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Fiscal Revenues and Expenditure in the Community

Granger-Causality Among Fiscal Variables in Thirteen Member States and Implications for Fiscal Adjustment

Tassos Belessiotis

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Table of Contents

Fiscal Revenues and Expenditure in the Community

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I. Introduction

One of the key convergence criteria set out in the Treaty on European Union concerns the public finances. According to article 104c and the appended protocol, Member States are to avoid excessive deficits defined in terms of a reference value of 3 percent of GDP and in terms of a public debt reference value of 60 percent of GDP. In its November 1994 review of the state of the public finances in the Member States the ECOFIN found that ten out of the then twelve had an excessive deficit. Correcting the public finances has become a most difficult problem to tackle in the move to stage III of EMU. This paper contributes to the debate on the correction of the fiscal imbalances in the Community by taking an empirical view of the determination of government expenditure and revenues and the possible interdependence between the two. Correction of fiscal imbalances and the feasibility of fiscal adjustment depend crucially on knowing the causes of fiscal deficits. Conversely, a permanent reduction in the fiscal disequilibrium characterizing the Member States will not be possible unless the proximate causes of these imbalances are established and adequately addressed.

Public expenditure has consistently exceeded receipts in virtually all the Member States of the Community and over much of the post-War II historical record. Since the first oil shock and throughout the period up to the first half of the last decade large deficits have continued to plague the public finances. Furthermore, on a cyclically adjusted basis, net borrowing by the general government remained in the range of 4 percent of Community GDP until the end of the 1980s. While the total deficit for the Community EC-12 did not start rising as a share of Community GDP until the recession of the 1990s, the structural deficit had marked a step increase in 1988 and continued on the upward path until 1993. In the Commission's November 1994 short-term forecast the structural and total deficit for virtually all the Member States is expected to persist at a time when the first date for the assessment of the prospects for monetary unification will be approaching.

Will it be feasible to redress the fiscal imbalances to the extent necessary to meet the convergence criteria? The present paper reviews this question by taking an explicitly empirical perspective based on Granger-causality. Drawing upon the evidence of fiscal data over the period 1960-94 from thirteen Community Member States[1] it attempts to determine

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1 Luxembourg and Sweden are excluded due to incomplete data availability in the AMECO data bank; see footnote 36 for a further comment.

the nature of government revenue and expenditure decisions as revealed by the data themselves, organized in a bivariate framework, without imposing prior restrictions on the underlying structural relationships[2]. While undoubtedly fiscal decisions are political, understanding of the dynamics of budgetary decisions as revealed by the historical correlations should also contribute to a better evaluation of the causes of fiscal imbalances and of the consequences of proposed fiscal consolidation policies in the Community.

In addition to the introduction, the paper has seven sections: section II reviews the relationship between revenue and expenditure determination from a public finance perspective; sections III and IV present general remarks on the Granger-causality model and the testing procedure followed in the paper; section V presents the results of the causality tests for government revenues and expenditure; section VI reviews the question of whether causality runs from public spending to the fiscal deficit or from revenues to the fiscal deficit, while section VII reviews the issue of whether fiscal imbalances Granger-cause government spending and increase the size of the government; and section VIII concludes with remarks on the prospects for fiscal adjustment in the Member States under review. Two annexes are also included: Annex I discusses the time-series properties of the data and presents some pertinent cointegration results, and Annex II presents further diagnostic results concerning the properties of the Granger-causality equations.

II. Government Revenue and Expenditure Determination

Fiscal imbalances in the Community have deteriorated to an extent unprecedented in a peace time period such as that since the early 1970s[3]. Government revenues in the Community EC-11 (excluding Greece, Spain, Luxembourg and Sweden for which consistent time series dating 1960 do not exist) have grown from an average of 35.4 percent of GDP in the 1960s to 44.9 percent of GDP in the first 1980s, and to an average of 45.6 percent in the first four years of the present decade. Revenue growth has not kept up with the growth of government expenditure. The latter has advanced by 15 percentage points in terms of GDP between the decade of the 1960s and the 1990s. The share of general government spending to GDP, which represented an average of 35.6 percent in the 1960s, averaged 50.6 percent of GDP in the first four years of the 1990s. These reflect substantial increases in inflation-adjusted terms too. Correspondingly, the small deficits recorded in the 1960s up to the early 1970s gave way to increasingly large deficits in subsequent decades. Thus, the average value of general government net borrowing in the 1960s was 0.24 percent of GDP; in the 1970s it grew to 2.6 percent of GDP; in the 1980s it grew by an average of another 1.5 percentage points to a value of 4.1 percent of GDP; and in the first four years of the 1990s it has grown to an

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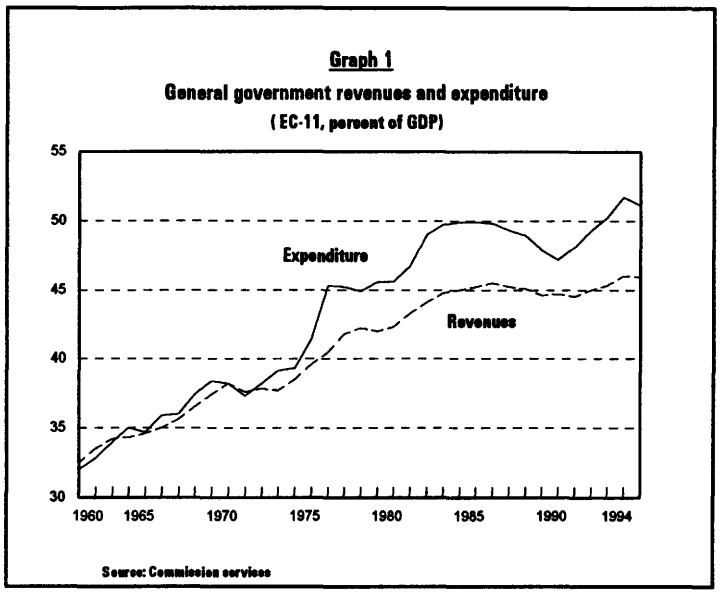
2 There is a paucity of empirical evidence on this issue from an international perspective, with a dominant part of the literature examining US data. Ram (1988b) has marshalled some evidence from a diverse international group, which includes some Community Member States, but his sample, which starts around 1958-1960, includes observations up to the mid-1980s. The present study adds another ten years of data, a crucial consideration since causality testing as well as the quality of inference depends on long data series.

3 de Haan et. al.(1994) discuss these developments in more detail.



average of 5.0 percent of GDP. The basic flow data are displayed in Graph 1 and are largely representative of the fiscal circumstances of all the eleven Member States constituting the EC-11 group shown here.

As a result of these trends, public debt has also risen throughout this period to levels which are currently threatening the sustainability of fiscal positions in most Member States. The awareness of the risks that persistent fiscal imbalances engender has increased in recent years, particularly since the adoption of the Treaty on European Union, and virtually all the Member States have adopted convergence programs aimed at complying with the debt and deficit, as well as the other, convergence criteria[4].

The rapid growth in government expenditure relative to GDP in the past quarter century, typified by Wagner's law[5], and the emergence of structural deficits is not restricted to the Community but it has been a characteristic of all the OECD economies[6]. An additional characteristic has been the failure to contain and ultimately reverse these imbalances so that both the mushrooming deficits and the growth in public debt come under control. In the case of the eleven Community Member States shown in Graph 1, it appears that the ratio of government expenditure to GDP has advanced in discontinuous jumps in 1974 and in 1981 subsequently reaching a plateau. In the latter part of the 1980s the rapid growth of the

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4 The Treaty on European Union sets out fiscal convergence criteria for the general government deficit (3 percent of GDP) and for the general government debt (60 percent of GDP or approaching this mark at a sufficient pace); see articles 104c and the protocol on the excessive deficit procedure of the Treaty.

5 Wagner's law refers to the notion that government expenditure rises faster than GDP and, as a result, the size of the government increases over time. One conventional explanation for Wagner's law (see the volume edited by Lybeck and Henrekson (1988) for a discussion of various aspects of Wagner's law) is that public goods are luxury goods characterized by steeply sloped Engel curves. This would suggest that the share of government expenditure in GDP would be bounded by unity; in most countries, however, this ratio has grown at a diminishing rate once a threshold level has been reached, or it has altogether stabilized. Thus, the luxury good explanation is inconsistent with the empirical facts. See footnote 30 below for a brief reference to equilibrium choice models explaining the size of the government in democracies.

6 See Roubini and Sachs (1989a), Roubini and Sachs (1989b), and Alesina and Perotti (1994) and the references therein.

Community economies contributed to reducing this ratio but the recession of the 1990s pushed it up once more.

The share of revenues in Community EC-11 GDP reached a peak of around 45 percent in the early 1980s and stabilized at that level for approximately ten years. There was a modest rise in the ratio in 1993 and in 1994 reflecting primarily the cyclical deterioration of GDP rather than discretionary taxation increases to reduce the deficit. During stage II of EMU, convergence programs provide for some revenue adjustments to contribute to budgetary consolidation.

Despite the policy adjustments incorporated in the convergence programs, the feasibility of fiscal adjustment and of respecting the fiscal convergence targets remains in doubt. A failure to address the fiscal imbalances, especially in periods of strong economic growth such as the second part of the 1980s, raises questions about the nature of the politico-economic model underlying revenue, expenditure and fiscal balance determination in these industrial democracies. It is clear that if the model which has generated the fiscal data of the Member States over the past thirty four years continues to prevail in the future, doubts should be raised about the fiscal consolidation prospects. It is of crucial importance, therefore, to establish the nature of the fiscal processes underlying the revenue and expenditure data.

In a review of six possible models which could account for the rise in deficits and in public debt, as well as the divergent fiscal experience among the OECD nations, Alesina and Perotti (1994) suggest that the data are consistent with the model which explains deficits in terms of political conflicts between social groups and among members of the same coalition government; and with the model which emphasizes budget institutions and procedures as determinants of deficits[7]. With respect to the former class of models, these predict that fragmentation of governments and low degree of political cohesion imply difficulties in effecting fiscal adjustment and delays in halting the rise of public debt; further, these models predict that coalition governments would tend to be associated with higher deficits and debt than single-party governments. de Haan, Sterks and de Kam (1992) also find support for these hypotheses in their study of the Community budgetary policies. Roubini and Sachs (1989a) find that in the period 1975-85 the OECD nations with the shortest average government tenure, characterized also by coalitions governments, were those with the largest increase in the debt ratio (Belgium, Ireland, Denmark, Sweden and Italy, recording increases of between 6.16 percentage points (Belgium) to 3.65 percentage points (Italy)).

The second class of models predicts that the rules according to which budgetary policy is designed, approved and executed determine the fiscal outcomes. The more stable budgetary policy is, the less likely it will be that the initial budget plans will be subsequently overturned by parliament. In addition, institutional arrangements which limit the number of admissible amendments to budgetary proposals and require rigid implementation procedures will also

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7 See Alesina and Perotti (1994) for a discussion and review of the evidence and its consistency with the various models. The other four politico-economic models examined are that based on opportunistic policy-makers and voters suffering from "fiscal illusion"; models based on intergenerational redistribution; models based on strategic incentives of today's government to burden future governments with fiscal imbalances; and models based on geographically dispersed interest and "pork barrel" politics.

contribute to fiscal discipline. de Haan, Sterks and de Kam (1992) also find support for these views.

With specific reference to the Community experience, von Hagen (1992) and von Hagen and Harden (1994) argue that budgetary procedures and institutions play an important role in determining fiscal outcomes. Fiscal consolidation requires that some form of commitment be adopted, which may take either the form of a specific numerical fiscal target or the form of a commitment procedure which elevates the objectives of sound public finances to a primary position in the administration. They find support for a hypothesis postulating that structural characteristics in the budgetary process enhance fiscal stability. Specifically, this structural hypothesis argues that budget procedures which give the prime minister or the finance minister a role of strategic dominance over spending ministers, which limit the amending power of parliament, and which impose restraints in the execution of the budget, are conducive to fiscal discipline. The underlying rationale is that while spending ministers are prone to support increases in public expenditure, with correspondingly large deficits consequences, actors in strategic dominance can limit this tendency by defending fiscally responsible strategies against political pressures arising from the day-to-day political discourse.

von Hagen and Harden (1994) also find a particular pattern of fiscal experience emerging across the Community. In the large European states where fiscal discipline has been maintained, the government has adopted a procedural commitment technology; this applies to the UK, France and Germany. On the other hand, in the smaller European states this commitment has taken the form of a specific numerical fiscal target, as can be seen from the experience of Denmark and Luxembourg. A mixture of commitment technologies has been used by the Netherlands, a medium-size Community state. While no immediate explanation for this pattern can be invoked, von Hagen and Harden speculate that the size of the economy, which is correlated both with the complexity of administrative tasks, and with the heterogeneity and diversity of special interests exercizing influence on the government, appears to favour procedural rather than numerical discipline technologies. These considerations are clearly relevant for the choice of the appropriate commitment mechanism to effect fiscal consolidation in the Member States.

On the other hand, von Hagen (1992) finds less support for the hypothesis that long-term fiscal constraints alone strengthen fiscal discipline. Instead, he finds that such constraints are effective when supported by effective commitment mechanisms in the budgetary process. Fiscal performance may improve in countries where disciplined budget procedures are in place; on the other hand, such restraints will be inadequate in overcoming fiscal discipline problems when budget procedures are not rigorous. von Hagen and Harden (1994) also found that countries ranking high in terms of the long-term constraint criterion have better fiscal outcomes than those ranking low.

The evidence reviewed by Alesina and Perotti (1994) is inconsistent with the purely economic model of fiscal policy. According to the tax smoothing hypothesis, the intertemporal budget constraint determines the path of taxation; taxation is assumed to be set in an optimizing manner in order to equalize the present value of an exogenously determined stream of expenditure with the present value of taxation. Taxes are set so that the excess burden of

(2)

taxation is minimized for a given path of expenditure, and budget deficits and surpluses act as buffer mechanisms, emerging when spending is temporarily high or temporarily low, respectively. This model is unable to explain either the persistence of fiscal imbalances in the post-1975 period, or the distribution of public indebtedness across different countries. Rather, the data support a politico-economic model of fiscal policy.

The model underlying the fiscal data has important implications for the possibility of fiscal adjustment. There is no unanimity on how feasible fiscal adjustment is in general, or how effective different fiscal adjustment strategies are, and the history of fiscal disequilibrium in the Community provides evidence that democratic governments are reluctant to correct fiscal imbalances in a durable manner. Since the beginning of the 1980s two models of fiscal strategies may be identified: the Reagan model, according to which reductions (increases) in taxation was expected to lead to reductions (increases) in spending; and the Thatcher-Kohl model according to which reductions in spending are prerequisites for making possible reductions in taxation[8]. These strategies imply specific causality notions, running from taxation to expenditure in the Reagan model, and from expenditure to taxation in the Thatcher-Kohl model. Furthermore, von Hagen (1992) attributes a crucial role to domestic institutions and policies when he finds that fiscal policies in the Community, as depicted by the time series of government deficits, public debt, and public spending, reflect country-specific reactions to common shocks. As a result, inter-country differences in fiscal performance could be accounted for by differences in fiscal institutions and procedures which shape the response of each Member State to these shocks. How feasible fiscal adjustment is will depend on the nature of this response.

According to some views, especially associated with Milton Friedman[9], raising taxation to reduce government deficits would be ineffective simply because the availability of higher revenues will lead to correspondingly higher expenditure. The underlying cause of the deficit is the level of government spending which, in turn, determines the level of taxation or the level of borrowing; increased taxation is the causal mechanism through which the growth of the government is effected. Because higher taxation will have no impact on the deficit, fiscal adjustment through tax increases is not possible. On the other hand, lowering taxation may not lead to lower expenditure but to an increase in the deficit, as the Reagan supply-side tax policies have shown. US fiscal data at the federal level provide support for the hypothesis postulating causality from revenues to government expenditure (see Manage and Marlow (1986), Blackley (1986), Ram (1988a), Bohn (1991), Joulfain and Mookerjee (1991)), although there is no consensus on this matter (see von Furstenberg et. al. (1985, 1986), and Anderson, Wallace and Warner (1986), for the opposite conclusion, and Hoover and Sheffrin (1992) who suggest that causality from revenue to expenditure characterizes the pre-1960 data; subsequently, the two variables are independent).

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8 See von Furstenberg et. al. (1985) for a discussion of the political economy of this issue. See also Pommerehne and Feld (1994), and Rajah and Smith (1994) for a discussion of fiscal policy in the post-1980 period in Germany and in the UK, respectively.

9 Anderson, Wallace, and Warner (1986) review these hypotheses with particular reference to the US experience. Another version of this hypothesis was articulated by President Calvin Coolidge's saying that "nothing is easier than spending public money; it does not appear to belong to anybody; the temptation is overwhelming to bestow it to somebody" (quoted in von Furstenberg et. al. (1985), p. 323).

The public choice school, associated with J. Buchanan and R. Wagner[10], contends that the composition of taxation has implications for government spending. Visible direct taxation constrains government spending since voters observe directly the cost of government services provided through public expenditure while the benefits are more diffuse[11]. This constraint effectively provides an incentive for governments to resort to indirect taxation and to inflationary finance to finance expenditure. Fiscal illusioned voters fail to completely internalize the cost of these tax policies, which take the form of higher interest rates through crowding-out phenomena and of higher inflation, and which are alternative to direct taxation. As consequence of these policies the stability of the private economy is undermined; such instability, in turn, gives rise to demands by the electorate that the government intervenes and, thus, it provides an incentive for the government to grow. In this model, where the government has an incentive to increase in size, fiscal adjustment may not be feasible[12].

Finally, Barro has argued that the causality runs from higher spending to higher taxation[13]. Voters are viewed as not suffering from fiscal illusion; rather, they are assumed to recognize that the current level of debt-financed expenditure ultimately implies an increase in current or future taxation and, therefore, it is implicitly suggested that expenditure changes cause corresponding (contemporaneous or future) revenue changes. As government bonds are not regarded as part of net wealth, the private sector capitalizes this expectation and adjusts accordingly its level of spending. The Barro model offers the least possibilities for fiscal adjustment. Although the model does not determine the size of the government, it implies that a permanent reduction in public spending will ultimately be accompanied by revenue reductions and by an increase in private spending associated with the expected decline in taxation and the rise in permanent income; thus, fiscal policy will have no impact on the level of economic activity and no impact on the level of the fiscal deficit.

III. Causality Tests on Revenues and Expenditure: General Remarks

One way to establish the nature of fiscal policy is to examine the relationship between revenues and expenditure in the framework of Granger causality. This framework, while not imposing any priors about the determination of the variables and while not testing directly

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10 See Buchanan and Wagner (1978).

11 It could now be argued, however, that such public expenditure illusion is less prevalent, as shown by the popularity of privatization, and the emphasis on expenditure reduction, policies in several Member States.

12 Another class of models where fiscal illusion or incomplete information play an important role in fiscal performance is that of the political business cycles. These models predict that pre-election expansionary policies will be reversed in the post-election period and that deficits will be larger in election years. Expansionary policies may take the form of easing of monetary policy or of increased expenditure and/or tax reductions. Whether the expansionary policy is completely or incompletely reversed will determine the extent to which electoral cycles lead to rising deficits. See Schuknecht (1994) for a discussion of the literature and some evidence drawn from developing countries.

13 See Barro (1974) and Barro (1978).

behaviour-based hypotheses, it allows the data to discriminate between the history of individual time series according to their ability to predict the current value of government revenues and expenditure. While the results of such test are generally consistent with more than one hypotheses, they also provide an objective statistical base to form empirical judgements about the correlations underlying the fiscal variables. As will be seen, this venue offers some surprising insights into the determination of fiscal policy in the Community.

The empirical methodology used to disentangle the relationship between general government revenues and expenditure in the 13 Community Member States is the Granger-causality tests. This methodology imposes no structure on the underlying relationship generating the data but it permits a free estimation of the cause and effect pattern, if any, in the relationship under investigation. The lack of structural information is generally a drawback when one attempts to interpret the results of causality tests. However, it is often possible to extract meaning from results which are consistent with structural relationships even if this would not substitute for exact structural econometric analysis[14].

The Granger causality tests exploits the underlying correlations of the data without imposing priors on the structure of the relationship in question. This implies that the correlations are viewed as "facts" generated by the time series which can be used to complement information from structural models on the structure of the economy. The advantage of this approach is that it is not necessary to specify the complex structure of the economy or to state which variables are treated as exogenous in the information set[15].

Variable X is said to Granger-cause variable Y if variable Y can be predicted better by past values of variable X and Y rather than by past values of Y alone. If X is found to Granger-cause Y then the information contained in X should be used in optimal forecasts of Y. In effect, this amounts to minimizing the forecasting variance of X conditional upon the information set. Hence, Granger-causality is distinguished from normal causality in that it is simply a statistical property reflecting the information content of the data.

The underlying hypotheses tested here are:

Causality hypothesis:	Causality structure
From revenues (R) to expenditure (X)	Uni-directional
From expenditure (X) to revenues (R)	Uni-directional
From expenditure (X) to the fiscal balance (F)	Uni-directional
From revenues (R) to the fiscal balance (F)	Uni-directional
From revenues (R) to expenditure (X) and from expenditure (X) to revenues (R)	Bi-directional
No causality from either variable	Independent

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14 See Sims (1980) who discusses extensively many of these issues, and Zellner (1979) on the concept of causality in philosophy and in science as well as the comments of his discussants in the same volume.

15 A disadvantage of this approach is, of course, that it does not discriminate between the various hypotheses discussed previously in section II.

In terms of the minimization of the forecast variance, the first hypothesis requires that σ^2 (X / lX, lR) < σ^2 (X / lX), where σ^2 is the variance of the forecast error of X (or R, depending on the hypothesis) conditional upon the lagged values of expenditure (lX) and of revenues (lR); the second hypothesis requires that σ^2 (R / lR, lX) < σ^2 (R / lR); the third hypothesis requires that σ^2 (X / lX) < σ^2 (X / lX, lR) and σ^2 (R / lR) < σ^2 (X / lX, lR) hold simultaneously; finally, the fourth hypothesis implies that σ^2 (X / lX) < σ^2 (X / lX, lR) and that σ^2 (R / lR) < σ^2 (R / lR, lX). Similar observations apply to causality tests involving the fiscal balance.

Each hypothesis about the causality structure of government spending and revenues has its own implications: if causality is found to be running from expenditure to revenues, the government may be seen as setting expenditure objectives and subsequently establishing the revenue needs to meet these spending commitments. If causality is found to run from revenues to expenditure, it is possible to argue that the government undertakes spending only when revenues are available; revenue availability in this case may be thought of as constraining spending (or as making possible expenditure reductions). In the case of bi-directional causality government revenues and expenditure are simultaneously determined. Finally, it is possible that no causality exists between the series.

It is also evident that if causality is uni-directional, running from expenditure to revenues, then fiscal consolidation, holding revenues constant, requires expenditure control. On the other hand, if revenues are found to determine expenditure, then fiscal adjustment through revenue increases could lead to expenditure increases too, implying also that the deficit may not be reduced unless the causal link is broken. The least propitious case for fiscal consolidation is that of bi-directional causality running from revenues to public spending; the most propitious is that where no causality can be found between government expenditure and revenues so that decisions on either variable does not have implications for each other. Finally, note that if the deficit generating process is independent of the processes generating the revenue and expenditure profiles, as von Hagen (1992) and von Hagen and Harden (1994) have argued, structural and institutional factors determine fiscal performance, and these same factors will be decisive in determining the feasibility of fiscal adjustment.

IV. Specification of the Granger-Causality Tests and Testing Procedure

The basic bivariate model used in the causality tests has the following general form:

$$Y_t = a11*(L)^h Y_t + a*X_t + a12*(L)^g X_t + \varepsilon_t \qquad (1)$$

and

$$X_t = b11*(L)^k X_t + b*Y_t + b12*(L)^m Y_t + \theta_t \qquad (2)$$

where Y and X are the variables in question, a11, a12, and b11, b12 are coefficient vectors, a and b are coefficients, h and g indicate the length of the lags in equation (1), k and m indicate

the length of the lags in equation (2), and ε and θ are error terms, where $\varepsilon_t \sim$ iid $(0, \sigma_\varepsilon^2)$ and $\theta_t \sim$ iid $(0, \sigma_\theta^2)$. Note further that L is the lag operator, such that $z^*(L)^j D_t = z_1{}^*D_{t-1} + z_2{}^*D_{t-2} + \ldots + z_j{}^*D_{t-j}$. Variables Y and X are assumed to be stationary.

It is clear from (1) and (2) that Y and X are jointly determined endogenous variables. The reduced form of the system presented by equations (1) and (2) is:

$$X_t = c11^*(L)^{\zeta}X_t + c12^*(L)^{\lambda}Y_t + u1_t \qquad (3)$$

and

$$Y_t = d11^*(L)^{\delta}X_t + d12^*(L)^{\xi}Y_t + u2_t \qquad (4)$$

where c11, c12, d11, and d12 are vectors of coefficients, ζ, λ, δ, and ξ represent the lags in question, and u1 and u2 are error terms such that $E(u1_\mu, u2_\nu) = 0$ for all $\mu \neq \nu$. It is evident that this condition allows for the possibility that the error terms are contemporaneously correlated, so that shocks in X (Y) affect both X (Y) and Y (X). As seen in equation (3), X is now affected only by past values of X and Y, captured by the polynomials c11(L) and c12(L). Past errors are uncorrelated with contemporaneous errors while the contemporaneous value of Y does not enter equation (3). Similarly, from equation (4) it can be seen that the contemporaneous value of X does not enter the equation and that, by hypothesis, contemporaneous and past errors are uncorrelated. The contemporaneous effect of Y on X will be captured through the contemporaneous error correlation, and any contemporaneous effect of X on Y will also be captured by the contemporaneous correlation of the error terms.

The Granger-causality tests are sensitive to the specification of the information set as well as to the specification of the lag structure. While with regard to the former only a well-specified structural model would provide the answer to the question of the exact variables to be included in the VARs. With regard to the latter, two test procedures can be used to identify the model. The first is a variable exclusion test which is based on the null hypothesis that the set of coefficients $c12(L)^{\lambda}$ in equation (3) is jointly equal to zero; if the null hypothesis can be rejected, then Y Granger-causes X. Similarly, in equation (4) the null hypothesis is that the set of coefficients $d11(L)^{\delta}$ is jointly equal to zero; if this hypothesis is rejected, then X Granger-causes Y. In either case, the causality is uni-directional, or causality runs from the variable in question to the dependent variable.

The correct lag structure is a crucial determinant of the quality of the tests since too short lags would effectively yield biased coefficient estimates and the test results would be invalid. On the other hand, too long lags, while they would produce unbiased coefficient estimates, the estimates would be inefficient and one would be unable to discriminate between competing hypotheses. Further, if the model is specified in such a way that each variable impinges on every other variable with the same lag structure, the number of parameters to be estimated increases by the square of the number of variables and it is possible that the degrees

of freedom are either severely restricted or entirely exhausted. In general, there is no a priori guide to the selection of the lags except that the theory suggests that all past values of the variables affect the current value and, therefore, an empirical measure must be devised. Presently, the Akaike final prediction error (FPE) criterion is used to identify the model[16].

If in each reduced form equation neither set of coefficients is jointly equal to zero, then bi-directional causality is present, with X "causing" Y and Y "causing" X.

Clearly, if neither null hypothesis can be rejected then the series are independent of the each other and no causality is present in the data.

The variable exclusion tests yield a likelihood ratio statistic distributed as χ^2, and an F statistic distributed with degrees of freedom according to the number of the exclusion restrictions in the numerator and the number of observations minus the number of regressors in the denominator. If the calculated statistics are greater (less) than the critical values, the null hypothesis is rejected (not rejected) and the excluded variable is said to (not to) Granger-cause the dependent variable.

As noted previously, the Akaike final prediction error (FPE) criterion is used as a model selection test. This test aims at identifying the model by trading-off bias in coefficient estimates associated with a parsimonious model against the inefficiency arising from the overparametrization of long lags.

The Akaike FPE criterion is defined as:

$$FPE_{(\varphi,\psi)} = \{(T + \varphi + \psi + 1)/(T - \varphi - \psi - 1)\}*\{SSR/T\} \qquad (5)$$

where φ and ψ are the lag lengths, T is the number of observations, and SSR is the regression sum of squared residuals. It is evident that the first term in (5) is a measure of the estimation error and the second term a measure of the modelling error. Unlike standard statistical tests which are specific to a given ad hoc level of significance, the FPE is based on the minimization of the mean square prediction error[17].

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16 An alternative way to identify the model is to use the Guilkey and Salemi (1982) experimental evidence on the small sample properties of the Granger causal ordering. They suggest that lag lengths of six to eight quarters in quarterly estimates, or three to four years in annual data, are appropriate. They also find that shorter lags provide better versions of the estimates than longer lags. Ram (1988a) uses this methodology in his causality tests.

17 Note that the FPE itself can be used as a vehicle to perform Granger-causality tests. Use of the FPE to identify the model in this case involves the following steps: (i) Estimate a one-dimensional VAR X process and determine the lag order with the use of the FPE; (ii) adding Y as an independent variable, estimate an equation such as (3) using Y as the manipulated variable to determine the lag length on Y according to the FPE; (iii) compare the smallest value of the FPE from step (i) with its value from step (ii); if the former is greater than the latter, then Y is said to cause X; if the former is smaller than the latter, then X is an independent process; (iv) repeat steps (i) - (ii) with X as the manipulated variable; (v) combine steps (i) to (iv) to identify the model. This method is also used in

V. Causality Results for Government Expenditure and Revenues

Reduced form bivariate equations for budget revenue and expenditure, as those presented in equations (1) and (2), for thirteen Community Member States were used to evaluate the causality structure of the data for the period 1960-94. The data, whose time-series properties are discussed in Annex I, are in absolute value and in nominal terms, and comprise total general government revenues and total general government expenditure including net capital transfers. The latter is the broadest possible concept for approximating the presence of the government in the economy. The data, therefore, present the most encompassing concepts of spending and receipts at the level of the general government. Nominal rather than inflation-adjusted data were used since budgetary exercises are generally defined in current values. The data periodicity is annual, dictated by availability; in addition, annual data are appropriate since budgetary exercises are principally annual in nature. The model used is a bivariate vector autoregressive model, defined over general government revenues and expenditure[18]. To satisfy the stationarity requirement, the model was specified in first difference form and, in the cases of Portugal and of the UK, second-difference, form.

The results are reported in Tables 1 and 2. The lag structure was determined through the minimization of the FPE criterion. The FPE values reported in the Tables are the minimum values following a grid search on the appropriate lag structure on the right-hand side variables. In general, the lag structure adopted in the estimation is consistent with the Guilkey and Salemi (1982) suggestion[19]. The F-statistic is the measured F-statistic associated with the restriction that the coefficients of lagged values of the expenditure variable in Table 1 (revenue variable in Table 2) are jointly equal to zero. LR is the likelihood ratio statistic associated with the same restriction.

In Table 1, the hypothesis that causality is running from revenues to expenditure is tested. This postulated version of causality is consistent with Friedman's views as noted previously. The results suggest that in the majority of cases under review, in ten Member States, the hypothesis finds substantial support. In these cases, the size of government is principally determined by resource (tax revenue) availability. In five cases (Germany, Spain, Portugal,

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section VI below. See Hsiao (1979) for the use of this test, and Hsiao (1981) for a concise application. Anderson, Wallace, and Warner (1986) also use this procedure in their review of the causality structure of the US federal budget data.

18 As a caveat to the results reported and discussed in the present and in the following sections, it should be noted that a bivariate model may not identify precisely the causal relationship if a higher-dimension model is appropriate. The present model could be extended in this respect to include other potentially relevant variables such as the output gap, inflation, demographic trends and socio-economic variables, and it may also be essential to use cyclically adjusted rather than current data. The elemental model adopted presently, which is also common in the literature, is intended to provide some initial results before more complicated VARs are considered; it also facilitates comparisons with results obtained elsewhere with a similar model. However, given that the results are sensitive to model specification, the conclusions drawn here cannot be generalized since they are only specific to the bivariate model used. An incomplete summary table of various models used in this literature is provided in Bella and Quintieri (no date).

19 See footnote 16.

Table 1
Granger-Causality Tests: From Revenues to Expenditure,
13 Community Member States
(Dependent variable: First-difference in government expenditure)

	Lag[1]	F (df)	LR (χ^2)	FPE
B	2, 1	9.68 (1, 28)$^+$	9.50 (1)*	0.119
DK	1, 1	0.98 (1, 30)	1.06 (1)	0.046
D	2, 2	12.71 (2, 27)*	21.23 (2)*	0.314
GR[2]	3, 4	4.64 (4, 8)$^+$	19.20 (4)*	0.118
E[3]	2, 2	18.14 (2, 17)*	25.13 (2)*	92.38
F	2, 2	4.53 (2, 27)$^+$	9.27 (2)*	1.104
IRL	4, 4	4.06 (2, 21)$^+$	17.17 (4)*	0.068
I	1, 3	4.61 (3, 26)$^+$	13.21 (3)*	1254
NL	2, 2	2.76 (2, 27)	5.95 (2)	0.146
P[4]	3, 4	8.63 (4, 20)*	28.09 (4)*	0.516
UK[4]	1, 1	0.66 (1, 27)	0.72 (1)	0.015
A	3, 3	23.18 (3, 24)*	42.17 (3)*	0.449
SF	3, 2	23.40 (2, 25)*	32.71 (2)*	0.078

df = Degrees of freedom
LR = Likelihood ratio statistic, distributed as χ^2 (df)
FPE = Final prediction error (Akaike) statistic, $x10^{-2}$

1 The first lag applies to the expenditure variable; the second, to the revenue variable; 2 Sample 1975-1994, total current expenditure ; 3 Sample 1971-1994; 4 Second difference equation

+ Significant at the 95% level; * Significant at the 99% level

Table 2
Granger-Causality Tests: From Expenditure to Revenues,
13 Community Member States
(Dependent variable: First-difference in revenues)

	Lag[1]	F (df)	LR (χ^2)	FPE
B	2, 3	2.25 (3, 25)	7.28 (3)	0.166
DK	4, 4	13.22 (4, 21)*	37.74 (4)*	0.189
D	2, 3	8.61 (3, 25)*	22.00 (3)*	0.260
GR[2]	2, 4	23.19 (4, 11)*	40.40 (4)*	0.542
E[3]	1, 2	4.20 (2, 18)$^+$	8.42 (2)$^+$	26.08
F	3, 4	3.86 (4, 22)$^+$	15.94 (4)*	0.666
IRL	2, 2	3.12 (2, 27)	6.46 (2)$^+$	0.035
I	3, 1	0.52 (1, 26)	0.61 (1)	901.83
NL	1, 2	13.95 (2, 28)*	22.12 (2)*	0.157
P[4]	2, 3	27.98 (3, 22)*	44.02 (3)*	0.319
UK[4]	6, 6	2.55 (5, 15)	16.00 (5)*	0.007
A	2, 3	2.15 (3, 25)	7.12 (3)	0.144
SF	4, 4	1.95 (4, 21)	9.45 (4)	0.034

df = Degrees of freedom
LR = Likelihood ratio statistic, distributed as χ^2 (df)
FPE = Final prediction error (Akaike) statistic, $x10^{-2}$

1 The first lag applies to the revenue variable; the second, to the expenditure variable; 2 Sample 1975-1994, total current expenditure; 3 Sample 1971-1994; 4 Second difference equation

+ Significant at the 95% level; * Significant at the 99% level

Austria, and Finland), the hypothesis that the vector of the coefficients of the lagged values of revenues is jointly equal to zero is rejected at the 99% level of significance. In another five cases (Belgium, Greece, France, Ireland, and Italy), the hypothesis of causality running from revenues to expenditure cannot be rejected at the 95% level of significance. According to the likelihood ratio test, the zero restriction on the coefficients of the revenue variables is rejected at the 99 % level of significance. In the remaining three Member States (Denmark, the Netherlands, and the UK), revenues do not contribute to the explanation of the current-period value of government expenditure since the null hypothesis of non-causality cannot be rejected at conventional significance levels.

Reversing the hypothesis to test causality running from expenditure to revenues yields the results reported in Table 2. According to the F-statistic, in seven Member States (Denmark, Germany, Greece, Spain, France, Ireland, and Portugal) the hypothesized causality is supported by the data. In five Member States (Denmark, Germany, Greece, the Netherlands, and Portugal) causality is supported at the 99% level of significance. In the cases of Spain and France the hypothesis is supported at the 95% level of significance. In the remaining six Member States there is no support for causality running from public expenditure to revenues.

On the other hand, the likelihood ratio test offers support for the hypothesis in a total of nine cases, with Ireland and the UK added to the group of seven suggested by the F test.

Table 3
Results of the Granger-Causality Tests
Summary

	From Expenditure to Revenues	From Revenues to Expenditure	Structure of Causality
B	No	Yes	U
DK	Yes	No	U
D	Yes	Yes	B
GR	Yes	Yes?	B?
E	Yes	Yes	B
F	Yes	Yes	B
IRL	No	Yes	U
I	No	Yes	U
NL	Yes	No	U
P	Yes	Yes	B
UK	No	No	I
A	No	Yes	U
SF	No	Yes	U

B = Bi-directional
U = Uni-directional
I = Independent

The results of the causality tests are summarized in Table 3. Causality is bi-directional in five cases, and perhaps six, cases if the UK is included in this group. Causality is uni-directional, running from revenues to government expenditure, in the cases of Belgium, Ireland, Italy, Austria and Finland, while in Denmark and the Netherlands causality is uni-directional running from government expenditure to revenues. For comparative purposes, note that Ram (1988b), using a sample stating in 1960 and ending in the mid-1980s, finds uni-directional causality from expenditure to revenues in the cases of Greece, Ireland, and Finland, and bi-directional causality in the case of the UK alone; he finds no evidence of causality running from revenue to expenditure in the Community nations he included in his investigation. It is likely, however, that his results are pertinent to the shorter sample used in his estimation, and they are also reflecting the influence of the Guilkey and Salemi (1982) model identification method used. It is evident that the longer sample used here and the alternative model identification methodology, produce different and, presently, greater support for the causality hypothesis, results.

The bi-directional causality characterizing the five Member States shown in Table 3 appears to be consistent with the prediction of Barro's (1978) model, that expenditure is a cause of government revenues. Barro's model implies that current debt-finance expenditure will induce the private economy to adjust its spending to reflect the incipient increase in liabilities associated with the increased deficit and, therefore, the long-run expenditure multiplier will be unity, since starting from a balanced budget an increase in expenditure would ultimately give rise to revenues to finance it. This prediction is tested for the cases where causality from government expenditure to budget revenues is found. The value of the multiplier, m (X), is presented in Table 4[20] together with the Wald statistic testing the restriction. The estimates

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20 The multipliers are based on the model (1-A)*X = B*Y, where A is the coefficient vector on the lagged dependent variable, X, and B is the coefficient vector on the lagged values of the independent variable, Y. In the long-run, where current and lagged values of the variables are the same, the value of the multiplier is m = B/(1-A). These estimates are shown in Table 4. Note also that the cointegration relationships underlying the data, as reported in Annex I, provide comparable estimates for the long-run expenditure and revenue multipliers which are presented in Annex I, Table A3.

provide some support to Barro's model. The long-run multiplier in four of the seven cases (Denmark, Germany, France and Portugal) is not statistically different from unity, but in the remaining cases the restriction is rejected by the data. In the four cases where the restriction is supported, the implication is that starting from a balanced budget position an expenditure shock will ultimately lead to an equivalent increase in revenues so that the balanced budget is restored, even though, as a result, the level of taxation will have increased. In the remaining cases, an expenditure shock will ultimately cause the deficit to increase, even though revenues will also increase but by less than the increase in expenditure; the multiplier is statistically different from, and less than, unity. Finally, the estimate for Portugal suggests that expenditure shocks may lead to a reduction in the deficit since they more than raise revenues in the long run; the point estimate for the multiplier, while not statistically different from unity, is equal to 1.15[21].

Table 4
Long-Run Expenditure and Revenue Multipliers

	m (X)	Wald $\chi^2(1)$	m (R)	Wald $\chi^2(1)$
B	-	-	0.92	0.24
DK	1.08	1.09	-	
D	0.93	4.85	0.99	0.02
GR	0.72	43.32	0.76	156.5
E	0.51	5.17	1.10	1.77
F	1.00	0.00	0.83	2.42
IRL	-	-	0.83	0.48
I	-	-	1.00	0.00
NL	0.74	11.70	-	-
P	1.15	0.35	0.99	0.00
A	-	-	1.05	0.47
SF	-	-	1.09	0.18

m (X) = expenditure multiplier; m (R) = revenue multiplier

The critical value of the $\chi^2(1)$ statistic is 3.84 at the 95% level of significance, and 6.63 at the 99% level of significance

While no priors may exist which predict the value of the long-run revenue multiplier (that is, the long-term increase in expenditure in response to a unit shock in revenues) it is nevertheless important to consider the estimates implicit in the Granger-causality equations because they have implications for fiscal performance. This multiplier is reported in Table 4 as m(R), together with the Wald statistic testing the restriction that its long-run value is unity. This restriction, if satisfied, would imply that Friedman's concerns, that revenue increases ultimately lead to expenditure increases, are legitimate and that they find support in the data. The test is applied to those cases where there is either uni-directional causality from revenues to expenditure, or where causality is bi-directional, also from revenues to expenditure. The results suggest that in nine of the ten cases reported in the Table the unit revenue multiplier restriction is supported by the data. With the exception of Greece, where the sample size leaves doubts about the quality of the estimates and where the restriction is rejected, in all other cases revenue increases are ultimately accompanied by equivalent increases in public spending. In Spain's case, taking the two multipliers together, the results suggest an inherent

21 It is possible that the multiplier estimates reported here do not reflect Barro's Ricardian behaviour on the part of the private sector but simply a government reaction to expenditure shocks. According to this interpretation, the estimates would again suggest that government revenue reaction is not commensurate to expenditure shocks in all those cases where the revenue multiplier is less than unity, implying an inherent bias for budget deficits. A discussion of factors underlying this bias may be found, among many contributions to this issue, in Roubini and Sachs (1989a, 1989b).

bias for fiscal deficits[22]. The point estimates for the multiplier range from a low of 0.83 to a high of 1.10; these results imply that small deviations from the balanced budget position will be observed in the event of revenue shocks and they cast doubt about the feasibility of attaining fiscal consolidation through revenue increases alone.

von Hagen (1992) has also provided Granger-causality estimates on the postulate that government spending contributes to the prediction of net lending as percent of GDP in the Community. He finds that government spending does not Granger-cause the deficit in any of the twelve Member States except Italy, although some weak evidence was found in the cases of Ireland, the Netherlands, and Portugal[23]. He concludes that rising expenditure does not contribute to the prediction of the rise in government deficits and debt in the Community in the period up to 1990s and, furthermore, he argues that "there are no systematic relationships between relatively large deficits, large primary deficits, or large debt ratios and relatively large expenditure ratios. Once again, this refutes the simple notion that large deficits or large debts are due to excessive spending" (p. 23).

The present results cast doubts at these findings. The long-run multiplier in three (Greece, Spain, and the Netherlands) of the seven cases where government expenditure Granger-causes revenues is less than unity suggesting that starting from a balanced budget an expenditure shock will lead to a deficit. Consequently, expenditure ought to be found as a Granger-cause of the deficit in these countries. It is possible that von Hagen's result is specific to the equation tested and the lag structure chosen, since, as noted previously, Granger-causality is sensitive to the model used. This conclusion is tested more rigorously in the next section where the relationship between government expenditure, revenues and the fiscal balance is investigated.

VI. Expenditure, Revenues, and Fiscal Performance in the Community

Is excess government spending or revenue inadequacy, or both, the factors determining fiscal imbalances and fiscal performance in the Community? While it is natural that either side of the budget may be a contributing factor to fiscal imbalances, von Hagen's notion, that it is primarily the budget procedure and institutional considerations rather than the paths of revenues and expenditure themselves that determine fiscal deficits, deserves examination. The framework of Granger-causality is employed once more to establish which side of the budget categories, revenues or expenditure, is the best predictor of the path of fiscal deficits in the Community.

The methodology used to identify the model is based on the minimization of the FPE value in a sequential regression where, first, the appropriate lag on the dependent variable was determined; secondly, the appropriate lag, that is the lag that yields the minimum value of the

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22 This has also been noted and confirmed by Gonzàlez Paramo et. al. (1994) in a cointegration context of Granger-causality estimates. Note also, in passing, that Blackley (1986) finds a long-term bias towards budget deficits in US federal budget data.

23 See von Hagen (1992), p. 20-23.

FPE when one independent variable is added in the equation, was determined; comparing the FPE values from these two processes it is possible to conclude that if the former is lower than the latter, the dependent variable is question is an independent process; if the latter is smaller than the former, then the independent variable Granger-causes the dependent variable[24].

Causality tests, using the current-value net borrowing of the general government as the dependent variable, were based on the following first-difference equation:

$$\Delta DF_t = a + \Sigma\beta_i \Delta DF_{t-i} + \Sigma\gamma_j \Delta H_{t-j} + \omega_t \qquad (6)$$

where $\Delta = X_t - X_{t-1}$ is the first-difference operator, DF is the fiscal balance of the general government defined as the difference between total receipts and total expenditure, i = 1 to n, H is the vector of the total expenditure and of the total receipts variables, j = 1 to m, and ω is an idd error term.

Table 5
Government Expenditure and Revenues as Predictors of the Fiscal Position: Granger-Causality Tests

	FPE Fiscal Balance	FPE Expenditure	FPE Revenues
B	216.54 (1)	186.30 (2)*	192.78 (1)+
DK	0.84 (4)	0.89 (2)	0.89 (2)
D	3.39 (2)	3.01 (1)*	3.01 (1)+
GR	20.0 (4)	4.23 (3)*	4.42 (3)+
E	3511.4 (4)	3169.4 (1)*	3169.4 (1)+
F	1120.9 (4)	1091.5 (4)*	1091.5 (4)+
IRL	0.041 (2)	0.044 (2)	0.044 (2)
I	0.425 (3)	2.893 (3)	3.011 (4)
NL	0.136 (1)	0.136 (2)	0.129 (2)+
P[1]	39.142 (5)	0.314 (6)*	0.280 (6)+
UK[1]	0.097 (4)	0.102 (3)	0.102 (3)
A	1.520 (2)	1.231 (2)*	1.231 (2)+
SF	0.222 (6)	0.157 (6)*	0.157 (6)+

* Expenditure Granger-causes the fiscal position
\+ Revenues Granger-cause the fiscal position
1 Second difference equation; FPE = $x10^{-2}$

The first column reports the minimum value of the FPE for the one-dimensional VAR process for the fiscal balance variable alone (lag in parentheses); the second column reports the minimum value of the FPE when only the expenditure variable is added to the fiscal balance equation; the third column reports the minimum value of the FPE when only the revenue variable is added in the equation.

The first-difference specification is warranted because the fiscal variables in all the Member States under consideration are generally non-stationary as I(0) but integrated of order one. The estimation was performed on the 1960-94 sample, with the exception of Greece and Spain where a shorter sample was available - see Tables 1 and 2 for the details. The results are presented in Table 5.

In several cases the data lend support to von Hagen's findings. Thus, in Denmark, Ireland, Italy, and the UK neither government expenditure nor government revenues are predictors of the fiscal deficit. In these cases the smallest FPE on the autoregression of the dependent variable is less than that obtained when either the expenditure or the revenue variable are used as the manipulated variables; in other words, the latter variables have no information content in predicting the fiscal balance. In these cases, therefore, the fiscal balance process is independent. This would tend to support von Hagen's contention that institutional and structural factors are at the background of the fiscal performance of these Member States. It is worth noting that for Italy von Hagen's structural indices are relatively low implying lesser

24 See footnote 17 for a discussion of the use of the Akaike criterion in Granger-causality tests.

fiscal discipline and worse fiscal performance than in the cases where the indices are high. It is surprising, however, that for the Member States where the indices have large values (Denmark and the UK) the fiscal process is found to be independent of the expenditure and revenue processes[25].

Results from eight Member States provide evidence of causality. In the cases of Belgium, Germany, Spain, France, Portugal, Austria, and Finland both the expenditure and the revenue history dominate over the history of the fiscal balance itself in predicting its current value. In the case of Greece, and noting the short sample, the estimates support the hypothesis that government spending and government revenues separately predict the deficit better than the autoregression of the deficit itself. Finally, in the case of the Netherlands the revenue history dominates the history of the fiscal balance in predicting the latter, even though, in a bivariate regression, the history of government expenditure is as good a predictor of the fiscal balance as the history of the fiscal balance itself.

These results provide partial refutation of von Hagen's generalizations. Fiscal imbalances are the result of expenditure and of revenue policies in Belgium, Germany, Greece, Spain, France, Portugal, Austria and Finland. His hypothesis finds lesser support in our sample since in only four cases does the fiscal history itself, as exemplified by the fiscal balance, is the principal predictor of the current value of the fiscal position[26].

VII. Do Fiscal Imbalances Increase Government Spending?

An important issue in the determination of the size of the government is Buchanan and Wagner's contention that fiscal deficits increase government spending. In a mechanical sense, it is evident that debt service payments will, ceteris paribus, contribute to raising government expenditure. As noted in section II, however, the Buchanan and Wagner contention rests on the hypothesis that the "true" tax cost of the provision of government services is hidden through the use of public sector borrowing. The current generation of taxpayers, it is argued, does not perceive accurately this cost, and as a result, it supports expansion of government-provided services. For this hypothesis to hold it is necessary that, either individually or in combination, three conditions are satisfied[27]: first, voters are not fully aware of the future tax liabilities of current deficits[28]; secondly, voters discount future tax liabilities at a rate higher

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25 See von Hagen (1992), p. 45-46.

26 It is possible that respecting the Maastricht Treaty fiscal criteria, which emphasize the deficit (and the debt) as a measure of fiscal convergence, will ultimately contribute to the dominance of the history of the fiscal position over the other variables in predicting current fiscal imbalances for all the Member States.

27 See Niskanen (1978).

28 This may be due to the complexity of the tax system, or to the method by which the tax liability is assessed, or due to the frequency at which the tax liability has to be met as well as due to the timing at which the tax assessment and the payment are made. Fiscal illusion could take either the form of underestimating, or of overestimating, the tax burden and expenditure benefits.

than the rate of interest on government debt; and, third, voters have finite lives and they value future tax liabilities less than they value current liabilities falling due within their lifetimes. The implication of these conditions is that there exist incentives which make possible the enlargement of the size of the government sector through budget deficits and debt-financed expenditure which postpones taxation to the future. Conditions which encourage the growth of public spending are typically those where vote-maximizing politicians dominate and, as a result, as Rogers and Rogers (1995) point out, fiscal deficits are a natural consequence of political competition. While this hypothesis may be subject to dispute, Niskanen (1978) finds that, in the case of the US, the data support the notion that federal deficits have raised government spending, and Rogers and Rogers (1995) find similar support at the state level[29]. There does not appear to be much empirical evidence examining the fiscal illusion/political competition hypothesis on European data[30].

Table 6
Granger-Causality Tests: From Fiscal Imbalances to Government Spending, 13 Community Member States (Dependent variable: First-difference in government expenditure)

	Lag[1]	F (df)	LR (χ^2)	FPE
B	2, 1	9.68 (1, 28)*	9.50 (1)*	0.123
DK	1, 1	0.98 (1, 30)	1.06 (1)	0.006
D	2, 2	12.71 (2, 27)*	21.23 (2)*	3.266
GR[2]	3, 4	2.87 (4, 8)	14.24 (4)*	16.130
E[3]	1, 2	18.68 (2, 18)*	24.72 (2)*	859.95
F	1, 2	4.41 (2, 28)*	8.76 (2)*	1.038
IRL	1, 4	3.62 (4, 23)	14.66 (4)	0.007
I	3, 5	8. 86 (5, 20)+	33.87 (5)*	7000.0
NL	2, 4	1.48 (4, 23)	6.88 (4)	0.163
P	6, 5	23.22 (5, 15)*	58.53 (5)*	1.196
UK	1, 2	0.74 (2, 25)	1.66 (2)	0.0156
A	3, 1	68.19 (1, 26)*	39.90 (1)*	0.445
SF	3, 2	23.40 (2, 25)*	32.71 (2)*	0.082

df = Degrees of freedom
LR = Likelihood ratio statistic, distributed as χ^2 (df)
FPE = Final prediction error (Akaike) statistic, $x10^{-2}$

1 The first lag applies to the expenditure variable; the second, to the fiscal balance variable; 2 Sample 1975-1994, total current expenditure; 3 Sample 1971-1994

+ Significant at the 95% level; * Significant at the 99% level

Using data on government current expenditure and revenues for the thirteen Community Member States, an attempt is made to establish the Granger-causality of the fiscal position on government spending. As previously, a first-difference equation explaining the current value of total general government expenditure as a function of its own history and the history of the fiscal position is utilized. The lag structure on the dependent variable (government expenditure) is chosen on the basis of the minimization of the FPE; the minimum value of the FPE is again established through to determine the lag structure of the independent variable (the fiscal position); once the model is so identified, the restriction that the coefficients of the independent variable are jointly equal

29 Rogers and Rogers (1985) estimate a probit model where the probability for a US state of being identified according to the Granger-causal orderings established is defined as a function of variables suggested by political competition theories and by fiscal illusion theories. Rogers and Rogers utilize this probit model to explain the correlations identified by the causality regressions.

30 An exception is Pommerehne and Schneider (1978) who examined data from 110 large Swiss municipalities and found that fiscal burden illusion is highly correlated with the type of democratic decision-making process adopted. They note that it is the latter rather than the individual decision which determine the final fiscal outcome and the presence of tax burden illusion. They also find some evidence of simultaneous presence of illusion on both the revenue and the expenditure side of fiscal actions. Little analysis has been devoted to the existence of expenditure benefit illusion.

to zero (the null hypothesis) is tested on the basis of the F and of the likelihood ratio statistics.

The results of these tests are presented in Table 6. In seven of the thirteen Member States (Belgium, Germany, Spain, France, Portugal, Austria, and Finland), the hypothesis that the fiscal position is a predictor of current government expenditure cannot be rejected at the 99% level of significance. In the case of Italy the hypothesis finds support at the 95% level of significance. In the remaining cases, there is no causality from the fiscal position to the level of current government spending.

These results provide considerable support to the postulated hypothesis, and some tentative explanations consistent with the findings can be suggested for several Member States. . In the case of Belgium it is possible that the results reflect the failure to resolve constitutional difficulties which have given rise to the unprecedented level of indebtedness; government spending through deficit finance may have been resorted to alleviate actual and potential regional frictions. Furthermore, as de Haan et. al. (1992) have noted, the consultative management of the social security system is responsible for the rise in Belgium's public debt; it cannot be excluded that such an arrangement is conducive to increasing the size of the public sector. The data also show that fiscal imbalances Granger-cause government spending in the case of France too. A distinctive characteristics of French fiscal policy, especially in the 1980s, has been its redistributive character which could explain this finding; redistribution policies have been pursued by virtually all the European countries in the post-War period[31].

The interpretation of the finding that fiscal imbalances contribute to government spending in the cases of Spain and Portugal is less transparent. In terms of the Rogers and Rogers (1995) political competition prediction, Spain and Portugal, over half of the years included in the sample when political parties were banned, could not be considered as meeting this condition.

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31 See Le Casheux (1994) for a review of the French experience. Meltzer and Richard (1981, 1983) have shown that the demand for income/wealth redistribution policies is an important factor explaining the size of government. This demand, in the manner of Alexis de Toqueville's original conception of the American democracy, is a positive function of income inequality; the latter is, in turn, a stylized fact of economic growth where incomes of skilled workers rise faster than incomes of unskilled individuals, giving rise to votes favouring income redistribution. Such policies would affect not only the current but also future generations of taxpayers, thus, contributing to government deficits and to the growth of public debt. Usher (1977) has also shown that support for redistributive public expenditure can arise from a median-voter model, while Boadway and Marchand (1995) show that public expenditure policies can be justified on redistributive grounds. One measure of redistribution policies is the share of the budget allocated to and the steady increase in social transfers which has taken place over the past thirty or so years; Todd (1983) has documented this development for the pre-1986 enlargement of the Community. In general, redistributive policies have been a dominant feature of European macroeconomics over much of the period since the 1960s, and it is possible that in several of the cases reported presently, where government deficits Granger-cause government expenditure, this is reflected in the data correlations. Todd (1983) finds some suggestive evidence for this hypothesis on an earlier set of Community data. While not directly tested in this paper, should this hypothesis find independent support in other work, it would suggest that the resolution of fiscal imbalances in the Community and the reduction of the size of the government will require more than a simple expenditure and revenue adjustment, but, instead, a more fundamental, political, decision.

However, with the restitution of democracy, political competition has become intense and this would support the notion that public sector imbalances are a cause of the rise in the size of the government[32]. Political competition is also a dominant feature of budgetary outcomes in the case of Italy[33] where the Rogers and Rogers prediction is also borne out by the data. Italy's regional redistribution policies have undoubtedly had an important impact on fiscal performance.

The support of the hypothesis in Finland's and Austria's cases may also reflect voters' perceptions about the costs of government expenditure but, more generally, about the role of the government in society. Both these nations, but also Germany where the hypothesis also finds support, have had political arrangements characterized by consensus building in public policy during the period covered by the sample; these arrangements may have supported growth in public expenditure and they may also have obscured the implications of fiscal imbalances.

The data reject Granger-causality from fiscal imbalances to government expenditure in the cases of Denmark, Greece, Ireland, the Netherlands, and the UK. At least in the case of Greece, one would have expected that the hypothesis of fiscal illusion and of resorting to debt finance to resolve distributional problems would find support. Also, Denmark's redistributive policies, it could be argued, would lend support to causality between fiscal imbalances and government spending. It is possible, however, that the reforms of the Danish public finances which were implemented in the 1980s are actually obscuring the relationship between fiscal deficits and government spending.

It should be stressed that the results presented in Table 6 are only suggestive. They do not directly test the Buchanan-Wagner, or the Rogers and Rogers political competition, hypothesis but they are only consistent with its basic premise. A more precise and rigorous test, together with evidence from political arrangements and institutions, would be necessary in order to provide a proper empirical evaluation of the hypothesis, and to determine the factors which have played a role in the increase of the size of the government in the Community since the early 1960s[34].

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32 Gonzàlez Pàramo et. al. (1994) and Nogueira Leite (1994) give an overview of the political environment in Spain and Portugal, respectively, within which fiscal policy choices have been made during the period since the restitution of democracy.

33 See European Economy (1993) for a discussion of fiscal performance in Italy.

34 Roubini and Sachs (1989a, 1989b) and the papers in the Lybeck and Henrekson (1988) volume provide tests of various hypotheses on the determinants of fiscal performance. Niskanen (1978) also provides a test on US data, even though his evidence is not definitive. The hypothesis rests crucially on the empirical evidence that the perceived tax-price elasticity of public services is negative. The US data for the period 1947-76 suggest that this elasticity is -0.6; the short-run income elasticity of demand for federal services is 1.1 and the long-run elasticity is 0.35. These results suggest that federal deficits have raised real federal spending. In absolute terms, however, this effect is not very large. Niskanen notes that the mean value of the federal deficit as percent of federal spending over the period 1947-76 was 4.4%; therefore, the deficit raised federal spending by about 2.7% during this period relative to the level where a balanced budget had been maintained. To place these estimates in perspective, the federal deficit in the 1975 recession represented around 20% of federal spending when the level of federal spending was about 13.2% higher than the balanced budget level.

VIII. Concluding Remarks

Fiscal data from the thirteen Community Member States under review provide substantial support, on the basis of a bivariate vector autoregressive model, to the notion that there is interdependence in budgetary decisions which have implications for fiscal performance. Among these Member States, only in the case of the UK the data suggest that the expenditure, revenue, and fiscal balance time series are independent. The data show that, in a sample of thirteen Member States, in more than half causality is uni-directional. In this group of countries, the evidence suggests that in two cases, those of Denmark and of the Netherlands, causality is running from general government expenditure to revenues. In Belgium, Ireland, Italy, Austria and Finland, on the other hand, causality is found to run from revenues to government expenditure.

An implication of these results, which are specific to the bivariate model used, is that fiscal adjustment in the first group will require control of government spending, holding the revenue side of the budget constant. The results also indicate that expenditure shocks, starting from a given fiscal position, will ultimately lead to a deterioration in the fiscal balance in the case of the Netherlands since the long-run expenditure multiplier is less than unity; in the case of Denmark, on the other hand, such expenditure shocks would raise revenues by an equivalent amount leaving the deficit unchanged.

The feasibility of fiscal adjustment in the second group (Belgium, Ireland, Italy, Austria and Finland), where revenues are found to Granger-cause public spending, may be more in doubt. An increase in taxation, according to the results, will ultimately lead to an increase in spending. In addition, the long-run revenue multiplier in virtually all countries in this group is unity, lending support to the notion that fiscal adjustment through revenue increases alone may have little effect on fiscal performance.

Bi-directional causality characterizes the fiscal data of Germany, Greece, Spain, France and Portugal. The evidence on bi-directional causality raises many questions about the feasibility of fiscal adjustment based on policies affecting the revenue and the expenditure side of the budget independently of each other. If the structure determining the prediction of revenues and of expenditure remains unchanged, the results suggest that expenditure cuts will ultimately lead to revenue reductions; similarly, revenue increases will correspondingly lead to expenditure increases. In the case of Spain, the revenue multiplier is twice as large as the expenditure multiplier, implying that a combination of revenue and expenditure shocks will lead to a worsening of the fiscal balance. In the remaining cases among those where bi-directional causality is found,, and with the exception of Greece, will a balance budget property be preserved in the event of expenditure or revenue shocks.

The evidence is to a limited degree consistent with the structural/institutional view of fiscal performance. The history of the fiscal process in five Member States (Denmark, Ireland, Italy, the Netherlands, and the UK) is a better predictor of the current fiscal position than when either the expenditure or the revenue time series are used as predictors. In the remaining eight Member States, however, the history of government expenditure and revenues is a better predictor of the fiscal position than the fiscal position itself.

Finally, the data provide evidence that fiscal imbalances Granger-cause government expenditure and contribute to the size of the government, measured by government expenditure, in eight Member States (Belgium, Germany, Spain, France, Portugal, Austria, Finland, and Italy). There are three principal hypotheses which are consistent with this finding. First, there is the Buchanan-Wagner argument that the current generation of taxpayers underestimates the cost of public spending associated with deficit -financed policies; governments are cognisant of this illusion and exploit the negative tax-price elasticity of demand for public spending by expanding deficit-financed expenditure. Secondly, Rogers and Rogers (1995) have pointed out the fiscal implications of political competition and its contribution to the growth of the size of the government in decentralized democracies. And, third, the rise in mean incomes relative to the median income in all Community countries since the early 1960s, and the consequent demand for income redistribution, may have, as suggested by Meltzer and Richard's (1981) amendment of Wagner's law, contributed decisively to the increase in the size of the government. Without directly testing these hypotheses, it is possible that the causality evidence is hinting that the nature of political discourse is responsible for the increase in the size of the public sector over the past thirty four years in these Member States.

In recent years, fiscal consolidation appears to have become particularly difficult at the same time as the urgency to accomplish it has also become more pronounced[35]. Virtually all the Member States have now submitted convergence programs, and they are expected to follow these commitments in the advance to stage III of EMU. These programs clearly signal a break from the history of the determination of fiscal variables characterizing the Member States over the past thirty or so years. The causality evidence discussed here suggests that such a break will be an essential ingredient for the achievement of durable fiscal rectitude in the Community.

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35 See the country reviews prepared for the European Economy (1994) for a discussion of these difficulties and the prospects for fiscal adjustment in the Member States.

ANNEX I

The Time Series Properties of the Expenditure and Revenue Data

Granger causality tests require that the time series in question are stationary. Since most macroeconomic time series are not stationary, it is essential to examine the properties of the revenue and expenditure series under investigation. Stationarity tests are reported in the Table A1 for the individual nominal general government revenues and expenditure time series in thirteen Community Member States[36], based on the following equation:

$$X_t = a + b*X_{t-1} + h*Time + \Sigma_{i=1}\delta_i*\Delta X_{t-i} + \omega_t \qquad (A.1)$$

where X is the variable in question, Time is a time trend, Δ is a first-difference operator and ω is an error term. Equation (A.1), which is an augmented Dickey-Fuller equation, allows for the possibility that the series have a time trend, as visual inspection suggests, while the lagged first-difference terms allow for autocorrelation correction. Stationarity requires that the roots of the residuals lie within the unit circle.

Table A.1 presents the unit root tests undertaken to determine the time series properties of the government revenue and expenditure data. Stationarity of the data used in the Granger-causality regressions is a necessary condition to determine the historical correlations characterizing the data. The fiscal balance variable obeys the same time series properties as its constituent parts.

The results are based on estimating equation (A.1) and on assessing the stationarity of the residuals. The test statistic used for testing stationarity is the MacKinnon surface response statistic[37]. Unlike the Dickey-Fuller and other test statistics, the MacKinnon statistic is conditional upon the number of observations and the presence or absence of a time trend as well as the number of variables used in the regression. The null hypothesis is that the time series is non-stationary; rejection of the null requires that the regression estimate of the test statistic is greater in absolute value than the critical value of the MacKinnon statistic.

As can be seen from the results presented in Table A1, in virtually all cases the level specification of the variables does not reject non-stationary. The exceptions are Belgium

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36 Luxembourg and Sweden are excluded since the time series were either incomplete (in the case of Luxembourg observations for the years 1988-90 are missing) or particularly short for empirical analysis (in the case of Sweden the data starts in 1980). The source of the data is the AMECO data bank.

37 See MacKinnon (1991). The critical values are calculated as $(\beta + \gamma/T + \delta/T^2)$, where β is the estimate of the asymptotic critical value for a test of size p, and γ and δ are estimates of the slope of the response function conditional upon the sample size T. MacKinnon provides estimates of the critical values for different significance levels and for various variable combinations, as well as for the case where a constant and a time trend are included in the estimating equation.

(revenues), Germany (expenditure and revenues), Greece (expenditure), Portugal (revenues), UK (revenues) and Austria (revenues). However, all the results provide statistically significant estimates for the coefficient of the time trend and, as a result, the time series of revenues and expenditure are characterized either as non-stationary or as trend-stationary. In either case, spurious regressions are at issue and to remove these problems, the series has been first-differenced. As can also be seen from the two last columns of Table A1, the hypothesis that the series is stationary cannot be rejected in all but three cases: in Portugal (expenditure) and in the UK (expenditure). Second-differencing these series, on the other hand, yields stationarity, as shown by the additional statistics reported under the relevant headings. The time series properties of the fiscal balance data (the results for which are not reported here for reasons of economy), which is a linear combination of, and is defined as the difference between, government revenues and total expenditure, are also characterized as non-stationary in level form; these series are integrated I(1), however. The fiscal balance data were used in the estimates presented in section VII of the text.

Table A2 presents the cointegration properties of the data. The cointegration estimation was based on the Johansen maximum likelihood estimation procedure. The Johansen method

Table A1
Stationarity Tests for General Government Expenditure (EXP) and Revenues (REV) in 13 Community Member States, 1960-1994

		Level		First difference	
	Variable	DF	ADF(1)	DF	ADF(1)
B	EXP	-2.66	-3.49	-4.43	-4.73
	REV	-4.97	-3.18	-7.60	-4.06
DK	EXP	-3.32	-3.53	-4.99	-4.24
	REV	-2.73	-2.31	-5.81	-3.36
D	EXP	-3.39	-4.16	-4.64	-4.91
	REV	-4.74	-3.63	-6.24	-4.08
GR[1]	EXP	-4.39	-4.30	-5.47	-5.34
	REV	-3.09	-3.69	-4.31	-3.29
E[2]	EXP	-2.53	-2.50	-4.64	-3.31
	REV	-3.55	-2.26	-8.74	-5.87
F	EXP	-1.92	-2.75	-3.82	-3.31
	REV	-2.09	-2.02	-5.44	-3.55
IRL	EXP	-2.76	-2.38	-5.63	-3.29
	REV	-3.30	-2.43	-7.17	-3.53
I	EXP	-3.06	-2.13	-5.09	-2.94
	REV	-3.24	-1.66	-7.15	-2.52
NL	EXP	-2.46	-2.86	-4.84	-4.41
	REV	-3.74	-2.84	-6.03	-3.96
P	EXP	-2.20	-3.88	-4.01	-3.17
	EXP[3]	-	-	-5.37	-2.99
	REV	-6.17	-4.10	-6.83	-3.13
UK	EXP	-3.77	-3.41	-4.02	-3.72
	EXP[3]	-	-	-5.33	-4.55
	REV	-3.17	-4.65	-3.66	-4.05
	REV[3]	-	-	-4.40	-4.07
A	EXP	-3.17	-3.74	-4.08	-3.71
	REV	-3.61	-4.68	-5.15	-4.23
SF	EXP	-2.62	-3.89	-4.24	-4.08
	REV	-3.59	-3.99	-4.93	-3.61

DF and ADF are the Dickey-Fuller and the augmented Dickey-Fuller statistics, respectively; ADF(1) is the ADF statistic of order 1; the critical values of the DF and ADF(1) statistics, calculated by the MacKinnon method, at the 95% level of significance are -4.08 and -4.09, respectively.

1 Sample 1975-1994; for the level specification the critical values of the DF and ADF statistics, at the 95% level of significance, are -4.22 and -4.24, respectively; for the first-difference specification the corresponding critical values are -3.70 and -3.72.

2 Sample 1971-1994; for the level specification the critical values of the DF and ADF statistics, at the 95% level of significance, are -4.22 and -4.26, respectively; for the first-difference specification the corresponding critical values are -3.65 and -3.68.

3 First difference of the first difference (second difference) specification; critical values of the DF and the ADF statistics, at the 95% level of significance, are -4.10 and -4.11, respectively.

Table A2
Cointegration Between General Government Revenues and Total Expenditure: Johansen Methodology
(1960-94; trended case; no trend in data generating process)

		Maximal eigenvalue criterion	Trace criterion
	VAR	Test statistic	Test statistic
B	1	26.38	28.08
DK	1	38.59	42.03
D	2	21.14	26.29
E	1	40.30	42.83
F	1	31.83	31.86
IRL	1	47.29	47.29
I	1	60.92	60.94
NL	1	23.22	24.84
P	4	65.25	65.27
UK	1	35.22	35.76
A	1	70.65	74.98
SF	1	79.42	79.52

VAR indicates the lag order used in the cointegrating regression; the critical value of the test statistic at the 95% level of significance is 14.90 under the maximal eigenvalue criterion, and 17.95 under the trace criterion.

Table A3
Long-Run Expenditure and Revenue Multipliers Implied by the Cointegration Vectors

	m (X)	m (R)
B	-	0.77
DK	0.90	-
D	0.93	1.07
E	-	0.80
F	0.78	0.79
I	-	1.15
NL	0.90	-
P	0.87	1.14
A	-	1.13
SF	-	1.20

m (X) = expenditure multiplier
m (R) = revenue multiplier

utilizes two criteria for establishing the presence of cointegration: the maximal eigenvalues and the trace of the stochastic matrix. The null hypothesis in the first case is that there are at most r cointegrating vectors against the alternative that there are r+1 cointegrating vectors; in the second case, the null hypothesis is that there are at most r cointegrating vectors against the alternative that there are at least r or more cointegrating vectors. Since the first test posits the alternative hypothesis as an equality it is considered to be more powerful than the second test[38].

Table A2 presents the test results for the existence of cointegration among the revenue and expenditure variables, under the hypothesis that there is a time trend in the series but there is no trend in the data generating process. The results establish that there is a unique vector in each case examined (there are insufficient data in the case of Greece and, consequently, no results are reported). The null hypothesis cannot be rejected both on the basis of the maximal eigenvalue criterion and on the basis of the trace of the stochastic matrix criterion. As can be seen from Table A2, the calculated statistic is larger than the critical value at the 95% level of significance in all case examined. The results also show that the hypothesis that there are more than one cointegrating vectors is not supported by the data (the

38 See S. Johansen and K. Juselius (1990). The results presented here were obtained with the MICROFIT 3.0 program.

calculated statistics in these cases, not shown presently, are consistently lower than the critical values).

Note also that the cointegration vectors allow the direct measurement of the expenditure and of the revenue multipliers. These are the long-run part of the cointegrating relationship and, as noted in footnote 14, the vectors yield estimates which are comparable in magnitude to those reported in Table 4 of the text. If the respective multipliers have a value of one, a balanced budget property would characterize the fiscal policy and the cointegrating vector should be [-1, 1]. In this case, the deficit (the difference between expenditure and revenues) would be a stationary variable and that shocks to revenues or expenditure would be transitory in their effect on the fiscal deficit; in other words, the deficit process would be mean reverting. (It is also clear that in a three-dimensional autoregressive system the necessary condition for the cointegration of government expenditure, revenues, and the deficit series which is consistent with a balanced budget property is [-1, 1, 1]). Table A3 presents the estimated expenditure and revenue multipliers implicit in the cointegration vectors. The results suggest that, in general, the [-1, 1] restriction on the cointegration vector is not satisfied and, consequently, the data suggest that in the sample under consideration there are forces leading to budget imbalances.

Table A4
Long-Run Expenditure and Revenue Multipliers Implied by the Cointegration Vectors

	m(R)	m (X)	LR $\chi^2(1)$
B	-1	1.30	1.53*
DK	-1	1.13	16.98
D	-1	0.93	13.12
E	-1	0.80	27.93
F	-1	0.79	19.23
I	-1	0.87	10.41
IRL	-1	1.21	16.05
NL	-1	0.90	21.61
P	-1	1.17	17.54
UK	-1	0.69	27.89
A	-1	0.89	55.25
SF	-1	0.83	69.47

m (X) = expenditure multiplier
m (R) = revenue multiplier

* m(R) = m(X) cannot be rejected

LR $\chi^2(1)$ = likelihood ratio; critical value at the 95% level of significance is 3.84.

To test more formally the restriction that the cointegration vector is [-1, 1], Table A4 shows the estimated unrestricted cointegrating vectors for general government revenues and expenditure for twelve Member States (Greece is not included due to lack of adequate observations) irrespective of whether the causality order indicates that both multipliers are pertinent, together with the test (likelihood ratio) statistic for the restriction that the multipliers are equal to unity (the VAR order is the same as that shown in Table A2). This restriction is rejected in eleven of the twelve cases; the exceptions is Belgium. On the basis of these results, it is clear that a balanced budget property would be preserved in Belgium, whereas, judging from the relative size of the multipliers, there appears to be a tendency towards deficits in the remaining cases except in Denmark, Ireland, and Portugal where the expenditure multiplier is considerably higher than the revenue multiplier. In the latter cases, an expenditure shock would raise revenues by approximately 15 to 20 percent above the expenditure change.

Table A5 presents the estimated weights by which disequilibrium in the revenue equation induces adjustments in revenues and expenditure towards the estimated cointegration relationship. These weights enter the revenue and expenditure equations in the error-

correction model implicit in the Johansen maximum likelihood estimation procedure. The interpretation of the weights is as follows: in the case of Belgium, for example, the first weight under the heading "Revenue equation", gives the speed of adjustment by which a 1 percent deviation from the long-run relationship induces a 0.08 percent adjustment towards the long-run relationship each year. Similarly, the same deviation also induces a 0.08 percent adjustment in expenditure towards the long-run relationship, as can be seen under the "Expenditure equation" column.

Table A5
Short-Run Adjustment Weights in the Revenue and Expenditure Equations

	Revenue equation	Expenditure equation
B	0.08	0.08
DK	0.29	0.29
D	-0.34	-1.18
E	-0.58	-0.89
F	-0.26	-0.34
I	1.00	1.13
IRL	0.19	0.15
NL	-0.41	-0.86
P	1.77	0.98
UK	-012	-0.19
A	-0.78	-1.11
SF	-0.25	-0.42

In general, the estimates suggest that disequilibrium in the revenue side of the budget induces adjustments not only in the revenue but also in the expenditure side. The sign of the adjustment weights in the identified cointegration vector should be negative to ensure stability. Thus, if estimated revenues are above their equilibrium value, then actual revenues would tend to decrease towards equilibrium if the adjustment coefficient is negative; on the other hand, if estimated revenues are above the equilibrium value, then expenditure would tend to increase if the adjustment weight in the expenditure equation is positive. The adjustment weights in the revenue and expenditure equations are positive in the cases of Belgium, Denmark, Italy, Ireland, and Portugal (with the exception of Italy and Portugal, the other coefficients are rather small in size). These suggest that disequilibrium in the revenue equation does not lead to equilibrium adjustments in revenues but rather in expenditure. Thus, if revenues are above the equilibrium relationship, actual revenues would tend to increase and correspondingly, expenditure would tend to increase too. The estimated adjustment weights suggest that there is evidence of instability in the budgetary process of these Member States.

The data suggest the opposite for the remaining Member States. Here, the revenue and expenditure adjustment weights are negative. These signs indicate that when revenues are above the equilibrium value, actual revenues would tend to decline towards equilibrium; furthermore, when revenues are above equilibrium, expenditure would tend to decline too, thus supporting budgetary adjustment. It would appear that the budgetary process in these Member States is more stable than that suggested for the previous group.

A comparison of the adjustment weights categorizes the Member States as follows: first, there is the group of countries where the adjustment weights are virtually identical (Belgium, Denmark, France, Ireland, Italy, and the UK); secondly, there is a group of countries where the expenditure adjustment dominates quantitatively the revenue adjustment in response to a disequilibrium in the revenue equation (Germany, Spain, the Netherlands, Austria, and Finland; and, in the case of Portugal the revenue weights is substantially larger than the expenditure weight, implying that deviations from equilibrium in the revenue function give rise to substantially greater adjustment on the revenue, rather than the expenditure, side of

the budget. Note also the virtual lack of adjustment to equilibrium implied by the weights in the case of Belgium.

In most cases the adjustment to deviations from the cointegrating relationship appear to be slow. With the exception of Germany, Italy, Portugal, and Austria, where the respective weights imply a virtual one-to-one relationship between deviations from the long-run relationship and subsequent revenue and/or expenditure adjustment, in the rest of the Member States such deviations are incompletely offset within a year.

Finally, the fact that the estimated weights which enter the expenditure equation are non-negligible in size suggests that government expenditure cannot be treated as exogenous to the parameters of the conditional revenue model. The non-exogeneity of government expenditure is, not surprisingly, consistent with the notion that fiscal policy decisions are made in such a manner that both the revenue and the expenditure side of the budget are affected.

ANNEX II

Some Diagnostics of the Granger-Causality Estimates

This Annex reports some additional diagnostic results for the Granger-causality equations used in the discussion of section VII of the main text. First, it is necessary that the equations have adequate explanatory power in determining the variance of the dependent variable; this is especially so since the expenditure-to-revenue causality estimates are used to determine the value of the long-run expenditure multipliers. And, secondly, an important condition for the reliability of the Granger-causality tests, based on testing the null hypothesis that the vector of coefficients of the variable is question is jointly not different from zero, is that residuals are not autocorrelated. Serial correlation would invalidate the test results based on the measured F statistics since the latter would not be distributed according to the F distribution.

Table A6
Statistical Characteristics of the Granger-Causality Equations

	From Revenue to Expenditure		From Expenditure to Revenue	
	Adjusted R^2	F ratio	Adjusted R^2	F ratio
B	0.76	1.49	0.54	0.04
DK	0.63	0.11	0.86	6.53
D	0.66	0.38	0.56	0.01
GR	0.95	0.99	0.97	0.05
E	0.94	1.21	0.60	0.37
F	0.86	0.07	0.90	0.29
IRL	0.65	0.50	0.72	0.53
I	0.81	0.55	0.82	0.11
NL	0.57	0.51	0.56	0.71
P	0.57	11.70	0.78	0.01
UK	0.02	0.96	0.41	1.32
A	0.90	0.42	0.59	0.09
SF	0.88	0.19	0.62	5.03

The F ratio tests the null hypothesis that the residuals from the causality regressions are an autoregressive process of order 1 against the alternative that they are not; rejection of the null requires F values significantly larger than the critical values.

Table A6 reports the adjusted R^2 and the F ratio for the Granger-causality equations presented in the text. The adjusted R^2 suggests that the independent variables in the equations explain a large part of the variance of the dependent variable. Note that the equations were estimated in first-difference form as well. In the Revenue-to-Expenditure causality the highest R^2 is found in the cases of Greece, Spain, France, and Finland; the lowest R^2 is found in the case of the UK, and in the cases of the Netherlands and of Portugal. In the Expenditure-to-Revenue causality the fit of each equation is equally good, with as much as 97% of the variation in the dependent variable (Greece), and a minimum of 41% (UK), explained by the independent variables.

The F ratio is used to test the hypothesis that the residuals are serially correlated of order one against the alternative that they are not serially correlated. Tests for higher order

autocorrelation were also performed but the Langrange multiplier (LM) statistics did not indicate that autocorrelation was a problem. Serial correlation appears to be somewhat of a concern in the cases of Portugal, especially in the Revenue-to-Expenditure causality tests, and in Denmark, in the Expenditure-to-Revenue causality regressions. However, additional tests for higher order serial correlation did not contribute to improving the results.

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