



On the sustainability of the Spanish public budget performance *

FRANCISCO DE CASTRO

Banco de España y Universidad Complutense de Madrid

PABLO HERNÁNDEZ DE COS

Banco de España

Recibido: noviembre, 2001

Aceptado: marzo, 2002

Abstract

In this paper, we address the issue of whether the current fiscal policy in Spain is sustainable. For this purpose we apply traditional empirical tests of fiscal sustainability proposed in the literature and, in addition, we introduce a deeper univariate analysis of the series involved. Our results show that a structural break seems to have taken place gradually in the Spanish budget performance, allowing to verify the intertemporal borrowing constraint in a «strong sense», which means that no problems in marketing public debt are expected to arise if fiscal variables follow the pattern of the past in the future.

Keywords: Sustainability, cointegration, structural breaks, intertemporal borrowing constraint.

JEL Classification: E60, F41, N10

1. Introduction

The most common definition of fiscal sustainability is based on the need for a fiscal deficit to be financed, i.e. on the concept of inter-temporal budget constraint, which requires that the current market value of debt be equal to the discounted sum of expected future primary surpluses. In this context, fiscal policy is sustainable if the discounted value of debt reaches zero at the limit.

The issue of whether the current fiscal policy can be maintained indefinitely, i.e. whether it is sustainable or not, is an important one, since it will determine the need for future discretionary policy actions. In this sense, since the concept of sustainability relies on the fact that governments need enough resources to ensure their ability to carry out the functions at-

* We wish to acknowledge J. Galí, J. M. Marqués, J. Vallés, J. M. González-Páramo and two anonymous referees for their suggestions and comments. We also thank J. L. Fernández for providing us with the programs needed to carry out some of the tests, and R. Peruga for very helpful discussions.

tributed to them, sustainability analysis helps to determine whether a current policy can be maintained in the long run with the ongoing ability to generate financial resources. In addition, fiscal sustainability has clear implications for other macroeconomic variables. In particular, a non-sustainable fiscal policy involves a risk of future interest rate rises leading to a slowdown in economic growth.

Testing sustainability in the Spanish case is of particular relevance due to the fact that several policy actions have been adopted in Spain since 1975, aimed at implementing a European Welfare State model and a modern tax system. This has led to a sharp increase in public expenditure and revenue. Furthermore, in recent times, Spain has gradually reduced its public deficit mainly as a result of a drop in spending that might have important consequences for fiscal sustainability.

As regards sustainability analysis, different tests are proposed in the literature. These pay special attention to integration orders of deficit and debt processes, and to the underlying stochastic structures and the existence of cointegration relationships between revenues and expenditures. Earlier tests in this literature indicated that the condition for fiscal sustainability is the stationarity of the debt (Hamilton and Flavin, 1986) or that the discounted debt process follows an $I(0)$ process without drift (Wilcox, 1989)¹. Later work developed alternative conditions for fiscal sustainability: provided that total public revenue and expenditure are first-order integrated, sustainability requires both series to be cointegrated (Hakkio and Rush (1991), Haug (1991), Smith and Zin (1991), Trehan and Walsh (1988,1991)). More recently, Quintos (1995) extended this literature by introducing «strong» and «weak» conditions for fiscal sustainability. The «strong» condition corresponds to the stationarity of the deficit process, while the «weak» condition verifies for higher than one orders of integration of the public debt, or even for some mildly explosive processes for this variable, implying the intertemporal borrowing constraint is satisfied but at a slower rate than in the stronger version.

From an economic point of view, it is claimed that there are important differences between the concepts of strong and weak sustainability². Strong sustainability is understood as a situation in which no future problems in the deficit's behaviour are expected to arise, and there is therefore no need for structural fiscal reforms, in the absence of significant changes in the processes followed by both public expenditures and revenues. On the other hand, weak sustainability implies that governments might have future problems in marketing their debt, involving a substantial risk of a rise in interest rates that may have perverse effects on economic growth and the public budget, necessitating fiscal reforms, or at least a consolidation effort. This possibility of future debt-marketing problems comes from the lower speed at which the intertemporal borrowing constraint is satisfied, as a consequence of the higher growth rate of the debt and, consequently the higher level for this variable in future years. Accordingly, the difference between both concepts of sustainability should be quite relevant, both from a positive and normative analysis of fiscal policy developments, in that weak sustainability can be taken as an indicator of the need for fiscal consolidation³.

Camarero *et al.* (1998) apply the aforementioned tests to the Spanish case, showing that public revenues and expenditures are cointegrated only when the possibility of structural shifts in this relationship is taken into account. According to their analysis, the deficit process is found to be sustainable in the weak sense. However, since over the sample period many fiscal reforms have taken place in Spain, we think that a deeper univariate analysis of the series involved is needed and may provide useful information for deriving sounder conclusions about the sustainability of Spanish fiscal policy in recent years. In this context, the existence of changes in the order of integration, which can be associated with fiscal reforms or with gradual fiscal adjustments, might invalidate the conclusions obtained from a cointegration analysis in that the latter only makes sense when the series involved are not stationary. For this reason, in this paper we apply the traditional tests of sustainability, following Quintos' approach and, in addition, we introduce a univariate analysis of the series, testing whether changes in the order of integration of the series have taken place that may offer a different picture than the cointegration analysis.

The rest of the paper is structured as follows. Section 2 presents a summary of fiscal policy performance during the sample period (1964-1998), which may be of particular interest for better understanding the results. Section 3 explains the theoretical framework, whereas section 4 shows the empirical analysis. Finally, section 5 draws the conclusions.

2. Deficit and debt in Spain ⁴

Since 1964, five distinct periods can be identified in relation to public finances in Spain, as can be observed in figures 1 and 2:

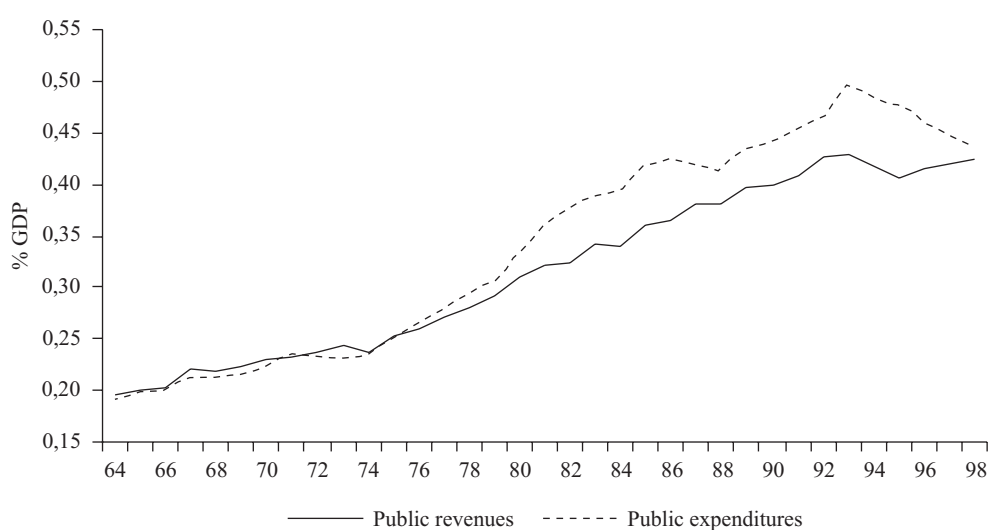
1964-75: a period of strong economic expansion, with average real GDP growth of 6.4 %, characterised by small budget surpluses, owing to the steady growth of government revenue and expenditure.

1975-85: against a background of economic crisis and political change, the previous situation changed in 1976, with the appearance of a budget deficit. Although it was small in the first two years, it grew continuously, except in 1979 and 1983, to reach 5.8 % of GDP in 1985. On the one hand, public expenditure as a percentage of GDP almost doubled in this period (from 23.5 % of GDP in 1974 to 41.6 % en 1985, which represents an average annual increase of 1.6 % of GDP) due to low economic growth (average real GDP growth of 1.6 %) and the building of the Welfare State. On the other hand, public revenues also increased significantly as a consequence of the 1977 and 1978 fiscal reforms, but at lower rates than in the case of expenditure (total revenues moved from 23.6 % of GDP in 1974 to 35.8 % en 1985, which represents an average annual growth of 1 % of GDP).

As a consequence of this budgetary imbalance, public debt also spiralled, from 12.1 % of GDP in 1979 to 43.7 % in 1985. However, this increase in debt did not lead to a similar rise in the interest burden because, until 1982, around two-thirds of the budget deficit was funded by the Banco de España and financial institutions, primarily through compulsory reserve requirements. In fact, public debt assumed by the private and external sectors under

orthodox financing arrangements played a very limited role, covering less than 25 % of the state-borrowing requirement. Nonetheless, as from 1983, the deficit was funded in a more orthodox fashion, and the government came to rely more heavily on Treasury bill issuance. This, together with the high interest rates prevailing in the period, caused the interest burden to double as a proportion of GDP between 1982 and 1985 (to 2 % in 1985).

1986 to 1988: following Spain's accession to the European Community and the commencement of a new cyclical expansion, there was a change in direction in Spanish fiscal po-

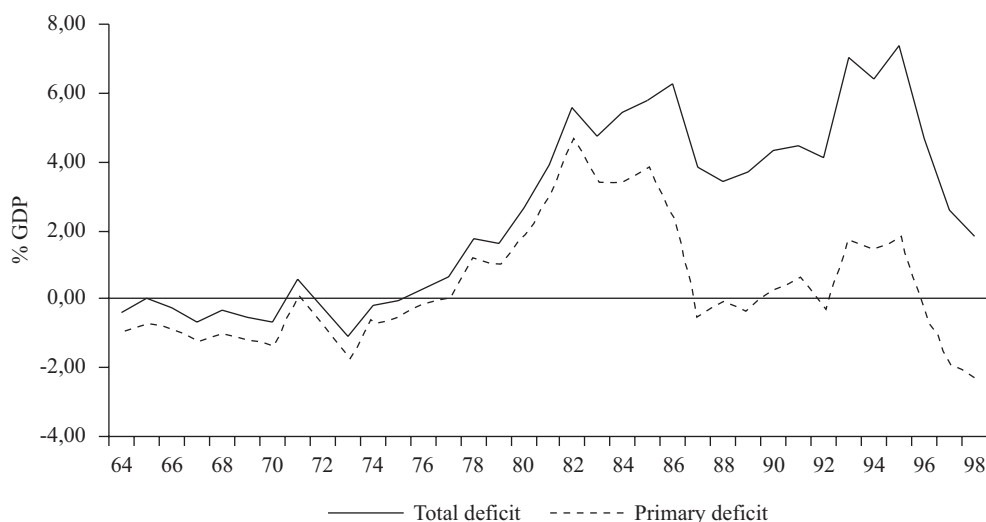


Source: Spanish National Institute of Statistics (INE).

Figure 1. Public revenues and expenditures

licy. The budget deficit was reduced from 5.8 % in 1985 to 3.4 % in 1988, essentially due to the growth of government revenue. In fact, public revenue as a percentage of GDP increased 2.2 percentage points while public expenditure fell by only 0.2 percentage points. Moreover, there was a significant improvement in the primary balance, which swung from -3.8 % in 1985 to a small surplus in 1988, enabling public debt to be whittled down to 41.7 % in 1988.

1989 to 1993: the aforementioned period of fiscal restraint came to an end in 1989, when the budget deficit began to grow again, to reach 7 % at the height of the economic crisis in 1993. The primary balance followed a similar path to the deficit. After small surpluses between 1987 and 1989, it moved into deficit in 1990, rising to 1.8 % of GDP in 1993. As regards public revenues and expenditures, similarly to the period 1975-1985, both increased significantly, reaching 42.8 % and 49.8 % of GDP, respectively, in 1993. Finally, there was only a slight increase in public debt, to 45.9 % of GDP, primarily as a consequence of the strong growth in GDP between 1989 and 1991 (11 % in nominal terms), and despite the in-



Source: INE.

Figure 2. Total and primary public deficit

crease in the cost of debt during this period. Thereafter, however, it rose to exceed 60 % of GDP in 1993, as a consequence of the increase in the budget deficits, the fall in nominal GDP growth and the prohibition on monetary financing of the deficit as from 1994, under the Treaty on European Union. At the same time, the interest burden rose, reaching 5.2 % of GDP in 1993.

1994 to 1998: fiscal policy was constrained in this period by the commitment to meet the convergence criteria set out in the Treaty on European Union to regulate access to the Third Stage of EMU. In accordance with this commitment, the tendency to imbalance in public finances came to an end in 1994, with a moderate reduction in the deficit. However, this was reversed again in 1995, when the budget deficit reached 7.3 %. Thereafter, there was a gradual decline in the deficit, which reached 1.8 % in 1998, in a context of economic recovery. The reduction in the public deficit was the result of a drop in spending, which fell by 5.7 points relative to GDP. Meanwhile, the share in GDP of total general government revenue declined slightly.

Finally, public debt peaked at over 70 % of GDP in 1996 and then declined slightly to 67.4 % of GDP in 1998. The factors responsible for this decline include the existence of primary surpluses in 1997 and 1998, the fall in interest rates and the revenue obtained from the privatisation of state-owned firms. Finally, interest payments, which peaked in 1995 (at 5.6 % of GDP), fell to 4.1 % of GDP in 1998. This can be explained by both the reduction in the level of public debt in 1997 and 1998 and the decline in interest rates from 1995 (the average interest rates on Treasury bills fell from 9.1 % in 1995 to 3.7 % in 1998, while those on government bonds fell from 11.1 % in 1994 to 6.4 % in 1998).

3. Theoretical framework

As stated in the introduction, the definition of sustainability employed in this paper is based on the concept of the fulfilment of the intertemporal borrowing constraint of the government. In period t the budget constraint can be expressed as follows ⁵:

$$\Delta B_{t+1} = i_t B_t + G_t - T_t$$

with B_t being the stock of debt at the end of period $t-1$ in nominal terms, G_t nominal public expenditure excluding interest payments, T_t nominal public revenues and i_t the average nominal interest rate on the debt in period $t-1$. Thus, the term $G_t - T_t$ is defined as the primary deficit. Accordingly, total public expenditures are

$$G_t^R = i_t B_t + G_t$$

Therefore, public deficit is defined as $D_t = G_t^R - T_t$. However, the latter variables are not the most accurate ones in a sustainability analysis. In fact, few or no conclusive results can be drawn from variables that show an upward trend if the economy shows a similar pattern. In other words, the relevant variables must be considered by taking into account the size of the economy, and any sustainability analysis should thus be performed using the latter variables as percentages of GDP and focusing on the burden that public debt imposes on the economy. Therefore, the budget constraint in period t and the definition of total public expenditures, both in GDP terms ⁶, are now

$$\begin{aligned} \Delta b_{t+1} &= \lambda_t b_t + g_t - t_t \\ g_t^R &= \lambda_t b_t + g_t \end{aligned} \quad [1]$$

where $\lambda_t = \frac{r_t - h_t}{1 + h_t}$, which can be understood as the addition to net debt due to the excess of the real ex-post interest rate, r_t , over h_t , the real GDP growth rate. Taking the excess of the real interest rate over the growth rate of the economy as stationary around a mean λ ⁷, [1] can be expressed as

$$\Delta b_{t+1} = \lambda b_t + g x_t - t_t \quad [2]$$

where $g x_t = g_t + (\lambda_t - \lambda) b_t$. Solving forward [2], we obtain

$$b_t = \sum_{j=0}^{\infty} \gamma^{j+1} (t_{t+j} - g x_{t+j}) + \lim_{j \rightarrow \infty} \gamma^{j+1} b_{t+j+1} \quad ; \quad \gamma^{j+1} = (1 + \lambda)^{-(j+1)} \quad [3]$$

Equation [2] and its implication [3] cannot be a subject of controversy, for they only summarise definitions of fiscal policy. As Hamilton and Flavin (1986) point out, what is of economic interest and subject to empirical refutation is what the creditors expect about the behaviour of bubble term in [3]. Taking expectations in this equation, the hypothesis that the government is subject to the intertemporal borrowing constraint can be expressed as

$$b_t = E_t \sum_{j=0}^{\infty} \gamma^{j+1} (t_{t+j} - g x_{t+j})$$

which is mathematically equivalent to the transversality condition $E_t \lim_{j \rightarrow \infty} \gamma^{j+1} b_{t+j+1} = 0$. Such transversality condition has a very well defined economic sense. According to the literature, it implies that, for a process to be sustainable, the current debt must equal the expected present value of future primary surpluses. Otherwise, stabilisation measures will be required in order to coax the public deficit back to a sustainable path.

Empirical testing requires using the representation of [3] in terms of Δb_t . Thus, taking first differences in [3] and using [2] yields to the following expression:

$$g_t^R - t_t = \sum_{j=0}^{\infty} \gamma^{j+1} (\Delta t_{t+j} - \Delta g x_{t+j}) + \lim_{j \rightarrow \infty} \gamma^{j+1} \Delta b_{t+j+1} \quad [4]$$

where the left-hand side of [4] represents the public deficit. In order to impose a constraint analogous to the intertemporal borrowing constraint faced by an individual the following transversality condition should hold:

$$E_t \lim_{j \rightarrow \infty} \gamma^{j+1} \Delta b_{t+j+1} = 0 \quad [5]$$

Sustainability tests in the literature aim to verify whether this transversality condition in the government budget constraint holds. These tests pay special attention to integration orders of deficit and debt processes, and to the underlying stochastic structures and the existence of cointegration relationships between revenues and expenditures. A usual procedure consists of testing the stationarity of Δb_t in various forms, or alternatively the stationarity of $g_t^R - t_t$ if both are I(1), according to the method employed by Trehan and Walsh (1988). This procedure implies testing cointegration between revenues and expenditures when the cointegrating vector (1,-1) is imposed. An alternative procedure would be to test cointegration in

$$t_t = \alpha + \beta g_t^R + \varepsilon_t \quad [6]$$

and afterwards, test the null $H_0: \beta = 1$. Accordingly, the deficit would be non-sustainable if Δb_t is non-stationary, or if cointegration in [6] does not hold with cointegrating vector (1,-1). In this case, the transversality condition holds because $\Delta b_t = Op(1)$ and, accordingly, the limit term in [5] behaves as

$$E_t \lim_{T \rightarrow \infty} \exp(-T k) = 0 \quad [7]$$

where k is a positive constant and $Op(\cdot)$ the rate at which a stochastic sequence converges in probability to a non-stochastic sequence. However, as Quintos (1995) shows, these methods only refer to sufficient conditions for sustainability. In general, it is not necessary for Δb_t to be I(0) for [5] to hold. If Δb_t is I(d), being d a finite order of integration, it verifies $\Delta b_t = Op(T^{d/2})$. In this case, the limit term in [5] behaves as

$$E_t \lim_{T \rightarrow \infty} \exp(-T k) T^{d/2} = 0 \quad [8]$$

This result determines that if Δb_t is an integrated process of any finite order, the discount factor decreases at a higher rate than Δb_t , making the transversality condition, and thus the intertemporal borrowing constraint, hold, although the limit term in [5] approaches zero at a lower speed than in the case when Δb_t is $I(0)$ ⁸. Consequently, using Quintos' terminology we will say that a deficit process is sustainable in its strong form if the limit term in the transversality condition behaves as [7], whereas if this limit behaves as [8] the process will be said to be sustainable in its weak form. Therefore, only when Δb_t contains explosive roots of high enough magnitude to offset the discount factor will the deficit be non-sustainable.

As stated before, strong sustainability means that no future problems, according to the current state of affairs, are likely to arise, whereas a weakly sustainable budget performance might lead in the future to problems in debt-marketing, that would involve a risk of interest rates increases. This risk only arises because of the higher stock of debt that a weakly sustainable fiscal policy would imply. Should debt-marketing problems occur, macroeconomic stability would be endangered and severe fiscal reforms should be adopted.

In this context, Quintos shows that $\beta = 1$ in [6] is only a sufficient condition for sustainability, in that it implies that the transversality condition behaves as [7]. However, it is not a necessary condition. Therefore, the necessary and sufficient condition is $0 < \beta \leq 1$, whereas cointegration is only a sufficient condition. Substituting [6] in [1] we obtain

$$b_{t+1} = (1 + \lambda_t(1 - \beta))b_t + (1 - \beta)g_t - \alpha - \varepsilon_t \quad [9]$$

or equivalently

$$\Delta b_{t+1} = \lambda_t(1 - \beta)b_t + (1 - \beta)g_t - \alpha - \varepsilon_t = (1 - \beta)g_t^R - \alpha - \varepsilon_t \quad [10]$$

If g_t^R is $I(1)$, $0 < \beta < 1$ implies, given [10], that Δb_t is $I(1)$, no matter whether ε_t is $I(0)$ or $I(1)$. In other words, cointegration in [6] plays no role, and consequently the transversality condition will behave as [8], being the deficit process sustainable only in its weak form. On the contrary, Δb_t will be $I(0)$ and thus the deficit strongly sustainable, when simultaneously $\beta = 1$ and ε_t are $I(0)$, i.e. cointegration between public revenues and expenditures holds. If we reject cointegration in [6] and β equals 1, the deficit will be sustainable in its weak form, because according to [10], Δb_t will be $I(1)$ as well. Finally, if $\beta = 0$ the deficit is not sustainable because according to [10] Δb_t would grow at a rate greater than λ , and thus the discount factor would never offset Δb_t . A summary of all the possibilities is found in table 1.

According to the process described earlier, Quintos suggests first to analyse the orders of integration of the variables g_t^R and t_t , and provided that they are $I(1)$, to estimate [6] and test the null $H_0: \beta = 0$ against the alternative $H_a: \beta > 0$. If H_0 is accepted the deficit is not sustainable, whereas if it is rejected the null $H_0: \beta = 1$ against $H_a: \beta < 1$ should be tested. Should H_0 be rejected, the result $0 < \beta < 1$ is obtained and the transversality condition would behave as [8], and accordingly the deficit would be weakly sustainable. In this case, as [9] shows, the undiscounted debt process contains an explosive root. On the other hand, if one cannot reject $H_0: \beta = 1$, one should test for a cointegration relationship in [6]. In case cointegration is accepted, the transversality condition will behave as [7], and therefore, the strong sustainability

result will hold. If, on the contrary, cointegration is rejected in [6], the transversality condition will behave again as [8], and thus the deficit will be weakly sustainable.

Table 1
Quintos' test

Cases for $g_t^R \sim I(1)$						
Values for β	and	Cointegration in (6)	Yields	Δb_t	\Rightarrow	Conclusion for sustainability
$\beta = 1$		Yes		I(0)		Strong sustainability
$\beta = 1$		No		I(1)		Weak sustainability
$0 < \beta < 1$		Plays no role		I(1)		Weak sustainability
$\beta = 0$		Plays no role		I(1)		No sustainability

Before presenting the application of these tests to the Spanish case, we would like to clarify some elements on the interpretation and limitations of the previous theoretical analysis. First, the concept of «weak sustainability» might be difficult to distinguish from a situation of non sustainability since «weak sustainability» refers to a situation in which the debt to GDP ratio continues to increase, although condition [8] might be satisfied, and, thus, from an economic point of view, the underlying fiscal policy cannot be indefinitely maintained. According to these arguments, the concept of «strong sustainability», or in other words, stationarity of the deficit process, seems to be, in our opinion, the most relevant one.

Second, the concept of sustainability is slightly different from the fulfilment of the intertemporal borrowing constraint. On the one hand, sustainability analysis tries to answer the question of whether the current fiscal policy can be maintained indefinitely assuming that the process followed by the relevant variables are going to be kept in the future as in the past, satisfying the intertemporal borrowing constraint. On the other hand, the intertemporal borrowing constraint can be fulfilled, even if the current fiscal policy is not sustainable, in the case economic agents expect a change of this fiscal policy somewhere in the future. In other words, testing debt sustainability is different from testing the fulfilment of the intertemporal borrowing constraint, since in a sustainability analysis we implicitly impose the condition that the public sector will behave in the future in the same way as in the past.

4. Empirical results

The empirical results presented in this section are based on ESA 79 National Accounts annual data for Spain of public debt (b_t), public deficit (d_t) and public revenues (t_t) and expenditure (g_t^R) for the period 1964-1998, taken as ratios over GDP⁹. The use of ratios to GDP is based on the consideration that for the sake of economic interpretation, such transformations really take into account the dimension of the economy¹⁰. We are aware that any long-run analysis based on such a small number of observations may be somewhat trouble-

some. Moreover, the well-known lack of power of unit-root tests added to this problem obliges us to treat the results with the greatest care.

Following the procedure described in the previous section, we first analyse the orders of integration of the variables g_t^R and t_t . Traditional unit root test (see Appendix A) lead us to conclude that the two variables are $I(1)$ and, consequently, it allows us to perform the cointegration analysis (see Appendix B). Our results on the cointegration tests show the absence of cointegration between public revenues and expenditures and they do not support the hypothesis of the existence of a structural break in the long-term relationship between public revenues and expenditure¹¹. Given that the condition $0 < \beta < 1$ holds, this situation of public finance can be identified, according to Quintos terminology, as sustainable in its weak form.

However, the existence of changes in the order of integration of the series involved, which can be associated with fiscal reforms or with gradual fiscal adjustments, might invalidate the previous conclusions as the cointegration analysis only makes sense when the series involved are not stationary. This is particularly relevant for the case of Spain, since, as described in section 2, over the sample period many fiscal reforms have taken place. In particular, since the late seventies, fiscal policy in Spain changed from a system in which the general government budgets were formally balanced, or even showed a small surplus, to another—as from 1976—with public deficits, linked to the expansion of spending as a consequence of moving towards European welfare state models. Also, the tax system was thoroughly overhauled, with the introduction of personal income tax in 1978 and VAT in 1986. Further, the progressive move as from 1983 from monetisation to a more orthodox financing of the deficit, which coincides in time with high budget imbalances, resulted in the emergence of a significant public debt balance and a subsequent increase in the interest burden. In addition, further to the 1978 Constitution, there has been a gradual fiscal decentralisation process, involving a drift of responsibilities for the management of certain services from the State to the regional governments along with the developments of the arrangements for financing these responsibilities. Lastly, since 1995 a gradual decline of the public deficit has taken place, mainly as a result of a reduction in public spending.

In this context, changes in the order of integration might be explained by changes in the budget performance that could have been brought about by, for instance, fiscal reforms, or even, by the consolidation of a given level of expenditures and revenues after a period of a progressive movement towards European standards. Thus, a deeper univariate analysis of the series involved might be of great interest and may provide useful information for deriving sounder conclusions about the sustainability of Spanish fiscal policy in recent years.

If the order of integration varies over time, more concretely, if Δb_t is not stationary in the first part of the sample but becomes stationary in the last part, although a global analysis would lead us to conclude that, according to [9], the deficit process is sustainable in a weak sense, the relevant issue for analysing the future behaviour will be the current process followed by this variable. As a result, we would conclude that sustainability seems to be turning to its strong form and no future fiscal problems are expected to arise, invalidating the conclusions derived from the previous cointegration analysis.

Earlier work on this issue was done by Leybourne, McCabe and Tremayne (1996) and Maeso (1997). The former paper tests the null of I(1) with invariant coefficient against the alternative of random coefficient. The latter tests the same null against the alternative of a constant coefficient with a different level since a given date, using rolling regressions. Here we follow Fernández (1999) and use a sequential procedure consisting of estimating the following set of equations:

$$\Delta y_t = \mu + \delta_1 D_{\tau t} y_{t-1} + \delta_2 (1 - D_{\tau t}) y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \varepsilon_t \quad [11]$$

$$\Delta y_t = \mu + \alpha_1 D_{\tau t} y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \varepsilon_t \quad [12]$$

$$\Delta y_t = \mu + \alpha_2 (1 - D_{\tau t}) y_{t-1} + \sum_{i=1}^p \gamma_i \Delta y_{t-i} + \varepsilon_t \quad [13]$$

Where

$$D_{\tau t} = \begin{cases} 0 & t \leq [\tau T] \\ 1 & t > [\tau T] \end{cases}$$

with $[\]$ meaning «integer part» of the argument inside and T being the total number of observations. [11] aims to test the existence of one unit root in both sub-samples simultaneously. On the contrary [12] and [13] impose I(1) in one part of the sample. Accordingly, a sequence for the pseudo-t-ratios t_{δ_1} , t_{δ_2} , t_{α_1} and t_{α_2} associated with the coefficients for every possible

Table 2
Partial integration tests

Statistic	Δb_t	t_t	g_t^R	d_t	Critical values		
					10%	5%	1%
Supt $_{\delta_1}$	-2.35	-0.59	-1.26	-1.89	-3.44	-3.76	-4.44
Year	1993	1974	1988	1976			
Meant $_{\delta_1}$	-0.97	0.98	0.25	-1.21	-2.37	-2.46	-3.23
Supt $_{\delta_2}$	-3.89*	-3.38	-3.59	-3.33	-3.80	-4.12	-4.76
Year	1987	1991	1988	1980			
Meant $_{\delta_2}$	-2.96**	-2.42*	-2.44*	-2.40*	-2.36	-2.59	-3.07
Supt $_{\alpha_1}$	-2.35	-0.68	-1.23	-1.67	-3.18	-3.48	-4.12
Year	1968	1970	1968	1990			
Meant $_{\alpha_1}$	-0.73	0.62	0.07	-0.68	-2.09	-2.35	-2.88
Supt $_{\alpha_2}$	-3.71*	-3.55	-3.37	-3.22	-3.60	-3.91	-4.52
Year	1987	1991	1988	1980			
Meant $_{\alpha_2}$	-2.80***	-2.09*	-2.23*	-2.11*	-2.09	-2.28	-2.65

Note: (*) (**) and (***) mean rejection of the null at the 10 %, 5 % and 1 % significance levels, respectively. Critical values were obtained from Monte Carlo simulations with 50,000 replications and have been taken from Fernández (1999).

break point is obtained. From every sequence two summary statistics are calculated: the mean and the lowest one. Following Fernandez these will be referred to as $Supt_{\delta_1}$, $Meant_{\delta_1}$, $Supt_{\delta_2}$, $Meant_{\delta_2}$, $Supt_{\alpha_1}$, $Meant_{\alpha_1}$, $Supt_{\alpha_2}$ and $Meant_{\alpha_2}$. As before, the Sup statistics have power for a unique break point, whereas the mean ones have power for gradual changes. According to Zivot and Andrews (1992), the break point is associated with the observation that corresponds to the Sup.

The results derived from these tests are shown in table 2. The general conclusion that can be extracted is that the Mean statistics for the last part of the sample tend to reject the null of $I(1)$ at the 10 % significance level, whereas the null is not rejected for the first part.

This indicates that the processes followed by the relevant variables are becoming stationary, and accordingly the debt as a percentage of GDP is becoming $I(1)$. The change is taking place in a gradual form and begins between the late 80s and the early 90s. This result has a direct economic interpretation since the first sample period, which covers from 1964 to the early 90s, was characterised by the implementation of a modern fiscal policy in Spain, which implied the building of the Welfare State and a new tax system, moving towards European models, that required a rapid expansion of public revenues and expenditures, accompanied by an explosion of debt. This situation corresponds to the weakly sustainable fiscal policy according to Quintos' terminology. Once those fiscal targets were achieved and with the additional constraint derived from the commitment to meet the convergence criteria set out in the Treaty on European Union, consolidation issues become more relevant in conducting fiscal policy and a regime shift took place.

Therefore, the conclusions drawn from the estimation of the cointegrating relationship must be questioned because the variables in [6] are not always $I(1)$, and, consequently, the cointegrating analysis loses sense at least for the whole sample period. Furthermore, our results show that in recent years the fiscal policy regime seems to be becoming «sustainable in a strong sense», according to Quintos' terminology, and no future problems in marketing public debt are expected to arise as far as this trend is confirmed.

Furthermore, the non-stationarity of the series in the first part of the sample would suggest the existence of a non-sustainable fiscal policy. However, the government had no problems in marketing its debt, suggesting that the intertemporal borrowing constraint still fulfilled. This could have happened because the agents expected a shift in the budget performance, which actually took place in the nineties. In other words, even though fiscal policy could be unsustainable the expected regime shift made the intertemporal borrowing constraint to hold.

5. Conclusions

In this paper, we address the issue of whether the current fiscal policy in Spain is sustainable. For this purpose, we apply the traditional tests of sustainability. In addition, we introduce a deeper univariate analysis of the series. Our findings can be summarised as follows.

According to the tests applied to find changes in the order of integration of the series, the processes followed by revenues, expenditures and deficit are becoming stationary, and the debt as percentage of GDP is thus turning from I(2) to I(1), making the transversality condition hold in its strong sense, in contrast with the results obtained by a cointegrating analysis. In fact, since the variables involved are not first-order integrated for the whole sample period, the cointegrating analysis is not valid, at least for the whole period.

Consequently, our results show that in recent years the public budget performance in Spain seems to be becoming «strongly sustainable», according to Quintos' terminology. This result seems consistent with the evolution of fiscal policy during recent years, characterised by a gradual decline in the deficit as a result of a drop in spending and a slight decline of total revenue over GDP that reversed the previous tendency to imbalance in public finances.

However, any conclusion to be derived from these results should bear in mind the limitations of the analysis, in particular the fact that this is based on past data and, consequently, the future evolution of some structural factors (for example, demographic trends) and their impact on public finances are not taken into account. Therefore, under this approach, the sustainability of the Spanish fiscal policy should be interpreted in the sense that no problems in marketing public debt are expected to arise under the hypothesis that the variables involved follow the pattern of the past in the future, which constitutes the essence of a sustainability analysis. Moreover, the well-known lack of power of unit-root tests added to the problem of the small number of observations of the series used in our analysis obliges us to treat the results with the greatest care.

Appendix A: Unit root tests

In table A.1 we summarise the unit root tests for the variables used in the analysis. In none of the cases do the tests reject the null hypothesis of the existence of one unit root for the fiscal variables. Since no constant or deterministic trend turned out to be significant for t_t , g_t^R or d_t , the tests reject the null of the existence of two unit roots.

The tests performed on the debt process do not clearly reject the existence of a constant and a deterministic trend. Thus, the ADF test does not offer conclusive results about the existence of one or two unit roots in the process followed by this variable, although it seems to favour the I(2) hypothesis. The Phillips-Perron method offers a different view in that it rejects the null of two unit roots against the alternative of only one unit root. However, given that d_t can be considered as I(1), according to (1), we might expect b_t to be I(2), or accordingly Δb_t to be I(1). The lack of power of unit-root tests, together with the difficulty of dis-

Table A.1
Unit root tests

I(1) vs. I(0)						
	ADF statistics			Phillips-Perron statistics		
	t_{α}	t_{α^*}	$t_{\alpha^{**}}$	$Z(t_{\alpha})$	$Z(t_{\alpha^*})$	$Z(t_{\alpha^{**}})$
b_t	0.92	-0.26	-2.46	2.07	0.77	-2.54
t_t	3.53	-0.76	-0.99	4.35	-0.78	-1.19
g_t^R	1.38	-1.12	-0.93	2.30	-1.14	-0.39
d_t	-0.84	-1.45	-1.40	-0.82	-1.45	-1.31
I(2) vs. I(1)						
b_t	-2.26**	-2.59	-2.44	-2.83***	-3.19**	-3.25*
t_t	-1.86*	-3.34**	-3.38*	-3.94***	-6.47***	-6.48***
g_t^R	-1.98**	-2.46	-2.63	-2.97***	-3.73***	-3.92**
d_t	-3.16***	-3.10**	-3.19	-5.25***	-5.18***	-5.27***

Note: The symbols *, ** and *** denote rejection of the null at the 10 %, 5 %, and 1 % significance levels, respectively. The number of lags used has been set to 1.

tinguishing between a I(2) process and a I(1) process with drift and time trend, prevents us, for the moment, from drawing further conclusions on this issue. Finally, GDP growth rate and inflation rate are, according to the unit root tests, I(1) variables.

Appendix B: Cointegration analysis

Given that t_t and g_t^R are I(1) processes (see appendix A), we perform Quintos' test and estimate (6) for the whole sample. We estimated (6) by OLS, the maximum likelihood procedure suggested by Johansen, and by the non-parametrical procedure proposed by Phillips and Hansen (1990)¹². Once [6] was estimated, we performed several cointegration tests based on the ADF and Phillips (1987) statistics and the Trace Statistic suggested by Johansen. The estimation and cointegration tests results are summarised in table B.1 and none of the tests reject the null of absence of cointegration between both variables. Moreover, the estimated coefficient is between zero and one, which, according to Quintos, would lead us to conclude that deficit is sustainable in the weaker form¹³. However, such a result is not at all informative because the absence of cointegration yields a spurious estimation of β . In order to avoid this problem and to complete Quintos' test, we estimated [6] in first differences (Hamilton, 1994) by OLS, yielding an estimated coefficient of $\beta = 0.31$. This coefficient was statistically different from 0 and 1. We also estimated the equation in first differences by instrumental variables in order to avoid estimation problems derived from the possible endogeneity of the regressors. In this case the estimated coefficient was $\beta = 0.27$, also statistically different from 0 and 1. Given that the condition $0 < \beta < 1$ holds, the transversality condition behaves as [8], and accordingly the deficit process is sustainable in its weaker form. Furthermore, by [9] we know that the debt process should have an explosive root, which is consis-

Table B.1
Long run relationship between t_t and g_t^R

$$t_t = \alpha + \beta g_t^R + u_t$$

	OLS (Phillips-Ouliaris)	Phillips-Hansen	Johansen	Critical values		
				10%	5%	1%
β	0.77	0.79	0.74			
ADF	-2.01	-1.92		-3.51	-3.80	-4.36
Z_α	-16.96	-17.01		-23.19	-27.08	-32.19
Z_t	-1.05	-1.79		-3.51	-3.80	-4.36
Trace $r = 0$			19.54		19.96	24.60
$r \leq 1$			4.41		9.24	12.97
Fully modified		$\beta = 0$ 704.09***		2.71	3.84	6.63
Wald test		$\beta = 1$ 51.97***				

Note: Critical values for the statistics Z_α and Z_t have been taken from Phillips and Ouliaris (1990).

tent with the positive t-ratios obtained in the unit-root tests on b_t without considering either a constant or a deterministic trend (see appendix A). The estimated explosive root in this case has been 1.01, and its small magnitude can explain why the process followed by this variable can be better approximated by a I(1) rather than by a I(2) one.

The results so far obtained are not conclusive in that the power of the ADF and other cointegration tests diminishes in the presence of structural breaks¹⁴. Thus, we carried out several tests that consider the possibility of structural breaks in the cointegration relationship. The tests we used were those proposed by Gregory and Hansen (1996), Hansen (1992) and Hansen and Johansen (1993).

Gregory and Hansen (1996) argue that the cointegrating vector may change during the sample period. In this case, in the presence of structural breaks the standard cointegration tests lose power and are biased to accept the null hypothesis of no cointegration. Thus, they propose a contrast over different model specifications which tests the null hypothesis of no cointegration against the alternative of cointegration with structural breaks. Hansen (1992) also considers the possibility of a structural break at an unknown point in time, although the null hypothesis is the existence of cointegration, in contrast with the Gregory and Hansen test. The statistics of these tests are complementary to those proposed by Gregory and Hansen, in the sense that Hansen tests the null of cointegration with no regime shift against the alternative that a regime shift has occurred. Hansen and Johansen (1993) do not examine directly the stability of the parameters in the cointegration equation, but the stability of the eigenvalues associated with the Error Correction Model (ECM henceforth) that yield to the estimation of the cointegrating vector. They propose a recursive Likelihood Ratio test with null of cointegration for every subsample. A summary of the results from these three tests is presented in table B.2.

The results from the tests above do not support the hypothesis of the existence of a structural break in the behaviour of the fiscal variables. Rather, they could be taken as evidence of

Table B.2
Structural breaks tests on the cointegration relationship

Test	Null hypothesis	Alternative hypothesis	
		Break point	Gradual change
Gregory-Hansen	No cointegration: Accepted	No	No
Hansen	Cointegration without structural breaks: Accepted	No	Weak evidence
Hansen-Johansen	Cointegration without structural breaks: Weak evidence	No	Weak evidence

a gradual shift, although the evidence on this latter issue is far from conclusive ¹⁵. Moreover, we do not have clear evidence of cointegration. Neither the Gregory and Hansen test nor the standard cointegration tests allow us to reject the null of no cointegration ¹⁶.

Notes

1. Wickens and Uctum (1993) develop a test for sustainability when a feedback rule between the deficit and debt is introduced.
2. In the context of this paper a sustainability analysis makes sense under the existence of positive debt and persistent deficits. Conversely, under an excess of assets over liabilities and persistent surplus sustainability is, by definition, always guaranteed.
3. Later, in section 3, we deal with some conceptual problems that might be associated to Quintos' analysis, in particular, with the concept of «weak sustainability».
4. See Argimón, Gómez, Hernández de Cos and Martí (1999) for a deeper analysis of fiscal policy in Spain.
5. In this paper, seigniorage is not considered as a source of public revenues since the current institutional framework in EMU avoids the possibility of deficit financing through monetisation. Nevertheless, we are aware that, in the sample period of analysis, the fiscal policy has been often conducted by extensive use of seigniorage.
6. The lower case letters indicate the same concepts in terms of GDP.
7. If λ_t is always negative the deficit process is sustainable and such an analysis would lack of relevance.
8. Quintos shows that when Δb_t contains a trend the bubble term still goes to zero, although at a lower rate than in (8), being the deficit weakly sustainable in this case.
9. Source: INE and Banco de España.
10. Camarero *et al.* use the same sources of data, performing their analysis not only with variables as ratios to GDP, but also in real terms in levels and in per capita real terms, though their sample period is two years shorter, ending in 1996. Accordingly, the differences between both articles when similar procedures are used, are entirely due to the different number of observations employed.
11. This latest result differ from the one obtained by Camarero *et al.* (1998) since they got evidence of cointegration with structural breaks. See footnote 10 for more details on these differences.
12. The latter may be advisable when the regressors may be endogenous, which leads to a second order asymptotic bias in the OLS estimators. The second-order asymptotic bias arises because the estimators are still consistent when cointegration holds. In order to correct this bias, they suggest estimating by instrumental variables, but the instruments do not fully eliminate the asymptotic bias when the regressors are endogenous. Therefore, they suggest semi-parametric corrections in the long run covariance matrix, which lead to asymptotically unbiased

sed-in-median estimators. These fully-modified estimators form the basis of the so-called fully-modified Wald tests, which can be used for testing general linear hypotheses of the coefficients in cointegrating regressions, and their asymptotic distributions are χ^2 . The correction in the long-run covariance matrix is based on the procedure suggested by Andrews and Monahan (1992).

13. The results derived from our estimations here are not very different from those of Camarero, Esteve and Tamarit (1998).
14. See Hansen (1992), Hansen and Johansen (1992), Gregory, Nason and Watt (1996) and Gregory and Hansen (1996).
15. Our results differ from those of Camarero *et al.* (1998). As regards the Gregory Hansen Test, Camarero *et al.*, when considering variables as ratios to GDP, find cointegration with a structural break in 1987 at the 10 % significance level or cointegration with a structural break in 1988, depending on the model used (called C and C/S models, respectively). In our case, we do not obtain evidence of the existence of a structural break, although with the C/S model the statistic is very close to significance at the 10 % level, being 1988 the most probable break point. With respect to the Hansen test, no significant differences arise between both papers when variables as ratios to GDP are used. While Camarero *et al.* find stability in the cointegration relationship, we only get evidence of gradual structural change, but at low significance levels. Again we stress that such differences are due to the small number of observations and the effects of the addition of two years more in the sample.
16. Although the Hansen test offers some evidence in favour of cointegration, according to Gregory and Hansen (1996) the Hansen test would only be valid once the null of no cointegration has been rejected.

References

- Andrews, D. W. K. and Monahan, J. C. (1992), "An Improved Heteroskedasticity and Autocorrelation Consistent Covariance Matrix Estimator", *Econometrica*, 60: 953-966.
- Argimón, I., Gómez, A. L., Hernández de Cos, P. and Martí, F. (1999), "El Sector de las Administraciones Públicas en España", *Estudios Económicos*, 68, Servicio de Estudios, Banco de España.
- Banerjee, A., Lumsdaine, R. and Stock, J. (1992), "Recursive and Sequential Tests of the Unit-Root and Trend-Break Hypothesis: Theory and International Evidence", *Journal of Business & Economic Statistics*, 10: 271-287.
- Camarero, M., Esteve, V. and Tamarit, R. (1998), "Cambio de Régimen y Sostenibilidad a Largo Plazo de la Política Fiscal: El Caso de España", *Instituto Valenciano de Investigaciones Económicas, Working Paper Series*, WP-EC 98-15.
- Dickey, D. and Fuller, W. (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", *Econometrica*, 49: 1057-1072.
- Dolado, J. and Viñals, J. (1991), "Macroeconomic Policy, External Targets and Constraints: The Case of Spain", in G. Alogoskoufis, L. Papademos and R. Porter (ed.), *External Constraints on Macroeconomic Policy: The European Experience*, Cambridge University Press.
- Engle, R. and Granger, C. (1987), "Cointegration and Error Correction, Representation, Estimation and Testing", *Econometrica*, 55: 251-276.
- Fernández, J. L. (1999), *Efecto de los Cambios Estructurales en el Análisis de Series Económicas no Estacionarias*, Ph. Dissertation, Universidad Complutense de Madrid.

- Gregory, A. W. and Hansen, B. A. (1996), "Residual-Based Tests for Cointegration in Models with Regime Shifts", *Journal of Econometrics*, 70: 99-126.
- Gregory, A. W., Nason, J. M. and Watt, D. G. (1996), "Testing for Structural Breaks in Cointegrated Relationships", *Journal of Econometrics*, 71: 321-341.
- Hakkio, C. S. and Rush, M. (1991), "Is the Budget Deficit 'Too Large?'" *Economic Inquiry*, 24: 429-445.
- Hamilton, J. (1994), *Time Series Analysis*, Princeton, NJ: Princeton University Press.
- Hamilton, J. and Flavin, M. (1986), "On the Limitations of Government Borrowing: A Framework for Empirical Testing", *American Economic Review*, 76: 808-819.
- Hansen, B. E. (1992), "Tests for Parameter Instability in Regressions with I(1) Processes", *Journal of Business & Economic Statistics*, 10: 321-335.
- Hansen, H. and Johansen, S. (1993), *Recursive Estimation in Cointegrated VAR Models*, Institute of Mathematical Statistics, University of Copenhagen.
- Haug, A. (1991), "Cointegration and Government Borrowing Constraints: Evidence for the United States", *Journal of Business & Economic Statistics*, 9: 97-101.
- Haug, A. (1992), "Has the Federal Budget Deficit Policy Changed in Recent Years?", *Unpublished manuscript*, University of Saskatchewan, Dept. of Economics.
- Hendry, D. F. and Neale, A. (1990), "The Impact of Structural Breaks on Unit Root Tests", in P. Hackl and A. Westlung (ed.), *Economic Structural Change*, Berlin: IIASA and Springer-Verlag.
- Johansen, S. (1988), "Statistical Analysis of Cointegrating Vectors", *Journal of Economic Dynamics and Control*, 12: 231-254.
- Johansen, S. (1991), "Estimation and Hypothesis Testing of Cointegrating Vectors in Gaussian Vector Autoregressive Models", *Econometrica*, 60: 1551-1580.
- Leybourne, S. J., McCabe, B. P. M. and Tremayne, A. R. (1996), "Can Economic Time Series be Differenced to Stationarity?", *Journal of Business & Economic Statistics*, 14: 435-446.
- Maeso, F. (1997), "Testing Unit Root in Processes with Changing Coefficient: An Application to Real Exchange Rate", mimeo, U.A.B.
- Perron, P. (1989), "The Great Crash, the Oil Price Shock, and the Unit Root Hypothesis", *Econometrica*, 57: 1361-1401.
- Perron, P. (1990), "Testing for Unit Root in a Time Series with a Changing Mean", *Journal of Business & Economic Statistics*, 8: 153-162.
- Perron, P. and Vogelsang, T. J. (1992), "Non-stationarity and Level Shifts with an Application to Purchasing Power Parity", *Journal of Business & Economic Statistics*, 10: 301-320.
- Phillips, P. C. B. (1987), "Time Series Regression with a Unit Root", *Econometrica*, 55: 277-301.
- Phillips, P. C. B. and Hansen, B. E. (1990), "Statistical Inference in Instrumental Variables Regression with I(1) Processes", *Review of Economic Studies*, 57: 99-125.
- Phillips, P. C. B. and Ouliaris, S. (1990), "Asymptotic Properties of Residual Based Tests for Cointegration", *Econometrica*, 58: 165-193.

- Phillips, P. C. B. and Perron, P. (1988), "Testing for a Unit Root in Time Series Regression", *Biometrika*, 75: 335-346.
- Quintos, C. E. (1995), "Sustainability of the Deficit Process with Structural Shifts", *Journal of Business & Economic Statistics*, 13: 409-417.
- Smith, G. and Zin, S. E. (1991), "Persistent Deficits and the Market Value of Government Debt", *Journal of Applied Econometrics*, 6: 31-44.
- Trehan, B. and Walsh, C. E. (1988), "Common Trends, the Government Budget Constraint and Revenue Smoothing", *Journal of Economic Dynamics and Control*, 12: 425-444.
- Trehan, B. and Walsh, C. E. (1991), "Testing Intertemporal Budget Constraints: Theory and Applications to U.S. Federal Budget and Current Account Deficits", *Journal of Money, Credit and Banking*, 23: 206-223.
- Walsh, C. E. (1998), *Monetary Theory and Policy*, Cambridge, Mass.: MIT Press.
- Wickens, M. R. and Uctum, M. (1993), "The Sustainability of Current Account Deficits: A Test of the US Intertemporal Budget Constraint", *Journal of Economic Dynamics and Control*, 17: 423-441.
- Wilcox, D. W. (1989), "The Sustainability of Government Deficits: Implications of the Present-Value Borrowing Constraint", *Journal of Money, Credit and Banking*, 21: 291-306.
- Zivot, E. and Andrews, D. (1992), "Further Evidence on the Great Crash, the Oil Price Shock, and the Unit Root Hypothesis", *Journal of Business & Economic Statistics*, 10: 251-270.

Resumen

En este trabajo se analiza la cuestión de si la política fiscal en España es sostenible. Para ello se aplican los tests de sostenibilidad propuestos tradicionalmente en la literatura y, adicionalmente, se efectúa un análisis univariante de las series relevantes. Nuestros resultados muestran que el desarrollo de la política fiscal en España parece haber sufrido una ruptura estructural, que se ha manifestado de manera gradual, de forma que la restricción presupuestaria intertemporal se verifica en su versión más estricta. Este resultado implica que no se esperan problemas de sostenibilidad de la deuda pública si las variables fiscales siguen en el futuro el mismo patrón de comportamiento estocástico que en el pasado.

Palabras clave: Cointegración, ruptura estructural, restricción presupuestaria intertemporal.

Clasificación JEL: E60, F41, N10.