FISCAL POLICY RESTRICTIONS IN A MONETARY SYSTEM: THE CASE OF SPAIN*

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ABSTRACT.

The idea that individual countries public debts and deficits might jeopardize a monetary union is widespread nowadays. This paper explores how a public deficit in any individual country, may endanger its stability as a member of a monetary system with narrow exchange rate bands. The portfolio balance approach, and the target zone models are the basic theoretical models considered. The models are applied to the case of Spain showing, on the whole, that this country must exert a tighter control over its public finances if it is to become a stable member of a monetary system. Non linearities, and short run dynamics, are taken into account in the empirical results, that also make use of standard cointegration techniques.

Keywords: Public debt, portfolio balance approach, target zones.

I. INTRODUCTION.

In a monetary union implying a fixed echange rate and perfect capital mobility, a small country loses the independence of its monetary policy. However, fiscal policy becomes more effective, at least in the short run, and a small country will have to rely on it in order to offset local shocks. However, the idea that a monetary union requires tight individual fiscal policies, seems to be widespread nowadays (this is exemplified in the limits set on public deficit and public outstanding debt in the Maastricht treaty). One argument that supports it, is that individual public deficits in each country would add to the total deficit of the union, and this might jeopardize the monetary stability of the monetary union (Goodhart,(1991)). Therefore, it would be unfair to allow any individual country to run a sizeable public deficit, while asking the remainig countries to run surpluses in order to keep the whole union budget balanced. Thus, limits of several kinds, as those set on the Maastricht treaty for example, might be appropriate.

The achievement of a monetary union, as it has been envisaged up to now, requires an intermediate step with narrow fluctuating bands for exchange rates. In this respect, public debts and deficits might pose a threat to the stability of this monetary system, and this would be another reason to limit them. The purpose of this paper is to explore that idea empirically for the spanish case. By comparing the spanish data to the leading EMS country, i.e. Germany, it is hoped to etasblish whether current levels of spanish public debt and deficits, might prevent this country from being a stable member of a monetary union (in the transition period). This is more important, given that Spain only meets the public debt requirement established in the Maastricht treaty. Besides, the framework of this paper could be applied to other countries with sizeables public debts and deficits.

The plan of the paper is as follows: section II establishes some theoretical links between exchange rates and public expenditures; section III relates these models to the target zone model for exchange rates; section IV gives the empirical results, and section V sums up.

II. PUBLIC EXPENDITURE AND THE EXCHANGE RATE.

This section is intended to provide a quick review of the impact of public expenditures on the exchange rate in some basic models. This will provide a guide to the empirical results, as to the sign and timing of this effect. It will also serve the purpose of showing that, as a general rule, and under control of the money supply, changes in public expenditure are not compatible with a stable exchange rate. We start reviewing basic results in a short run model, and then proceed to consider the longer run impacts under two opposite and extreme assumptions, depending on whether the public debt is net private wealth or not (the Barro-Ricardo assumption, Barro,1974). The first case that we consider, is a small open economy in the short run with a flexible exchange rate, and imperfect capital mobility. This can be framed in the standard short run IS-LM model plus a balance of payments. The short run assumption basically implies some degree of output flexibility, and sluggish prices. In this conventional model, an expansion of the public expenditure shifts the IS curve rightwards (in an interest rate output plane). Thus, interest rates go up and output increases. This implies a worsening of the trade balance, and an improvement of the capital account: depending on which effect is stronger, the exchange rate will depreciate (strong trade balance effect), or else will appreciate (stronger capital account effect). If the degree of capital mobility is sufficient, the higher interest rate will induce an inflow of foreign capital, more than enough to finance the added trade deficit: therefore, the exchange rate appreciates. If rational expectations are assumed, and the inflow of foreign capital is made to depend (positively) on the interest rate differential, less the expected depreciation of the exchange rate, the basic result stays the same: a sufficient degree of capital mobility will induce an appreciation of the exchange rate. In the extreme case of perfect capital mobility, we are in the Mundell-Fleming model, so that the real stimulus provided by the fiscal expansion is completely swamped by the required exchange rate apreciation (in such a way that interest rates are kept in line with the exogenously given world interest rate level).

In longer run models, it is reasonable to assume output roughly fixed, and prices flexible. Also, portfolio adjustments must be taken into consideration explicitely. Let us start analyzing the relationship between interest rates and the exchange rate, implied by the portfolio balance approach and the balance of payments, under less than perfect capital substitutability. The basic model is given by the following three equations,

$$\Delta b_w = b_{w,-1} \cdot i_w + d.q \qquad (2.1)$$

$$\Delta b_w = z \ (b^d_w - b_{w,-1}) \qquad (2.2)$$

$$b^d_w = - f.i \qquad (2.3)$$

where (2.1) is a simplified balance of payments equation, (2.2) is a partial adjustment equation for desired foreign bonds, and (2.3) is the long run demand for foreign bonds (b_w, is the volume of foreign bonds held by the domestic economy, i_w the foreign interest rate, q stands for competitiveness (log of the exchange rate over domestic prices) and i is the domestic interest rate; d, z, and f, are parameters greater than zero, and z is less than one). Solving the model for q an b_w, yields the next equation for q,

$$q = - i.(f.z/d)((1-(1+i_w)L)/(1-(1-z)L) \qquad (2.4)$$

where L stands for the back shift operator. The dynamic response of q to changes in i is given by the following lag structure, derived from (2.4),

$$q = (f.z/d) \ (-i + ((i_w+z)/(1-z)) \sum (1-z)^s \ i_{-s}) \qquad (2.5)$$

where the sum runs from s=1 to infinity. Interestingly enough, this shows a reversal in sign, first negative and from then on positive. This positive impact dominates in the long run, so that the total impact is equal to (i_w.f/d): therefore, we should not be surprised to find that higher interest rates lead to depreciation, when estimating "long run equations" (see section IV). It is also worth pointing out that the solution for the interest rate, given a fixed exchange rate and a constant rate of domestic inflation, k, is given, from (2.4), by,

$$i - i_{-1} = (1+i_w)\ (i_{-1} - i_{-2}) + (k.d/f) \tag{2.6}$$

where $q-q_{-1}=-k$. This implies an explosive path for the domestic interest rate, with ever incresasing increments: since this path is clearly not sustainable, a permanent loss of competitiveness cannot be handled for ever, increasing the domestic interest rate (a result first pointed out by Tobin,1963).

Having established some facts about the short run dynamics, we now turn to a more complete analysis of the long run impact of public expenditures on the exchange rate in a portfolio balance model. We consider the simplest possible model, that yet, keeps all the essential features. The model is given by the following five equations,

$$K_1 = m + b + b_w \tag{2.7}$$

$$m = - z.i \tag{2.8}$$

$$K_3 = b_w + d.q \tag{2.9}$$

$$b_w = - f.i + k_4 \tag{2.10}$$

$$g + i.b = 0 \tag{2.11}$$

where m are real money balances, b_w, b, the real stock of domestic and foreign bonds respectively, held by the domestic private sector, g is the net public expenditure in real terms, k_1, k_2, k_3 and k_4, are constants, and the remaining variables have been defined before (i_w is taken equal to one for simplicity). Equation (2.7) is the definition of total private domestic real wealth, equation (2.8) is the demand for money; equation (2.9) is the balance of payments; equation (2.10) is the domestic demand for foreign bonds, and equation (2.11) is the government budget constraint. In order to analyze the sign of the impact of g on the exchange rate, let us consider first the following derivative,

$$(di/dg) = - 1 /(b+(z+f)i) \qquad (2.12)$$

which can be obtained in a straightforward way using the implicit function rule. For any value of b, a sufficiently high degree of capital mobility (high f), will ensure that this derivative is negative. If g increases, this implies, in turn, an increase in the demand for money that can only be accomodated by lower prices, since the nominal money stock is held constant. Also, from (2.9) and (2.10) together, this implies a smaller q: since prices have decreased, this amounts to a substantial apreciation of the domestic currency. Thus, a fiscal expansion leads in the long run to an appreciated domestic currency in this model. However, this effect is reached through a reduction in the domestic interest rate, contrary to the short run version of the economy considered before.

It might be argued that the model (2.7-11) does not adequately reflect a long run equilibrium, since the public debt must be repaid by the government somehow. Therefore, neither can it be taken as net wealth by the private sector. One possible simple model that takes into account this feature is the following,

$$y^* = - a_1 . i + a_2 . g + a_3 . q \quad (2.13)$$

$$m = - z . i \quad (2.14)$$

$$0 = d_1 . y^* + d_2 . q \quad (2.15)$$

$$g = Tx \quad (2.16)$$

where y^* is equilibrium real output, Tx taxes, a_1, a_2, a_3, d_1, d_2, fixed parameters, and the remaining symbols as before. Equation (2.16) is the government budget constraint, written in such a way that there is no outstanding stock of bonds in long run equilibrium. The wealth definition of the previous model (2.7) is replaced by a more traditional IS equation (2.13): this is required in order to link government expenditures to the remaining of the model. Taxes are substituted out, and the positive coefficient a_2, is the net result of the positive impact of g on demand, and its negative effect through the reduction of real disposable income. Domestic output is taken to be constant and equal to its long run equilibrium value. Having abandoned the portfolio balance approach for the reasons just mentioned, it is simpler to forget about foreign bonds, so that the new equation for the balance of payments is given by (2.15) (constants have not been taken into account except for y^*).

In this model, competitiveness is determined solely on the basis of the current account (see 2.15). Thus, the result of increased government expenditures is simply a higher interest rate (2.13), lower real money balances (2.14), and therefore, a higher price level. And given a fixed value for q, this finally implies a depreciation of the domestic currency. In sum, an expansion of the public expenditure level, leads to a depreciation of the domestic currency.

The same result can be reached through more or less standard monetary arguments. Assuming a real output growth rate smaller than the real interest rate attached to public bonds, public deficits today mean future monetary expansions, and therefore, future inflation (this is the Sargent-Wallace basic result). If we add perfectly competitive foreign goods trade, so that purchasing power parity holds, that immediately implies a depreciating home currency, at the inflation rate. Assuming, further, perfect substitutability of home and foreign bonds, and rational expectations, we obtain the uncovered interest parity condition. Thus, a public deficit will imply an expected depreciating currency, and a higher nominal interest rate at home than abroad (this argument forms the basis of one of the procedures reviewed in the next section, in order to test the effect of the public deficit on the exchange rate).

If we consider the same problem, with an intertemporal optimizing consumer with rational forward looking expectations, and with public deficits financed smoothly over time, an expansion of public expenditures will be exactly matched by an equal increase of private savings (this is an implication of the Barro-Ricardo hypothesis). Therefore, the current account will remain unaffected. If the deficit is financed with money, a depreciation will follow (under perfect and imperfect foreign trade).

Summarizing the results of this section, an increase in public expenditures will generally give rise in the short run to an appreciation of the domestic currency; in the long run, this effect will persist, or else will ve reversed, depending on whether public bonds are net private wealth or not, respectively. In both cases, however, the effect will work its way through a positive (long run) relationship between the interest rate and the home currency, measured in units of foreing money (that is, a higher interest rate will induce a depreciation, and conversely).

III. PUBLIC DEFICIT AND THE TARGET ZONE MODEL.

This section presents two models devised to explain the behaviour of the exchange rate in a target zone model. The presentation is directed to make both models operational, so that they can be estimated empirically.

The first model starts by assuming perfect substitutability of foreign and domestic bonds, and rational expectations (Craig,1991). Therefore, uncovered interest parity holds, that is, $i_t = i_{wt} + \Delta s^e_{t+1}$, where s_t is the log of the nominal exchange rate in domestic units, and the superindex $(.)^e$, means expectations as of time t. The next step is to split the expected change of the exchange rate in two components: changes inside the target zone, and changes of the central value of the band. Thus, we can write,

$$\begin{aligned} \Delta s^e_{t+1} &= \Delta c^e_{t+1} + \Delta s^e_{t+1} - \Delta c^e_{t+1} \\ &= \Delta c^e_{t+1} + \Delta p^e_{t+1} \qquad (3.1) \end{aligned}$$

where p=s-c, that is, the distance of the actual exchange rate from the central value of the band. The next step is to derive a model for the second component of (3.1), that is Δp^e_{t+1}. This can be achieved by means of the target zone model for exchange rates (Krugman,1991, Krugman and Miller,1992, Rose and Svensson,1991, and Svensson,1993). This approach starts from the following general specification for the exchange rate,

$$s_t = f_t + a.\Delta s^e_{t+1} \qquad (3.2)$$

where f_t are the fundamentals and a is a positive parameter. As such, this model is compatible with virtually all models of exchange rate determination, that also take account of expectations. If the fundamentals, f_t, that might even follow a random walk stochastic process, push the current rate towards the zone limit, and away from its central value, the expectations will come into play in a particular way: since the likelihood of a change of s_t is greater in one direction (towards the central value) than in the other, this asymetry will induce a non linearity in the behaviour of s_t. Finally, the relationship between s_t and f_t takes on an S shaped form (Krugman,1991). This non linearity, in turn, can be modelled in a number of different ways. One simplification is simply to assume a polynomial approximation, derived out of a Taylor series expansion, that is,

$$\Delta p_{t+1} = b_1 . p_t + b_2 . p^2_t + b_3 . p^3_t + \ldots + v_t \tag{3.3}$$

(p_t is used instead of s_t itself, since we are specifying a model for the exchange rate inside the band). If we knew the coefficients in this model, and using the uncovered interest parity condition, we could obtain an estimate of the expected change of the central rate, that is,

$$\begin{aligned} i_t - i_{wt} &= \Delta s^e_{t+1} \\ &= \Delta c^e_{t+1} + \Delta p^e_{t+1} \end{aligned} \tag{3.4}$$

from which we immediately get,

$$\Delta c^e_{t+1} = (i_t - i_{wt} - \Delta p^e_{t+1}) \tag{3.5}$$

Thus, the right hand side of (3.5) can be taken as as measure of market expectations about the future central rate for the band. By definition we now have,

$$\begin{aligned} \Delta c^e_{t+1} &= E(c_{t+1}/I_t) - c_t \\ &= q_t . d_t \end{aligned} \tag{3.6}$$

where q_t is the probability that the central band changes in t+1, and d_t is the size of the change (both as expected by the market). There exist now, more or less formal models to relate

q_t an d_t to macroeconomic variables (Craig,1991, Lindberg et. al., 1991). One obvious candidate is the public deficit: if we assume the Sargent-Wallace,1981 not sustainability result, the public deficit would be a leading indicator for future inflation; and assuming a constant real rate of return, and the Fisher equation for nominal interest rates, we obtain a positive correlation between the domestic public deficit and the nominal interest rate. Finally, and from (3.5,6), the public deficit in this framework would necessarily anticipate a future depreciation of the central exchange rate. In sum, sustained public deficits would be incompatible with a target zone for the exchange rate (note that this result is obtained with any monetary policy, in this model).

The framework presented in the preceding paragraphs is more adequate for short run interest rates. In this case, the assumption of complete substitutability of foreign and domestic markets is more realistic. Therefore, it is convenient to present and use empirically, other framework of analysis more suited to an environment of imperfect substitutability of capitals. There is another aspect of the target zone model just presented, worth discussing. In earlier presentations (Krugman,1991, Craigg,1991), the fundamentals were assumed to follow a purely random walk stochastic process. But this approach does not leave any room for a direct effect of the fundamentals on the behaviour of the exchange rate inside the band. However, casual observations of the behaviour of some currencies (notably, the German mark), shows the contrary. Therefore, it should be convenient to allow for this effect. There have been some theoretical advances, that go some way towards solving this problem (Svensson,1992). The framework presented next, relies on the theoretical proof of the existence of this relationship, and is directly devised for empirical purposes. We shall start by an equation for the balance of payments given by,

$$\Delta R = b.s_t + x_t \quad (3.7)$$

where b is a parameter greater than zero, R stands for foreign reserves, and x_t gathers all remaining determinants of the balance of payments accounts (prices, incomes, and interest rates, basically). We define an equilibrium value for the exchange rate by setting $\Delta R=0$ (Wren-Lewis,1992), that is,

$$s^*_t = x_t \;/\; b \quad (3.8)$$

and this can be called the fundamental equilibrium exchange rate. Then (3.7) can be rewritten as,

$$\Delta R_t = b.(s_t - s^*_t) \quad (3.9)$$

Now, we introduce a positive non linear function h(.) that gives the value for s_t in terms of s^*_t and s^*_{t-1}, that is,

$$s_t = h(s^*_t,\; s^*_{t-1}) \quad (3.10)$$

This function fulfills the following properties,

$$x_t = h(x_t,\; x_t)$$
$$x_t > h(x_t,\; x_{t-1}) > x_{t-1} > 0$$
$$0 < x_t < h(x_t,\; x_{t-1}) < x_{t-1} \quad (3.11)$$

A function that meets this properties is, for example, the following,

$$h = s^*_{-1} + (w/2)\; (\exp(\Delta s^*)-1) \;/\; (\exp(\Delta s^*)+1) \quad (3.12)$$

where w is the short run band width for the exchange rate (a positive number smaller than four). In this way, the short run exchange rate reacts to fundamentals (s^*_t), but smoothly, in the sense that changes in the fundamentals are dampened. This is the basic effect of the target zone model, i.e. smoothing short run fluctuations. On the other hand, the exchange rate sooner or later is driven to its fundamental value (the first property in 3.11). This property tries to capture the idea that the central band cannot be incompatible with the fundamentals in the long run. It may be appropriate also, when the monetary authorities implicitly follow some kind of target zone for the exchange rate in the short run. This last rule of behaviour seems to have been common in recent years, and the model finally implied for the exchange rate can be derived along the lines of formal target zone models (Pessach and Razin,1992).

The specification of the h(.) function in (3.12) is somewhat complex for empirical purposes. A simpler and straightforward approximation would be the following,

$$\Delta s_t = a_1 . \Delta s^*_t - a_2 . (\Delta s^*_t)^3 - a_3 . (s - s^*)_{t-1} \qquad (3.13)$$

which is the equation that has been estimated (see next section). If the fundamentals involve a forward expectation on the exchange rate, then the non linearity can be dealt with empirically with the generalized method of moments estimation procedure. In order to explain more fully this specification, let us assume first that the authority follows a simple reaction function rule of the form,

$$\Delta s_t = - b_1 . \Delta R_t - b_2 . \Delta R_{t-1} \qquad (3.14)$$

Plugging (3.9) into (3.14) and rearranging, the final form equation for the exchange rate would simply be then given by,

$$\Delta s_t = a_1 . \Delta s^*_t - a_3 . (s - s^*)_{t-1} \qquad (3.15)$$

which is the familiar error correction mechanism specification provided $0<a_3<1$ (the a's being simple functions of the b's). In this model, the exchange rate is partially fixed in the short run, and fully flexible in the long run, being determined by its fundamentals. All that model (3.13) does, is to add a short run non linear term, devised to dampen the effect of fundamental changes, but leaving the long run equilibrium unchanged. This seems a fairly sensible description of the actual behaviour of exchange rates in a target zone model (explicit or implicit).

One last question regarding the modelling of bilateral exchange rates in this context deserves a few comments, and that is the impact of economic links with the rest of the world. Let, then, s^{12} be the exchange rate of country one vs. country two, measured in units of country one (and similarly for other rates, so that, for example, $s^{12}.s^{23}=s^{13}$). Let, also, B^{12} be the balance of payments of country one vs. country two (a positive sign indicating a surplus). Then, given these definitions, $B^{12}+s^{12}.B^{21}=0$ (identically). Let us assume now, that exchange rates are fully flexible and, therefore, aggregate balance of payments for each country are zero. Then we have,

$$B^{12} + B^{13} = 0$$
$$B^{21} + B^{23} = 0 \qquad (3.16)$$

and the balance of payment of the rest of the world will also be equal to zero. Linearizing these two expressions we can write them as,

$$0 = - b_0 + b_1.s^{12} - a_0 + a_1.s^{13}$$
$$0 = b_0/s^{12} - b_1 - c_0 + c_1.s^{23} \qquad (3.17)$$

Using the property that $s^{12}.s^{23}=s^{13}$, this system can easily be solved for s^{12}, s^{13}, that is, the two bilateral exchange rates of the country under study. From there, it is easy to work out the several effects of shocks in trade conditions with the rest of the world (changes in a_0, c_0), on the exchange rate between countries one and two. In particular, it is straightforward to obtain the following expression for s^{12},

$$s^{12} = (b_0/b_1) + (a_0.c_1.b_1 - a_1.c_0.b_0)/(D.b_1) \qquad (3.18)$$

which shows that the bilateral fundamentals, as given by the corresponding balance of payments, determine the bilateral rate, plus a second term that gathers the links to the rest of the world of both countries ($D=c_1.b_1+a_1(c_0+b_1)$). As a general rule, one can expect changes in a_0, to be of the same sign and similar size, to changes in c_0 (that is, changes that come about because of some modifications in economic conditions of the rest of the world, for example, a higher world inflation rate). Therefore, and if this holds true, there will be some compensations in the second term in (3.18). This is why it is legitimate, to a certain extent at least, to forget about the rest of the world, when modelling the exchange rate between two countries, as it is done in the next section.

IV. EMPIRICAL RESULTS.

This section presents the empirical results obtained with the two models of the preceding section. The purpose is to determine up to what point the spanish public deficit (or stock of outstanding debt), prevents this country from entering a monetary system such as the EMS. Since it is commonly believed that the leading country in th EMS is Germany, the empirical exercise is carried out by comparing spanish to german data (the basic data source is the International Financial Statistics, published by the IMF; some spanish series have been taken from the Statistical Bulletin of the Bank of Spain, and from the Statistical National Institute.).

The first results to be presented, correspond to the model 3.1-6 of the preceding section. One important remark that must be made beforehand, is that it is likely that the monetary authorities in Spain did follow an implicit band for the exchange rate, before joining the EMS in 1989, or even the EEC in 1986 (as can be inferred from the Annual Report of the Bank of Spain in those years). On the other hand, if this was true the model for the exchange rate should have the mean reversion property. A simple model was estimated first, in order to give an empirical content to the expectations in (3.5), with the following results,

$$\Delta s_t = \underset{(2.7)}{0.3}\ s_{t-1} \cdot w_{t-1} - \underset{(2.6)}{0.017}\ s^3_{t-1} \cdot w_{t-1} + \underset{(3.2)}{.4}\ \Delta s_{t-1}$$

$$T = 58(78.III\text{-}92.IV)\ ;\ R^2 = 0.23\ ;\ s.e. = 0.027\ ;\ D.W. = 1.82 \qquad (4.1)$$

where s_t is the log of the spanish/german exchange rate (ptas. per deutsche mark), and $w_t=(t/64)^2$, t=1,2,... . This weighting intends to capture the hypothesis suggested before, namely that the band for the exchange rate was introduced along time more firmly (rather than abruptly when joining the EEC or the EMS). The mean reversion property hypothesis can be accepted for large t, given that the coefficient of $s^3_{t-1} \cdot w_{t-1}$ is negative, as expected. Therefore, the expected change of the central band, whether explicit or implicit, has been defined accordingly and using (3.5), (i_t is the three month interbank spanish interest rate, i_w, the german interbank interest rate, and Δp^e_{t+1} is obtained from (4.1); the only point worth mentioning is that Δp^e_{t+1} must be multiplied by four, since i and i_w are annualized rates, and the estimation are carried out with quarterly data). Correlating this variable with spanish and german macroeconomic data leads to the following regression results,

$$\Delta c^*_{t+1} = \underset{(5.0)}{19} + \underset{(1.9)}{0.35} \log(SCP/GCP)_t + \underset{(2.3)}{1.5} \log(SP/GP)_t - \underset{(5.1)}{2.9} \log(GY)_t$$

$$T = 28(85.IV\text{-}92.III) \;;\; R^2 = 0.64 \;;\; s.e. = 0.045 \;;\; D.W. = 1.5 \qquad (4.2)$$

where SCP and GCP are spanish and german total credit to the public sector, SP, GP, are spanish and german prices, and GY is German GDP. Standard errors are corrected with the White procedure, since some tests point slightly to the possible existence of some unspecified form of heteroskedasticity, and a Lagrange test accepts the null of no first order autocorrelation. Two important results must be noted: first, the relative public deficit seems to affect the expected change of the central band, and, second, this result holds only in the last part of the sample. In sum, and despite all its shortcomings, this model indicates that the public deficit in Spain is at a dangerous level for this country to belong to a narrow band monetary zone.

The second model presented in (3.7-15), requires first the specification of a model for the pta./mark exchange rate. At this stage, it may be appropriate to follow a cointegration analysis of the type suggested by Engel and Granger (1987). The first step is to obtain a so called long run cointegration relationship. This yields the following results,

$$s_t = 213 - 0.03\ GY - 0.01\ SY + 0.3\ SP - .97\ GP + 0.6\ (i-i_w)$$
$$(15.)\ (3.5)\qquad (7.0)\qquad (21.0)\qquad (11.1)\qquad (7.1)$$

$T = 49(80.II-92.II)$; $R^2 = 0.98$: s.e. = 1.35 ; D.W. = 1.52 (4.3)

where SY is the Spanish GDP, and the remaining variables are defined as before. The sample had to be shortened slightly at he beginning, given the data availability. The hypothesis of a unit root cannot be rejected in any of the single variables (with ADF tests). On the other hand, the same test rejects the unit root hypothesis in the residuals of this last equation (-5.07 is the Mc Kinnon value at the 5% significance level, and the value of the ADF is -5.3; on the other hand, the null of no first order autocorrelation is also accepted). All variables are measured in original units, rather than in logs (a non nested test, is in favour of this specification). The residuals of this equation are also stationary in variance (that is, the variance does not follow a non-stochastic trend). This last point is important, since otherwise the coefficients of the long run regression might be biased. As for the meaning of the results, it should be pointed out that the sign of the coefficients of GY, SP, and GP is as expected, according to the current account. The sign of SY, and notably that of $i-i_w$, are in agreement with a long run equilibrium in the portfolio balance model (see section II).

Turning now to the short run dynamics, and taking into account the possible short run non linearity, the model finally obtained in a shortened sample has been the following,

$$\Delta s_t = 0.97\ \Delta sh_t - 0.074\ (\Delta sh_t)^3 - 0.7\ (s - sh)_{t-1}$$
$$\quad (3.8) \qquad (2.1) \qquad (3.7)$$

$$T = 26(86.II\text{-}92.II) \ ; \ R^2 = 0.49 \ ; \ D.W.=1.64 \ ; \ s.e. = 1.0 \qquad (4.4)$$

where sh_t is the estimated long run solution given by,

$$sh_t = 201 - 0.05\ GY_t - 0.007\ SY_t + 0.26\ SP_t - 0.75\ GP_t$$
$$\quad (4.7) \quad (3.3) \qquad (2.1) \qquad (3.6) \qquad (2.2)$$

$$+\ 0.4\ (i-i_w)_t$$
$$(2.2) \qquad (4.5)$$

that is estimated jointly with (4.4). There are several features of this model, worth pointing out: first, the long run solution is estimated jointly with the short run dynamics, which seems to be the best procedure (see, Inder,1993); second, the same short run dynamics is applied to every variable in the equilibrium solution: this helps achieve a substantial reduction in the number of parameters estimated; third, the short run non linearity suggested in the previous section is clearly significant; fourth, the short run dynamic coefficients sum up nearly to one, so that in the long run, we shall always have $s_t=sh_t$ (and this is not true otherwise, when $\Delta sh_t=k$ and distinct from zero; Alogouskofis and Smith,1991 and Salmon,1982); fifth, the short run dynamics adopts the conventional error correction mechanism specification, plus a simple non linear term; sixth, since the coefficient of $(\Delta sh_t)^3$ is negative, changes in sh_t of any sign are equally dampened (this would clearly not be true, if the coefficient of $(\Delta sh_t)^2$ was not zero).

The equation is reasonably stable over all subsamples, except for the non linear term, which becomes clearly significant precisely at the time that Spain joined the EEC (this is why, only the equation estimated over this subsample is given in the text). The equation passes conventional specification tests (notably, residual autocorrelation, heteroskedasticity of several kinds, non normality, and omitted regressors). A Ramsey non linearity test was run, adding as regressors in a second run the square and cube of the fitted variable in a first run: the test rejects further non linearities. In a short run specification of the exchange rate, there is always the possibility that expected future variables have an impact on the current value of the dependent variable. This was tested, adding, Δsh_{t+1} to the basic equation (4.4): the expected sign is positive, so that a one tail test is appropriate, and it detects a non trivial effect at the 90% level. Therefore, there are some signs pointing to the relevance of this effect, but not sufficiently clear to include this variable as a regressor in the final specification. Note also, that equating the expected future vaulue of s_{t+1} to its long run value in t+1 is not equivalent to fully short run rational expectations, but implies long run rationality (see comment fourth, below 4.5). This does not seem unreasonable, and on the other hand, does not suffer from one of the basic problems of an adaptive expectations scheme, namely, that the expected variable never catches up with the actual current value of the original variable, if this last one is permanently changing.

The main conclusion of this section, as far as the question addressed in this paper is concerned, is that there is a long run well identified empirically and positive link between the exchange rate and the interest rate differential (a higher domestic interest rate, implying a depreciation). This is consistent with both models presented in section II (although in the portfolio balance model, there is a switch in the sign of the short run effect). Therefore, whether we think of the public debt as net private wealth or not, there is a significant long run link between public debt and the exchange rate: in the first case, the higher public deficit will induce a long run depreciation, and in the second, and under certain circumstances, an appreciation. But whatever the sign, the link is empirically relevant, and that is what counts for the question at hand.

V. CONCLUSIONS.

The models presented in section II, establish a long run, or equilibrium, link between the public expenditure and the exchange rate (in a flexible exchange rate model). This link, establishes in both models a positive relationship between the interest rate and the exchange rate (measured in domestic per foreign units). Whether an expansion of the public expenditure will finally appreciate or depreciate the exchange rate, depends on whether the public debt is considered as net real wealth of the private sector, or not: in the first case it will work its way through lower interest rates, and in the second it will mean higher nominal interest rates. Section III considers the implications of these models for the long run stability of the central band in a target zone model. Section IV presents empirical results for both models. The first has also been estimated for other countries, but it is too demanding with respect to the thoretical assumptions (Craig,1991, Lindberg et. al.,1991). Therefore, another less stringent model has also been estimated. In both cases, however, a positive and sizeable link between interest and exchange rates has been found. Therefore, the link between the public deficit and the central band of a target zone model is established for the spanish case. This means that, spanish membership to a monetary system with narrow bands for exchange rates, such as the EMS, might be endangered by the size of its public debt outstanding (as measured by the total credit to the public sector). Since the public debt condition, is the only Maastricht requirement met by Spain, the results of this paper are more siginificant.

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