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Red Signals: Current Account Deficits and Sustainability

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Red Signals: Trade Deficits and the Current Account

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Abstract

This paper proposes a method to asses the potential problems of sustainability of a country's sovereign debt. We claim that the relevant variables used for this analysis are typically subject to changes which are associated with changes in macroeconomics policies. We propose a procedure for identifying periods under which the trade deficit and the current account accumulate at a nonstationary rate. Our approach is based on imposing identifying restrictions on Markov switching type models. An empirical application of the procedure to UK data is examined and discussed. We find that periods of nonstationary trade deficit typically precede a current account crisis.

Keywords: Deficits Sustainability; Markov Switching ADF.

JEL Classification: C22; E31; G12.

1 Introduction

The persistence of a country trade deficit has been the focus of study of many academics and a main concern for policy makers. A possible view is that trade deficits are to, some extent, irrelevant since they only represent the ability of a country to borrow from abroad (countries with more developed capital markets are more likely to be able to borrow).

The crucial question, however, is whether accumulating debt over time (as a results of the existence of the trade deficits) is sustainable. Different tests have been developed to provide an answer to this question. These tests basically assume as 'given' the rate of growth of the economy (and the pattern for the trade balance), thus implicitly implying that the economy will continue to evolve as it did in the past. For example, Taylor (2002) has argued that for the debt to be sustainable the current account has to be mean reverting.[1] He proposes to first test for such a possibility and then enquire how fast the economy adjusts to its long run equilibrium, with the speed of adjustment being interpreted as a measure of capital mobility. These tests (see Taylor (2002) for a survey) typically provide us with a dichotomous answer: they do (or do not) reject sustainability.

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[1]This result is implied by the long run solution of any model which includes an intertemporal budget constraint.

This paper proposes an alternative and complementary procedure. Our approach is motivated by the fact that the stochastic properties of the variables in question are typically subject to breaks which are a reflection of the policy changes taking place over the sample.

We start by noticing that the current account can be described as a unit root process if the trade balance is either I(1) or I(0) but it accumulates at an explosive rate.[2] Specifically, we propose to identify periods under which: i) the long-run relationship between imports and exports is 'switched off' (and the deficits accumulate at a nonstationary rate), ii) the current account is non stationary (which may be due to trade balances being non stationary or be triggered by other economic variables such as an increase in the level of the interest rate). Since, therefore, the problem is essentially one of distiguishing the stationary periods from the nonstationary ones we propose the use of switching error correction (ECM) and switching augmented Dickey Fuller (ADF) type models as in Hall et al. 1997, 1999. In our application, we impose identifying restrictions which characterize a state as associated with periods where the debt accumulates at a non-stationary rate, and the other state as associated with periods under which the current account appears to be consistent with its long run value (for either a debtor or a creditor country).

A nice feature of our analysis is that it can accommodate situations when the economy may depart for several sub-periods from the equilibrium at a non-stationary rate, even though the debt might be sustainable (in the long run). Visual inspection based on filters probabilities is used to select periods where a change in policy is required for the economy not to enter in an unsustainable path. Finally, we are able to identify periods of higher and lower capital mobility and, as a by-product, to obtain more accurate estimates of the speed of adjustment towards the long run equilibrium.

1.1 A Simple Sustainability Condition

Consider an economy which growths at a rate g_t, with $E(g_t) = g$, where the nominal interest rate is r_t, with $E(r_t) = r$. Also, $b_t = \frac{B_t}{y_t}$ denotes the level of real debt, where y_t is the output and $z_t = b_t - b_{t-1}$ is the current account. A country external balance constraint can be written as

$$b_t = i_t b_{t-1} + m_t - x_t, \tag{1}$$

where $x_t = \frac{X_t}{y_t}$ are the exports as a percentage of output, $m_t = \frac{M_t}{y_t}$ are the imports as a percentage of output and $i_t = \frac{1+r_t}{1+g_t}$. Solving forward equation (1), we obtain the following expression for the level of debt:

$$b_{t-1} = -\sum_{j=0}^{\infty} i^{-(j+1)} E_{t-1}(x_{t+j} - m_{t+j}) + \lim i^{-(j+1)} E_{t-1} b_{t+j}. \tag{2}$$

Taylor (2002) has shown that a sufficient condition for the intertemporal national long run budget constraint (LRBC) to hold (when $\lim i^{-(j+1)} E_{t-1} b_{t+j} = 0$) is that i_t has to be a stochastic process strictly bounded from below by $\delta > 0$ in expected value and that $z_t = b_t - b_{t-1}$ has to be stationary.

Taylor (2002) also inquires about the speed of adjustment towards the long run equilibrium (which is interpreted as the degree of the capital mobility) using the following regression

$$\Delta z_t = \alpha + \beta z_{t-1} + \sigma u_t, \tag{3}$$

and studies the rate of convergence through an analysis of the estimated parameters.

[2] In the latter case, exports and imports (defined as a percentage of income) cointegrate.

From equation (1) it is important to notice that b_t is I(1) whenever $x_t - m_t$ is I(1). As a result, we speculate that sub-period associated with nonstationary behaviour in the trade balance can be regarded as a red signal: the longer the economy experiences explosive deficits the less likely it will be sustainable. The econometric methodology proposed in this paper will allow us to distinguish between periods which are associated with unsustainable outcomes from those where the LRBC condition holds. Furthermore an answer to the dichotomous question of sustainability can be obtained by checking global stationarity conditions of the estimated model.

2 The Econometric Model

In the proceeding we introduce a multivariate Markov ECM for exports and imports and a switching ADF model of the current account. Both models are reparametrized so that one state of nature can be associated with unsustainability of the LRBC. The estimated probabilities of being in such a regime will then be used to identify periods which could trigger the LRBC condition over time.

2.1 A Switching Error Correction Approach

Consider the following simple model for the I(1) bivariate time series $\{(m_t, x_t)^{\prime} : t = 1, 2, \ldots\}$,

$$\begin{aligned} x_t + \beta m_t &= u_t, \qquad u_t = \mu_u + u_{t-1} + \eta_{1t}, \\ x_t + \alpha m_t &= e_t, \qquad e_t = [\mu_{e0}(1-s_t) + \mu_{e1}s_t] + [\rho(1-s_t) + s_t]e_{t-1} + [\sigma_{e0}(1-s_t) + \sigma_{e1}s_t]\eta_{2t}, \end{aligned} \tag{4}$$

where $\alpha \neq 0$, $\beta \in \mathsf{R}$, $|\rho| < 1$, $\{\boldsymbol{\eta}_t = (\eta_{1t}, \eta_{2t})^{\prime}\}$ is a white-noise process with zero mean and positive-definite covariance matrix Σ, $\{s_t\}$ indicates the state (or regime) that the system is in at date t and it is an homogeneous, irreducible, and aperiodic Markov chain of order 1 with state space $\mathsf{S} = \{0, 1\}$ and transition probabilities $p_{ij} = \Pr\{s_t = j | s_{t-1} = i\}$, $i, j \in \mathsf{S}$, which are independent of $\{\boldsymbol{\eta}_t\}$. Hence, the time series $\{e_t\}$ satisfies a model which allows the dynamic behavior of the series to be governed by either a stable first-order stochastic difference equation or a random walk scheme, depending on the realized value of the state indicator s_t. Consequently, the system in (4) defines a cointegrated system where adjustment towards the long-run equilibrium determined by $x + \alpha m = 0$ does not necessarily takes place at each date t but only during periods that are associated with one of the two regimes [cf. Hall et al. (1997) and Psaradakis et.al. (2002)]. Deviations from equilibrium tend to decay to the mean level as long as $s_t = 0$; otherwise, e_t behaves like a nonstationary process, and there is no tendency for the system in to move towards equilibrium.

An alternative characterization of such state-dependent behavior may be given in terms of the error-correction representation of the system in (4). The latter can be written as

$$\begin{aligned} \Delta x_t &= [\mu_{\Delta x0}(1-s_t) + \mu_{\Delta x1}s_t] - \gamma_{\Delta x}(1-s_t)e_{t-1} + [\sigma_{\Delta x0}(1-s_t) + \sigma_{\Delta x1}s_t]\varepsilon_{1t}, \\ \Delta m_t &= [\mu_{\Delta m0}(1-s_t) + \mu_{\Delta m1}s_t] + \gamma_{\Delta m}(1-s_t)e_{t-1} + [\sigma_{\Delta m0}(1-s_t) + \sigma_{\Delta m1}s_t]\varepsilon_{2t}, \end{aligned} \tag{5}$$

where $\mu_{\Delta xi} = \delta(\alpha\mu_u - \beta\mu_{ei})$, $\gamma_{\Delta x} = \delta\beta(1-\rho)$, $\sigma_{\Delta xi}\varepsilon_{1t} = \delta(\alpha\eta_{1t} - \beta\sigma_{ei}\eta_{2t})$, $\mu_{\Delta mi} = \delta(\mu_{ei} - \mu_u)$, $\gamma_{\Delta m} = \delta(1-\rho)$, $\sigma_{\Delta mi}\varepsilon_{2t} = \delta(\sigma_{ei}\eta_{2t} - \eta_{1t})$, and $\delta = (\alpha - \beta)^{-1}$, for $i = 0, 1$. In (5), $e_{t-1} = x_{t-1} + \alpha m_{t-1}$ represents the deviation from the long-run equilibrium at date $t-1$, while the coefficients on e_{t-1} measure the strength of short-run disequilibrium adjustment. Clearly, correction for past disequilibrium only takes place when $s_t = 0$.

At this point, some remarks on the properties of the 'equilibrium error' $\{e_t\}$ are in order. It is clear from the Markov specification in (4) that $\{e_t\}$ is 'locally' nonstationary in the state characterized by

$s_t = 1$. However, second-order stationarity of an autoregressive process with Markov regimes does not require the characteristic polynomial of the process to have all its zeros lying on the open unit disk.[3] Hence, despite the occasional nonstationary behavior of $\{e_t\}$ (when $s_t = 1$), the equilibrium error can be 'globally' stationary, provided that p_{00}, p_{11}, and ρ satisfy appropriate restrictions. For the equilibrium error $\{e_t\}$ that evolves according to (4), a necessary and sufficient condition for second-order stationarity is that (Francq and Zakoïan, 2001)

$$p_{00}\rho^2 + p_{11} + (1 - p_{00} - p_{11})\rho^2 < 1, \qquad p_{00}\rho^2 + p_{11} < 2. \tag{6}$$

It can be easily verified that, for an irreducible and aperiodic Markov chain $\{s_t\}$, the conditions in (6) are always satisfied when $|\rho| < 1$. It follows, of course, that our characterization of the model implies that cointegration between x_t and m_t is a global property that is guaranteed by the second-order stationarity of the equilibrium error $\{e_t\}$. Yet, as long as $s_t = 1$, x_t and m_t do not respond to deviations from the long-run equilibrium.

2.2 A Switching Augmented Dickey Fuller Approach

Consider the following model for the current account, z_t:

$$\Delta z_t = [\mu_{\Delta z0}(1 - s_t') + \mu_{\Delta z1} s_t'] + \lambda(1 - s_t') z_{t-1} + [\sigma_{\Delta z0}(1 - s_t') + \sigma_{\Delta z1} s_t']\zeta_t, \tag{7}$$

where $-2 < \lambda < 0$ and $\{s_t'\}$ is a state indicator, independent of $\{\zeta_t\}$, with state space $\mathsf{S}' = \{0, 1\}$ and transition probabilities $q_{ij} = \Pr\{s_t' = j | s_{t-1}' = i\}$, $i, j \in \mathsf{S}'$. Thus, from (7), the current account follows a Markov switching autoregressive process which is mean-reverting in one state of nature and nonstationary in the other. Note that necessary and sufficient condition for second-order stationarity in (7) are equivalent to those defined in (6) with $\rho = \lambda + 1$, $p_{00} = q_{00}$ and $p_{11} = q_{11}$.

3 Empirical Results

The data set used for our empirical analysis consists of 127 quarterly observations on real imports, real exports and real current account for United Kingdom over the period 1970:1 - 2001:3. All the time series are found to be integrated of order one at 1% significance level. More specifically, the standard ADF test yields -3.460 for imports, -2.894 for exports, -3.364 for the trade balance and -2.715 for current account, when lag lengths are selected using the AIC criterion. We also compute the trace test statistic of Johansen which takes the value of 20.614, thus rejecting the hypothesis of no cointegration between imports and exports at 5% significance level. Clearly all the results, being on the margin of significance, do not seem to provide a strong basis for a sustainability analysis. Nevertheless, a more clear cut picture will emerge once we turn to the results obtained by using the approach discussed in the previous section.

Having established the 'global' characteristics of the series, we now focus on their 'local' behavior by estimating the nonlinear models discussed in the previous section. In Tables 1, we report maximum likelihood (ML) estimates (based on the Gaussian likelihood) and associated asymptotic standard errors of the parameters of the system in (5). The estimated adjustment coefficients are of the correct signs and imply that the error correction model for imports is characterized by a faster disequilibrium

[3] As a matter of fact, stationarity within each regime is generally neither necessary nor sufficient for the second-order stationarity of a Markov switching autoregressive process (see Francq and Zakoïan, 2001).

adjustment. Turning to the Markov switching ADF equation (7), the estimated parameters show significant evidence of shifts between regimes, as reported in Table 2.

The inferred probabilities that the system (5) is in the unsustainable regime at each date in the sample and based on currently available information, are shown in Figure 1, together with a time plot of the equilibrium error e_t. The unstable regime is clearly associated with the periods 1972:4–1974:2 and 1979:1–1979:2. The first period is characterized by a highly expansionary budget with the objective of reducing unemployment which reached his historical high in 1972) and the first oil crises of 1973 while the latter pick out the 'winter of discontent' (strike of the public sector and increasingly high inflation). The expected time of remaining in the unsustainable regime is found to be 3.8 quarters while the estimated unconditional probability of an unsustainable trade balance is 0.1. As it will be clear in the remaining, the period of time that the economy remains in a trade balance explosive path are crucial to asses the sustainability of the current account.

A different picture emerges from Figure 2, which shows the inferred probabilities that LRBC is unsustainable based on equation (7).[4] The unstable regime is associated with the periods 1974:1–1974:4 and 1988:1-1990:2 (associated with the increase of the interest rate of the late eighties).

Comparing the results from both models, it is clear that periods associated with a unit root behaviour in the trade balance (during the early 70's) precedes a nonstationary behaviour in the current account. This result clearly gives an indication (a red signal) that the continuing deficits could trigger a sustainability problem for the LRBC. On the other hand the very short periods of trade deficits (during the late 70's) do not seem to be large enough to trigger a crisis. Interestingly, the current account crisis of the late 80 is a synchronous combination of a period of I(0) trade deficit with a period of very high interest rates. The results also suggest that prolonged periods of unstable trade balances can be regarded as a good predictor of current account crises in the future.

Another interesting finding is that the current account crisis of the early 70's took place when the interest rates were very low, thus implying that the country needed to borrow a considerable amount from abroad (and therefore it can be thought as being a period of high capital mobility). On the other hand, periods associated with a high level of the interest rate (during the late 80's) contributed to the deterioration of the current account and did not necessarily represent periods of high capital mobility.[5] Finally, the results suggest that the periods when the trade balance are unsustainable are better proxies for periods of high capital mobility.

4 Summary

This paper has proposed an alternative way to asses the question of sustainability of a country debt. We use a multivariate Markov switching ECM and a Markov switching ADF model to identify periods under which the deficits and the current account accumulate at a nonstationary manner. The potential applicability of the proposed procedure has been illustrated through an analysis of UK data. We have found that evidence of unstable behaviour in trade balances is usually followed by nonstationary behaviour in the current account. We claim that those periods are a good proxy of a high degree of capital mobility.

[4] Note that despite the fact that one regime has being restricted to be I(1), the model satisfy (satisfies) the global stationarity conditions stated in (6).

[5] This result is consistent with the fact that the trade deficits are not explosive for this period of time.

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Table 1. Estimates (Standard Errors) of Eq. (5)

$\mu_{\Delta x0}$	-0.0594	(0.0393)
$\mu_{\Delta x1}$	0.1179	(0.3061)
$\gamma_{\Delta x}$	-0.0712	(0.0469)
$\sigma^2_{\Delta x0}$	0.0314	(0.0052)
$\sigma^2_{\Delta x1}$	0.1600	(0.1678)
$\mu_{\Delta m0}$	0.0503	(0.0421)
$\mu_{\Delta m1}$	0.2736	(0.2654)
$\gamma_{\Delta m}$	0.0988	(0.0458)
$\sigma^2_{\Delta m0}$	0.0491	(0.0073)
$\sigma^2_{\Delta m1}$	0.0839	(0.0659)
$\sigma_{\Delta x0,\Delta m0}$	0.0233	(0.0056)
$\sigma_{\Delta x1,\Delta m1}$	0.0552	(0.0671)
p_{00}	0.7374	(0.2746)
p_{11}	0.9720	(0.0373)
LogL	279.5424	

Table 2. Estimates (Standard Errors) of Eq. (7)

$\mu_{\Delta z0}$	0.0040	(0.0466)
$\mu_{\Delta z1}$	-0.1012	(0.0504)
λ	-0.4600	(0.1741)
$\sigma^2_{\Delta z0}$	0.2403	(0.0382)
$\sigma^2_{\Delta z1}$	0.2268	(0.0320)
q_{00}	0.8636	(0.1864)
q_{11}	0.8079	(0.1517)
LogL	-4.2208	

Probabilities of the Non-correcting State

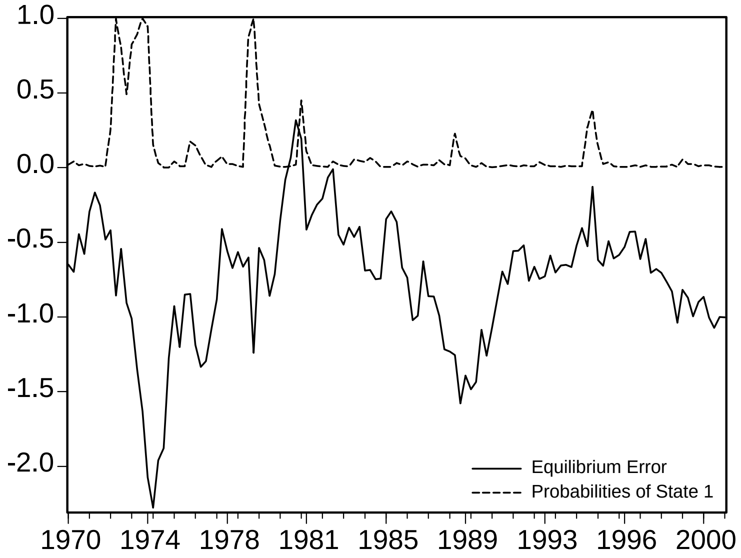

Figure 1

Figure 1:

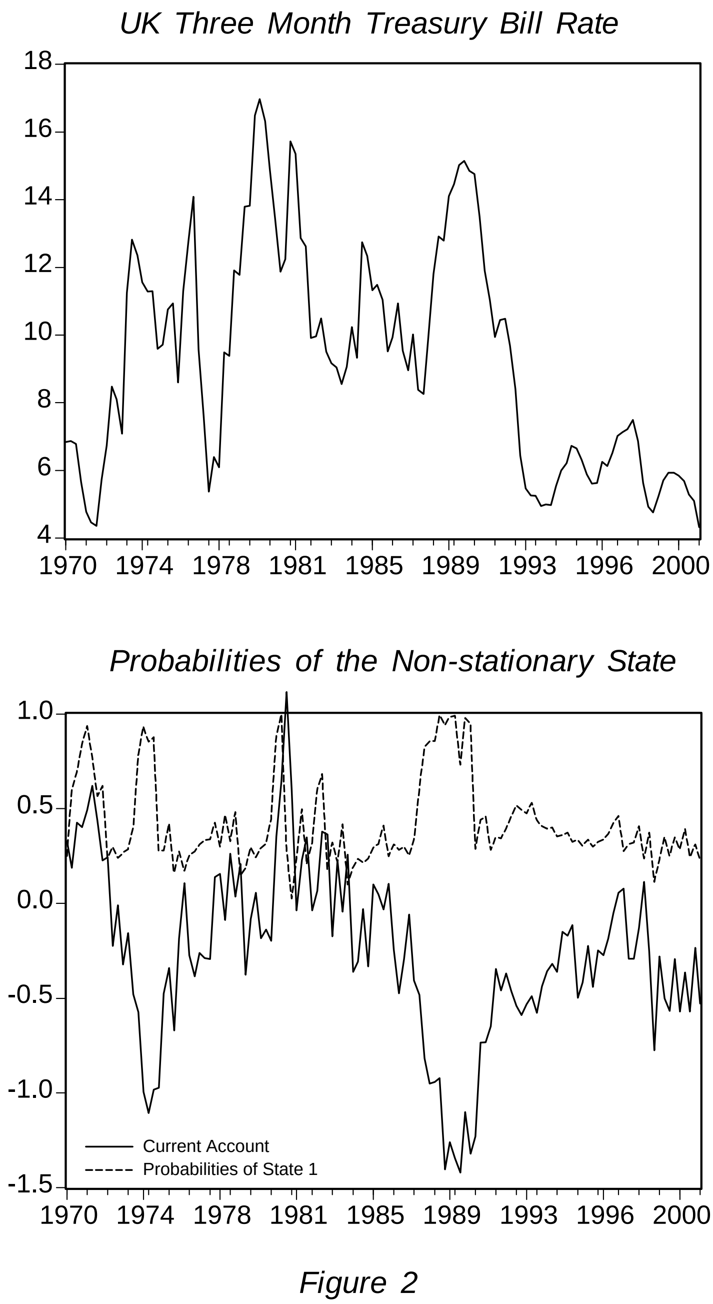
UK Three Month Treasury Bill Rate
18
16
14
12
10
8
6
4
1970 1974 1978 1981 1985 1989 1993 1996 2000
Probabilities of the Non-stationary State
1.0
0.5
0.0
-0.5
-1.0
-1.5
Current Account
Probabilities of State 1
1970 1974 1978 1981 1985 1989 1993 1996 2000
Figure 2

Figure 2: