GOVERNMENT DEFICIT SUSTAINABILITY, AND MONETARY VERSUS FISCAL DOMINANCE: THE CASE OF SPAIN, 1850-2000*

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Abstract

In this paper, we provide a test of the sustainability of the Spanish government deficit over the period 1850-2000, and examine the role played by monetary and fiscal dominance in order to get fiscal solvency. The longer than usual span of the data would allow us to obtain some more robust results on the fulfilling of the intertemporal budget constraint than in most of previous analyses. First, we analyze the relationship between primary surplus and debt, following the recent critique of Bohn (2007), and investigate the possibility of structural changes occurring along the period by means of the new approach of Kejriwal and Perron (2008). The analysis is complemented in two directions: (i) performing Granger-causality tests in order to distinguish properly between a fiscal dominant and a monetary dominant regime; and (ii) presenting the impulse-response functions of debt to innovations in the primary surplus, through the approach of Canzoneri, Cumby and Diba (2001).

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1. Introduction

The role of fiscal policy goes beyond the traditional stabilization function. Questions such as the balancing of budget deficits, the interactions between monetary and fiscal policies, and the fiscal discipline required in monetary unions, have been also intensively discussed in the last decades. In particular, one of the main problems concerning fiscal authorities is the sustainability of government deficits, which is related to the issue of long-run solvency. The public deficit can be sustainable if the government can borrow. However, if the interest rate on the government debt exceeds the growth rate of the economy, debt dynamics would lead to an ever-increasing ratio of debt to GDP. The dynamics of debt accumulation could be stopped only if the ratio of the budget deficit to GDP would turn to be a surplus, or if seigniorage were allowed for.

The usual procedure in most of the empirical contributions on the long-run sustainability of budget deficits consists of testing the government's intertemporal budget constraint (IBC); a non exhaustive list would include, among others, Hamilton and Flavin (1986), Trehan and Walsh (1988, 1991), Haug (1995), Quintos (1995), Martin (2000) or Bajo-Rubio, Díaz-Roldán and Esteve (2008, 2009). The results, however, are sometimes inconclusive due to differences in the econometric methodology, the particular specification of the transversality condition, and the sample period used. A common criticism to most of the available literature is that the econometric procedures used require a large number of observations, which is not usually the case in most tests of the IBC; an exception is Bajo-Rubio, Díaz-Roldán and Esteve (2010).

On the other hand, the traditional macroeconomic analysis assumes that the fiscal authority sets primary surpluses in order to assure fiscal solvency, for any path the price level could take. In this way, the monetary authority is expected to set the price level, without facing any constraint; whereas fiscal authority would adjust, so that the budget surplus path would be endogenous. This scenario is referred in the literature as the Ricardian or "monetary dominant" (MD) regime. However, a new approach has emerged in the 1990s, which assumes that fiscal authorities are able to set primary surpluses that follow an arbitrary process, not necessarily compatible with solvency. In such a context, the budget surplus would be exogenous, and the endogenous adjustment of the price level would be required in order to achieve fiscal solvency. Hence, in this

case the monetary authority could only control the timing of inflation. This is the so-called non-Ricardian or "fiscal dominant" (FD) regime, and the literature developed on these assumptions is referred as the Fiscal Theory of the Price Level (FTPL). The FTPL builds on the contributions of, among others, Leeper (1991), Sims (1994), Woodford (1994, 1995, 2001), and Cochrane (2001, 2005); a survey is provided in Carlstrom and Fuerst (2000), and some critical appraisals of the theory can be found, e.g., in McCallum (2001) or Buiter (2002). The empirical evidence regarding the FTPL, however, is not too abundant; see, e.g., Bajo-Rubio, Díaz-Roldán and Esteve (2009) and the references therein.

In this paper, we will try to analyze whether the empirical evidence would support the sustainability of government deficits, as well as the role played by monetary and fiscal dominance in order to get fiscal solvency, for the case of Spain over the period 1850-2000. In a companion paper (Bajo-Rubio, Díaz-Roldán and Esteve, 2010) we investigated this issue through the estimation of a cointegration between government expenditures and revenues derived from the IBC, and then analyzed the possibility of non-linear behaviour of fiscal authorities through the estimation of a threshold cointegration model. In the present paper, however, we will first analyze if public finances are sustainable by examining instead the relationship between primary surplus and debt, and then investigate how this fiscal sustainability is achieved: i.e., through the endogenous adjustment of the primary budget surplus (in an MD regime), or through the endogenous adjustment of the price level (in an FD regime).

Regarding the empirical methodology, we will analyze the relationship between primary surplus and debt in the line of Bohn (1998), but incorporating the later critique to previous tests on sustainability using cointegration techniques, recently developed by this same author in Bohn (2007). Given the long-run span of the data, we will test for the eventual presence of structural breaks in the estimated relationship between primary surplus and debt, making use of the new approach of Kejriwal and Perron (2008a,b) to testing for multiple structural changes in cointegrated regression models. In addition, we will also perform Granger-causality tests between these two variables, since the above method might not be able to distinguish properly between an FD and an MD regime (see below). Finally, in order to check the robustness of our results, we will present the

impulse-response functions of debt to innovations in the primary surplus, following the approach of Canzoneri, Cumby and Diba (2001).

As mentioned before, the empirical analysis will be performed for the case of Spain over the period 1850-2000. Recall that a common criticism to most tests of the IBC is that the econometric procedures used require a large number of observations. Accordingly, the longer than usual span of the data (i.e., 150 years) will allow us to obtain some more robust results than in most of previous analyses. On the other hand, the Spanish case can be of interest given the permanent difficulties experienced when balancing the government budget across those years. For most of this period, and until the fiscal reform of 1978, public revenues proved insufficient to finance even small amounts of public expenditures, so deficits became chronic, leading the government to a continuous resource to seigniorage.

In section 2, we describe the underlying theoretical framework. Next, in section 3 we introduce the empirical methodology, briefly discuss our dataset, and present the results. Finally, the main conclusions are summarized in section 4.

2. Theoretical framework

As we have seen, according to the traditional analysis, prices would be determined by monetary policy. On the contrary, the FTPL develops the idea that sometimes, in order to guarantee fiscal solvency, monetary policy would be addressed to accommodate the path of expenditures and revenues chosen by the government, even at the cost of generating inflation. An antecedent of this claim can be found in Sargent and Wallace's (1981) contribution, where the interaction of fiscal and monetary variables in the financing of deficits, through taxes and seigniorage, was already analyzed. In this way, fiscal solvency can act as a restriction on the policy followed by a central bank.

In order to describe the two possible ways of achieving fiscal sustainability, we will make use of the government's IBC, written in terms of GDP shares:

$$b_t = \sum_{j=0}^{\infty} \left(\frac{1+x}{1+r} \right)^{j+1} E_t s_{t+j+1} + \lim_{j \to \infty} \left(\frac{1+x}{1+r} \right)^{j+1} E_t b_{t+j+1} \qquad (1)$$

where b and s denote, respectively, the public debt and primary surplus, both as ratios to GDP; E is the expectations operator; and x and r stand, respectively, for the rate of growth of real GDP and the real interest rate, both assumed to be constant for simplicity. The condition for fiscal sustainability is:

$$\lim_{j\to\infty}\left(\frac{1+x}{1+r}\right)^{j+1} E_t b_{t+j+1} = 0 \qquad (2)$$

i.e., the transversality condition; or, equivalently:

$$b_t = \sum_{j=0}^{\infty}\left(\frac{1+x}{1+r}\right)^{j+1} E_t s_{t+j+1} \qquad (3)$$

i.e., solvency requires that the government must run expected future budget surpluses equal, in present-value terms, to the current value of its outstanding debt.

Notice that, in equilibrium, the fiscal solvency condition holds under both the MD and FD regimes; the difference between the two regimes lies in how solvency is achieved. According to the MD regime approach, the price level would be determined in the money market, following the quantity theory of money, and the primary surplus would adjust endogenously to satisfy the IBC. In terms of equation (3), s would be set to meet a given b, independently of the price level.

On the other hand, when the FD regime prevails, the primary surplus is set exogenously by the government, regardless of the level of public debt. In this framework, the price level would adjust in order to assure the fulfilment of the IBC. And the main implication for fiscal policy would be that government solvency turns to be a sufficient condition for price stability.

In terms of equation (3), we can write this latter equation as:

$$\frac{B_t}{P_t y_t} = \sum_{j=0}^{\infty}\left(\frac{1+x}{1+r}\right)^{j+1} E_t s_{t+j+1} \qquad (3')$$

where B, P, and y denote, respectively, the nominal value of public debt, the price level, and real GDP. Then, given B, y, and s, P would "jump" to satisfy (3'). In other words, if the market believes the government's commitment when setting s, a value of P will be set so that B was not excessive and (3') could be satisfied.

The underlying assumption of the FTPL is that there are interactions between monetary and fiscal policies. In this line, Carlstrom and Fuerst (2000) show the restrictions that the government's budget may place on monetary policy. If the policy regime can be qualified as an MD or as an FD regime, depends on the particular role played by either the monetary or the fiscal authority. So, whether monetary or fiscal policy determines prices involves an assumption about which policymaker will move first, i.e., the central bank or the fiscal authority. In terms of the game theory approach, the solution would be given by the leader-follower model but, in practice, this is an empirical question.

3. Empirical methodology, data, and results

As shown in Bajo-Rubio, Díaz-Roldán and Esteve (2009), the empirical literature has usually made use of two approaches to test for the prevalence of monetary dominance versus fiscal dominance:

(i) The *backward-looking* approach (e.g., Bohn, 1998), so that, in a Ricardian regime, an increase in the previous level of debt would result in a larger primary surplus today; i.e., $\Delta b_{t-1} \rightarrow \Delta s_t$.

(ii) The *forward-looking* approach (e.g., Canzoneri, Cumby and Diba, 2001), so that, in a Ricardian regime, a larger primary surplus today would lead to a reduction in the future level of debt; i.e., $\Delta s_t \rightarrow \nabla b_{t+1}$.

According to the first approach, one should estimate a cointegration relationship between the primary surplus and the (lagged) level of debt, both as ratios to GDP:

$$s_t = \alpha + \beta b_{t-1} + v_t \qquad (4)$$

where v_t denotes an error term. In this equation, a positive and significant estimate of β would be a sufficient condition for solvency, indicating that the government satisfies its present-value budget constraint. In addition, an estimated $\beta > 0$ would indicate the prevalence of an MD regime, and an estimated $\beta \leq 0$ the prevalence of an FD regime.

Testing whether $\beta > 0$ from the estimation of (4) or, alternatively, whether $\beta' = 1$ from the estimation of a cointegration relationship such as:

$$rev_t = \alpha' + \beta' exp_t + \varepsilon_t \qquad (5)$$

where exp_t and rev_t denote the ratios of the government's total expenditures and revenues to GDP, and ε_t is an error term, are customary approaches to test for the sustainability of public finances. However, this kind of assessments of fiscal sustainability based on unit root and cointegration tests have been recently criticized by Bohn (2007), on the grounds that such tests are incapable of rejecting sustainability. Specifically, Bohn derives the following three propositions:

(i) If b_t is integrated of order m for any finite $m \geq 0$, then b_t satisfies the transversality condition, and b_t and s_t satisfy the IBC.

(ii) Suppose $exp_t \sim I(m_G)$ and $rev_t \sim I(m_T)$, possibly with different orders of integration and not necessarily cointegrated, where $\Delta b_t = exp_t - rev_t$; then $b_t \sim I(m)$ with $m \leq \max(m_G, m_T) + 1$, so the transversality condition and the IBC hold.

(iii) If b_t and s_t follow an error-correction specification of the form $s_t - \rho b_{t-1} = z_t$, and z_t is integrated of order m for some $\rho < 0$ such that $|\rho| \in (0, 1+r]$ where r is a constant interest rate, then b_t satisfies the transversality condition and the IBC holds.

We use data on total revenues, total (i.e., inclusive of debt interest) expenditures, primary (i.e., excluding interest payments) budget surplus, and total gross debt, all of them as percentages of GDP, for the Spanish central government over the period 1850-2000. The data sources are Comín and Díaz (2005) for the public sector variables, and Prados de la Escosura (2003) for GDP. The time evolution of the total and primary government surplus ($rev-exp$ and s, respectively) is shown in Figure 1, and that of the total gross debt (b) in Figure 2. In the next paragraphs, we will briefly discuss the main developments of the Spain public finances between 1850 and 2000; a more detailed account of the evolution of the Spanish public sector over this one-and-a-half-century period can be found in Comín (1995, 1996).

The behaviour of the Spanish public sector was mainly characterized along most of the period by the pervasiveness of budget deficits. This was the result of small amounts of expenditures dictated by an insufficient level of revenues, given the inability of governments, representing the wealthy classes of the society, to affect their particular interests. In general, the main task of the Spanish public sector was providing a high degree of protection and regulation, in order to favour some particular groups and

sectors, rather than satisfying collective needs (such as infrastructures, or social expenditures). In fact, Spain had to wait until the restoration of democracy after 1977, and especially the integration in the now European Union (EU) in 1986, to enjoy a public sector comparable to that of the rest of Western Europe.

On the other hand, given the above features, government debt has frequently served to finance not deficits, but rather public expenditures. As such, and at least until the 1960s, their interest payments have represented a dead weight on government expenditure. This can be seen, e.g., in the significant difference between total and primary government surplus in Figure 1. The maximum levels of government debt can be found at the mid 1870s, following a period of political instability after the so-called "Glorious Revolution", when it amounted to more than 150% of GDP, and at the beginning of the 20th century, following the last wars in Cuba and the Philippines, to reach more than 125% of GDP. Later on, only at the end of the Spanish Civil War and in the mid 1990s (just before the fiscal consolidation that allowed Spain to join the European monetary union) the ratio debt-GDP reached significant, though lower, levels, reaching around 70% and 60%, respectively. For most of the period, inflation was used to reduce the real value of indebtedness. Only after 1982, budget deficits were increasingly financed in a more orthodox way; and, finally, from 1993 on government deficits financing by the central bank was explicitly forbidden according to the provisions of Article 104a of the Maastricht Treaty.

In order to examine the three Bohn's propositions, we begin by testing for the order of integration of the variables b_t, exp_t, and rev_t, using the tests of Ng and Perron (2001). These authors proposed using the tests statistics $\overline{MZ}_{\alpha}^{GLS}$ and $\overline{MZ}_{t}^{GLS}$, which are modified versions of the Z_{α} and Z_{t} Phillips-Perron tests; and ADF^{GLS}, a modified version of the Augmented Dickey-Fuller test. Such modifications improve the tests with regard to both size distortions and power. According to the results in Table 1, the null hypothesis of no stationarity cannot be rejected, independently of the test, for the three series in levels; and the presence of two unit roots is clearly rejected at the 1% significance level. Therefore, the three series would be concluded to be I(1), and the first two propositions of Bohn (2007) would hold.

Next, we estimate the error-correction specification analogue to (4):

$$\Delta s_t = \omega + \delta(L)\Delta b_{t-1} + \rho(s_{t-1} - \alpha - \beta b_{t-2}) + \gamma(L)\Delta s_t + \eta_t \qquad (6)$$

where η_t is an error term. The results are shown in Table 2 and, as can be seen, the error-correction coefficient is estimated at −0.21, and the long-run coefficient β at 0.02. The two estimates are significant at the 1% level. Accordingly, the third proposition of Bohn (2007) would hold, and public finances would have been sustainable over the long run. In particular, the adjustment of the primary surplus-GDP ratio to a given change in the debt-GDP ratio would have had an average half-life of about three years[1]. These results would confirm those found using the more traditional approach, i.e., from the estimation of a cointegration equation such as (5), in Bajo-Rubio, Díaz-Roldán and Esteve (2010).

Notice that, while it allows obtaining estimates that are more robust, using long spans of data increases the likelihood of finding instabilities in the estimated equations. Hence, we will test for the stability of equation (6) using the tests recently proposed by Kejriwal and Perron (2008a,b), who provide a comprehensive treatment of the problem of testing for multiple structural changes in cointegrated systems.

Specifically, these authors propose three types of test statistics to test for multiple breaks in cointegrated regression models:

a) First, a sup Wald test of the null hypothesis of no structural break ($m = 0$) versus the alternative hypothesis that there are a fixed (arbitrary) number of breaks ($m = k$):

$$\sup F_T^*(k) = \sup_{\lambda \in \Lambda_\varepsilon} \frac{SSR_0 - SSR_k}{\hat{\sigma}^2}$$

where SSR_0 and SSR_k denote, respectively, the sums of squared residuals under the null hypothesis of no breaks, and under the alternative hypothesis of k breaks; $\lambda=\{\lambda_1, ..., \lambda_m\}$ is the vector of breaks fractions defined by $\lambda_i=T_i/T$ for $i=1,..., m$; and T_i are the break dates.

[1] Computed as $\log(0.5)\Big/\log\left(1-\left|\hat{\beta}\right|\right)$, where $\hat{\beta}$ is the estimate of β in equation (6); in our case, −0.21.

b) Second, a test of the null hypothesis of no structural break (m = 0) versus the alternative hypothesis that there is an unknown number of breaks given some upper bound M ($1 \le m \le M$):

$$UD\max F_T^*(M) = \max_{1 \le k \le m} F_T^*(k)$$

c) In addition to the tests above, Kejriwal and Perron also propose a sequential procedure that not only enables detection of parameter instability but also allows a consistent estimation of the number of breaks, i.e., a sequential test of the null hypothesis of k breaks versus the alternative hypothesis of k+1 breaks:

$$F_T(k+1 \mid k) = \max_{1 \le j \le k+1} \sup_{\tau \in \Lambda_{j,\varepsilon}} T\left\{SSR_T\left(\hat{T}_1,...,\hat{T}_k\right)\right\} - \left\{SSR_T\left(\hat{T}_1,...,\hat{T}_{j-1},\tau,\hat{T}_j,...,\hat{T}_k\right)\right\} / SSR_{k+1}$$

where $\Lambda_{j,\varepsilon} = \left\{\tau; \hat{T}_{j-1} + \left(\hat{T}_j - \hat{T}_{j-1}\right)\varepsilon \le \tau \le \hat{T}_j - \left(\hat{T}_j - \hat{T}_{j-1}\right)\varepsilon\right\}$, and the model with k breaks is obtained by a global minimization of the sum of squared residuals.

The results of applying the Kejriwal-Perron tests to the relationship given by equation (6) are shown in Table 3, where up to three possible breaks have been allowed for (the results did not change if up to five breaks were allowed instead). As can be seen, none of the tests proves to be significant and the sequential procedure selects no break point, which would point to a stable long-run relationship between the primary surplus and debt to GDP ratios over the whole period.

Recall that, in addition to implying fiscal solvency, a positive estimate of β in equation (6) would indicate, according to the *backward-looking* approach, the prevalence of an MD regime. However, there is a possible ambiguity here, since a positive estimate of β is strictly compatible with the presence of both an MD and an FD regime. That is, in an MD regime we would observe that an increase in debt in period t would lead to a larger primary surplus *ex-post*; i.e.: $\Delta b_t \to \Delta s_{t+1}$, which implies an estimated $\beta > 0$. Yet, in an FD regime, a decrease in the expected primary surplus would lead to a fall in the current debt ratio, through a price increase; i.e.: $\nabla E_t s_{t+1} \to \nabla b_t$, which also implies an estimated $\beta > 0$. For that reason, we will complement the above analysis with Granger-causality tests between the primary surplus and debt to GDP ratios.

In particular, according to Sims, Stock and Watson (1990), if two I(1) series X_t and Y_t are cointegrated, the relevant regression is the following:

$$X_t = \alpha_0 + \delta_1 X_{t-1} + \gamma_1 (X_{t-1} - \beta Y_{t-1}) + \sum_{i=1}^{m} \alpha_{1i} \Delta X_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \Delta Y_{t-i} + \zeta_t \qquad (7)$$

with an analogous representation holding for Y_t as dependent variable. Then, to testing for Granger-causality, the null hypotheses would be: (i) $\gamma_1 = 0$, for the absence of long-run causality; and (ii) $\alpha_{2i} = 0$, for the absence of short-run causality. And the standard F test can be used to test for Granger-causality in the short and in the long run.

The results of the Granger-causality test for the variables primary budget surplus and government gross debt are presented in Table 4. We report F statistics on the null hypotheses $\gamma_1 = 0$ and $\alpha_{2i} = 0$, from the estimation of equation (7) with s_t and b_{t-1} alternatively as dependent variables. Up to three lags of the first difference of each of these variables have been included, and the number of lags has been chosen using the Akaike information criterion. The results in Table 4 indicate the presence of both long-run and short-run Granger-causality from primary surplus to debt, which would point to the prevalence of an FD regime over the period of analysis.

Finally, in order to offer a more complete picture, we present the results from applying the so-called *forward-looking* approach, following Canzoneri, Cumby and Diba (2001). According to these authors, in an MD regime a positive innovation in the primary surplus pays off some of the debt, so the future level of debt would fall. In turn, in an FD regime a positive innovation in the primary surplus should lead to a higher future level of debt, via a lower price level. Notice, however, that a possible ambiguity can also emerge here since, even if a positive innovation in the primary surplus leads to a reduction in the future level of debt, this could be compatible with an FD regime. In particular, if innovations in the primary surplus were negatively correlated with future surpluses, the future level of debt would fall through a rise in the price level; and such a case could be justified since a higher surplus today might reduce the need of future surpluses.

The impulse-response function of the debt-GDP ratio to innovations in the primary surplus-GDP ratio, from an estimated VAR in these two variables, is shown in

Figure 3 together with ±2 standard errors, over a 10-year horizon. The VAR was estimated with one lag and a constant; up to five lags were tested, and the optimal lag order was selected using the Akaike information criterion. As can be seen in the figure, the debt-GDP ratio exhibits a small, but positive, response following an innovation in the surplus-GDP ratio, and then decreases to move gradually toward zero. Accordingly, this approach would also indicate that an FD regime would have prevailed over the period of analysis.

The results of this section would agree and confirm for a longer period extending from 1850 to 2000, those previously obtained by Sabaté, Gadea and Escario (2006). Using a different approach (in particular, from the estimation of a stationary VAR model), these authors also found the prevalence of an FD regime in the Spanish case for the period 1874-1935.

4. Conclusions

In this paper, we have tried to provide some additional empirical evidence on the sustainability of government deficits, as well as on the role played by monetary and fiscal dominance in order to get fiscal solvency, for the case of Spain over the period 1850-2000. More specifically, we have tried to find if public finances were sustainable, and then investigated how this fiscal sustainability was achieved: i.e., through the endogenous adjustment of the primary budget surplus (in an MD regime), or through the endogenous adjustment of the price level (in an FD regime). An important point to be stressed is that our dataset extends over 150 years, which should allow us to obtain some more robust results as compared to other previous analyses.

First, we have analyzed the sustainability of government deficits by examining the relationship between primary surplus and debt, following the recent critique of Bohn (2007) to previous tests on sustainability using cointegration techniques. We found that the debt-to-GDP ratio was integrated of order one, as they were the ratios of total government expenditures and revenues to GDP too. In addition, we estimated an error-correction relationship between primary surplus and debt (both as ratios to GDP), finding a significant error-correction coefficient, and a long-run coefficient positive and also significantly different from zero at the 1% level. Accordingly, the three

propositions derived by Bohn (2007) would hold, and public finances would have been sustainable over the long run, with an estimated adjustment of the primary surplus-GDP ratio to a given change in the debt-GDP ratio with an average half-life of about three years. Given the long-run span of the data, we also tested for the eventual presence of structural breaks in the estimated relationship between primary surplus and debt, following the new approach recently proposed by Kejriwal and Perron (2008a,b), but the results pointed to a stable long-run relationship between the primary surplus and debt to GDP ratios over the whole period.

Even though these results could be taken *prima facie* as evidence in favour of the prevalence of an MD regime, in fact the above method might not be able to distinguish properly between an FD and an MD regime. That is, in equilibrium, the fiscal solvency condition holds under both the MD and FD regimes, and the difference between them would come from how fiscal sustainability is achieved, i.e., through the adjustment of either the primary surplus or the price level in the MD and the FD case, respectively. For that reason, in order to distinguish between the two regimes, we next performed Granger-causality tests between primary surplus and debt. The results showed the presence of both long-run and short-run Granger-causality from primary surplus to debt, which would point to the prevalence of an FD regime over the period of analysis.

Finally, we also presented the impulse-response function of debt to innovations in the primary surplus, following the approach of Canzoneri, Cumby and Diba (2001). Again, since the debt-GDP ratio showed a small, but positive, response following an innovation in the surplus-GDP ratio, to decrease later gradually toward zero, this approach would also indicate that an FD regime would have prevailed along the period analyzed.

Summarizing our findings, the Spanish government deficit would have been sustainable along the period 1850-2000, since the condition of fiscal solvency was fulfilled. In addition, the relationship between primary deficit and debt was found to be stable over the long run, and the whole period can be characterized as one of fiscal dominance. In other words, fiscal authorities would have set budget deficits exogenously, and the endogenous adjustment of the price level was required in order to

achieve fiscal solvency, so that monetary policy was subordinated to the needs of financing the budget deficit. Nevertheless, as shown in Bajo-Rubio, Díaz-Roldán and Esteve (2010), if the deficit was above a certain threshold (estimated at around 4.5% of GDP), budget deficits would have been cut in order to assure their long-run sustainability.

Overall, the picture that emerges would be typical of a less developed country, with a rather undisciplined public sector, unable to collect revenues enough to finance even small amounts of expenditure, and compelled to engage in inflationary financing of the deficit (Comín, 1995). This was the case of Spain over most of this period, since the development of a public sector comparable to that of the rest of Western Europe can be dated only following the restoration of democracy after 1977, and especially after joining the EU in 1986. On the other hand, the more orthodox practices on deficit financing set around the mid-1980s, ending in the explicit ban on financing by the central bank after 1993, seem to be located at the very end of the sample. Accordingly, this would leave an insufficient number of observations available to detect any structural change, or to modify the results on fiscal dominance.

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Figure 1
Total and primary government surplus: Spain, 1850-2000

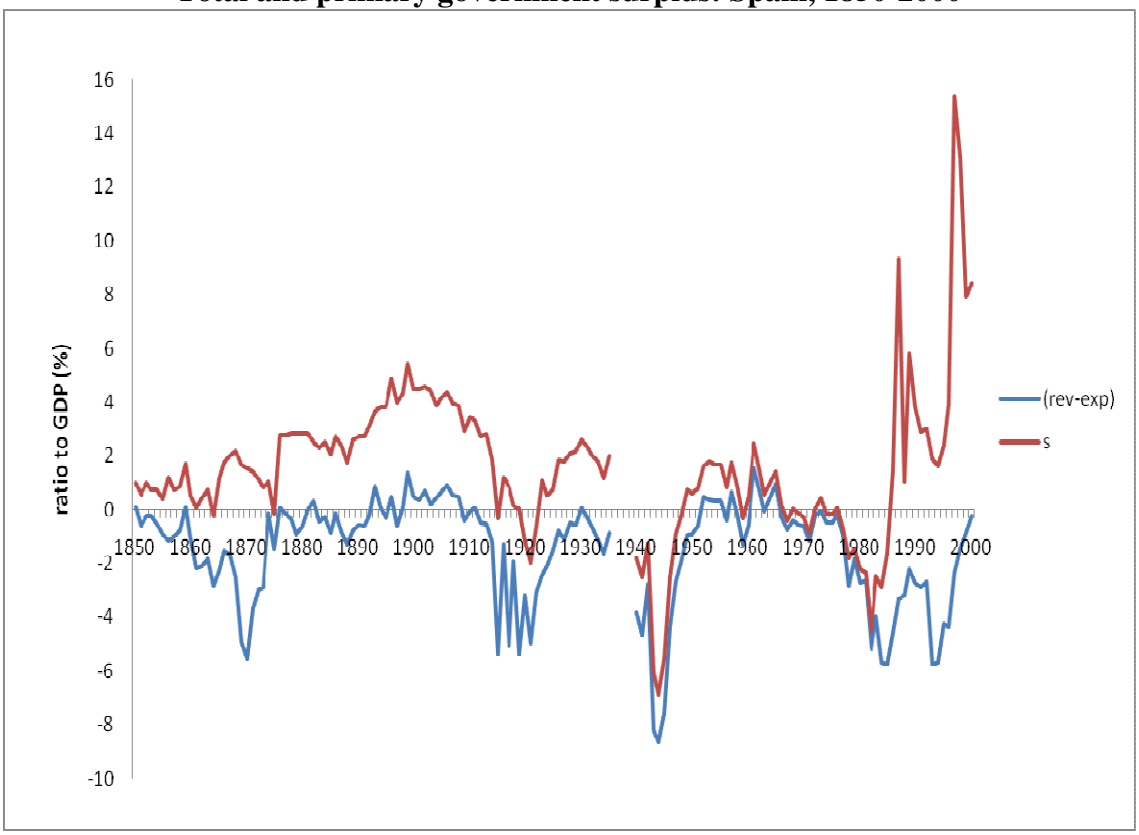

Figure 2
Total gross debt: Spain, 1850-2000



Figure 3
Response of debt/GDP to primary surplus/GDP from an estimated VAR

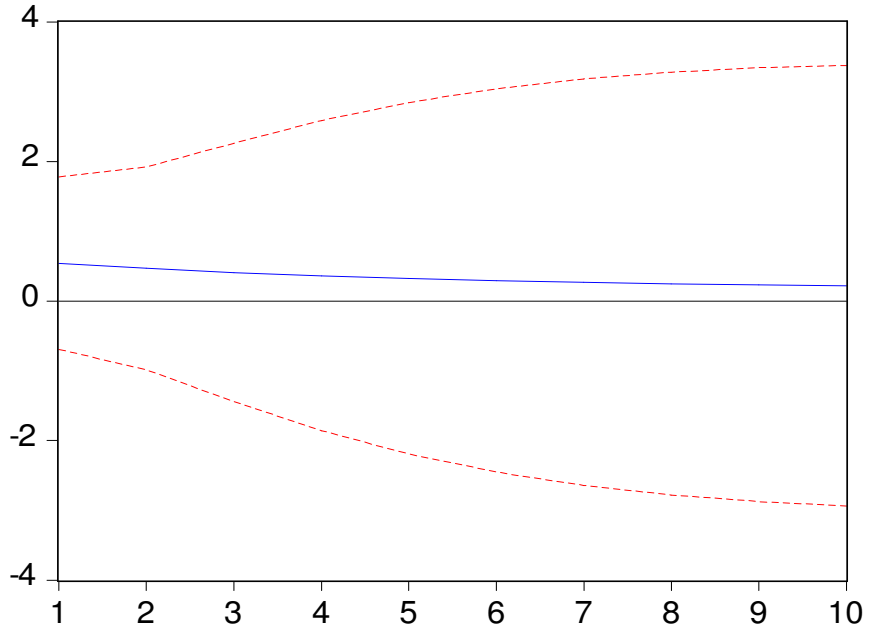

Table 1
Ng-Perron tests for unit roots

I(2) vs. I(1)

	$\overline{MZ}_{\alpha}^{GLS}$	$\overline{MZ}_{t}^{GLS}$	ADF^{GLS}
Δb_t	−32.66*	−4.03*	−4.58*
Δexp_t	−62.46*	−5.58*	−8.54*
Δrev_t	−72.03*	−6.00*	−13.03*

I(1) vs. I(0)

	$\overline{MZ}_{\alpha}^{GLS}$	$\overline{MZ}_{t}^{GLS}$	ADF^{GLS}
b_t	−11.62	−2.37	−2.40
exp_t	−7.59	−1.85	−1.87
rev_t	−8.18	−1.82	−1.83

Notes:
(i) * denotes significance at the 1% level. The critical values are taken from Ng and Perron (2001), Table 1.
(ii) The autoregressive truncation lag has been selected using the modified Akaike information criterion, as proposed by Perron and Ng (1996).

Table 2
Estimation of a long-run nonlinear relationship between s_t and b_{t-1}

Error-correction coefficient	-0.21^{*} (−3.84)
Long-run coefficient	0.02^{*} (2.75)

Notes:
(i) *t*-statistics in parentheses.
(ii) * denotes significance at the 1% level.

Table 3
Kejriwal-Perron tests for structural change

sup $F_T(1)$	sup $F_T(2)$	sup $F_T(3)$	*UD* max	Number of breaks selected
6.62	5.33	4.19	6.62	0

Note: No test statistic is significant at the conventional levels. The critical values are taken from Kejriwal and Perron (2008a), Table 1.10, trending case.

Table 4
Sims-Stock-Watson tests for Granger-causality

H_0	$s_t \rightarrow b_{t-1}$	$b_{t-1} \rightarrow s_t$
$\gamma_1 = 0$	77.46^{*}	1.45
$\alpha_{2i} = 0$	3.26^{**}	1.13

Notes:
(i) The reported values are *F*-statistics on the null hypotheses $\gamma_1 = 0$ and $\alpha_{2i} = 0$, from the estimation of equation (7) in the text using s_t and b_{t-1} alternatively as dependent variables.
(ii) * and ** denote significance at the 1% and 5% levels, respectively.