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An asymmetrical overshooting correction model for G20 nominal effective exchange rates

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Abstract

This paper develops an asymmetrical overshooting correction autoregressive model to capture excessive nominal exchange rate variation. It is based on the widely accepted perception that open economies might react differently to under-evaluation or over-evaluation of their currency because of the trade-off between fostering their net exports and maintaining their international purchasing power. Our approach departs from existing works by considering explicitly both size and sign effects: the strength of the overshooting correction mechanism is indeed allowed to differ between large and small depreciations and appreciations. Evidence of overshooting correction is found in most G20 countries. Formal statistical tests confirm sign and/or size asymmetry of the overshooting correction mechanism in most countries. It turns out that the overshooting correction specification is heterogeneous among countries, even though most of Emerging Market and Developing Economies are found to adjust to over-depreciation whereas the Euro Area and the US are shown to adjust to over-appreciation only.

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1. Introduction

In open-economy macroeconomics, the dynamics of a country's current account (CA) is generated by the totality of domestic residents' transaction with the rest of the world. Given that these transactions reflect stocks of net claims or liabilities, the CA conveys the inter-temporal saving-investment decisions of market agents and their expectations about macroeconomic aggregates and policy choices (Sachs et al. 1981; Svensson and Razin 1983). Running large and persistent current account deficits amounts to being indebted to the rest of the world. Unsustainable CA deficits may result in sudden exchange rate crisis that are reminiscent of those observed in Chile in 1982, Mexico in 1994-95 and the Southeast Asia countries in 1997 (Yol 2009). Moreover, it can lead, as with most developing countries, to capital reversal and sudden stop (see for example, Calvo 1998; Edwards 2004; and Hutchison and Noy 2006). Furthermore, it is an intergenerational problem: persistent current account deficits tend to increase domestic interest rates relative to their foreign counterparts and simultaneously increase the debt burden of future generations, therefore lowering their standard of living (Hakkio 1995; Apergis et al. 2000).

From a policy perspective, the relevance of the inquiry cannot be overly emphasized. Recent trends in global imbalances preceding the 2007-08 financial crisis have reinvigorated attention on the long-run sustainability of current account imbalances. Global imbalances are intimately connected to the financial crisis (Obstfeld and Rogoff 2009). As countries cannot go on forever accumulating net liabilities, an eventual adjustment is inevitable to bring the current account within sustainable range. The "loss decade" of Latin America—when the oil price shocks of the 1970s affected the current accounts of many Latin American countries leading them to suffer debt overhang and currency crises in the 1980s— makes another painful example of the social cost of abrupt current account adjustment. This correction mechanism requires policy choices to avert the social cost that usually accompanies external imbalance crises.

Several studies such as Milesi-Ferretti and Razin (1996) and Honkapohja and Koskela (1999) have argued that prolonged current account deficits are increasingly likely to result into crisis when the size of the export sector is small, domestic saving is low, financial system is weak, and external debt is high. Abrupt correction of the imbalance, then, can lead to painful loss in output and employment if policies are not designed beforehand and instituted gradually to avert such painful adjustment.

Generally, CAs in Africa have seen remarkable improvements (Salisu 2005) and there is empirical evidence of current account sustainability on the continent. Calderón et al. (2007) concludes that CAs of African countries are not very persistent; are positively linked with domestic growth and strongly linked with public and private savings. Similarly, Holmes (2003) finds evidence in favour of current account mean-reversion in 21 African countries. Further, Chu et al. (2007) investigates CA sustainability in a sample of 48 African countries over the period 1980-2004 and finds that CA is not sustainable in only 11 of those countries. However, none of these studies has been able to examine whether the source of CA sustainability or lack thereof in African countries comes from common factors or country-specific factors.

Against this backdrop, this article is, to our knowledge, the first to investigate the source of current account sustainability. To do so, we apply Reese and Westerlund (2016)'s panel analysis of nonstationarity in idiosyncratic and common components with cross-sectional average (PANICCA). This approach allows to investigate the sources of nonstationarity by disentangling common factors and idiosyncratic components of a series and to establish whether nonstationarity is pervasive, unit specific or both (Salisu 2019). The rest of the paper is structured as follows. In Section 2 we outline the theoretical underpinnings of current account sustainability. In the third section we describe Reese and Westerlund (2016)'s PANICCA test. Empirical results are presented and discussed in Section 4. The last section concludes.

2. Theoretical framework

In this study we follow the intertemporal approach to the current account. The intertemporal budget constraint is defined as

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

where C, I, B, G, r and Y indicate consumption, private investment, net foreign assets, government spending, the world real interest rate and output respectively.

Rearranging the terms, and using net exports $NX_t = X_t - M_t = Y_t - (C_t + I_t + G_t)$, we get

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

where X and M stand for exports and imports of goods and services respectively.

The current account (CA) is then given by

$$B_t - B_{t-1} = r_t B_{t-1} + NX_t = CA_t \quad (3)$$

If we iterate equation (2) forward and solve recursively (see Trehan and Walsh 1991; Christopoulos and León-Ledesma 2010 and Chen 2011), then the long-run budget constraint (LRBC) is obtained as follows

$$B_{t-1} = -\sum_{j=0}^{\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) NX_{t+j} | \varphi_{t-1}\right) + \lim_{j\to\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) B_{t+j} | \varphi_{t-1}\right) \quad (4)$$

where φ_{t-1} is the information set available at time $t-1$.

Then as *t* tends to infinity the present discounted value of the expected net foreign assets converges to zero, and the transversality condition becomes

$$\lim_{j\to\infty} E\left(\prod_{i=0}^{j}\left(\frac{1}{1+r_{t+i}}\right) B_{t+j} | \varphi_{t-1}\right) = 0 \quad (5)$$

This condition implies that for an economy that grows at a positive rate, CA is sustainable if the ratio of the current account to GDP is level stationary[1] (see Christopoulos and León-Ledesma 2010; Habimana 2018). This implies that there might be short-term fluctuations, but in the long run the country's intertemporal budget constraint is satisfied (Habimana 2017). Intuitively, the sustainability condition requires that the current account deficits do not grow faster than output in expected values.

[1] A level stationary current account is a sufficient condition and an indication of a 'strong' form of sustainability (Bohn 2007; Quintos 1995; Donoso and Martin 2014). It is worth mentioning, however, that current account sustainability in its strong form may be less dire from a policy perspective.

3. PANICCA unit root test

We are interested in knowing whether current account sustainability or lack thereof comes from common factors that affect African countries, idiosyncratic (country-specific) factors or both. Bai and Ng (2004, 2010) suggest the panel analysis of non-stationarity in idiosyncratic and common components (PANIC) procedure that consists of taking the first difference of the series y_{it} to avoid the problem of spurious regression and then applying the method of principal components (PC) to obtain common and idiosyncratic components. With this method, it is then possible to test which of the two components is the source of nonstationarity. However, Reese and Westerlund (2016), based on existing Monte Carlo evidence (for example, Pesaran et al. 2013; Westerlund and Urbain 2015), argue that the use of PC can render PANIC distorted in small samples. To improve the performance in small samples, Reese and Westerlund takes the PANIC approach but apply the cross-section average augmentation approach of Pesaran (2007) and Pesaran et al. (2013) instead of PC procedure, resulting in PANICCA — Panic on cross-section averages.

This approach is based on the following common factor model:

$$y_{i,t} = \alpha_i{}'D_{t,p} + \lambda_i{}'F_t + e_{i,t} \qquad i = 1,2...N; \qquad t = 1,2...T \qquad (6)$$

where $y_{i,t}$ is the variable of interest, $e_{i,t}$ is a scalar idiosyncratic error, F_t is a vector of common factors with λ_i being the associated vector of loading coefficients, and $D_{t,p}$ is a vector of trends with p equal to zero for the constant-only specification or to 1 for the constant and trend specification. This approach follows the following procedure. First, F_t and $e_{i,t}$ are estimated and then tested for unit roots. To test whether F_t is stationary or not, the ADF-type test is applied if only one factor is estimated. If there are at least two factors, then the iterative procedure as described in Bai and Ng (2004) is followed. For unit root test in $e_{i,t}$, three test statistics namely P_a, P_b, and panel-modified Sargan–Bhargava (PMSB) of Bai and Ng (2010) are proposed (see Reese and Westerlund 2016, p.966-968).

4. Data and empirical results

4.1. Data

Annual data on current account as percent of GDP spanning 1980-2019 were obtained from the World Economic Outlook (WEO) produced by the IMF. Except for Nigeria, for which there is no current account data from WEO for the period 1980-1989, all countries have full current account data in the WEO dataset. Current account data for Nigeria from 1980-1989 were extracted from the World Development Indicator (WDI) database published by the World Bank. In total, 45 African countries are included in our analysis and they are listed in Table IV.

4.2. Empirical results

Our empirical investigation proceeds as follows. First, we implement conventional (first-generation) panel unit root tests that have been amply applied in the literature of panel unit root testing. Secondly, PANICCA test is applied and results are compared. Further, we report results for sub-samples. For subsamples we investigate CA sustainability within the Economic Community of West African States (ECOWAS), the CFA Franc Zone, Southern African

Development Community (SADC) and Common Market for Eastern and Southern Africa (COMESA).

Table II reports results of first-generation panel unit root tests applied to the ratio of CA to GDP. These tests are Breitung (2000), Breitung and Das (2005), The Levin–Lin–Chu (2002), Harris–Tzavalis (1999), Im-Pesaran-Shin (2003) and Hadri (2000) Lagrange multiplier (LM). As summarized in Table I, the first four tests consider the null hypothesis that all the panels contain a unit root, while the null hypothesis for Hadri's test is that all the panels are (trend) stationary.

Table I. Traditional panel unit root tests

Test	Null hypothesis (H0)	Alternative hypothesis(H1)
Breitung lambda	Panels contain unit roots	Panels are stationary
LLC adjusted t*	Panels contain unit roots	Panels are stationary
Harris Tzavalis rho	Panels contain unit roots	Panels are stationary
IPS W-stat	All panels contain unit roots	Some panels are stationary
Hadri LM	All panels are stationary	Some panels contain unit roots

The results of the first four tests in Table II overwhelmingly reject the null hypothesis and provide support for current account sustainability at 1% level of significance across the whole sample and all subsamples. Hadri's test, however, rejects the null hypothesis that CAs of all countries are stationary. Based on these results it would be incorrect to infer that current accounts in Africa are stationary. The nature of the joint hypothesis of traditional panel unit root tests implies that the rejection of the null of joint non-stationarity can be driven by a small number of countries. For example, in a sample of 12 countries, Breuer et al. (2001) find that the rejection of the null of joint non-stationarity was driven by only three cases. Moreover, the first generation of panel unit root tests assume that cross-sectional units are independent[2] and thus these tests are unable to inform us on the sources of non/stationarity; whether it is due to common shocks or shocks that are specific to individual countries.

Table II. Traditional panel unit root tests results

	Full sample	ECOWAS	CFA	SADC	COMESA
Breitung Lambda	-7.825	-3.021	-4.684	-4.466	-5.906
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
LLC adjusted t*	-7.458	-3.977	-6.336	-3.927	-4.678
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Harris Tzavalis rho	0.578	0.636	0.554	0.683	0.667
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IPS W-stat	-10.186	-6.368	-6.282	-4.694	-5.122
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

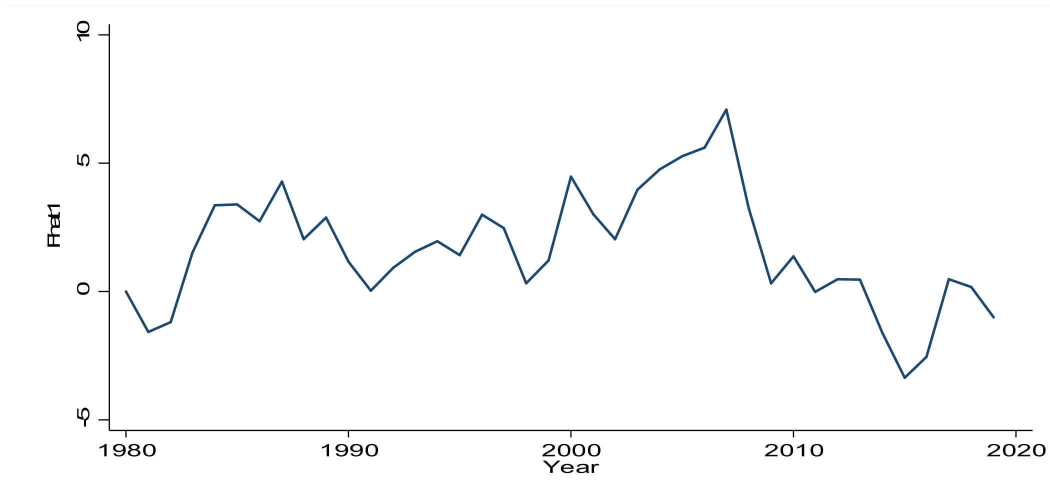
[2] The assumption of cross-sectional independence is quite unrealistic; cross-section dependence can arise due to spatial or spillover effects or could be due to unobserved (or unobservable) common factors (Baltagi and Pesaran 2007; Habimana 2016).

Hadri LM	24.126	33.978	14.787	16.889	12.977
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: P-values are in parentheses.

To shed more light on the sources of current account sustainability we implement the PANICCA test. First this test is applied to the common factors and then to country-specific components. Using the information criterion as described in Bai and Ng (2002) and Reese and Westerlund (2016), only one common factor is estimated, and it is depicted in Figure 1.

Figure 1. Estimated common factor



Results in Table III indicate overwhelming rejection of a unit root in the common component. This finding is consistent across the full sample and within different groups of economic integration. A stationary common component implies that global events do not have the potential to produce permanent shocks to the current account of these countries.

To test for panel unit root in the estimated idiosyncratic components, three tests are implemented, namely Pa, Pb and PSMB (see Reese and Westerlund 2016). Since CA as percent of GDP does not appear to be trending, we use the constant-only specification. In the full sample, the three tests provide evidence against the null hypothesis of nonstationary idiosyncratic factors. It is worth recalling, however, that the alternative hypothesis for these three tests is that there is at least one country for which the idiosyncratic component of CA is stationary. It is expected therefore that these tests overwhelmingly reject the null hypothesis if there is a number of country-specific components that are stationary.

The p-value of the PMSB test is relatively large compared to other two tests —and this pattern is observed across different subsamples of countries as well — which is not surprising because, via Monte Carlo simulations, Reese and Westerlund (2016) find that the PSMB test exhibit the best size (the probability of falsely rejecting the null hypothesis) accuracy, which makes it relatively more conservative and more reliable. Looking at the results across subsamples, there is relatively little evidence of stationary idiosyncratic components within ECOWAS.

Table III. PANICCA test results

	Full sample	ECOWAS	CFA Zone	SADC	COMESA
Common Factor ($\hat{F}_t$)	-4.4405	-2.8453	-5.0568	-3.6137	-5.2703
	(0.0001)	(0.0042)	(0.0001)	(0.0001)	(0.0001)
Idiosyncratic components ($\hat{e}_{i,t}$)					
P_a test stat	-13.104	-1.424	-4.587	-7.476	-8.532
	(0.0000)	(0.0772)	(0.0000)	(0.0000)	(0.0000)
P_b test stat	-5.782	-1.219	-2.432	-3.409	-3.462
	(0.0000)	(0.1115)	(0.0075)	(0.0003)	(0.0003)
PMSB test stat	-2.62	-0.628	-1.301	-1.794	-1.427
	(0.0044)	(0.2649)	(0.0966)	(0.0364)	(0.0768)
# of countries	45	14	13	14	17
# of Years	40	40	40	40	40
# of obs	1800	560	520	560	680

Note: P-values are in parentheses. The null hypothesis of a unit root in the idiosyncratic components of all panels is tested using P_a, P_b and PMSB tests.

At this point, there is evidence that the common factor is stationary, and some idiosyncratic components are stationary as well, but we do not know which ones. As also recommended by Reese and Westerlund (2016), we further report country-by-country results of the ADF test applied on the idiosyncratic component of CA. These results help to shed light on the rather vague null hypothesis and results of Pa, Pb and PMSB tests. Results in Table IV indicate that out of 45 country-specific components of CA, 31—nearly 70%— are stationary. For the 30% of countries exhibiting idiosyncratic nonstationarity, the overall health of these countries' current accounts is related to more country-specific structural issues; hence, policy targeted at addressing these issues are essential for CA sustainability.

Table IV. ADF test on idiosyncratic components (Full sample, 1980-2019)

	Countries	t-stat.	ADF MacKinnon approximate p-value
1	Cabo Verde	-7.854	0.0000
2	Cameroon	-5.025	0.0000
3	Sao Tome	-4.792	0.0001
4	Central African Republic	-4.537	0.0002
5	The Gambia	-4.073	0.0011
6	Republic of Congo	-3.786	0.0031
7	Comoros	-3.665	0.0046
8	Angola	-3.662	0.0047
9	Guinea	-3.612	0.0055
10	Libya	-3.488	0.0083
11	Nigeria	-3.396	0.0111
12	Gabon	-3.383	0.0115
13	Rwanda	-3.357	0.0125
14	Botswana	-3.298	0.015
15	Seychelles	-3.262	0.0167
16	Togo	-3.244	0.0176
17	Senegal	-3.144	0.0234
18	South Africa	-3.067	0.0291
19	Sierra Leone	-3.051	0.0304
20	Mali	-3.043	0.0311
21	Benin	-3.016	0.0335
22	Kenya	-2.904	0.0449
23	Cote d'Ivoire	-2.894	0.0461
24	Mauritius	-2.835	0.0534
25	Malawi	-2.76	0.0642
26	Guinea-Bissau	-2.742	0.067
27	Burundi	-2.706	0.073
28	Burkina Faso	-2.637	0.0855
29	Morocco	-2.629	0.0871
30	Congo, DRC	-2.592	0.0946
31	Chad	-2.574	0.0985
32	Sudan	-2.54	0.106
33	Egypt	-2.47	0.1229
34	Ethiopia	-2.417	0.1369
35	Eswatini	-2.388	0.1453
36	Ghana	-2.34	0.1593
37	Zambia	-2.275	0.1801
38	Lesotho	-2.249	0.189
39	Tunisia	-2.202	0.2056
40	Madagascar	-2.075	0.2548
41	Algeria	-2.069	0.2573
42	Niger	-1.919	0.3234
43	Tanzania	-1.838	0.3618
44	Uganda	-1.45	0.558
45	Mozambique	-0.984	0.7592

5. Conclusion

This paper contributes to the empirical literature on testing current account sustainability. We implement the recently developed panel unit root test of Resse and Westerlund (2016) to investigate the sources of current account sustainability in a sample of 45 African countries. The analysis is performed on the full sample and on different blocks of economic integration, namely ECOWAS, CFA Franc Zone and SADC. Our empirical results indicate that overall, current accounts of African countries are on a sustainable path. This sustainability is mainly driven by the common component and 70% of country-specific components which are mean-reverting. A stationary common component implies that global events do not have the potential to produce permanent shocks to the current account of these countries. However, for the 30% of countries exhibiting idiosyncratic nonstationarity, the overall health of these countries' current accounts is related to more country-specific structural issues; hence, policy targeted at addressing these issues are essential for CA sustainability.

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