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Are Fiscal deficits inflationary? Evidence for the EU

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Abstract

Are fiscal deficits inflationary? While the answer from conventional economic theory and from the monetary authorities is a conclusive yes, the evidence from the empirical literature is an unsettled maybe. This paper investigates the inflationary effect of central government deficits in a sample of six European Union members, namely Belgium, France, Germany, Italy, Netherlands and the UK, focusing on post-war annual data. Given the heterogeneous order of integration of the variables involved, the paper employs recently developed robust econometric methodologies, such as the bounds testing-ARDL approach, to examine the existence of a long-run relationship, and the LA-VAR causality analysis, to confirm the direction of causality. The results do not support the formulated hypothesis, suggesting the possibility of more flexible fiscal policies in the EU.

JEL Classification: C12, C32, E31, E62

KEYWORDS: fiscal deficits, inflation, bounds testing, ARDL, LA-VAR, European Union.

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1. Introduction

One of the main causes of concern with undisciplined fiscal policies is the conventional notion that persistently high budget deficits inevitably give rise to monetization and inflation, which monetary policy on its own is powerless to prevent. Although the empirical evidence does not provide convincing support for this hypothesis, such concerns are often expressed at the institutional level:

"Many of us who are central bankers expect that a substantial reduction in the long-term prospective deficit of the United States will significantly lower very long-term prospective inflation expectations vis-à-vis other countries" A. Greenspan (1995: p. 141)

"The European Council underlines the importance of safeguarding sound government finances as a means to strengthening the conditions for price stability […]"

Resolution of the European Council on the Stability and Growth Pact, 17 June 1997

This paper investigates whether the proposition of a positive effect of budget deficits on inflation can be verified in the particular case of the European Union (EU) during the post-war period. This was a central point in the discussion over the necessity of the Maastricht's fiscal convergence criteria to prevent excessive inflation in the Economic and Monetary Union (EMU). It also justified the guidelines later established in the 'Stability and Growth Pact'.

Since the early eighties, several studies, focused almost exclusively on the particular case of the United States, have attempted to verify empirically the existence of this effect. However, the results have been far from conclusive. On the one hand, Allen and Smith (1983), McMillin (1986) and Hondroyiannis and Papapetrou (1997), among others, report some evidence that deficits have an effect on money growth and inflation. On the other hand, Barro (1987), King (1995) and Abizadeh and Yousefi (1998), for example, argue that such a relation is not found in the data. Dwyer (1982) and Joines (1985) present evidence that higher inflation contributes to larger government deficits. Smithin (1994) suggests that growing deficits are historically connected with lower inflation rates. King (1998) examines this question with a very simple pooled regression of inflation on debt, for several OECD countries, and also finds evidence of a negative relation.

This paper extends the debate from the US to the European economies, where this issue is particularly important given the foremost objective of price stability and the consequent restrictions imposed on national fiscal policies. Another important contribution of the paper is the use of recently developed econometric methodologies, suitable to examine the relationship between variables displaying distinct orders of integration, a question overlooked in the previous literature. In particular, it employs the bounds testing-ARDL approach, suggested by Pesaran, Shin and Smith (1999), to test the hypothesis of a long-run equilibrium relationship, and the LA-VAR approach, suggested by Toda and Yamamoto (1995) and Dolado and Lüktephol (1996), to test the existence and direction of causality between budget deficits and inflation in the EU.

The relation between these variables has important implications for the conduct of fiscal and monetary policies. A positive effect of deficits on inflation emphasize the need for fiscal discipline, such as that embodied in the convergence criteria established in Maastricht and extended in the Stability and Growth Pact. The findings of this paper, however, suggest that deficits do not cause inflation in the major EU economies; indeed, the opposite effect prevails in most countries.

The next section of the paper reviews the main economic mechanisms governing the relations between the variables. The channels through which the government's budget interacts with money creation and inflation are diverse, and the direction of causality is not always clear. Section 3 describes the data set and presents the econometric methodology. Section 4 displays the results of the tests and, finally, section 5 summarises and offers some concluding remarks.

2. The relation between deficits and inflation

Which are the channels of interaction between fiscal deficits and inflation? This section reviews some of the theoretical justifications that have been proposed in the literature to examine the relationship between fiscal and monetary policies or, more precisely, between the budget deficits and the levels of monetization and inflation.

One approach adopts the analytical framework proposed by Sargent and Wallace (1981), where seigniorage assumes the central role for deficit finance. It views the relation basically as a game between the fiscal and the monetary authorities. Under the assumption that the fiscal authority is the first to make a move ('Stackelberg leader'), the monetary authority is left with a difficult choice in order to balance the intertemporal budget (the 'unpleasant monetarist arithmetic'). It either loosens its policy in the short-run to avoid high inflation in the long-run, or tightens its policy today at the expense

of an inevitable future increase in inflation. A tighter monetary policy increases the real interest rate (and consequently the debt-service costs), slows the economy (worsening the deficit through the automatic stabilisers), and reduces the seigniorage revenues. The budget deficit increases and eventually may become unsustainable (see Vieira, 1999). Sooner or later, therefore, the fiscal imbalance must be financed through seigniorage. In sum, a fiscal dominant regime implies unavoidably a positive intertemporal correlation between deficits and inflation, with causation running primarily from deficits to inflation.

A second approach argues that the main channel is the effect of inflation on the real value of the stock of debt and on the real interest rate (see for example Dornbusch, 1998). While Sargent and Wallace (1981) saw the first approach as an economic policy game between fiscal and monetary authorities, Keynes (1971), for example regarded this second as a 'social game' between rentiers and workers. Society does not tolerate ever-increasing taxes, and therefore other ways, such as inflation, must be considered to reduce the accumulated stock of debt. According to this analysis causation runs primarily from budget deficits to inflation, but the mechanism by which higher inflation helps close the budget deficit is different: inflation reduces the real stock of debt and permits accelerated debt repayment through higher nominal interest rates.

Other less referred channels can be identified. One is the wealth effect, a demand-side effect which can be found for example in Patinkin (1965): the rise in the real value of the stock of bonds increases perceived private wealth, and therefore spending, leading to inflation. There may be also a supply-side effect, through the cost of factors: a deficit caused by an increase in certain public expenditures may augment the demand for scarce resources, increasing their cost (see, for example, Wray, 1997). These two effects may be regarded as 'non-monetization effects' of deficits.

The wealth effect was particularly denied by Barro's Ricardian Equivalence Proposition. Instead, Barro (1979) focused on the positive relationship between *expected* inflation and budget deficits. Higher inflation expectations imply higher real interest rates and therefore higher debt-service costs.

Finally, a different view of the connection between inflation and deficits is proposed for example by Persson *et al.* (1998). According to these authors, the fiscal gains from higher inflation arise mainly from the nominal features of the tax and transfer system, rather than from the more traditional sources considered above of seigniorage and devaluation of real debt. In general, inflation tends to increase real, effective tax rates while eroding the real value of money transfers, due for example to an imperfect

indexation of the tax and transfer systems. Analysing the particular case of Sweden in 1994, they conclude that the fiscal gains from inflation may be quite substantial. According to this view, causality may run both ways, since higher inflation would tend to reduce budget deficits, irrespective of the underlying source of inflation. This effect contradicts the more conventional Tanzi (or Olivera-Tanzi) effect of the nominal characteristics of the tax system, according to which higher inflation reduces the real government revenues due to lags in tax collection. This Tanzi effect has certainly become less significant with the modernisation of the tax collection system.

The question of which particular theoretical view best describes the interrelationship between deficits and inflation is beyond the scope of this paper, which is focused primarily on identifying the statistical relations. The empirical implications of all these theoretical models are not always consistent, and a particular attention must be devoted in the tests to the direction of causality.

3. Data and econometric methodology

The empirical application is focused on six core EU members: Belgium, France, Germany, Italy, Netherlands and the United Kingdom. These countries constitute a more or less homogeneous group, having shared similar objectives of economic integration during the last decades, and represent the bulk of economic activity in the EU. Although constituting only two fifths of the current number of members, these six countries represented in 1996 more than four fifths of the total EU's gross domestic product. It is also a balanced sample, where one half of the countries (Belgium, Italy and the Netherlands) traditionally present very high debt-GDP ratios, while the other half is usually more fiscally disciplined.

Considering the large sample theory of the tests performed below, annual data for the period 1950-1996 will be analysed. Annual data allows a longer time period and avoids seasonality problems, which are a characteristic of higher frequency fiscal data. The two end points of this sample period were chosen following criteria of data reliability and comparability, on one side, and to avoid the interference of the 'EMU convergence criteria effect', on the other side.

All data are from the IMF's *International Financial Statistics*, complemented with occasional information from official national statistical institutions to fill some missing observations, and refer to central government operations.[i] The total deficit variables are expressed as ratios to GDP, while the inflation rates refer to the growth rate of the consumer price index.

The empirical analysis employs a VAR framework, allowing feedback effects and avoiding the arbitrary choice of endogenous variables. The univariate statistical properties of the series involved were analysed with different unit root tests. Since the results are basically equivalent, Table 1 displays only the results of an ADF test where the number of lagged dependent variables is chosen according to a sequential testing procedure, starting from four lags and rejecting the last lagged term if not significant at the 10% level of significance. The regressions do not include a time trend since this deterministic variable was found not to be statistically significant.

The null hypothesis of a nonstationary deficit series can only be rejected in Germany and in the UK. The inflation rate seems to be stationary in Belgium, France and perhaps also in Germany, given the proximity to the 5% significance level. This disparity of results makes it difficult to examine the relation between deficits and inflation using a homogeneous, directly comparable methodology. Different procedures have to be employed, according to the stochastic characteristics of the underlying

time series. With only stationary variables, the standard OLS regression and block causality tests can be applied. Conversely, if all variables involved are I(1), cointegration procedures will be employed. Finally, when the model includes a mixture of stationary and nonstationary variables, the analysis follows the bounds testing-ARDL procedure suggested in Pesaran, Shin and Smith (1999), henceforth PSS. Being a very recent methodology, it is convenient to present the latter in some detail.

The PSS approach presents the major advantage of being adequate to test the existence of a long-run level relationship whether the underlying regressors are I(0) or, at maximum, I(1). It avoids the pre-testing problems involved in unit root tests, and will therefore be initially applied to all six countries. The appropriate testing procedure depends on the specification of the deterministic variables included in the model to be estimated. For example, if the underlying level variables are allowed to follow a linear trend under the null hypothesis, the model with unrestricted intercepts and no trends (model III in PSS) is more adequate. This model is based on the following error correction model specification

$$Dy_t = a + P_y y_{t-1} + P_x x_{t-1} + \sum_{j=1}^{p-1} q_j Dy_{t-j} + \sum_{j=1}^{q-1} f_j Dx_{t-j} + e_t , \qquad (1)$$

where y_t represents the dependent variable, x_t is a vector (a scalar vector in the application below) of possibly long-run forcing variables, P_y and P_x are the respective long-run multipliers, and q_j and f_j represent the short-run dynamic coefficients. PSS also include on the right-hand side of equation (1) the current first-differenced x_t variables. However, Pesaran and Pesaran (1997) argue that they should not be included if there is no *a priori* knowledge of which is (are) the long-run forcing variable(s). In this case of uncertainty, regression (1) is estimated for all variables, and the results of the tests are compared to identify the direction of the long-run relationship. This seems a more adequate procedure in terms of the present study. Although the main purpose is to examine whether the fiscal problems of a country have an effect on inflation, it is advisable not to disregard the possibility of opposite effects, as noted above.

If the variables do not follow a deterministic trend, but a constant is allowed in the error correction term, the test is based on a model with a restricted intercept and no trend (model II in PSS)

$$Dy_t = P_y\left(y_{t-1} - a_y\right) + P_x\left(x_{t-1} - a_x\right) + \sum_{j=1}^{p-1} q_j Dy_{t-j} + \sum_{j=1}^{q-1} f_j Dx_{t-j} + e_t . \qquad (2)$$

The choice of the correct lag structure of the model is also a very important issue in these tests, although no single strategy has yet been identified in the literature as being the most efficient. An inevitable trade-off must be considered, between the problems of overparameterization in small samples and the necessity to avoid serial correlation in the residuals. Two alternative strategies will be followed below. The first allows a very flexible choice for the dynamic lag structure of the model, by choosing a lag order (p,q) so that the element of order $(p+1,q+1)$ is rejected at the 10% significance level. The second imposes an order $(p=q)$ so that the joint significance of the $(p+1=q+1)$ terms is not rejected with an *F*-test. In the particular case of the tests performed here, both strategies lead to qualitatively similar results in almost all cases, as shown in the tables below.

When model III is considered, the test is based on the standard *Wald*- or *F*-statistic of joint significance of the lagged levels of all the variables included.[ii] With model II the joint test is extended to the significance of the intercept term. The null hypothesis is the non-existence of a long-term relationship between the variables considered. In general terms,

$$H_0: P_y=0 \text{ and } P_x=0,$$

$$H_a: P_y \neq 0 \text{ or } P_x \neq 0.$$[iii]

The asymptotic distribution of the statistics is non-standard under the null, but it is derived and tabulated in PSS (Tables C1). Given the uncertainty about the order of integration of the variables, there are two sets of critical values, each assuming a polar case of all variables being I(0) or all I(1). If the test statistic is above the band formed by the 'critical values bounds', it suggests a rejection of the null hypothesis of no long-term relationship. Conversely, if it falls bellow the band, the null cannot be rejected. Otherwise, no conclusive inference can be drawn, and further information about the correct order of integration of the variables is required.

One caveat worth reporting is that, according to assumption 3 in PSS, this bounds testing approach is not valid when the null hypothesis is rejected in more than one of the first-differenced regressions. In terms of equations (1) and (2), this entails the identification requirement that the lagged level of y_t cannot enter any of the equations for the x_t variables (although there may still be Granger-causality from y_t to x_t in the short run, a possibility which will be explored below).

After concluding in favour of the existence of a long-run relationship between the variables (and its direction), the second stage of the procedure is to employ the two-step autoregressive distributed lag (ARDL) approach suggested in Pesaran and Shin (1999) to examine the parameters of that relationship.

This approach yields consistent estimates of the long-run coefficients regardless of whether the underlying regressors are I(0) or I(1). The order of the ARDL is selected according to the Schwarz Bayesian Criterion (SBC), since this was found by the authors to perform slightly better than the Akaike Information Criterion (AIC).

4. Testing the relationship

Table 2 reports the summary results of applying the bounds testing-ARDL procedure to the relationship between the total central government deficit and inflation. The upper part of the table applies the bounds testing procedure to all countries, while the lower part presents the estimates of the model in those cases where a significant long-run relationship was found. In two cases, identified in the table's footnotes, it was necessary to include dummies in the model to solve problems of non-normality. The asymptotic critical values are not affected by the inclusion of these particular dummies.

The results in Table 2 suggest the existence of a long-run relationship between inflation and the total deficit in three countries, positive in the cases of Belgium and Italy, negative in France. This latter result does reflect the idiosyncratic behaviour of the French fiscal variables relatively to the rest of the EU. The period of high inflation in the second half of the seventies corresponds in France to the period of lower deficits, when all other countries experienced deteriorating fiscal positions due mostly to the first energy shock and the end of the Bretton Woods fixed exchange rate system. Since the early eighties the drop in the inflation rate was accompanied by a growing budget deficit, following the expansionary fiscal policies implemented after the election of F. Mitterrand in 1981, contrasting markedly with the contractionary policies adopted elsewhere in Europe. This inverse relationship may simply be an incidental consequence of the business cycle in France, rather than a reflection of the true underlying causal orderings.[iv]

In the cases of Belgium and Italy, the relation between the deficit and the inflation rate is positive, but with the latter being the long-run 'forcing variable'. This result is difficult to reconcile with conventional economic theories. The deficit is usually thought of as being the primary forcing variable in the relationship, with inflation being the result but also then being one of the mechanisms by which the deficit is closed, whether through seigniorage, or debt deflation. At most, one might expect bi-directional causality, rather than one way from inflation to deficit. One possible explanation for the result in Table 2 is the effect of inflation on the government's interest expenditures, particularly

important in heavily indebted countries such as Belgium and Italy. Both countries display a value of public debt well above the respective annual GDP.

Further tests are performed below to check the robustness of these results. For Italy and the Netherlands it is possible to complement the ARDL procedure with the more conventional vector-error correction model, since both variables involved appear to be I(1). Table 3 reports the results of the Johansen cointegration tests for these countries.

The null hypothesis of no cointegration could only be clearly rejected in the case of Italy. The cointegrating vector, normalised on the deficit (def_t) is (standard errors in parenthesis),

$$\begin{array}{rcc} def_t = & 0.8714\, p_t & +0.0116\,, \\ & (0.2215) & (0.0185) \end{array}$$

again revealing the existence of a positive long-run relationship between deficits and inflation. Furthermore, the error correction term was found to be significant only in the equation for def_t, confirming all the findings of the ARDL procedure. In the case of Germany, where both variables may be stationary, estimation by ordinary least squares provided the equation

$$\begin{array}{rcc} def_t = & 0.0125\, p_t & +0.0112, \\ & (0.0635) & (0.0024) \end{array}$$

again showing a positive, but not statistically significant relation.

Further complementary analysis may be provided by the non-causality tests presented in Table 4. As before, the distinct order of integration of the variables requires a methodology which is robust to the data characteristics. Consequently, the non-causality tests will be performed using the 'lag-augmented VAR' (LA-VAR) methodology proposed by Toda and Yamamoto (1995) and Dolado and Lütkepohl (1996), which avoids pre-test biases, being particularly useful when there is uncertainty concerning the order of integration/cointegration of the variables.[v] Basically, their method employs a VAR model with an order exceeding the true order by the highest degree of integration of the variables. The main drawback of the test is the loss of power and efficiency, due to the overfit of the VAR model.

For most countries in the sample, there is a significant causal relationship running from the inflation rate to the total deficit. The opposite effect was also found in the case of France, confirming the findings of the ARDL procedure, but it is significant only at the 10% level. At the usual significance levels, no evidence was found of an effect of deficits on inflation in any country of the sample.

5. Summary and conclusions

Causality and cointegration tests have various limitations. However, a central contribution of this paper is that robust estimation and testing techniques have been used, notably the methods of Pesaran, Shin and Smith (1999), Toda and Yamamoto (1995), and Dolado and Lütkepohl (1996), particularly suited to deal with models where variables display distinct orders of integration. This means that we can be particularly confident of the validity of the main results. A second contribution of this paper is that it introduces the research to the case of the EU, where this question deserves particular attention, being a major assumption to justify the present limitations on national fiscal policies.

The results obtained here provide little support for the proposition that budget deficits have been an important contributing factor to inflation in the major European economies over the last 45 years. On the contrary, where evidence exists of a long-run relationship between inflation and deficits, this evidence is more consistent with the view that it was inflation that contributed to deficits, rather than the reverse.

One possible explanation for the lack of empirical evidence on the effects of deficits on monetization and inflation could be the change of economic policy objectives since the early eighties, towards price stability and fiscal consolidation. In spite of the evident accomplishment in reducing inflation, the efforts on the fiscal side have not been so successful, and this could justify why no statistically significant evidence was found of this relation in some countries.

Fratianni and Spinelli (1999) present evidence of this change of regime in the case of Italy. They report that the long period of *fiscal dominance*, in which the deficits determined the growth of the money supply, was reversed in the eighties and nineties, with the entry in the EMS, the higher independence of the central bank after 1981 and, more recently, the Maastricht Treaty. In fact, repeating the same empirical tests on the pre-ERM period 1950-1978, reveals a (weak) positive effect of deficits on inflation in Italy, not found for the whole period (results not shown but available on request). However, for most countries the results in this sub-period suggest again that it is inflation that affects the deficit. The short time period, though, demands extra caution on the interpretation of these results.

Overall, the findings of this paper suggest the possibility of greater flexibility of fiscal policies. More particularly, they provide some support for criticisms of the Maastricht Treaty's deficit convergence criterion and the even stricter rules outlined in the 'Stability and Growth Pact'. The criterion was proposed fundamentally as a mechanism to protect monetary policy. The results obtained here suggest

that, in fact, the Maastricht criterion will be ineffectual because there is no evidence for the assumed links between deficits and inflation on which the criterion rests.

Indeed, it can be argued that the pursuit of the Maastricht criterion could have caused further budgetary problems. If the private sector believed that deficit reduction was a necessary condition for a *permanent* fall in inflation, the fall in inflation which actually took place may have been interpreted as *temporary*, given the continuing fiscal problems.[vi] This would tend to increase the long-term interest rate on government debt, producing a heavier debt-service burden, and therefore higher total deficits. This credibility problem may help explain why the results of the tests suggest a causal relationship running from the inflation rate to the deficit, and not the contrary as suggested by conventional economic theory. This point also highlights the central role of the interest rate in the intertemporal budget dynamics, which appears to be especially important in highly indebted countries such as Belgium and Italy. It suggests that a positive relation between deficits and inflation can be found even outside a regime in which fiscal policy is dominant, and strengthens the case for a careful examination of the direction of causality.

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Table 1: Unit root tests on the series of total deficit (def_t) and inflation (p_t)

	Belgium	France	Germany	Italy	Netherlands	UK
def_t	-1.3384 (0)	-2.4347 (0)	-4.7637*** (0)	-1.1295 (1)	-2.1618 (0)	-3.2308** (0)
π	-3.2224** (0)	-3.4258** (0)	-2.9169* (2)	-2.3886 (0)	-2.0678 (3)	-2.3876 (0)

In parenthesis is the number of lagged differenced terms used in the regression. The asterisks (*), (**) and (***) indicate rejection of the null hypothesis of nonstationarity at the 10, 5 and 1% significance levels, respectively. Critical values (MacKinnon, 1991): -2.60(10%), -2.93(5%) and -3.58(1%).

Table 2: Bounds testing-ARDL procedure applied to the relation def_t , p_t

dependent variable		order chosen with *t*-tests				order chosen with *F*-tests		
		order		model		order	model	
		p	q	III	II	p=q	III	II
B	$Ddef_t$	1	1	6.9379**	-	1	6.9379**	-
	Dp	1	1	5.0971?	-	1	5.0971?	-
F	$Ddef_t$	1	2	1.5435	1.0300	1	4.1970	-
	Dp	1	3	11.5857**	7.7783**	1	6.8237**	-
G	$Ddef_t$	4	1	12.0395**	8.0333**	4	5.1388?	3.4295
	Dp	3	2	5.4228?	3.6728	1	18.7133**	-
I	$Ddef_t$	2	1	10.0335**	6.7896**	2	5.7101?	3.8607
	Dp	1	3	1.6896	1.1265	3	2.8263	1.8842
N	$Ddef_t$	1	1	2.7826	-	1	2.7826	-
	Dp	4	1	3.7730	2.5197	4	2.8839	1.9516
UK	$Ddef_t$	1	1	4.3743	-	1	4.3743	-
	Dp	1	1	2.8832	-	1	2.8832	-

Country	dependent variable	underlying ARDL		long-run coefficients		ECT coefficient
		order (p,q)	R^2	regressor	intercept	
Belgium†	def_t	(2,1)	93.7%	1.4379 (0.8095)	-0.0235 (0.0428)	-0.0887 (0.0418)
France‡	p_t	(2,2)	72.9%	-2.2728 (0.5631)	-0.0912 (0.0125)	-0.4578 (0.0873)
Italy	def_t	(3,2)	91.4%	0.7907 (0.1918)	0.0203 (0.0162)	-0.2139 (0.0591)

Upper part: (**) the null hypothesis of no long-run relationship is rejected at the 5% significance level; (?) the result is not conclusive, falling inside the band; (-) the chosen order is too low to allow the test. Critical values bounds (PSS): [5.43/6-24] for model II and [4.94/5.73] for model III, for 5% significance levels. Lower part: †(‡) the model includes point dummy variables in 1958, 1981 (1958) to solve problems of non-normality. Order chosen by the SBC, starting from a maximum of 4. Below the estimates are the standard errors, in parenthesis.

Table 3: Johansen cointegration tests - total deficit (def_t) and inflation (p_t)

	Italy		Netherlands	
	l_{MAX} test	*Trace* test	l_{MAX} test	*Trace* test
order	1	1	1	1
H_0: r=0	18.0289**	20.8593**	12.4690	16.6107
H_0: r≤1	2.8304	2.8304	4.1417	4.1417

Critical values (Pesaran, Shin and Smith, 1997): 15.87/20.18 (5%) and 13.81/17.88 (10%) for the l_{MAX}/Trace tests and the null hypothesis of r=0, and 9.16 (5%) and 7.53 (10%) for both tests of r≤1.

Table 4: LA-VAR non-causality tests

	Belgium	France	Germany	Italy	Netherlands	UK
$p \rightarrow def$	7.4837***	5.5849**	33.8739***	11.6704***	3.1387*	0.7193
	[.006]	[.018]	[.000]	[.001]	[.076]	[.396]
$def \rightarrow p$	1.8058	3.1387*	3.3428	0.6101	0.7582	0.0022
	[.179]	[.076]	[.188]	[.435]	[.384]	[.963]
order	2	2	3	2	2	2

The asterisks (***), (**) and (*) indicate rejection of the null hypothesis of no causality at the 1%, 5% and 10% levels of significance, respectively. In brackets are the *p*-values of the test (χ^2 distribution).

[i] The observations on the deficit variable are from the *Nationale Bank van België* for Belgium in 1950/53, from the *Bundesministerium der Finanzen* for Germany in 1950, and from the *Ministero del Tesoro* for Italy in 1992.

[ii] PSS also suggest an alternative test, based on the *t*-statistic of the significance of the lagged dependent variable, which is basically an extension of the cointegration test proposed by Banerjee, Dolado and Mestre (1998) to the case where the order of integration of the variables is uncertain.

[iii] It is important to note that this allows the theoretical possibility of a 'degenerate' long-run relationship between the variables, under the null hypothesis, in which the lagged levels of the forcing variables do not enter the equation for Dy_t. This possibility will be carefully considered in the empirical applications.

[iv] As noted before, Smithin (1994) also reports evidence of a negative correlation between deficits and inflation in the US and Canada, while King (1998) finds a negative relation between debt and inflation in a pooled group of OECD countries, supposedly due to the negative effects of contractionary monetary policies on the budget (unpleasant *fiscal* arithmetic).

[v] For applications see for example Mills (1998) and Yamada (1998).

[vi] As noted by the European Commission (1995: p. 14), “prospects for the resolution of the fiscal imbalances remain uncertain, and fiscal convergence continues to be elusive”.