73	0.79	0.360	0.96
	0.27	0.13	0.22		
Spain	0.50	0.67	0.59	0.864	0.81
	0.06	0.13	0.03		
Global				0.925	

*For each country, the first row corresponds to the Ljung-Box *Q* test and the second to the Breusch-Godfrey test.

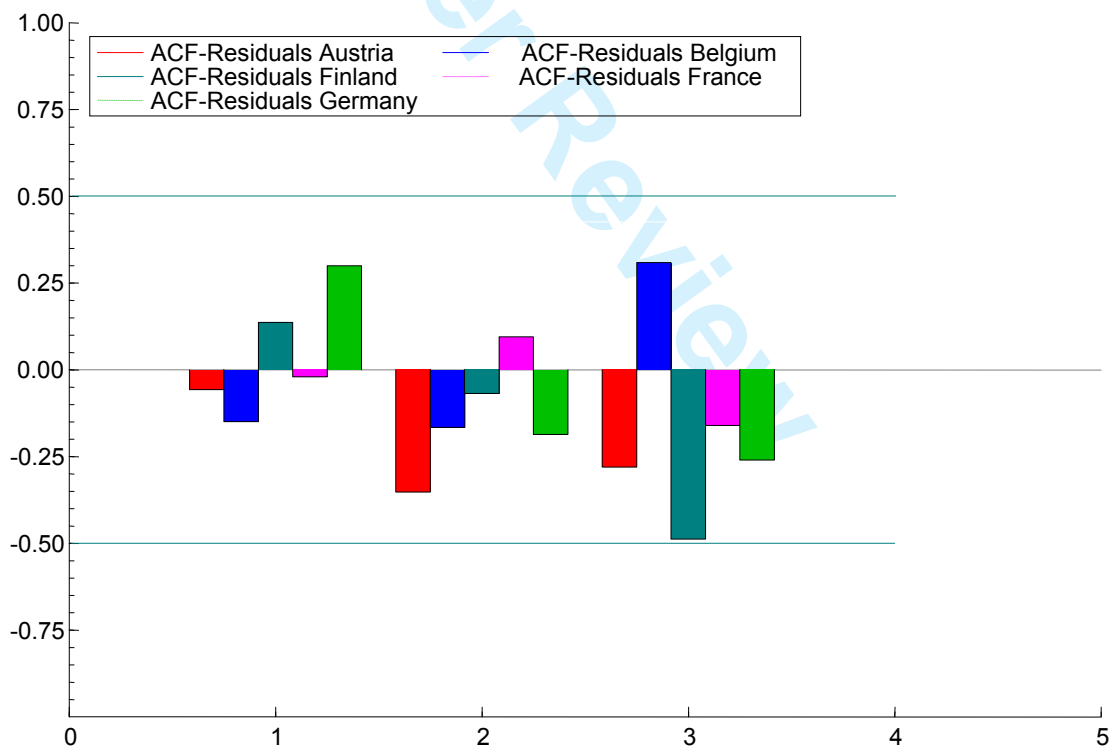
The information provided about the test results refers to the *p*-value.

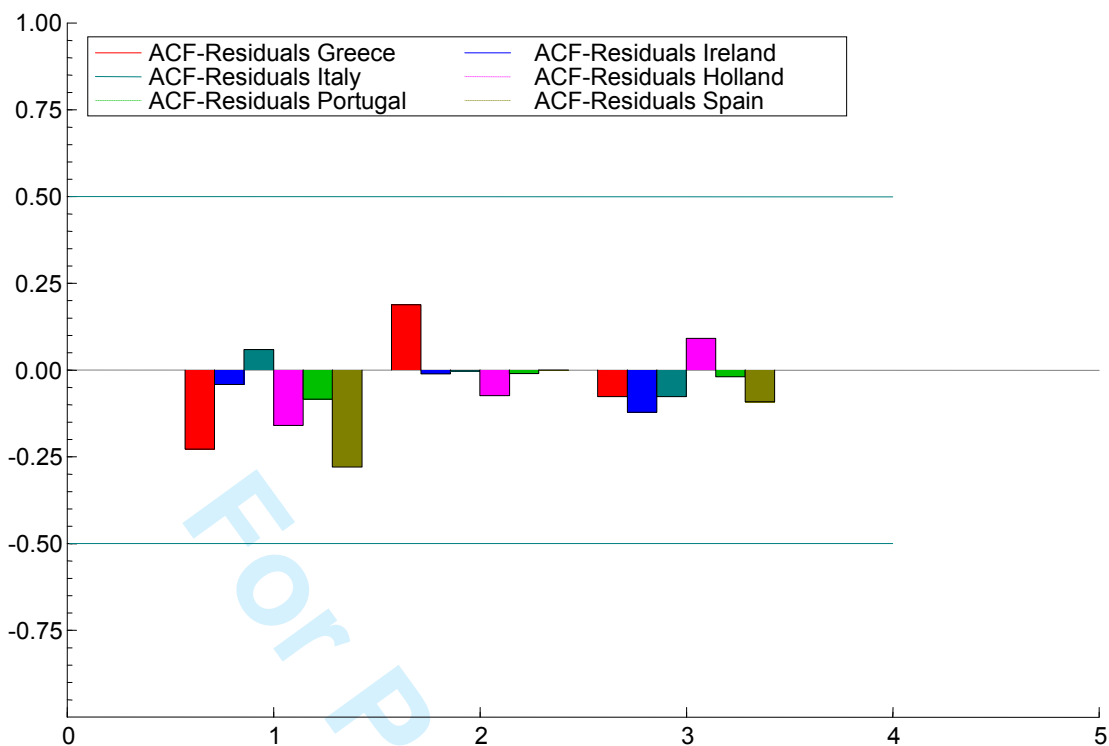
Source: the authors, from the results of the estimations.

TABLE 7: SHORT-TERM AND LONG-TERM EFFECTS OF OUTPUT GAP AND DEBT BEFORE AND AFTER MAASTRICHT TREATY.

Country	Before Maastricht				After Maastricht			
	β_1	Accumulated response	β_3	Accumulated response	$\beta_1+\beta_2$	Accumulated response	$\beta_3+\beta_4$	Accumulated response
Austria	-0,039	-0,075	-0,064	-0,122	-0,003	-0,007	0,142	0,270
Belgium	-0,028	-0,161	-0,095	-0,545	-0,524	-3,003	0,019	0,107
Finland	0,206	0,311	0,608	0,916	0,273	0,412	0,078	0,118
France	-0,262	-0,637	0,025	0,060	-0,335	-0,814	0,039	0,095
Germany	-0,801	-1,748	1,049	2,291	-0,445	-0,971	-0,018	-0,039
Greece	-1,458	-1,998	0,094	0,128	-0,905	-1,241	0,030	0,040
Ireland	0,207	0,359	0,168	0,291	-0,269	-0,466	0,007	0,012
Italy	-0,757	-1,806	0,181	0,431	-0,399	-0,952	0,077	0,184
Holland	-0,320	-0,550	-0,125	-0,215	-0,177	-0,305	0,030	0,051
Portugal	-0,118	-0,179	0,026	0,040	-0,032	-0,049	0,028	0,043
Spain	-0,199	-0,764	0,089	0,342	0,012	0,045	0,003	0,013
Euro area	-0,151	-0,834	0,011	0,061	-0,165	-0,912	0,012	0,066

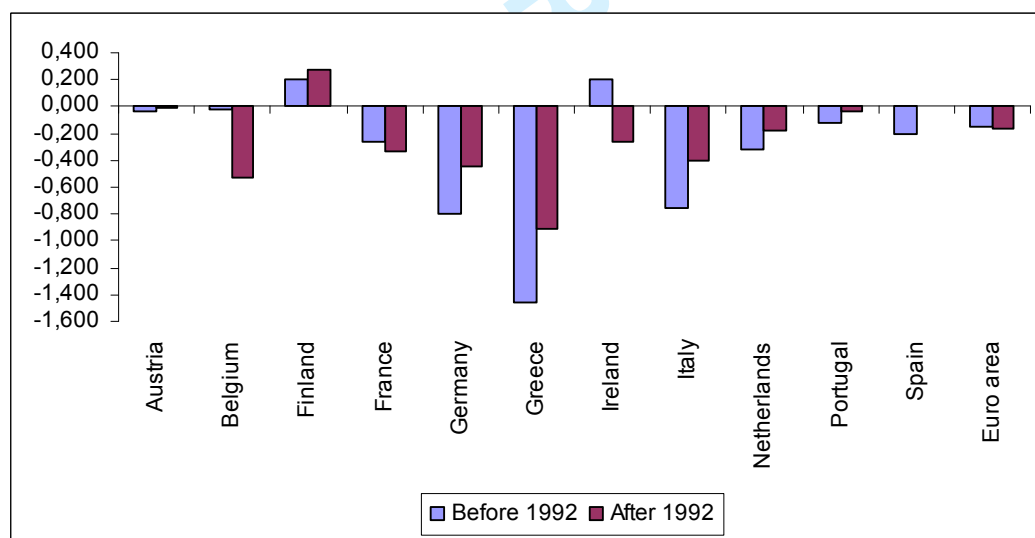
Source: the authors, from the results of the estimations.

GRAPH 1: AUTOCORRELATION FUNCTION OF THE RESIDUALS ESTIMATED BY GLS:



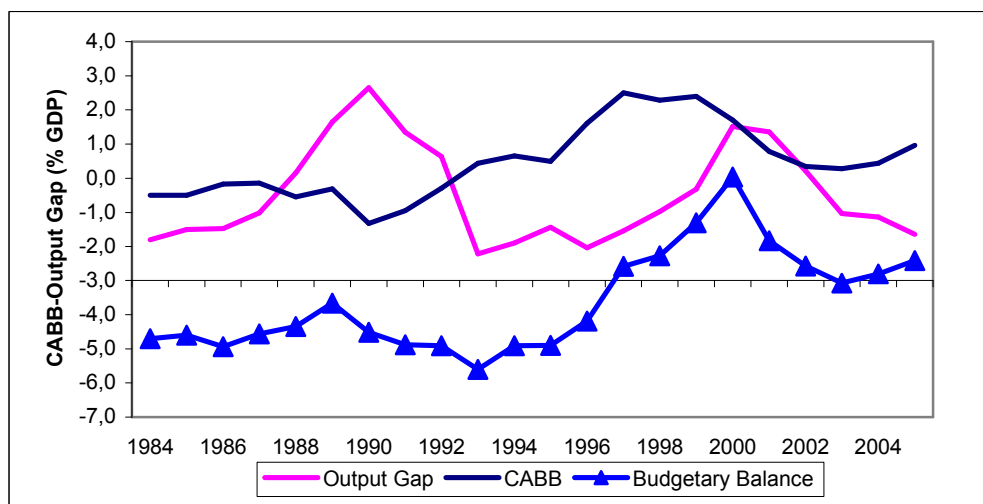
Source: the authors, from the results of the estimations.

GRAPH 2: ESTIMATED COEFFICIENTS FOR THE OG:



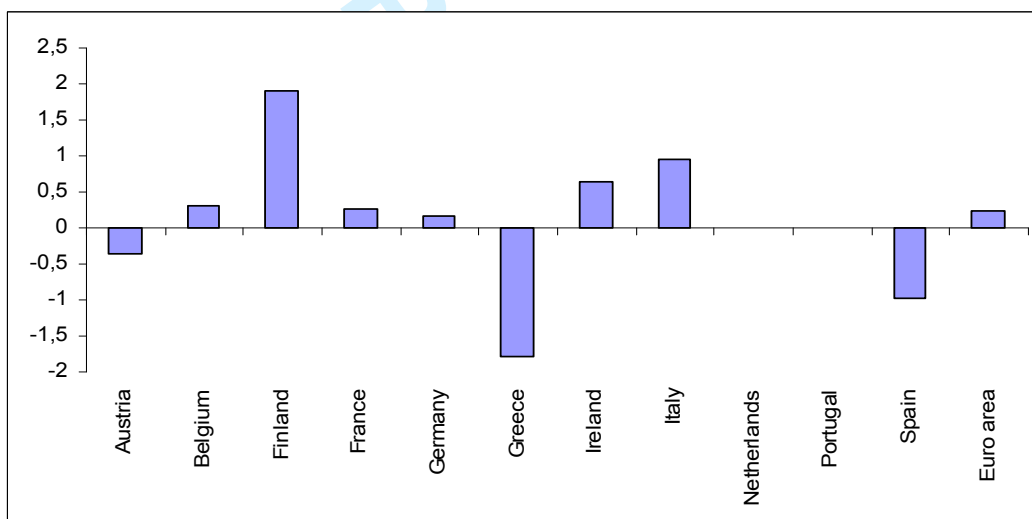
Source: the authors, from the results of the estimations.

GRAPH 3: FISCAL POLICY IN EMU, 1984-2005.

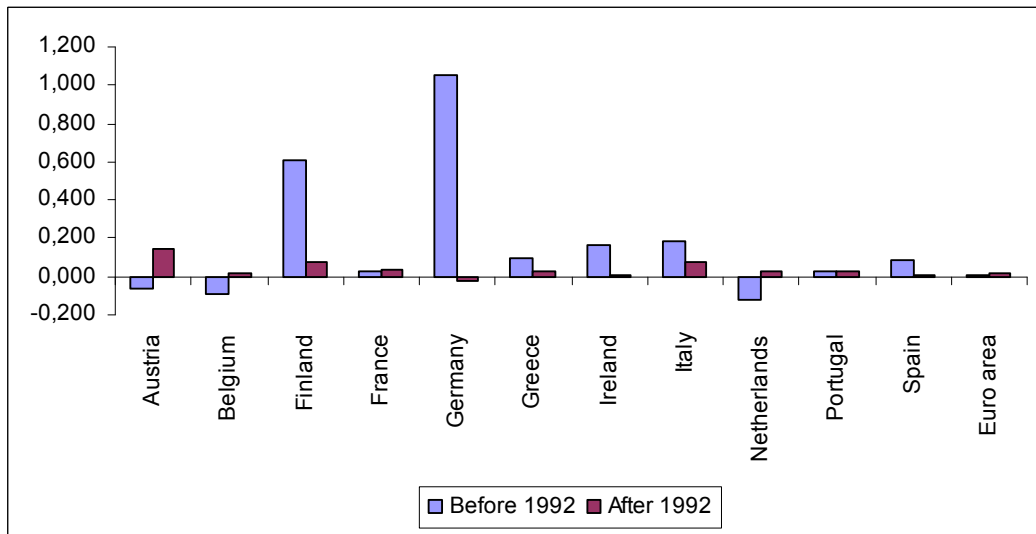


Source: OECD Economic Outlook.

GRAPH 4: CHANGE IN CABB/CHANGE IN OG, 2005-2000



Source: OECD Economic Outlook.

GRAPH 5: ESTIMATED COEFFICIENTS FOR THE PUBLIC DEBT:

Source: the authors, from the results of the estimations.