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The effects of interest rates on the BRICS exchange rate: a 2SLS approach

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Abstract

This study explores the impact of interest rates on the exchange rates of the BRICS nations—Brazil, Russia, India, China, and South Africa. By incorporating control variables such as inflation and broad money supply, this analysis employs Granger causality tests to detect potential endogeneity and estimates a Two-Stage Least Squares (2SLS) model using panel data. The findings reveal that interest rates significantly influence exchange rates in these countries, emphasizing their importance in the formulation of effective monetary policies.

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1 Introduction

Emerging markets have consistently attracted the attention of economists and investors due to their distinctive characteristics compared to developed economies. These features include expansive domestic consumption markets, export dependency on commodities, and the occurrence of negative betas in asset pricing. Furthermore, these economies often exhibit high benchmark interest rates, creating lucrative opportunities for foreign investors, particularly in the context of public-private partnerships for infrastructure development [Yamahki and Breviglieri, 2022]

In this context, exchange rates are pivotal for decision-making processes and directly influence the macroeconomic stability of these nations. This study examines the effect of interest rates on the exchange rates of BRICS countries, with inflation and broad money supply as control variables. Granger causality tests are conducted to assess variable interdependence, and a 2SLS model is applied to mitigate endogeneity biases.

The literature on exchange rates in emerging markets is extensive, with significant contributions from authors such as Chue and Cook (2008), Devereux et al. (2006), and Turhan et al. (2013). More recent studies (e.g., Banerjee and Goyal, 2022; Aldasoro et al., 2023) further underscore the ongoing relevance of this topic, particularly for economies characterized by dynamic investment opportunities.

This work aims to expand on this body of research by providing empirical evidence of the impact of interest rates on BRICS exchange rates. The results offer insights for economic policymakers focused on stabilizing exchange rates to enhance trade balances and economic performance in the region.

2 Methodology

2.1 Data

The dataset comprises annual data from 2003 to 2021, including nominal exchange rates (E) in US dollars, interest rates (I), inflation (π), and broad money supply (M). Exchange rate data were sourced from the International Monetary Fund (IMF), while money supply data were obtained from the Federal Reserve Economic Data (FRED) of the St. Louis FED. To account for potential distortions, all variables were transformed into natural logarithms.

2.2 Granger Causality

To verify the existence of endogeneity between the variables, the Granger Causality test is performed, estimated using Equations (1) and (2).

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{j=1}^{q} \beta_j X_{t-j} + \xi_t \tag{1}$$

$$X_t = \sigma_0 + \sum_{i=1}^{r} \sigma_i X_{t-i} + \sum_{j=1}^{s} \rho_j Y_{t-j} + \mu_t \tag{2}$$

The test evaluates whether past values of one variable enhance the prediction of another. For example, if interest rates Granger-cause exchange rates, it implies that historical interest rate data significantly explain variations in exchange rates.

2.3 Two-Stage Least Squares (2SLS)

The 2SLS method addresses endogeneity by using lagged explanatory variables as instruments. Equation (3) outlines the model structure:

$$E_t = \beta_0 + \beta_1 E_{t-1} + \beta_2 I_t + \beta_3 I_{t-1} + \beta_4 \pi_t + \beta_5 \pi_{t-1} + \beta_6 M_t + \beta_7 M_{t-1} + \varepsilon_t \tag{3}$$

3 Results

The Granger causality test results are summarized in Table 1.

The presence of endogeneity is evident between interest rates and exchange rates, among other variable pairs. This validates the use of 2SLS to ensure consistent parameter estimation. Endogeneity is due to the explanatory variable

Table 1: Granger Causality Test

Null Hypothesis	p-value
I Granger-cause E	0.0371**
E not Granger-cause I	0.9060
π not Granger-cause E	0.3585
E Granger-cause π	0.0381**
M not Granger-cause E	0.9164
E not Granger-cause M	0.7424
π not Granger-cause I	0.6772
I not Granger-cause π	0.6176
M Granger-cause I	0.0197**
I Granger-cause M	0.0311**
M not Granger-cause π	0.5637
π Granger-cause M	3.E-06***

being correlated with the error term. To correct this problem, one of the possibilities is to use time lags of the original regressors, making them instrumental variables and assuming zero correlation between the instruments and the model errors [Wooldridge, 2011]. In this way, the 2SLS model was estimated, and its results are presented in Table 2.

The results from Table 2 indicate that exchange rates are statistically significant in explaining BRICS exchange rates. Thus, an increase in interest rates in the previous year would lead to an increase in the exchange rate, causing a depreciation of the country's currency. This depreciation could enhance exports and negatively affect imports, improving the trade balance. However, the interest rate observed in the previous two years is negatively related to the exchange rate, meaning that positive variations in interest rates in the two years prior would hurt the exchange rate.

The control variable for inflation proved to be statistically significant. Considering the previous year and the two prior years, inflation positively influences the exchange rate, with this depreciation potentially creating a favorable scenario for exports and an unfavorable one for imports. In contrast, a generalized decrease in prices would lead to a decline in the exchange rate, appreciating the country's currency. When the price level rises, the goods and services traded in the market become less competitive, and to compensate for this effect, the exchange rate tends to increase, causing the economy to overheat and restore competitiveness to the goods and services.

The control variable for broad money supply was also statistically significant in the previous two years, showing a positive correlation with the exchange rate. This is likely because an increase in the money supply raises the general price level, resulting in a depreciated exchange rate. If the opposite were true, it would reduce demand for goods and services, causing a decrease in prices and, consequently, a drop in the exchange rate.

Table 2: Results

Dependent Variable:	**2SLS**
E_t	1.0641^{***}
	(0.0779)
E_{t-1}	-0.0746
	(0.0726)
I_t	-0.02323
	(0.0388)
I_{t-1}	0.0551^{***}
	(0.01442)
I_{t-2}	-0.0803^{**}
	(0.0331)
π_t	2.71848^{***}
	(0.7969)
π_{t-1}	-3.5358^{***}
	(1.0154)
π_{t-2}	0.9120^{***}
	(0.3079)
M_t	0.0480
	(0.1836)
M_{t-1}	-0.6612
	(0.4332)
M_{t-2}	0.5972^{*}
	(0.3080)
R^2	0.9991
Adjusted R^2	0.9948
F-statistic	5,048.111
Log-Likelihood	143.6904
AIC	-259.3809

Note: *, **, and *** indicate rejection of the null hypothesis at the levels of 10%, 5%, and 1% respectively. The values in parentheses are the standard errors of the estimated parameters.

Therefore, the negative influence of interest rates in the previous two years on the exchange rate may be related to the effects of interest rates on inflation. Higher interest rates in the two years prior could reduce inflation in the following year, and this lower inflation would lead to a lower exchange rate.

4 Final Considerations

This study investigates the relationship between interest rates and exchange rates in BRICS countries, employing Granger causality tests and 2SLS models. The results underscore the critical role of monetary policy in exchange rate stabilization and its implications for trade balances and economic growth. Future research could explore the differential impacts across individual BRICS countries to refine these findings further.

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