Current account sustainability in advanced economies

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Abstract

This paper investigates the sustainability of current accounts in advanced economies, using a panel of 27 countries and annual data over the 1980-2008 period. We find strong evidence in favour of nonlinear but stationary current-account trajectories for 14 countries, while the remaining 13 appear to be nonstationary and, thus, unsustainable. Our analysis indicates that careful empirical modeling of current-account dynamics, particularly in relation to cross-section dependence and nonlinear behaviour, is crucial for appropriate economic policymaking.

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Keywords: Current account sustainability, panel unit root tests, nonlinearity

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1. Introduction

The emergence of large imbalances in the current accounts of many advanced economies in the last decade has received much attention in the literature, renewing the interest and debate regarding the concept of current-account sustainability. Apart from its relevance in terms of international economic theory, this issue is charged with significant economic policy implications particularly if, as many observers believe, the 'global imbalances' characterising the world economy in the years leading up to 2007-2008 were one of the root causes of the subsequent financial and economic crisis. More generally, to the extent that they reflect the efficient inter-temporal allocation of capital, temporary current account deficits can be beneficial, but persistent deficits can lead to an unsustainable level of national indebtedness, and thus to a default and/or a costly adjustment process via a fall in aggregate demand and growth. Therefore, the sustainability of the current account is a key policy objective.

From a theoretical viewpoint, the notion of sustainability is associated to the inter-temporal model of the current account, which is based on the assumptions of perfect capital mobility and consumption-smoothing behaviour. The 'sustainability hypothesis' defines the condition that current account dynamics are consistent with a country's inter-temporal budget constraint (IBC), in the sense that this can be met in the long run without the need for drastic corrections. In such a case, the current account acts as a shock-absorber, allowing to smooth consumption over time.

Although a non-stationary current account does not necessarily violate the IBC (e.g. Quintos, 1995; Bohn, 2007), stationarity is a sufficient condition to ensure that current account dynamics are sustainable and, more precisely, implies a 'strong' from of sustainability consistent with non-persistent deficits. Several studies have, thus, made use of unit-root testing procedures to investigate the sustainability hypothesis. Most of the early literature produced mixed results (e.g. Trehan and Walsh, 1991; Husted, 1992; Ghosh, 1995), but was based on the use of univariate unit-root tests which suffer from well-known power problems, particularly when the time-series under analysis is short and/or stationary but subject to nonlinear behaviour. Employing more powerful panel unit root (PUR) tests, which exploit both the cross-section and time-series information in the data, some studies obtain strong rejections of the unit-root hypothesis for the current account, e.g. Holmes (2006), Holmes et al. (2010), Lau and Baharumshah (2005), Lau et al. (2006), Wu (2000). However, these studies deal with a restricted number of countries and/or rely on first-generation PUR tests, which suffer from severe size distortion and produce misleading inference in the presence of cross-section dependence (e.g. Banerjee et al., 2005).

More recently, another strand of the literature has focused on the use of nonlinear univariate unit-root tests (Chen, 2011; Christopoulos and León-Ledesma, 2010; Kim et al., 2009). Both empirical evidence and theoretical arguments point to the presence of nonlinearities in current account dynamics, as any factors affecting the expectations of market participants regarding a country's net indebtedness (e.g. risk perception, current or future policy changes, etc…) can have an impact on the equilibrium level of the current account and its speed of mean-reversion. In particular, when deficits reach a certain 'dangerous' threshold level, this may trigger sharp current account corrections via market forces and/or government intervention, which would result in nonlinear dynamics (e.g. Freund, 2005).

These recent developments in the literature suggest that a comprehensive empirical analysis of current-account dynamics is crucial for appropriate economic policymaking. In particular, investigation of the sustainability hypothesis requires careful modelling of the potential effects of cross-section dependence and/or nonlinearities in relation to current-account stationarity. Building on this, this paper re-examines the evidence on the sustainability hypothesis making a number of contributions to the literature. We use annual data for 27 advanced economies over the 1980-2008 years, thus covering a larger number of countries and/or a longer time-period than earlier studies.[**] We address two main questions: First, do the large imbalances observed empirically reflect unsustainable current accounts for all of the advanced economies or are they driven by a limited number of countries?; Second, if the observed imbalances are indeed determined by a subset of the advanced economies' external debts, which countries' current accounts are on an unsustainable path and which are not?

To provide answers to these questions, we focus on the concept of 'strong sustainability' of current accounts and rely on PUR tests, dealing with a number of issues related to their implementation. More specifically, as a way of comparing our analysis to much of the evidence so far gathered on current account sustainability, we start by performing a number of commonly-used first-generation PUR tests. Next, to ascertain and deal with its possible effects on PUR procedures, we perform a formal test of cross-section dependence in panels, developed by Pesaran (2004), and implement two second-generation PUR tests which explicitly model and correct for cross-section dependence. Subsequently, we propose and carry out formal tests to detect panel nonlinearities and, to take into account the potential role these can play in current account dynamics, we make use of a nonlinear second-generation PUR test recently proposed by Cerrato et al. (2009). Finally, to determine which countries' current accounts appear to be on an unsustainable trajectory and which do not, we rely on a sequential panel selection procedure, developed by Chortareas and Kapetanios (2009) to separate out the stationary and nonstationary series in a panel dataset.

[**] The time span is limited to 2008 to avoid undue influence from the subsequent crisis years.

The remaining part of the paper is organised as follows. Section 2 illustrates formally the analytical framework linking the sustainability of the current account to its stochastic properties. As well as describing the data, Section 3 and its subsections illustrate and implement the PUR, cross-section dependence and panel nonlinearity tests used in this paper. Section 4 is devoted to the distinction between stationary and non-stationary current-account series in our panel, while Section 5 concludes.

2. Analytical framework

Following Christopoulos and León-Ledesma (2010), assuming zero output growth the open economy budget constraint at time t can be formalised as

$$Y_t + \left(1 + r_t\right) B_{t-1} = C_t + I_t + G_t + B_t \tag{1}$$

where C_t is consumption, I_t is investment, G_t is public consumption, B_t is the net stock of debt, Y_t is income and r_t is the (non-constant) world interest rate. Equation (1) can be rearranged as

$$B_t = \left(1 + r_t\right) B_{t-1} + NX_t \tag{2}$$

where $NX_t \equiv Y_t - \left(C_t + I_t + G_t\right)$ is net exports. Iterating (2) forward we obtain

$$B_{t-1} = -\sum_{j=0}^{\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) NX_{t+j} \mid I_{t-1}\right) + \lim_{j\to\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) B_{t+j} \mid I_{t-1}\right) \qquad (3)$$

where I_{t-1} defines the information set of private agents at time $t-1$ and $E(\cdot)$ is the conditional expectation operator. Current account sustainability implies that the following transversality condition is satisfied

$$\lim_{j\to\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) B_{t+j} \mid I_{t-1}\right) = 0 . \qquad (4)$$

That is, the present discounted value of the expected stock of assets must converge to zero as t tends to infinity. Trehan and Walsh (1991) show that, given the equality relation between the current account (CA) and the capital account (KA), i.e. $CA_t = -KA_t = B_t - B_{t-1}$, a sufficient (but not necessary) condition for the sustainability hypothesis to hold is that the current account is stationary. Following Quintos (1995), in this case the current account can be said to be 'strongly sustainable'.

This 'strong' type of sustainability, however, is not the only current-account trajectory which is strictly consistent with the IBC. In line with Quintos (1995), one can show that even if CA is I(1) sustainability still holds, as the current account dynamics will still not violate the IBC. However, when CA is I(1), the undiscounted current account is persistently in deficit, which means that the country will eventually find it difficult to finance its external debt – in such a case, the current account can be said to be only 'weakly sustainable'. Further, following Bohn (2007), the analysis can be extended to consider higher orders of integration and show that a sufficient condition for the IBC and, thus, sustainability to hold is that the current account is integrated of *any* finite order. Though theoretically possible, this type of 'sustainability' can be labelled as 'absurdly weak', as it leads to gradually growing difficulties in financing persistent current account deficits.

Given its more stringent economic-policy implications, in this paper we focus solely on the 'strong sustainability' hypothesis. Moreover, in a growing economy, persistent current account deficits can be sustainable, as long as their expected value does not grow faster than output. Thus, the 'strong sustainability' hypothesis will hold if the current account to output ratio, $y_t = CA_t / Y_t$, is stationary. Our analysis investigates the stochastic properties of y_t.

3. Panel unit root tests

We carry out the empirical study of the sustainability hypothesis using PUR tests and annual data over the 1980-2008 period. The data are from the IMF World Economic Outlook (WEO) database and relate to a balanced panel of 27 advanced economies: Australia, Belgium, Canada, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Korea, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States.[††]

To compare our analysis to many previous studies making use of first-generation PUR tests, we start by implementing four well-known such tests proposed by Maddala and Wu (1999, MW), Choi (2001), Im et al. (2003, IPS) and Levin et al. (2002, LLC), considering both models with only a constant and models including a constant and a deterministic trend. Throughout the econometric analysis carried out in this paper, lag selection is performed

[††] The choice of countries and time period follows the WEO definition of "advanced economies" and data availability.

using the general-to-simple procedure proposed by Ng and Perron (1995), setting the maximum number of lags at 3.

Table 1. First-generation PUR tests

	Constant	**Constant & Trend**
Choi	9.388**	13.770**
MW	151.565**	197.100**
IPS	-1.811*	-2.112
LLC	-1.410^	-0.792

**, * and ^ indicate, respectively, rejection at the 1%, 5% and 10% significance levels. The lag order was selected following the general-to-specific procedure suggested by Ng and Perron (1995)

The results from first-generation PUR tests are reported in Table 1. With the partial exception of the LLC test, the decisive rejections of the unit-root null reported in previous studies are confirmed, providing evidence in favour of the 'strong sustainability' hypothesis. As mentioned, however, this outcome may be unduly influenced by cross-section dependence and/or nonlinearities, which greatly weaken the reliability of first-generation PUR tests. In what follows we tackle both of these issues.

3.1 Cross-section dependence

Pesaran (2004) suggests a formal test of cross-section dependence (CD), based on mean pairwise correlation coefficients for variable series or regression residuals. In the case of unbalanced panels the CD test statistic is defined as

$$CD = \sqrt{\left(\frac{2}{N(N-1)}\right)\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\sqrt{T_{ij}}\,\widehat{\rho}_{ij}\right)} \tag{5}$$

where $\widehat{\rho}_{ij}$ indicates the pairwise correlation coefficients between all country series, while T_{ij} is the number of observations used to estimate the correlation coefficient between the series in countries i and j. For $T_{ij} > 3$ and sufficiently large N, under the null of cross-section independence $CD \sim N(0,1)$. Moreover, the CD test is robust to the presence of nonstationary processes, parameter heterogeneity or structural breaks, and was shown to perform well even in small samples.

We perform the CD test using the average of pairwise correlation coefficients of OLS residuals obtained from standard augmented Dickey–Fuller (1979, ADF) regressions for each country. The results are reported in Table 2.

Table 2. Cross-section dependence test

	Constant	Constant & Trend
CD stastistic	3.190	3.270
p-value	0.001	0.001

The CD test strongly rejects the null hypothesis of cross-section independence, independently of whether the underlying ADF regressions contain only a constant or a constant and a deterministic trend. This outcome casts serious doubts on the results obtained from first-generation PUR tests, suggesting that the presence of cross-section dependence should be duly taken account of. Thus, in the next section we briefly describe and then implement two second-generation PUR tests.

3.1.1 Second-generation linear PUR tests

The first second-generation PUR test we make use of is that developed by Breitung and Das (2005, BD). The BD test is based on the pooled OLS regression of the following simple AR(1) process

$$\Delta y_{it} = \phi y_{i,t-1} + e_{it} \tag{6}$$

The null hypothesis of $\phi = 0$ is tested against the homogenous alternative $\phi < 0$, via the pooled OLS *t*-statistic

$$t_{rob} = \frac{\sum_{t=1}^{T} y'_{t-1} \Delta y_t}{\sqrt{\sum_{t=1}^{T} y'_{t-1} \widehat{\Omega} y_{t-1}}} \tag{7}$$

where the variance estimate, $\widehat{\Omega} = \frac{1}{T}\sum_{t=1}^{T} \widehat{e}_t \widehat{e}'_t$, is based on panel corrected standard errors (PCSE), so that it is robust to weak cross-section dependence. Breitung and Das (2005) suggest procedures to pre-whiten the data from serial correlation and allow for non-zero deterministic terms.

The second test was proposed by Pesaran (2007) and is constructed as a modified version of the IPS test which is robust to cross-sectional dependence, assumed to arise from a common factor. The test is based on the following cross-sectionally augmented ADF (CADF) regression

$$\Delta y_{it} = a_i + b_i y_{i,t-1} + c_i \overline{y}_{t-1} + \sum_{j=0}^{p} d_{ij} \Delta \overline{y}_{t-j} + \sum_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + e_{it} \tag{8}$$

where the lags of the cross-section mean $\overline{y}_t = N^{-1} \sum_{i=1}^{N} y_{it}$ and $\Delta \overline{y}_t$ are introduced as additional regressors to filter out the effects of the common factor. The PUR test is a cross-sectionally augmented version of the IPS test, given by

$$CIPS(N,T) = \overline{t}(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) \tag{9}$$

where, for the *i*th unit, $t_i(N,T)$ is given by the *t*-ratio of b_i in (8). The unit-root hypothesis is $H_0 : \beta_i = 0 \forall i$, tested against the possibly heterogeneous alternatives

$$H_1 \; : \; \begin{cases} \beta_i < 0 & \text{for } i = 1,...,N_1 \\ \beta_i = 0 & \text{for } i = N_1 + 1,...,N \end{cases} \tag{10}$$

The testing procedure can be readily extended to models containing linear trends.

Table 3. Second-generation linear PUR tests

	Constant	**Constant & Trend**
BD	-0.82	1.14
CIPS	-1.84	-2.28

The lag order was selected following the general-to-specific procedure suggested by Ng and Perron (1995)

The results in Table 3 indicate that, contrary to first-generation tests, the BD and CIPS tests do not reject the unit-root null. This outcome reverses our previous conclusion and signals that current account dynamics are *not* in fact ‘strongly sustainable’. As pointed out, both the BD and CIPS tests are robust to the presence of cross-section dependence so that, given the evidence provided by the CD test, the results in Table 3 are certainly more reliable than the evidence provided by first-generation PUR tests and reported in Table 2. Nonetheless, as argued by Christopoulos and León-Ledesma (2010) among others, a comprehensive assessment of current account dynamics should take account of possible nonlinearities. This is critical for PUR testing too since, if the current-account series under analysis were in fact nonlinearly stationary, linear PUR tests such as the BD and CIPS tests would be likely to provide false evidence in favour of nonstationarity. In other words, the results in Table 3 could, once again, be misleading.

To deal with this issue, in the next section we put forward and carry out formal tests to detect nonlinearities in panels and, subsequently, make use of a nonlinear second-generation PUR test.

3.2 Panel nonlinearity

In a time-series context, the so-called RESET test proposed by Ramsey (1969) is routinely used to ascertain the presence of nonlinearities. A standard formulation of the test (RESET 1) is based on the following auxiliary regression

$$y_t = g_0 + \sum_{j=1}^{p} g_j y_{t-j} + \sum_{k=1}^{q} \xi_k \hat{y}_t^{k+1} + e_t, \quad \text{for } q \geq 1 \tag{11}$$

where g_j and ξ_k are parameters. In the absence of significant nonlinearities, nonlinear transformations of the fitted value $(\hat{y}_t)$ should have no explanatory power with respect to y_t. Thus, the null hypothesis of linearity can be tested via a standard F or χ^2 statistic on $H_0 : \xi_1 = \cdots = \xi_q = 0$.

An alternative test (RESET 2) can be developed making use of higher-order trend terms (τ), rather than powers of $\hat{y}_t$, to capture any potential nonlinearities. Specifically, the test can be based on

$$y_t = g_0 + \sum_{j=1}^{p} g_j y_{t-j} + \sum_{k=1}^{q} \varsigma_k \tau^{k+1} + e_t, \quad \text{for } q \geq 1 \tag{12}$$

so that the associated null hypothesis is $H_0 : \varsigma_1 = \cdots = \varsigma_q = 0$.

The RESET test may not be robust in regressions with I(1) processes, but this drawback can be dealt with in a panel context. Specifically, following Maddala and Wu (1999), we propose to combine the individual RESET test significance levels to obtain a Fisher-type statistic (Fisher, 1932). Formally, let the p-value from the ith RESET test be denoted by p_i $(i = 1,...,N)$, such that p_i are independent and uniform $[0,1]$ variables and $-2\ln p_i$ has a χ^2 distribution with 2 degrees of freedom. Then, by the additive property of χ^2 variables, we have that

$$P = -2\sum_{i=1}^{N} \ln p_i \sim \chi^2_{2N}$$

The P test statistic is suitable for panels with a small cross-section dimension, as it does not require $N \to \infty$ to be satisfied. A second Fisher-type test, which does require $N \to \infty$, is that proposed by Choi (2001):

$$P_m = \frac{-2\sum_{i=1}^{N} \ln p_i - 2N}{\sqrt{4N}} \sim N(0,1)$$

In this context, both P and P_m are upper tail tests of the null hypothesis that all panel units are linear processes, against the alternative that at least some units in the panel contain significant nonlinearities.

To control for the effects of cross-section dependence, we use the CADF-regression approach developed by Pesaran (2007) to perform the univariate RESET tests and obtain the individual p-values, which are then combined to calculate the P and P_m Fisher-type statistics. The results are reported in Table 4.

Table 4. Panel RESET tests

	RESET 1		RESET 2	
	P	P_m	P	P_m
Fisher-type statistic	72.220	1.753	221.957	16.162
p-value	0.049	0.040	0.000	0.000

Both variants of the panel RESET test reject the null of panel linearity, very strongly in the case of the RESET 2 test. Taking account of this evidence, we further investigate the stochastic properties of advanced economies' current accounts via a nonlinear second-generation PUR test proposed by Cerrato et al. (2009).

3.2.1 A Second-generation nonlinear PUR test

Cerrato et al. (2009) assume the following dynamic nonlinear heterogeneous Exponential Smooth Transition Autoregressive (ESTAR) model

$$y_{it} = \beta_i y_{i,t-1} + \nu_i y_{i,t-1} Z\left(\theta_i; y_{i,t-d}\right) + u_{it}, \qquad t = 1,...,T, \qquad i = 1,...,N, \tag{13}$$

where the error term, u_{it}, has a one-factor structure. The transition function is of the exponential form $Z\left(\theta_i; y_{i,t-d}\right) = 1 - \exp\left(-\theta_i y_{i,t-d}^2\right)$, where $\theta_i \geq 0$ and $d \geq 1$ is the delay parameter. Assuming $d = 1$ and y_{it} is mean-zero and follows a unit-root process in the middle regime, the model can be rewritten in first-difference form as

$$\Delta y_{it} = \nu_i y_{i,t-1}\left[1 - \exp\left(-\theta_i y_{i,t-1}^2\right)\right] + \gamma_i f_t + \varepsilon_{it} \tag{14}$$

where f_t is the common factor. The null hypothesis is $H_0 : \theta_i = 0 \forall i$, which is tested against the possibly heterogeneous alternatives

$$H_1 \; : \; \begin{cases} \theta_i > 0 & \text{for } i = 1,...,N_1 \\ \theta_i = 0 & \text{for } i = N_1 + 1,...,N \end{cases} \tag{15}$$

H_1 implies that some units are generated by a stationary ESTAR model, but allows for some other units being unit-root processes. Since v_i is not identified under the null, to test H_0 Cerrato et al. (2009) use a Taylor expansion on (14) to obtain the auxiliary regression

$$\Delta y_{it} = a_i + b_i y_{i,t-1}^3 + c_i \Delta \overline{y}_t + d_i \overline{y}_{t-1}^3 + e_{it} \tag{16}$$

which uses the approximation $f_t \approx \frac{1}{\overline{\gamma}} \Delta \overline{y}_t - \frac{b}{\overline{\gamma}} \overline{y}_{t-1}^3$, where $\overline{\gamma} = \frac{1}{N} \sum_{i=1}^{N} \gamma_i$, $\Delta \overline{y}_t = \frac{1}{N} \sum_{i=1}^{N} \Delta y_{it}$, $\overline{y}_{t-1}^3 = \frac{1}{N} \sum_{i=1}^{N} y_{i,t-1}^3$ and *b* is the mean of b_i. The unit-root test is based on the *t*-statistic on b_i, denoted by $t_i(N,T) = \frac{\hat{b}_i}{s.e.(\hat{b}_i)}$. The PUR test is constructed as

$$NCIPS = \overline{t}(N,T) = N^{-1} \sum_{i=1}^{N} t_i(N,T) \tag{17}$$

The *NCIPS* is, thus, a nonlinear cross-sectionally augmented version of the IPS test. If the error term follows an *AR(p)* specification the common factor f_t can be proxied by $\left\{ \overline{y}_{t-1}^3, \sum_{j=1}^{p} \Delta \overline{y}_{t-j}^3 \right\}$, suggesting the general NCADF regression

$$\Delta y_{it} = a_i + b_i y_{i,t-1}^3 + c_i \overline{y}_{t-1}^3 + \sum_{j=1}^{p} d_{ij} \Delta \overline{y}_{t-j}^3 + \sum_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + e_{it} \tag{18}$$

Cerrato et al. (2009) provide critical values for the NCADF and NCIPS test statistics and recommend demeaning or demeaning and de-trending the data to accommodate stochastic processes with, respectively, a non-zero mean or a non-zero mean and linear trend.

Table 5. Second-generation nonlinear PUR test

	Constant	**Constant & Trend**
NCIPS	-2.15**	-2.42**

** indicates rejection at the 1% significance level. The lag order was selected following the general-to-specific procedure suggested by Ng and Perron (1995)

As shown in Table 5, the NCIPS strongly rejects the unit-root null both for the 'constant-only' and 'constant & trend' versions of the test. Once again, this outcome reverses the inference previously obtained via the BD and CIPS tests and supports the characterisation of current accounts as stationary and, by implication, strongly sustainable processes, albeit subject to nonlinear (ESTAR) behaviour.

In conclusion, the econometric analysis carried out strongly suggests that relaying solely on traditional PUR tests to investigate the sustainability hypothesis may lead to misleading inference, and thus incorrect economic policy measures. In particular, accurate empirical modelling of current-account dynamics requires that both cross-section dependence and nonlinearities be duly taken account of. Based on the evidence provided by the CD and panel RESET tests, the NCIPS test appears as the most suitable methodology to investigate the sustainability hypothesis for advanced economies. Thus, for the panel as a whole, we conclude that current accounts in advanced economies are globally stationary and strongly sustainable, but characterised by nonlinear dynamics. This outcome is crucial in terms of economic-policy modelling, as it implies that current accounts are subject to multiple equilibria so that, in particular circumstances (e.g. confidence crises or large shocks), mean-reversion occurs toward different equilibrium levels and/or at changed speeds.

4. Separating stationary from non-stationary series

The popularity of PUR tests in the literature depends largely on the greater power of these tests, which often results in the uncovering of evidence in favour of stationary behaviour (for the panel as a whole) when univariate tests fail to reject the unit-root null. However, since the hypothesis being tested is the joint null of a unit root for all cross-sections in the panel, PUR tests pose interpretation problems. In particular, it has been pointed out that the null hypothesis may be rejected even if a small fraction or, at the limit, one single series in the panel is, in fact, stationary (e.g. Taylor and Sarno, 1998; Karlsson and Lothgren, 2000). Thus, even when the joint panel unit-root null is rejected, further investigating which cross-section units within the panel display stationary behaviour remains relevant.

In our case, the NCIPS test rejects the hypothesis that all of the current account series under analysis are on an unsustainable path, in favour of the alternative that at least a positive fraction of them are nonlinearly stationary, and thus sustainable. In order to qualify this conclusion and clarify which countries' current accounts appear nonlinearly stationary and which do not, we now re-examine this issue by adopting a formal procedure proposed by Chortareas and Kapetanios (2009), namely the "Sequential Panel Selection Method" (SPSM).

SPSM aims at exploiting the advantages granted by a panel dataset to identify the stationary series within the panel. The procedure is carried out by performing a sequence of PUR tests on a reducing panel dataset, where the reduction results from dropping series for which there is significant evidence of stationarity. More precisely, SPSM is carried out in three steps:

1. Perform the PUR test on all the (remaining) series in the panel. If the test cannot reject the unit-root null, the procedure is stopped and the conclusion is that all the series in the panel are non-stationary. If, on the contrary, the PUR null is rejected, go to Step 2;
2. Remove from the dataset the series displaying the strongest evidence of stationary behaviour according to the unit root test being used (e.g. the series with the minimum NCADF statistic);
3. Return to Step 1.

Thus, SPSM sequentially picks out the series of a panel dataset for which there is evidence of stationary behaviour, separating them from those for which the unit-root null cannot be rejected.

Table 6 reports the results from applying the SPSM to the NCIPS test. For each sequence in Table 6, the first column gives the NCIPS test statistic, the second reports the minimum NCADF statistic and the third indicates the associated country, which is then dropped from the panel before proceeding with the next sequence. Thus, for the model with only a constant, sequence 1 shows that the NCIPS test rejects the null of a unit root for the whole 27-country panel, with a test statistic of -2.15 which is significant at the 1 per cent level. This is the result reported in Table 5. Among the individual series, the strongest rejection occurs for Taiwan, with a NCADF statistic of -3.71, which is also significant at the 1 per cent level. Consequently, Taiwan's current account series is removed from the dataset and the SPSM proceeds by applying the NCIPS test to the remaining 26 series in the panel (sequence 2). The NCIPS turns out to be again significant at the 1 per cent level and the lowest NCADF statistic is associated to Spain, which is then dropped from the sample before proceeding with sequence 3, and so on. As mentioned, this sequential testing stops when the NCIPS cannot reject the unit root null, indicating that the hypothesis that all the remaining series in the panel are non-stationary cannot be rejected.

Table 6. SPSM results based on the NCIPS and NCADF tests

Country	Constant			Constant & Trend		
Sequence	NCIPS statistic	Min. NCADF statistic	I(0) series	NCIPS statistic	Min. NCADF statistic	I(0) series
1	-2.15**	-3.71*	Taiwan	-2.42**	-4.65**	Switzerland
2	-2.29**	-4.49**	Spain	-2.34**	-4.19**	Norway
3	-2.21**	-4.00**	Czech Republic	-2.23**	-3.52*	United Kingdom
4	-2.10**	-3.87**	Belgium	-2.19**	-3.44*	Australia
5	-2.02*	-3.59*	Israel	-2.15**	-3.41*	Ireland
6	-1.99*	-3.42*	Australia	-2.08*	-3.11*	Korea
7	-1.93^	-3.11*	Switzerland	-2.07*	-3.11*	Canada
8				-1.98^	-3.02^	Czech Republic
9				-1.93^	-2.98^	Finland

**, * and ^ indicate, respectively, rejection at the 1%, 5% and 10% significance levels. The lag order was selected following the general-to-specific procedure suggested by Ng and Perron (1995)

Combining the results for the constant-only and constant & trend models, overall the SPSM provides significant evidence of non-linear mean-reversion for only 13 out of the 27 countries in our dataset: Australia, Belgium, Canada, Czech Republic, Finland, Korea, Ireland, Israel, Norway, Spain, Switzerland, Taiwan, United Kingdom. The implication is that the current-account dynamics of these countries, though nonlinear, follow globally stationary ESTAR processes and are, thus, 'strongly sustainable'. This is not so for the remaining 14 countries, for which the finding of non-stationary current accounts suggests growing difficulties to fund their external debt so that, eventually, a correction of the imbalances is bound to take place.

5. Conclusions

The sustainability of the current account is a key policy objective, as persistent current account deficits can lead to significant economic costs, in terms of severe adjustment processes, difficulties in funding external debts or even a default. As such, accurate empirical modelling of current-account dynamics is crucial as a foundation for the design of appropriate policy measures. Focusing on this issue, this paper examines the 'strong sustainability' hypothesis for the current accounts of 27 advanced economies using panel unit root tests.

As reported in previous studies, we find broad support for current account stationarity using first-generation PUR tests. However, as pointed out by Banerjee et al. (2005) among others, these tests suffer from significant size distortion in the presence of cross-section dependence between the panel units. Since a formal test proposed by Pesaran (2004) rejects the null of cross-section independence, we move on to the implementation of two second-generation (linear) PUR tests, developed by Breitung and Das (2005) and Pesaran (2007). Contrary to their first-generation counterparts, the BD and CIPS tests do not reject the unit-root null, indicating that current accounts are non-stationary and thus not strongly sustainable. Since several factors point to the possible presence of nonlinear dynamics in current accounts, we further propose and perform formal tests to detect panel nonlinearities and find that the null hypothesis of linearity is strongly rejected by the data. Taking account of this, we proceed to testing the unit root hypothesis against the alternative scenario of a nonlinear stationary process making use of the NCIPS test, a nonlinear second-generation PUR test proposed by Cerrato et al. (2009). The NCIPS rejects the null that all current accounts in advanced economies are non-stationary, favouring the alternative hypothesis that (at least) a positive fraction of them follow globally stationary ESTAR processes. Given the significant evidence uncovered for both cross-section dependence and panel nonlinearities, the NCIPS results appear as the most reliable. Thus, the answer to the first of the two main questions addressed by this paper is that the large imbalances observed empirically do not reflect unsustainable current accounts for all of the advanced countries. Rather, they are determined by the unsustainable current-account trajectories of a subset of advanced economies.

To provide an answer to the second question, i.e. which countries' current accounts are on an unsustainable path and which are not, we rely on the "Sequential Panel Selection Method" developed by Chortareas and Kapetanios (2009). The SPSM indicates that for 13 out of the 27 advanced economies in our panel there is significant evidence of stationary and nonlinear current-account dynamics, while the remaining 14 appear to be non-stationary.

Overall, the analysis carried out in this paper conveys two main messages. In terms of the debate on the sustainability hypothesis, our results bring support to the view that several advanced economies' current accounts were on an unsustainable trajectory in the years preceding the recent global economic crisis. More research is needed to further investigate the mechanisms linking the global imbalances phenomenon to the so-called 'Great Recession'. As regards the empirical investigation of this and other issues related to current-account dynamics, the evidence indicates that both cross-section dependence and nonlinearities should be taken account of to avoid misleading inference, and thus incorrect economic policy conclusions.

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