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 non-stationary 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 non-stationary trade deficits typically coincide with current account crises.

Keywords: Deficits Sustainability; Markov Switching ADF.
JEL Classification: C22; E31; G12.

1 Introduction

The persistence of trade deficits has been a focus of study for many academics and has been a main concern for policy makers. One 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 implying that the economy will continue to evolve as it did in the past. For example, Trehan and Walsh (1988, 1991) and Taylor (2002) have argued that for the debt to be sustainable the current account has to be mean reverting. These types of tests (see Trehan and Walsh (1991) for a survey) typically provide a dichotomous answer: they do (or do not) reject sustainability.

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

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We start by noticing that the current account can be described as a unit root process if trade deficits either are I(1) or are I(0) and do accumulate at an non-stationary rate. Specifically, we propose to identify periods under which: *i*) trade deficits accumulate at a non-stationary rate and *ii*) the current account is non stationary (which may be due to trade deficits being non stationary or be triggered by other economic variables such as an increase in the level of the interest rate). Since the problem is essentially one of distinguishing the stationary periods from the non-stationary ones, we propose the use of a switching augmented Dickey Fuller (ADF) model as in Hall et al. (1999). In our application, we impose identifying restrictions which characterize a state as associated with periods where the current account is non-stationary, and the other state as associated with periods under which it is stationary and therefore appears to be consistent with the long-run budget constraint.

A nice feature of our analysis is that it can accommodate situations when the economy may depart for several sub-periods from the sustainable path even though the debt might be sustainable (in the long-run). Visual inspection based on filters probabilities is used to select periods during which a change in policy is required for the economy not to enter into an unsustainable path.

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, $b_t = \dfrac{B_t}{y_t}$ denotes the level of real debt, where y_t denotes output and $b_t - b_{t-1}$ is the current account. A country's external balance constraint can be written as

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

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

$$b_{t-1} = -\sum_{j=0}^{\infty} E({}_t\rho_{t+j}^{-1}(x_{t+j} - m_{t+j})|I_{t-1}) + \lim_{j\to\infty} E({}_t\rho_{t+j}^{-1} b_{t+j}|I_{t-1}),. \tag{2}$$

where ${}_t\rho_{t+j} = \prod_{\nu=0}^{j} i_{t+\nu}$.

Threhan and Walsh (1988 and 1991) have shown that a sufficient condition for the intertemporal national long-run budget constraint (LRBC) to hold (when $\lim_{j\to\infty} E({}_t\rho_{t+j}^{-1} b_{t+j}|I_{t-1}) = 0$) is that i_t is a stochastic process strictly bounded from below by $\delta > 0$ in expected value and that $b_t - b_{t-1}$ is stationary.

This condition can be easily derived by noticing that if $b_t - b_{t-1}$ is stationary, it has a moving average representation

$$b_t - b_{t-1} = \delta + \psi(L)\varepsilon_t,$$

which can be written (doing a Beveridge and Nelson decomposition) as

$$b_{t+j} = b_{t-1} + (j+1)\delta + \psi(1)(\varepsilon_t + \varepsilon_{t+1} + ...\varepsilon_{t+j}) + \eta_{t+j} - \eta_{t-1}, \tag{3}$$

were η_t is a stationary process. Then it is clear from equation (3) that b_t has a unit root and a trend component. On the other hand ρ_t^{t+j} is explosive since ${}_t\rho_{t+j} = i_{t+j}\,{}_t\rho_{t+j-1}$ and $i_t > 1$ if the economy is not dynamically inefficient. Then it follows that whenever $b_t - b_{t-1} = (i_t - 1)b_{t-1} + m_t - x_t$ is

I(0), the transversality conditions holds, i.e., $\lim_{j\to\infty} E({}_t\rho_{t+j}^{-1} b_{t+j}|I_{t-1}) = 0$, since $\{b_{t+j}\}$ is of smaller order than $\{{}_t\rho_{t+j}\}$.

Notice as well that for $b_t - b_{t-1}$ to be I(0) it requires either that (i) $(i_t - 1)b_{t-1}$ and $m_t - x_t$ to be I(0) or (ii) that both series should be I(1) and that those series should cointegrate. This case deserves a closer look since, for debtor countries, the service of the debt has to be paid with trade surpluses. In other words, the service of the debt should cointegrate with $x_t - m_t$. Then, we can assume that whenever we observe a unit root in the trade 'deficit' would in turn result in a violation of the sustainability condition (since the interest rates are bounded from below and (ii) would not hold).

Another interesting case arise when violations of the sustainability condition come as a result of situations in which the trade deficit is stationary but $(i_t - 1)b_{t-1}$ is I(1). This can arise when, even though trade deficits are stationary, they are accumulated at a high enough rate (this will result in an I(0) trade deficit and an I(1) current account).[1]

To summarize, whenever the current account is I(0) the LRBC will hold, and when it is I(1) it won't. On the other hand, the trade balance being I(0) is not sufficient for the LRBC to hold, but the trade 'deficit' being I(1) is sufficient for the condition to not hold. Therefore, we treat the order of integration of trade deficits as an informative signal since, even though the information contained in the current account is sufficient to determine whether the LRBC is sustainable, the additional information given by the trade balance may hint at the possible solution to the eventual crisis.[2]

We also think that, given that the LRBC is a long-run condition, it is possible that countries may face debt problems for periods when the long-run sustainability condition holds. Therefore, we want to explore the situation in which countries might satisfy the LRBC condition, but do face big enough short run imbalances which might evolve into future violations of the LRBC, i.e., situations in which the long-run condition is satisfied but the existence of temporary deviations from this condition may provide a red signal that might be informative to assess whether a country is likely to face future debt problems.[3]

Therefore, we propose to identify in the sample sub-periods during which the current account (and the trade balance) seem to be non-stationary and treat these periods as a red signal: The longer the economy stays in those periods, the more likely that the LRBC will be violated.[4] The econometric methodology proposed in this paper allows us to distinguish periods which are associated with unsustainable outcomes from those in which the LRBC condition holds. Furthermore, an answer to the dichotomous question of sustainability can be obtained by checking the global stationarity conditions of the estimated model.

[1] This possibility only arises when we consider time-varying interest rates.

[2] The reasons why a country may face a LRBC potential inconsistencies are clearly country specific and any attempt to explain possible policy remedies is outside the scope of this note. Nevertheless, we speculate that the complementary information might be used in the following manner: for example, a country that faces non-stationary trade deficits may attempt a (real) devaluation of the currency, while a country that has no 'chronic' trade problems and high service of the debt may attempt to improve the conditions of the service of the debt. Many developing countries (such as Argentina) did face both types of problems. Unfortunately, the quality of the data of those countries is not suitable for the methodology proposed in this paper.

[3] The converse can also be true. Statistical violations of the sustainability condition for the whole sample may arise from sporadic deviations which make the tests to lose power to reject the unit root hypothesis (the violation of the LRBC).

[4] In terms of our econometric methodology, the more persistent is the regime where the current account is I(1) (and less persistent regime where it is I(0)), the less likely it is that the LRBC will hold.

2 The Econometric Model

In the proceeding section we introduce a switching ADF model of the current account, $b_t - b_{t-1}$, and the trade balance, $x_t - m_t$. We reparametrize the model 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 unsustainability of the LRBC condition over time.

2.1 A Switching Augmented Dickey Fuller

Consider the following simple model for the time series $\{(z_t)^\intercal : t = 1, 2, \ldots\}$:

$$\Delta z_t = [\mu_0(1 - s_t) + \mu_1 s_t] + \lambda(1 - s_t)z_{t-1} + \sigma\eta_t, \tag{4}$$

where $-2 < \lambda < 0$, η_t is a white-noise process, and $\{s_t\}$ indicates the state (or regime) that the system is in at date t. $\{s_t\}$ is a homogeneous, irreducible, and aperiodic Markov chain of order 1 with state space $\mathbb{S} = \{0, 1\}$ and transition probabilities $p_{ij} = \Pr\{s_t = j | s_{t-1} = i\}$, $i, j \in \mathbb{S}$, which are independent of $\{\eta_t\}$. Hence, the time series $\{z_t\}$ satisfies a model which allows the dynamic behavior of the series to be governed by either a stable first-order stochastic difference equation, when $s_t = 0$, or by a random walk scheme, when $s_t = 1$. More specifically, although the underlying state variable that dictates the changes in regime are unobservable, the likelihood of each of the possible regimes being operable at each sample observation can be inferred on the basis of the estimated filter probabilities $P(s_t = \ell | \mathbf{w}_1, \ldots, \mathbf{w}_t; \widehat{\boldsymbol{\theta}})$, $\ell = 0, 1$, where $\mathbf{w}_t' = [\Delta z_t' : z_{t-1}]$ and $\widehat{\boldsymbol{\theta}}$ is an estimator of the unknown parameters in (4). Thus, we can evaluate the extent to which changes in the order of integration have actually occurred and identify the location of such changes in the sample.

In subsequent analysis, the parameters of the Markov switching model in (4) are estimated by the method of maximum likelihood (ML), assuming that the conditional probability density function of Δz_t given $\{\mathbf{w}_{t-1}, \ldots, \mathbf{w}_1, s_t, s_{t-1}, \ldots, s_0\}$ is Gaussian. The conditional likelihood function is evaluated by using an iterative filtering algorithm similar to the one discussed in Hamilton (1994, ch. 22). The ML estimates are then found by a quasi-Newton optimization algorithm that uses the Broyden–Fletcher–Goldfarb–Shano secant update to the Hessian.

At this point, some remarks on the properties of the time series $\{z_t\}$ are in order. It is clear from the Markov specification in (4) that $\{z_t\}$ is 'locally' non-stationary 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.[5] Hence, despite its occasional non-stationary behavior, $\{z_t\}$ (when $s_t = 1$) can be 'globally' stationary, provided that p_{00}, p_{11}, and $\rho = 1 + \lambda$ satisfy appropriate restrictions. For the time series $\{z_t\}$ that evolves according to (4), a necessary and sufficient condition for second-order stationarity is that (Francq and Zakoïan, 2001)[6]

$$p_{00}\rho^2 + p_{11} + (1 - p_{00} - p_{11})\rho^2 < 1, \qquad p_{00}\rho^2 + p_{11} < 2. \tag{5}$$

[5] 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).

[6] It follows 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 $\{y_t = x_t - m_t\}$.[cf. Psaradakis et.al. (2003)].

3 Empirical Results

The data set used for our empirical analysis consists of 132 quarterly observations on real current account and trade balance for Japan, the UK, and the USA over the period 1970:1 - 2002:4. Table 1 shows that the ADF tests do not reject the hypothesis that all the time series are integrated of order one at a 5% significance level (with the only exception being the UK trade balance, where the unit root hypothesis is rejected at the conventional 5%). On the other hand, the KPSS tests show that for UK the null of stationarity cannot be rejected for both the current account and the trade balance (using the AIC criterion to select lag lengths). Therefore, using standard unit root tests not only we find conflicting results for the UK current account, but also we face clear problems of interpretation of the results for Japan. This is because the non rejection of the unit root hypothesis (or the rejection of the stationary hypothesis when using the KPSS) seems to be due to apparent increasing current account surpluses, which can hardly be associated with 'debt' sustainability problems. Given the well known fragility of the standard unit root tests and the potential interpretation problems mentioned above, we argue that these results do not seem to provide a strong basis for a LRBC sustainability analysis and that 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 Table 2 we report maximum likelihood (ML) estimates (based on the Gaussian likelihood) and associated asymptotic standard errors of the parameters of the Markov switching ADF equation (4) for the current account and trade balance series. The estimated adjustment coefficients are of the correct signs and show significant evidence of shifts between regimes.[7]

The inferred probabilities, $P(s_t = 1|\mathbf{w}_1, \ldots, \mathbf{w}_t; \widehat{\boldsymbol{\theta}})$, that the equation (4) is in the unsustainable regime at each date are shown in Figure 1, together with a time plot of the time series under analysis.

Starting with Japan, the unstable regime is associated with much of the years 1973 and 1979 for both the trade balance and the current account. The former period is characterized by the first oil crisis while the latter unstable period coincides with the second oil price shock. After those periods, both the current account and the trade balance seem to behave as I(0) variables, which seems to imply that the LRBC should hold. Also notice that, for the current account, the expected time that the economy remains in a stable regime is 50 quarters while the expected time it remains in the unstable regime is 4 quarters We find that the periods where the trade balance is unsustainable are typically associated with those of unsustainability of the current account.

Turning to the UK and based on the current account, the unstable regime is associated with the periods 1973-1974, and 1987-1989. In the first period the UK pursued a highly expansionary budget policy and was also hit by the first oil crisis, while the second period is associated with the Lawson boom during which UK was growing faster than most of its trading partners. We find that the expected time of remaining in the unsustainable regime is 4.5 quarters while the estimated expected time of remaining in the sustainable regime is around 6 quarters. At the end of the sample, the current account seems to be stationary (despite the existence of considerable stationary trade deficits), and this seems to imply that the LRBC condition appears to hold.

Finally the filter probabilities for the USA current account associates the unstable regime with two periods 1983-1987 and 1993-2002. The former period of instability was mainly caused by a unstable trade deficits.which were probably caused by the strength of the dollar.In the period 1993-

[7] Note that all the results satisfy the global stationarity conditon outlined in eq. (5),

2002 the strong US economic growth relative to foreign trading partners might have been a key factor in the growth of US trade and current deficits. Our results show that the expected time to remain in a sustainable regime it is around 21 quarters while the expected time to remain in a unsustainable regime is 29 quarters. Unlike the other countries under scrutiny, the observations at the end of the sample are characterized as an unsustainable period and it should definitely be interpreted as a red signal, i.e., there should be a change in the pattern of the trade balance (and therefore in the current account) or otherwise the LRBC would not be satisfied.

4 Summary

This paper has proposed an alternative way to asses the question of sustainability of a country's debt. We use a Markov switching ADF model to identify periods under which the trade deficits and the current account accumulate in a non-stationary manner. The potential applicability of the proposed procedure has been illustrated through an analysis of Japanese, UK and USA data. We have found that evidence against the LRBC might be attributed to the effect of short run deviations on the statistical properties of unit roots test and that the condition seems to hold on average, even though the results for USA are more contentious. We also find that unstable behavior in trade balances is usually associated with the non-stationary behavior of the current account.

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Table 1. ADF and KPSS tests.

	Japan		UK		USA	
	C.A.	T.B.	C.A.	T.B.	C.A.	T.B.
ADF	−1.837	−2.390	−2.758	−3.089	−0.697	−0.784
KPSS	4.341	1.244	0.516	0.110	1.551	2.226

Note: 1% (5%) ADF C.V. = −3.483 (−2.884) and 1% (5%) KPSS C.V. = 0.739 (0.463).

Table 2. Estimates (Standard Errors) of Eq. (4)

	Japan		UK		USA	
	C.A.	T.B.	C.A.	T.B.	C.A.	T.B.
μ_0	0.0790	0.0927	−0.0976	−0.3696	−0.0337	−0.1759
	(0.0159)	(0.0195)	(0.0419)	(0.0993)	(0.2204)	(0.1145)
μ_1	−0.1835	−0.1834	0.0048	−0.0199	−0.2800	−0.3716
	(0.0435)	(0.0474)	(0.0391)	(0.0366)	(0.0929)	(0.2142)
λ	−0.1206	−0.1637	−0.4498	−0.5403	−0.1271	−0.0863
	(0.0268)	(0.0352)	(0.1132)	(0.1209)	(0.0565)	(0.0231)
σ^2	0.0946	0.1179	0.2259	0.2174	0.8466	0.8096
	(0.0060)	(0.0076)	(0.0158)	(0.0155)	(0.0861)	(0.0600)
p_{00}	0.9804	0.9762	0.8388	0.7266	0.9487	0.9519
	(0.0110)	(0.0180)	(0.1367)	(0.2331)	(0.0425)	(0.1101)
p_{11}	0.7948	0.7619	0.7893	0.7605	0.9641	0.9652
	(0.1101)	(0.1519)	(0.1312)	(0.1322)	(0.0217)	(0.0236)
LogL	109.444	81.682	−0.724	2.217	−169.672	−160.549

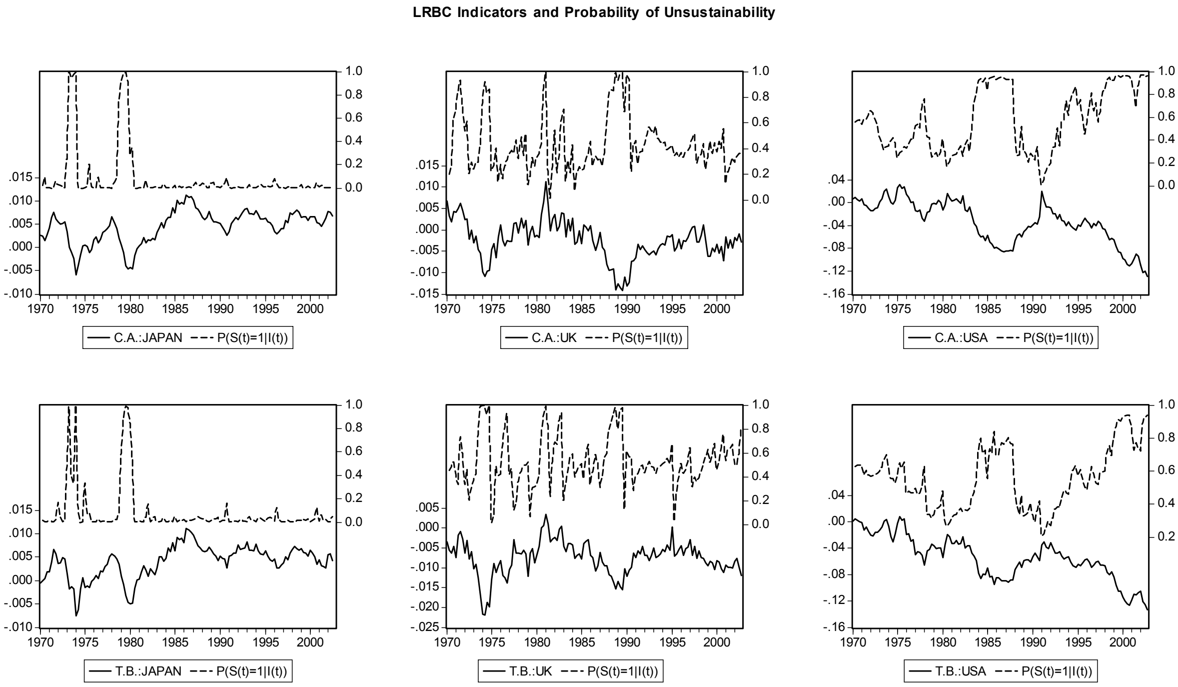
LRBC Indicators and Probability of Unsustainability
C.A.:JAPAN
P(S(t)=1|I(t))
C.A.:UK
P(S(t)=1|I(t))
C.A.:USA
P(S(t)=1|I(t))
T.B.:JAPAN
P(S(t)=1|I(t))
T.B.:UK
P(S(t)=1|I(t))
T.B.:USA
P(S(t)=1|I(t))

Figure 1: