Magna Scientia Advanced Research and Reviews

eISSN: 2582-9394

Cross Ref DOI: 10.30574/msarr

Journal homepage: https://magnascientiapub.com/journals/msarr/

(REVIEW ARTICLE)

The relationship between the real exchange rate and capital account: The Case for South Africa

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Magna Scientia Advanced Research and Reviews, 2026, 16(01), 077-081

Publication history: Received on 13 December 2025; revised on 21 January 2026; accepted on 24 January 2026

Article DOI: https://doi.org/10.30574/msarr.2026.16.1.0010

Abstract

This paper examines the relationship between the rand exchange rate and South Africa's capital account. Results we obtained from the autoregressive distribution lag (ARDL) framework suggest that while there is no short run causality between real exchange rate and capital account, in the long run, capital account Granger cause real exchange rate. We interpret our results to suggest that capital inflow play an important role in explaining the dynamic changes in South African rand. Our finding has important policy implication.

Keywords: Exchange rate; Balance of payment; Cointegration; Error corrections

1 Introduction

This paper examines the relationship between real exchange rate and capital account for South Africa. Capital account is a balance of payment account that is made up of the transfer of financial assets and the procurement and disposal of non-produced /nonfinancial assets. The International Monetary Fund (IMF) have pushed for a number of economic reforms in Africa including liberalization of the capital account and foreign exchange markets. Thus, the South African government has inaugurated policies that allowed foreign investors varied degrees of access to their capital markets and adopted a flexible foreign exchange rate system.

2 Literature Review

The literature is not clear on the extent to which capital account affects foreign exchange rate or vice versa. The traditional model on the relation between capital account and foreign exchange rate assumes that changes in international currency flow affects exchange rate (See Machlup, 1939, 1940; Robinson, 1937). The idea behind this model is that exchange rate is determined by changes in demands and supplies in the foreign exchange market. Hau and Rey (2004, 2006) provided empirical support for this model. They document a short-run effect of capital flows on exchange rate. Chakraborty (2003) used the unrestricted VAR framework to show that for India, real effective exchange rate response to one standard deviation innovation to foreign capital inflows. Disyatat and Galati (2007) and Adler and Tovar (2011) suggest that large capital inflows into developing and emerging markets could lead to currency appreciation. However, these countries could use accumulated reserve to sterilize currency appreciation. Muller-Plantenberg (2010) showed how balance of payment imbalances affect the demand for currencies in the foreign exchange market. They found empirical support on their model for major industrial countries as well as countries that suffer from currency crisis.

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On the other hand, it could be argued that capital account does not necessary affect real exchange rate. It could also be said that Capital restrictions does not necessarily solve currency fluctuation. Ghosh and Kim (2012) demonstrated the equality between trade restrictions and capital account in a two-period small-open-economy model. Glick and Michael (2002) demonstrated on a comprehensive panel data set of 69 developing countries that capital restrictions do not effectively protect economies from currency problems.

Consequently, this paper examines the causal relationship between capital account and real effective exchange rate of South African rand. The paper uses the ARDL cointegration and the Granger-causality methodology. The remainder of the paper is organized as follows: Section 2 presents the literature review. Section 3 presents the methodology including the bound test for cointegration and Granger causality test results. Finally, section 4 offers some concluding remarks and findings

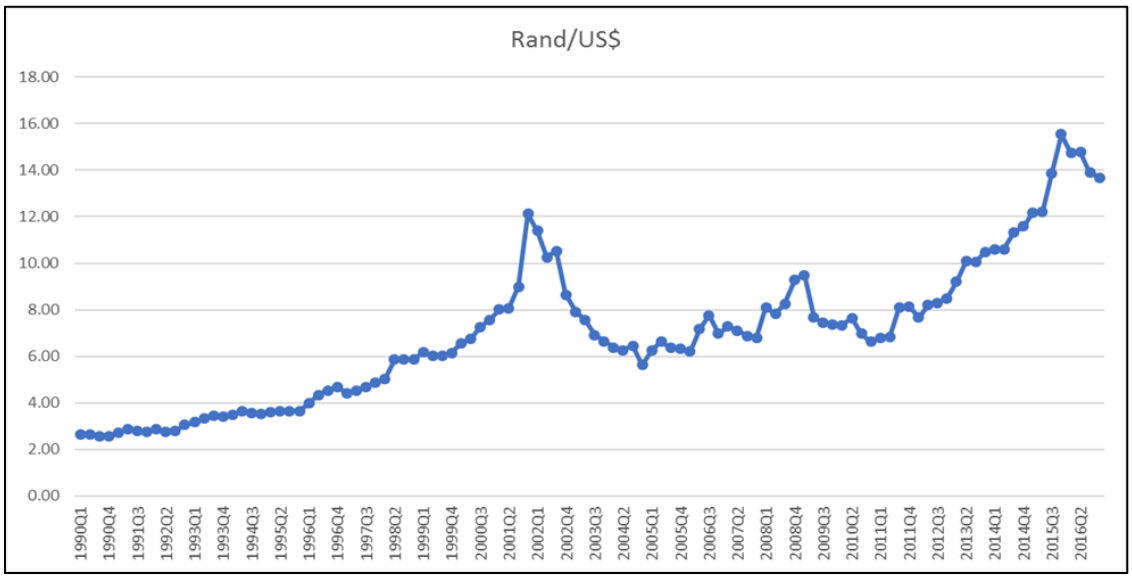

Figure 1 South African Real Exchange Rate

3 Some Modeling Issues

We use quarterly data from 1975Q1 through June 2006Q1, accounting for 125 quarterly observations. The data are obtained from the St. Louis Federal Reserve Statistical Release. The ARDL bounds testing approach starts with estimating the conditional ARDL error correction model (ARDL-ECM) model as follows:

$$\Delta REER_t = \alpha_0 + \sum_{i-1}^{p} \gamma_i \, \Delta REER_{t-1} + \sum_{i-0}^{p} \delta_i \, \Delta Capital\ Account_{t-1} + \pi_1 \, REER_{t-1} + \pi_2 \, Capital\ Account_{t-1} + \varepsilon_i \quad (1)$$

$$\Delta Capital\ Account_t = \alpha_0 + \sum_{i-1}^{p} \gamma_i \, \Delta Capital\ Account_{t-1} + \sum_{i-0}^{p} \delta_i \, \Delta REER_{t-1} + \pi_1 \, Capital\ Account_{t-1} + \pi_2 \, REER_{t-1} + \varepsilon_i \quad (2)$$

In equation 1 and 2, Δ denotes the first difference operator, α_0 is the drift component and ε_i is the random error. The left-hand side is the one-quarter real effective exchange rate and capital account for equations 1 and 2 respectively. The expressions on the right-hand side, with the summation sign ($\gamma_i, and\ \delta_i$) represent the short-run dynamics while the remaining two expressions ($\pi_1\ and\ \pi_2$) represent the long-run relationship. Equation 2 is the case for which we alternate the dependent variable. We then use the partial *F*-test to test the null hypothesis of no co-integration as follows:

$$H_1: \pi_1 = \pi_2 = 0 \quad (3a)$$

$$H_{1a}: \pi_1 \neq 0;\ \pi_2 \neq 0 \qquad (3b)$$

As discussed by Pesaran, Shin, and Smith (2001), the distribution of the *F*-statistics for testing the relations in the ARDL model are non-standard and therefore permit us to analyze the ARDL models even when we do not know whether the regressors are *I*(1) (integrated of order one or nonstationary) or *I*(0) (Integrated of order zero or stationary). Pesaran, Shin, and Smith (2001) provide upper and lower bound critical values, where the upper bound critical values assume all variables are *I*(1) and the lower bound critical values assume all variables are *I*(0). This permits us to make co-integration inference irrespective of whether the regressors are of *I* (1) or *I*(0). We reject the null hypothesis of no co-integration if the calculated *F*-statistic is above the upper critical value. We cannot reject the null if the *F*-statistic is below the lower critical value. Our results are inconclusive if the *F*-statistics falls between the upper and the lower critical values. Evidence of co-integration can be ascertained if the ECT in equation 4 and 5 below is negative and significant.

The error correction version of ARDL model incorporates the short-run dynamics with the long-run elasticities which are the coefficient of the one lagged dependent variable (multiplied with a negative sign) and divided by the coefficient of the one lagged dependent variable. The error correction version of ARDL model is as follows:

$$\Delta REER_t = \alpha_0 + \sum_{i-1}^{p} \gamma_i\ \Delta REER_{t-1} + \sum_{i-0}^{p} \delta_i\ \Delta Capital\ Account_{t-1} + \psi\ ECT_{t-1} + \quad \mu_i \qquad (4)$$

$$\Delta Capital\ Account_t = \alpha_0 + \sum_{i-1}^{p} \gamma_i\ \Delta Capital\ Account_{t-1} + \sum_{i-0}^{p} \delta_i\ \Delta REER_{t-1} + \psi\ ECT_{t-1} + \quad \mu_i \qquad (5)$$

In equations 4, ECT is the residual obtained from the estimated co-integration model of equation (1) and ψ is the speed of adjustment parameter. In equation (5), we again alternate the dependent variable to capital account and adjust the formula accordingly. The ARDL approach is appealing as it estimates the short and long-run dynamic relationships of capital account and exchange rate simultaneously. For short term dynamics, we test whether each of the coefficients $\gamma_i, and\ \delta_i$ in equation 4 and 5 are statistically significant. The long-run relationship among the series exists if the coefficient ψ is negative and significant. The ARDL model relieves the burden of determining the order of integration amongst the regressors. The model distinguishes between dependent and explanatory variables and permits the testing of long-run equilibrium relationship among these variables.

4 Methodology

4.1 Alternative Empirical Results

This study uses autoregressive distribution lag (ARDL) bound testing procedure to test for cointegration. The ARDL framework is only valid if and only if the series are either *I(0)* or *I(1).* To this end, we begin our analysis by checking the stationarity of real exchange rate and capital account using the Augmented Dickey-Fuller (ADF) and the Philip Parron (PP) procedure. Our results in Table 1 suggest that capital account is stationary in levels whereas real exchange rate is non-stationary in levels but become stationary when converted to first-differences.

Table 1 Unit Root Test Results

	ADF(h) Test		**PP(k) Test**	
	Intercept	Intercept and trend	Intercept	Intercept and trend
A. Variable in Levels				
Exchange rate (REER)	-1.909(3)	-3.175(3)	-1.849(4)	-2.455(4)
Capital Account	-3.659(2)**	-3.607(2)**	-8.710(7)**	-8.742(7)**
B. Variable in First-Difference (Δ)				
Δ (REER)	-5.356(2)**	-5.336(2)**	-9.571(5)**	-9.536(5)**

Δ (Capital Account)	-8.717(3)**	-8.734(3)**	-43.815(31)**	-52.175(34)**

Notes: The proper lags (*h* and *k*) are determined based on the AIC. An ** indicates rejection of the null hypothesis of non-stationarity at the 5% level of significance.

Table 2 show the partial F-statistics along with the asymptotic critical values of the bounds testing procedure associated with the null hypothesis of no co-integration or long-run equilibrium relationship between real effective exchange rate and capital account.

Table 2 Bound test for cointegration

	90% Critical Value bounds		**95% Critical Value bounds**	
F-Statistics	I(0)	I(I)	I(0)	I(I)
$F_{REER}(REER/Capital\ Account)$ = 1.9008	3.02	3.51	3.62	4.16
$F_{Capital\ Account}(Capital\ Account/REER)$ = 4.4334				

Note: Critical value bounds are from Pesaran *et al*. (2001).

Results in table 2 provide evidence that when capital account is the dependent variable, the calculated *F*-statistic $F_{Capital\ Account}(Capital\ Account/REER)$ = 4.4334 is greater than the upper bound of the critical value of 4.16 at the 5% level of statistical significant whereas when exchange rate is the dependent variable, the calculated *F*-statistic $F_{REER}(REER/Capital\ Account)$ = 1.9008 lower than the lower bound critical value of 3.62 at the 5% level of significance. These results clearly indicate a co-integrating relationship among REER and Capital account when capital account is the dependent variable. The presence of co-integration implies a stationary long-run relationship among capital account and real exchange rate. This suggests the existence of ripple effects in which shocks in real exchange rates are transmitted to South Africa's current account.

Table 3 Results of Granger causality

	Chi Square-Statistics [probability values]		
	$\Delta REER_t$	**ΔCapital Account$_t$**	**ECT_{t-1}**
Dependent variable			[t-statistics]
$\Delta REER_t$	-	6.703	-
		[0.153]	
ΔCapital Account$_t$	2.189	-	-0.291**
	[0.701]		[-2.231]

Notes: Horizontal rows report the test results based on the error-correction model. "ECT" is the equilibrium error. Δ represents the first-difference operator. The values associated with Δ(.) are the respective chi-squared statistics associated with the joint significance of the lagged coefficients.

** Statistical significance at the 5% levels

Table 3 report results of the Granger causality model. The statistical insignificance of the chi square on the difference short-run estimates suggests that there are no short-term causal effects. However, the lagged error correction term, when capital account is the dependent variable, is negative and significant, a confirmation of the findings from the cointegration test that there is a long-run relationship. The error correction coefficient is high (-0.291), which suggest that capital account exhibit fast adjustment toward long-run equilibrium.

5 Concluding and Findings

By using autoregressive distribution lag (ARDL) bound cointegration procedure and the Granger causality model, the nature of the relationship between real exchange rate and capital account was studied for South Africa during the first quarter of 1975 to the first quarter of 2006. The ARDL cointegration test support the presence of a long-run relationship between real exchange rate and capital account. In addition, Granger causality tests support a long-run unidirectional causality from real exchange rate to capital account and no short run causality between real exchange rate and capital

account. A negative and significant error-correction term suggests that some proportions of the divergence between the capital account and real exchange rate, will be corrected within the subsequent period.

Compliance with ethical standards

Disclosure of conflict of interest

No the conflict of interest to be disclosed.

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