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Mean Reversion of the Current Account and Sustainability: Evidence from European Countries

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Mean Reversion of the Current Account and Sustainability: Evidence from European Countries

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Abstract: *Stationarity of the current account is suggested as an indicator of the current account sustainability in the literature. We explore the presence of mean-reverting behaviour in current accounts of 24 European countries, using linear and nonlinear unit root tests. Our results suggest mean reversion of the current account-to-GDP ratios for almost two-thirds of the countries in our sample, hence; provide supporting evidence for the current account sustainability of these countries.*

Jel Classification: C22, F32

Keywords: Current account sustainability, stationarity, non-linear adjustment, non-linear models.

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I. Introduction

Current account sustainability is explored in the recent literature by the help of linear and nonlinear unit root tests for numerous countries. The central conjecture behind this econometric approach is that a stationary current account to GDP ratio is a sufficient condition for the long-run intertemporal budget constraint to be satisfied[2]. This implies that the growth rate of the current account deficit is not greater than that of the expected output, indicating a finite debt-to-GDP ratio. In this case, even perpetual current account deficits could be run by a country, without inferring a sharp, unexpected and painful adjustment in the future.

Stationarity implies that positive or negative deviations from the mean level of the current account would eventually be corrected. In this study, we explore the possibility of such mean-reverting behaviour for the current account. In particular, we test for the existence of nonlinear dynamics in the adjustment mechanism for the current account-to- GDP ratios of 24 European countries, employing Exponential Smooth Transition Autoregressive (ESTAR) and Asymmetric Exponential Smooth Transition Autoregressive (AESTAR) tests. Our results suggest the presence of mean-reverting behavior for half of the countries in our sample.

Current account adjustment could be triggered by alternative forces such as government policies, market dynamics, changes in portfolio allocations, fluctuations in risk perceptions etc. Nonlinear models allow for asymmetries in adjustment depending on the size or sign of the deviations from the mean level in current account (Clarida et al., 2007). ESTAR model provides a framework where the series behave differently depending on its particular deviation from a symmetric threshold band. When the series exceeds this band, a stationary, mean-reverting behaviour towards the band is observed. However, the series exhibits random walk behaviour within the band. Hence, the magnitude of the imbalance is of essence for the correction behaviour. The AESTAR model further captures a possible asymmetric behaviour around the band. The adjustment could be quicker against positive deviations from the long-run mean compared to negative deviations, or vice versa.

The literature that employs linear or nonlinear unit root tests provides mixed evidence on the sustainability issue so far[3]. Among the studies that employ nonlinear models, sustainability hypothesis is favoured for most of the G7 countries in Clarida et al (2007); for US in Christopoulos and Leon-Ledesma (2010) and for a couple of Central and Eastern European Economies in Cueastas (2013). Our study contributes to this literature by testing the presence of nonlinear behaviour in 24 European countries.

Next section demonstrates the econometric testing framework. Third section presents the results. Fourth section includes the discussion and concludes.

II. Econometric Methodology

Self-exciting threshold models are found to perform well to capture the asymmetric behaviour of several macroeconomic variables in the recent literature. These models assume that the regime-switching behaviour depends on the past values of the series itself. Among these models, Smooth Transition Autoregressive (STAR) type models suggest a gradual or smooth adjustment to the mean (Granger and Teräsvirta, 1993). ESTAR model (Kapetanios et al., 2003), which is a popular extension of smooth transition models, assumes that this gradual adjustment is also *symmetric* around a certain inaction band. The series might display unit root behaviour inside a band while it follows a smooth adjustment pattern towards the band, once this band is exceeded. The symmetric adjustment below or above the band is captured by the exponential form of the function:

$$\Delta c_t = a_1 c_{t-1} + a_2 c_{t-1}\left[1 - \exp(-\theta(c_{t-d} - \lambda)^2)\right] + \varepsilon_t \qquad (1)$$

[2] See Trehan and Walsh (1982) and Taylor (2002) for proofs.

[3] See Christopoulos and Leon-Ledesma (2010) for a review of this literature.

where the brackets include the transition function with θ controlling the speed of adjustment. Kapetanios et al. (2003) imposes a zero-mean stochastic process, select $\lambda = 0$ and further impose $a_1 = 0$ and set the delay parameter as $d = 1$ after which equation (1) reads:

$$\Delta c_t = a_2 c_{t-1}\left[1 - \exp(-\theta c^2{}_{t-1})\right] + \varepsilon_t \qquad (2)$$

In equation (2), the series is governed by unit root behaviour close to its attractor, while displaying a mean-reverting process when it is far away from this long-run mean. Testing for linearity and unit root, we set the null hypothesis as $H_0 : \theta = 0$ against the alternative $H_1 : \theta > 0$. However, parameter (a_2) would be unidentified under the null. In order to overcome this identification problem, Kapetanios et.al (2003) employs an auxiliary regression, including a first order Taylor series approximation. The general model with serially correlated errors then would be:

$$\Delta \pi_t = \sum_{j=1}^{p} p_j \Delta \pi_{t-j} + \gamma \pi_{t-1}{}^3 + error \qquad (3)$$

The asymptotic critical values for the t-statistics are tabulated in Kapetanios et.al (2003).

Sollis (2009) provides an extension of ESTAR type of modelling in a way to allow for asymmetric adjustment around the band. AESTAR model contains two transition functions which helps us to capture different paces of adjustment above or below the band:

$$\Delta c_t = G(\theta_1, c_{t-1})\left[S(\theta_2, c_{t-1})a_1 + \{1 - S(\theta_2, c_{t-1})\}a_2\right]c_{t-1} + \varepsilon_t \qquad (4)$$

where

$$G(\theta_1, c_{t-d}) = 1 - \exp(-\theta_1 c^2{}_{t-1}),\ \theta_1 > 0 \qquad (5)$$

$$S(\theta_2, c_{t-d}) = \left[1 + \exp(-\theta_2 c_{t-1})\right]^{-1},\ \theta_2 > 0 \qquad (6)$$

Assuming $\theta_1 > 0$ and $\theta_2 \rightarrow \infty$, if c_{t-1} moves from 0 to -∞ then $S(\theta_2, c_{t-d}) \rightarrow 0$, hence an ESTAR type transition is observed between the central regime model $\Delta c_t = \varepsilon_t$ and the outer regime model $\Delta c_t = a_2 c_{t-1} + \varepsilon_t$. In the same way, if c_{t-1} moves from 0 to ∞ then $S(\theta_2, c_{t-d}) \rightarrow 1$ and ESTAR transition occurs between the central regime model $\Delta c_t = \varepsilon_t$ and the outer regime model $\Delta c_t = a_1 c_{t-1} + \varepsilon_t$. In both cases, the speed of transition is determined by θ_1. The asymmetry in adjustment requires $a_1 \neq a_2$. The general model that accounts for serially correlated errors is:

$$\Delta c_t = G(\theta_1, c_{t-1})\left[S(\theta_2, c_{t-1})a_1 + \{1 - S(\theta_2, c_{t-1})\}a_2\right]c_{t-1} + \sum_{i=1}^{k} \kappa_i \Delta c_{t-i} + \varepsilon_t \qquad (7)$$

Sollis (2009) suggests a two-step Taylor series expansion to deal with the identification problem similar to ESTAR case above. Accordingly:

$$\Delta c_t = \phi_1 (c_{t-1})^3 + \phi_2 (c_{t-1})^4 + \sum_{i=1}^{k} \kappa_i \Delta c_{t-i} + \mu_t \qquad (8)$$

with $\phi_1 = a_2^* \theta_1$, $\phi_2 = c\left(a_2^* - a_1^*\right)\theta_1\theta_2$, c=0.25, a_1^* and a_2^* are functions of a_1 and a_2 as defined in Sollis (2009). The null hypothesis of this auxiliary model is H_0: $\phi_1 = \phi_2 = 0$. Sollis (2009) develops asymptotic distribution of an F-test and provides critical values for zero mean, non-zero mean and deterministic trend cases.

III. Results

We conduct linear and non-linear unit root tests for the current account to GDP ratios for 24 countries in Table 1. Data is obtained from Eurostat and seasonally adjusted using X-12 filter. We chose countries with at least 63 data points; hence the quarterly data goes back to 1998Q1 for the country with the shortest sample. The first two columns of the table include the number of observations, *n*, and the average current account to GDP ratio, *Av CA.* The following three columns are devoted to the results of the linear unit root tests, with *ADF*, *ERS* and *PP* denoting Augmented-Dickey-Fuller, Elliot-Rothenberg-Stock and Phillips-Perron test statistics, respectively. The last two columns present the nonlinear unit root tests where t_{nl} stands for t-test for ESTAR estimation and $F_{AE,\mu}$ denotes the F-test for AESTAR estimation. We evaluate the results of the linear and non-linear unit root tests separately as well as in a joint manner in the following part of this section.

A first look Table 1 indicates that nine countries out of our whole sample of 24 countries reveal no sign of stationarity: Austria, Germany, Greece, Hungary, Ireland, Italy, Portugal, Romania (except of very weak evidence in ERS test) and Spain. Neither the linear, nor the non-linear unit root tests can reject the null of unit root and/or linearity for these countries.

Our second observation is that both type of unit root tests, linear or non-linear, point out the presence of mean-reverting behaviour for four countries: Czech Republic, Lithuania, Luxemburg and UK.

For a third group of countries, nonlinear unit root tests are more successful in detecting possible mean-reverting behaviour compared to the linear unit root tests. For Bulgaria, Denmark, Netherlands, Finland, France and Latvia, linear unit root tests do not reject the null of unit root. However, both ESTAR and AESTAR nonlinear tests point out nonlinear adjustment behaviour for Bulgaria, Denmark and Netherlands; AESTAR test indicates nonlinear adjustment behaviour for Finland and France; and ESTAR test detect nonlinear adjustment behaviour for Latvia.

The results are relatively mixed for the four countries in the rest of the sample. For Estonia, Slovakia and Slovenia, only PP test implies stationary behaviour among the linear tests whereas ESTAR type nonlinearity is suggested for Estonia and Slovakia (weakly) whereas AESTAR type nonlinearity is detected for Slovakia (relatively more significant compared to ESTAR test statistics) and Slovenia. For Sweden, linear unit root tests provide weak evidence of stationarity whereas AESTAR tests suggest nonlinear mean-reverting behaviour at 5 percent significance level.

IV. Discussion and Conclusions

We explore the presence of mean-reverting behaviour in current account for 24 countries, using linear and nonlinear unit root tests. In particular, we conjecture smooth transition for the current account adjustment, employing popular ESTAR test and the recently developed AESTAR test. Our results indicate mean-reversion in current account for 15 countries out of our sample which supports evidence for the sustainability of the current account.

It is important to note that, while mean-reversion could imply sustainability of the current account; its absence does not necessarily imply unsustainability. For example, it is hard to argue that nonstationarity of current account to GDP ratios for countries with historically positive levels of current account balance (such as Austria or Germany in our sample) would imply unsustainability. Also, as discussed in Wickens (2008) a country whose debt assets are accumulated by the rest of the world as foreign exchange reserves could run long-lasting current account deficits in order to offset the resulting inflows on the capital account.

Table 1: Linear and Nonlinear Unit Root Test Results

	n	Av CA	ADF		ERS		PP		t_{nl}		$F_{AE,\mu}$	
Austria	95	0.77	-1.38		6.55		-		-		2.96	
Bulgaria	79	-5.88	-1.36		8.55		-		-	*	9.93	***
Czech Rep.	75	-3.47	-4.60	***	1.28	***	-	***	-	***	16.11	***
Denmark	95	2.62	-1.78		9.42		-		-	***	7.89	***
Estonia	83	-6.39	-2.08		18.99		-	**	-	**	3.19	
Finland	95	2.42	-1.72		14.82		-		-		5.35	**
France	79	0.27	-0.70		15.63		0.89		-		8.10	***
Germany	95	2.37	-0.85		15.58		-		-		2.20	
Greece	75	-7.17	-0.71		14.90		-		-		3.40	
Hungary	75	-4.71	-1.82		8.63		-		-		2.28	
Ireland	67	-0.50	-0.94		6.85		-		-		2.94	
Italy	95	-0.42	-1.82		9.22		-		-		1.97	
Latvia	87	-3.08	-2.16		10.13		-		-	**	1.12	
Lithuania	75	-6.67	-2.84	*	6.66		-	**	-	***	5.78	**
Luxemburg	75	9.25	-6.95	***	1.06	***	-	***	-	***	19.90	***
Netherlands	95	5.46	-1.79		6.68		-		-	***	11.06	***
Portugal	75	-7.65	-1.62		18.40		-		-		1.13	
Romania	63	-6.34	-2.13		3.36	*	-		-		4.23	
Slovakia	79	-4.71	-2.48		6.45		-	**	-	*	8.52	***
Slovenia	75	-0.69	-1.29		6.53		-	**	-		7.13	***
Spain	95	-3.70	-0.77		10.53		-		-		0.57	
Sweeden	79	5.49	-2.62	*	47.21		-	*	-		6.58	**
UK	95	-2.01	-3.46	**	6.66		-	***	-	***	9.97	***

Note: Number of lags selected by Akaike Information Criteria.,** and *** stand for significance levels at 10%,5% and 1%, respectively.*

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