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Capital Account Openness, Exchange Rate Flexibility and Exchange Rate Misalignment: Evidence from Developing Economies*

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The study endeavours to investigate macroeconomic determinants of exchange rate misalignment in developing countries with a particular emphasis on exchange rate flexibility and capital account openness. At the first stage, the Behavioural Equilibrium Exchange Rate approach has been adopted to compute exchange rate misalignment by estimating the real exchange rate model using the Cross-Sectionally Augmented Autoregressive Distributed Lags technique. In the second stage, the study employs alternative econometric techniques, namely, Pooled Mean Group, Mean Group, and Dynamic Fixed Effects, to assess the drivers of exchange rate misalignment. The empirical results show that both exchange rate flexibility and capital account openness effectively reduce RER misalignment in developing, emerging, and non-emerging economies, through different channels. RER flexibility enables market-adjusted changes, and capital account openness achieves long-run allocative efficiency through connecting the domestic market with global financial flow. Moreover, macroeconomic variables such as GDP growth, inflation, financial sector development, natural resource rents, and foreign direct investment are found to be major drivers of exchange rate misalignment in these countries. Overall, the analysis underlines the need for coherent policy coordination, focusing on capital account liberalization and a flexible exchange rate regime for managing exchange rate misalignment.

Keywords: Capital Account Openness, Exchange Rate Flexibility, Exchange Rate Misalignment, Panel Data Model

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I. Introduction

Exchange rate (ER) policies undoubtedly play a crucial role in the overall macroeconomic management of developing countries where structural and financial limitations, market imperfections, and external vulnerabilities are pronounced. At one hand, they are fundamental components of macroeconomic stability, foreign capital flows, trade competitiveness, external debt sustainability, and inflation stability. On the other hand, they represent a country's strategic preferences regarding monetary sovereignty, global integration of domestic markets, balance of payment outcomes, and external stability. Historical events, such as the debt crisis of the 1970s, underscore the importance of effective ER management, specifically in developing countries. The financial crisis of 1997-1998 uncovered the vulnerability of emerging markets to external shocks and ER misalignments. More recently, sharp currency fluctuations have also been caused by the COVID-19 pandemic, including the instability of the Turkish lira, the hasty decline of South Asian currencies with respect to the U.S. dollar, and the extreme devaluation of various African currencies in 2022. These events highlighted the fragile nature of the external positions in economies operating with limited buffers. Similarly, unprecedented capital outflows from emerging markets during global monetary tightening have further reinforced their exposure to ER instability. This signifies that ER misalignment is not merely a theoretical construct but a pressing policy challenge with real consequences for growth, inflation, and social welfare.

Recent global developments underscored the importance of analysing the causes and effects of ER misalignment in developing countries, as persistent deviations of the real exchange rate (RER) from its equilibrium level, overvaluation or undervaluation, can cause significant economic distortions. These may include trade imbalances, loss of global competitiveness, loss of monetary independence, and inflationary pressures. The existing literature also provides sufficient evidence by linking prolonged overvaluation of the RER to severe economic crises (Frankel and Saravelos, 2012; Gnimassoun and Mignon, 2015), hence highlighting the need to study the factors causing persistent ER movements.

The RER misalignment is determined by both structural factors, such as productivity differentials, institutional quality, terms of trade, demographic transition, and policy decisions, including exchange rate regimes, foreign exchange interventions, monetary tightening, and fiscal indiscipline. Among various structural and policy variables,

exchange rate flexibility (ERF) and capital account openness (CAO) appear particularly crucial in determining RER misalignment. The ERF, which describes a currency's ability to adapt to changing market conditions, can act as a safety valve for developing countries owing to their shock absorption characteristic and enabling ERs to align with economic fundamentals at a faster rate, while fixed or pegged regimes may offer short-term stability at the risk of long-term imbalances. The inherent rigidity of fixed/pegged exchange rates can inevitably lead to macroeconomic imbalances and currency misalignment. On the other hand, CAO gauges the intensity of free foreign capital movements among countries. It can improve allocative efficiency of resources and help in attracting foreign investment. However, economies with weak institutional frameworks and underdeveloped financial markets are more vulnerable to speculative attacks and prone to sudden capital flight. The interaction of these two factors, namely, ERF and CAO, is, therefore, critical as it has the potential to either lessen or exacerbate RER misalignment in developing economies.

The theoretical underpinnings concerning capital account openness and exchange rate flexibility are fundamentally complementary and support this integration, along with some contrasting implications for macro-financial stability. For instance, the Mundell-Fleming model (1960s) through Impossible Trinity, and Optimum Currency Area (Mundell, 1961) underscores the significance of flexible exchange rates and capital mobility for developing countries due to their several advantages; the combination of ERF and CAO ensures monetary independence in developing countries, speedy adjustment of the foreign exchange market towards equilibrium, improvement in country's shock absorption capacity, access to foreign investment, and diversification of risks and portfolios. Moreover, the monetary approach to balance of payment (Frankel and Johnson, 1976) and New Open Economy Macroeconomics (Obstfeld and Rogoff, 1995) also advocate that external sector imbalances are adjusted through flexible exchange rate. They argue that this adjustment mechanism helps restore money market equilibrium in the short run while simultaneously accommodating long-term monetary preferences. McKinnon–Shaw hypothesis and the international approach to capital account explain the investment efficiency owing to financial liberalization and capital account openness, including responsiveness of capital flows to economic policies, and faster adjustment towards equilibrium (Mckinnon, 1973; Shaw, 1973). On the flip side, the implications of both ERF and CAO present some caution for macro-financial stability and policy control. For instance, countries with ERF may experience external sector instability through excessive currency volatility, terms of

trade shocks, the Dutch disease phenomenon, and the fear of dollarization. Similarly, global market integration may lead to international capital flows volatility, asset bubbles, and sudden stops if capital flows are poorly managed. Policymakers need to balance these contrasting forces and design policy frameworks that can manage the combination of CAO and ERF most effectively.

For developing countries with structural challenges and weak institutional framework such as volatile commodity revenues, reliance on a narrow export base, and underdeveloped financial markets (Dubas, 2009), persistent misalignments can create inflationary pressures, undermine export competitiveness, discourage foreign investment, and ultimately stifle growth. Moreover, in an interconnected global economy, the fallouts of misalignments in one region can transmit into international financial markets, amplifying systemic risks (Edwards, 2018; Mahraddika, 2020). Hence, understanding the drivers of misalignment, particularly the role of ERF and CAO, is a matter of urgent policy importance in the developing world.

Given this contextual background, the study has four interrelated objectives that contribute to the literature on RER misalignment, specifically in developing countries: First, the study computes RER misalignment for a sample of developing countries over the period 1980-2021 by using the Behavioural Equilibrium Exchange Rate (BEER) approach. In this regard, the RER model has been estimated by employing the Cross-Sectionally Augmented Autoregressive Distributed Lags (CS-ARDL) technique. This is a novel methodological contribution of the study as CS-ARDL explicitly addresses cross sectional dependence and unobserved global factors that are pronounced in developing countries. By accounting for these econometric challenges, the study improves the robustness of misalignment estimates. Second, the study empirically examines the direct and simultaneous impacts of two important policy variables (exchange rate flexibility and capital account openness) on RER misalignment, thereby presenting the policy–misalignment nexus. In doing so, the study expands the literature beyond the separate assessment of the impact of ERF and CAO on misalignment. Our findings provide important insights for policy makers in developing economies to design policies in their specific context and prioritize their preferences to adopt the policy mix.

Third, an important contribution of the study is the comparative analysis of emerging and non-emerging developing economies to capture and uncover the possible heterogeneity in the impact of CAO and ERF on RER misalignment. This exercise allows us to move beyond the average effect and to identify how financial development,

institutional quality, and structural factors influence the effectiveness of CAO and ERF for misalignment. Along with confirming the complementary role of both, we also establish the prerequisites required in each set of countries to institutionalize benefits from the ERF and CAO. Hence, our study shifts the debate from whether the CAO and ERF matter to which policy instrument matters more for which group of countries and under what conditions. Fourth, the study provides policy-relevant implications for developing countries on designing effective exchange rate regimes and external sector strategies. The analysis suggests the policy framework that leads towards macro-financial stability, promotes automatic adjustment mechanisms, and also facilitates policy control. By incorporating both macroeconomic and policy variables into the analysis and employing advanced econometric techniques, the study contributes to the empirical literature in novel ways.

The significance of the study can be gauged from various perspectives. Firstly, this study empirically addresses a relatively under-researched issue of how CAO and ERF influence RER misalignment in developing countries, despite their immense economic significance. RER misalignment may result in economic instability and dampen external sector competitiveness, thereby making this research extremely relevant. Secondly, this study combines both real and financial sector variables in estimating equilibrium RER. This enables us to understand RER misalignment from a wider perspective and recognise the role of financial integration in determining RER behaviour. Thirdly, the study employs the CS-ARDL technique to address cross-sectional dependence, offering a more robust and reliable empirical analysis. Finally, the research adopts a comparative approach by dividing the sample into emerging and non-emerging developing countries. This allows us to understand how ERF and CAO affect different groups of countries with varying levels of development. This exercise enables the design of policies specific to the needs of each group, instead of prescribing a one-size-fits-all solution. Overall, the study not only contributes to the academic literature but also to the policy debate on the exchange rate management, CAO, and RER misalignment in developing countries.

The rest of the paper is structured as follows: Section II examines the literature and identifies important research gaps; Section III outlines the methodology, data sources, and estimation techniques; Section IV presents and discusses the empirical findings; and the final section concludes with an overview of the key findings and their policy implications.

II. Literature Review

ER misalignment, characterized by a sustained divergence between the actual and equilibrium exchange rates, has far-reaching consequences for macroeconomic stability, trade performance, and resource allocation. The literature on ER misalignment extensively covers its determinants, consequences, and the role of policy frameworks, particularly CAO and ERF. This section synthesizes existing empirical research, paying special attention to findings from developing nations.

Fukuda and Ohno (2003) examine post-crisis exchange rate behavior in Singapore, Thailand, Korea, Taiwan, and Malaysia by analyzing how these currencies evolve after the collapse of pre-crisis de facto pegs to the U.S. dollar. The study emphasizes that strong trade and financial integration across East Asia causes regime changes in one country to influence exchange rate behavior in neighboring economies. Strong institutions and sophisticated financial systems reduce ER misalignments. Applying structural break analysis for the Australian case, Hoarau et al. (2008) find that RER deviations need to be corrected through a sound monetary policy. Moreover, the study finds that an inflation-targeting policy combined with a managed (dirty) flexible exchange rate regime works effectively in mitigating RER misalignments in the Australian economy. Saadaoui et al. (2013) scrutinize the effect of capital account openness on exchange rate misalignment in emerging and industrialized economies from the period 1982 to 2008. From the evidence, they establish a negative link between CAO and ER misalignment. The authors contend that greater capital mobility facilitates easy monetary adjustment and contribute in the reduction of misalignment, whereas the restrictive capital controls tend to have the opposite effect. Caputo (2015) uses the Behavioral Equilibrium Exchange Rate (BEER) method within an Error Correction Model (ECM) framework to examine the long-run link between ER regimes and ER misalignment for the period 1964 to 2005. The study finds that misalignment tends to be comparatively small under fixed exchange rate regimes. Montecino (2018) further emphasizes that restrictions on capital flows tend to exacerbate undervaluation, with effects more pronounced under prolonged misalignment episodes. By contrast, developing countries often encounter sustained exchange rate misalignments due to structural rigidities, underdeveloped institutions, and heightened exposure to external volatility (Hyder and Mahboob, 2006; Combes et al., 2012). While the selection of exchange rate regimes is widely regarded as a key determinant of misalignment, empirical results remain heterogeneous across regions and methodological frameworks.

Several studies affirm the stabilizing effect of flexible regimes. For instance, the country-specific study of Hyder and Mahboob (2006) on Pakistan finds that enhanced flexibility facilitates a more efficient return to equilibrium. Similarly, Coudert and Couharde (2009) report that greater ERF in emerging markets expedites realignment during inflationary or externally driven episodes. Nonetheless, Dubas (2009), in a panel study of 102 developing economies, finds that floating regimes may also lead to heightened volatility in misalignment, particularly in markets lacking robust monetary institutions. Jongwanich (2009) provides detailed evidence on real exchange rate misalignment in East and Southeast Asian economies by comparing actual real exchange rates with their estimated long-run equilibrium levels over the period surrounding the 1997-1998 Asian financial crisis. Overall, the evidence from East Asia indicates that real exchange rate misalignment is closely linked to crisis dynamics, capital flow episodes, and policy responses, and that persistent misalignment diminished in the post-crisis period as exchange rate movements became more consistent with underlying fundamentals.

The interplay between CAO and ER flexibility emerges as a moderating factor. Combes et al. (2012), examining a cross-section of 42 developing economies, demonstrate that flexible regimes help absorb appreciation pressures resulting from capital inflows. Dagdeviren et al. (2012), for Turkey's transition from a fixed to a floating regime, find that greater flexibility significantly reduced RER misalignment during economic crises. Holtemoller and Mallick (2013) also confirm that exchange rate flexibility lowers the risk of disequilibrium, highlighting the effectiveness of market-determined ER adjustments. Vu (2015) explains that RER fluctuations vary across exchange rate regimes, by using evidence from two East Asian Economies namely, Korea and Thailand, that experience clear regime shifts over time. Using a structural VAR approach, the results show that exchange-rate-specific shocks play a much larger role in RER fluctuations under floating regimes in both Korea and Thailand. Demand shocks remain the dominant source of real exchange rate fluctuations across both regimes and both countries; supply shocks contribute modestly, while monetary shocks play only a limited role in explaining real exchange rate dynamics. The study highlights that increased flexibility enhances adjustment to fundamental shocks but also exposes these economies to greater non-fundamental exchange rate volatility. The study highlights the policy trade-off between stabilization and adjustment inherent in regime choice. However, Bikai and Owoundi (2016), in the context of Sub-Saharan Africa, contend that structural fundamentals exert a stronger influence than

regime type alone in addressing misalignment. Recent empirical contributions continue to reinforce the importance of well-designed ER regimes. Mahraddika (2020) and Aman et al. (2022) provide evidence that intermediate or managed floating regimes, when combined with CAO, tend to reduce both the size and duration of RER misalignments in emerging economies. Regional analyses by Slimani and Ben Allem (2018) for the MENA region and by Dakoure et al. (2023) for Sub-Saharan Africa consistently find that fixed regimes amplify misalignment pressures, while flexible arrangements support correction mechanisms through market-based adjustments.

Despite the substantial body of existing research, there remains a substantial gap in understanding the distinct roles played by CAO and ERF in determining misalignment, mainly in the context of developing countries. While several studies have explored the general association between ER regimes and macroeconomic outcomes, the majority of the literature has tended to focus on developed or emerging market economies, often neglecting the structural specificities and institutional constraints that characterize low- and middle-income countries. Moreover, some of the existing studies take into account the ER regime and CAO jointly, either by using regime classification schemes or interaction terms. In addition, a significant number of earlier investigations either rely on static estimation techniques or do not take into consideration important econometric concerns such as cross-sectional dependence (CSD), heterogeneous slope coefficients, and the mixed order of integration that are commonly observed in macroeconomic panel datasets.

These methodological limitations raise concerns about the robustness and generalizability of existing findings, specifically for developing economies. In light of these gaps, the present study seeks to contribute to the literature by disentangling the individual effects of CAO and ERF on RER misalignment in developing countries. Utilizing the CS-ARDL estimation technique, this study rigorously addresses cross-sectional dependence, thereby enhancing the reliability and contextual relevance of its empirical findings. By doing so, the research seeks to bridge a significant gap in the existing literature by delivering a more refined and methodologically sound investigation into the policy-driven determinants of exchange rate misalignment within developing economies.

III. Methodology and Data

This study has employed a structured two-stage methodology to assess the effect of CAO and ERF on RER misalignment in a panel of 48 developing countries from 1980 to 2021. The methodology is based on a Behavioural Equilibrium Exchange Rate (BEER) framework, supported by advanced panel econometric techniques to address heterogeneity, non-stationarity and cross-sectional dependence. This section outlines the theoretical underpinnings, model specifications, data sources, and estimation methods employed.

1. Estimation and Computation of RER Misalignment

The first step is to estimate the Equilibrium RER (ERER), defined as the level of the RER that is consistent with a country's long-term economic fundamentals and macroeconomic balance. To this end, the study has employed the BEER approach developed by Clark and MacDonald (1999), a widely recognized approach for modelling the RER in response to structural macroeconomic determinants. Later, RER misalignment is computed by taking the difference between the observed RER and the estimated ERER. BEER is preferable for this study because our research question focuses specifically on how structural fundamentals and policy variables shape long-run equilibrium exchange rates and misalignment across 48 heterogeneous developing economies. One of the key elements of this approach is that it is a statistical, data-driven method, and estimates a long-run relationship between the RER and a set of key economic fundamentals that explain its actual and observed behaviour. BEER approach is more efficient with the economic and structural variables, while applying the other two approaches is associated with more data and theoretical challenges, specifically in the context of developing countries. For instance, the Fundamental Real Exchange Rate (FEER) approach requires an unobservable policy target, such as full employment and current account targets, which are usually difficult to obtain for developing countries. On the other hand, the Natural Real Exchange Rate (NATREX) approach relies on long-term natural trends that may be disguised by a structural break (Jehan and Irhsad, 2020; Carrera et al., 2021; Dakure et al., 2023).

Within the BEER framework, the real exchange rate (RER) is modelled as a function of key macroeconomic fundamentals that influence external competitiveness and long-

run equilibrium dynamics. These determinants are selected based on the standard economic theory and empirical practice. The relationship is formalized as follows:

$$LRER_{it} = \beta_0 + \beta_1 GE_{it} + \beta_2 PROD_{it} + \beta_3 NFA_{it} + \beta_4 TOT_{it} + \beta_5 RIRD_{it} + \beta_6 TO_{it} + \beta_7 INV_{it} + e_{it} \quad (1)$$

LRER represents the log of the real bilateral exchange rate computed as $[RER = OER * (\frac{CPIus}{CPI\ home})]$ where OER is the official exchange rate (local currency units per USD). Government expenditure (GE), expressed as a share of GDP, serves as a proxy for fiscal policy stance and domestic demand pressures, where higher public spending often correlates with appreciation of the RER through demand-side effects. Productivity differentials (PROD) are measured as the ratio of the country's GDP per capita to the US GDP per capita. It captures relative labor efficiency and competitiveness, typically suggesting that productivity gains in the tradable sector support real appreciation. The net foreign asset (NFA) as a percentage of GDP reflects the long-term sustainability of a country's external accounts, where positive balances can strengthen the currency, while negative positions may exert depreciation pressure. Terms of trade (TOT), defined as the ratio of export to import prices, affect a country's external income and influence the equilibrium exchange rate through price effects on traded goods. Trade openness (TO), measured as the share of exports and imports in GDP, signifies the country's connection to the world market and can apply either appreciation or depreciation pressure on the currency based on trade balance and structural competitiveness. The real interest rate differential (RIRD), measured as the difference between domestic and US real interest, signifies the difference in the real rate of return on financial instruments between countries and influences capital flows and, thereby, the RER. Finally, domestic investment (INV) as a percentage of GDP is also added in the model in order to capture capital accumulation and its effects on both the import demand and future productive capacity. These variables jointly determine the equilibrium relationship with the RER, and deviations from this long-run path constitute the misalignment.

(1) Equilibrium RER and Misalignment Calculation

To estimate the equilibrium RER, the long-term trend components of the explanatory variables are extracted using the Hodrick–Prescott (HP) filter, which separates structural

components from cyclical fluctuations.[1] This filtering technique smooths out short-term fluctuations and reveals the underlying trends. The fitted values from the long-run regression using these trend components define the ELRER. The RER misalignment is then computed as the difference between the actual LRER and its equilibrium value:

$$mis_{it} = \frac{LRER_{it} - ELRER_{it}}{ELRER_{it}} \times 100$$

A positive misalignment indicates that the currency is overvalued, meaning it is stronger than justified by fundamentals, while a negative misalignment implies undervaluation of the domestic currency.

2. Estimation of the Determinants of RER Misalignment

The second stage of the methodology analyses the institutional and macroeconomic factors that drive deviations of RER from the equilibrium RER. In this model, the misalignment estimated from Model 1 becomes the dependent variable. Building on the work of Nouira and Sekkat (2015), Saadaoui et al. (2013), Montecino (2018), Mahraddika (2020), Carrera et al. (2021), and Dakoure et al. (2023), this study employs a panel regression framework to model the macroeconomic drivers of RER misalignment in developing economies.

$$\begin{aligned} mis_{it} = {} & \alpha_1 + \alpha_2 ERF_{it} + \alpha_3 CAO_{it} + \alpha_4 FD_{it} + \alpha_5 INF_{it} + \alpha_6 FDI_{it} \\ & + \alpha_7 RR_{it} + \alpha_8 GDP_{it} + v_{it} \end{aligned} \quad (2)$$

In this model, mis_{it} represents the degree of RER misalignment for country *i* at time *t*, calculated as the deviation of the actual RER from its estimated equilibrium level. The variable ERF_{it} captures exchange rate flexibility, proxied by exchange

[1] Hodrick–Prescott (HP) filter is widely used to extract long-run trends (Hodrick and Prescott, 1997) in various BEER based studies (Coudert and Couharde, 2009; Jongwanich, 2009; Jehan and Irshad, 2020). Despite its limitations such as sensitivity to the choice of the smoothing parameter and end-point bias, HP filter efficiently separates smooth long-term movements from cyclical fluctuations without discarding low-frequency information as compared to the other alternative methods such as linear trends, moving averages, or first-differencing.

market pressure; this reflects the extent to which the ER responds to market forces. A higher degree of flexibility is expected to mitigate persistent misalignments by allowing for nominal adjustments in response to economic shocks. Capital account openness, denoted as CAO_{it}, is measured by the Chinn-Ito index and reflects the degree of liberalization of cross-border capital flows. The value of this index lies between -2.5 and +2.5. A higher value indicates greater capital account openness. While openness can enhance financial integration and investment, it may also lead to short-term ER volatility and misalignment, particularly in countries with underdeveloped financial systems. Financial development, represented by FD_{it}, is measured as domestic credit to the private sector as a percentage of GDP, serving as a proxy for the depth and efficiency of the financial system. Well-developed financial markets facilitate more effective shock absorption and reduce the risk of misalignment. Inflation, denoted as INF_{it}, is included as a control variable that captures domestic price instability. It acts as a proxy for monetary policy stance. High inflation reduces competitiveness and can cause the real exchange rate appreciation, increasing misalignment. Foreign direct investment, FDI_{it}, measured as a percentage of GDP, reflects long-term capital inflows. While FDI can enhance productivity and support equilibrium ERs, sudden surges may exert appreciation pressure, contributing to temporary misalignment. Natural resource rent, RR_{it} represents the share of national income derived from the extraction of natural resources. It is measured as the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forest rents as a percentage of GDP. Resource-rich economies are often susceptible to RER appreciation due to commodity windfalls, a phenomenon known as "Dutch Disease" which may lead to structural overvaluation and reduced competitiveness in other sectors. Finally, GDP_{it}, representing growth of gross domestic product, serves as an indicator of macroeconomic performance. Higher economic growth is often associated with improving fundamentals and can justify real appreciation, whereas weak or volatile growth may coincide with RER misalignment. The error term v_{it} captures unobserved factors that vary across countries and over time. Subscripts *i* and *t* denote the cross-sectional (country) and temporal (year) dimensions of the dataset, respectively, reflecting the panel nature of the analysis. Together, these variables provide a

comprehensive framework for understanding the macroeconomic, structural, and institutional drivers of RER misalignment in developing economies.[2]

3. Data Analysis

The empirical analysis is based on an unbalanced panel of 48 developing countries, listed in Table A2 in the Appendix. The period covered depends on the availability of reliable and consistent annual data. Countries are selected based on the availability of a complete series for the required macroeconomic and policy indicators. Data for the study are obtained from internationally recognized and reputable sources. The World Bank's World Development Indicators (WDIs) provides a comprehensive set of macroeconomic variables. We employ the exchange market pressure index in the main analysis and the ER regime (ERR) classification proposed by Ilzetzki et al. (2019) in the robustness analysis as proxies for exchange rate flexibility (ERF). Similarly, for capital account openness (CAO), we have used the Chinn-Ito Index (2006) in the main analysis, whereas, for the robustness checks, we have utilized the Financial Openness Index developed by Lane and Milesi-Ferretti (2018) and further updated by Milesi-Ferrettin (2022).

4. Estimation Techniques

(1) Pre-Estimation Panel Data Tests

a. Cross-Sectional Dependence Test

Before employing panel cointegration techniques, it is imperative to assess the presence of cross-sectional dependence (CSD) among the panel units. CSD occurs when the regions or countries of the panel are economically or financially interdependent such that disturbances between units are correlated. To evaluate this potential interdependence, the present study employs the methodology proposed by Pesaran (2015, 2021). This test is based on the pairwise correlation coefficient average across residuals and is specifically suitable when the number of time periods is more than the number of cross-sectional units. The null hypothesis assumes cross-sectional

[2] Please see Table A1 in the Appendix for the detailed construction of each variable used in Model 1 and Model 2.

independence among units, while the alternative indicates the presence of interdependence across the panel. The Pesaran (2021) CD statistic is expressed as:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \quad (\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}) \tag{3}$$

where, N is the number of cross-sectional units (e.g., countries in our case) and T is the number of time periods. $\hat{\rho}_{ij}$ is the estimated pair-wise correlation of the residuals between units i and j. The extended form of the CD test is particularly well-suited for panel datasets characterized by both a substantial cross-sectional dimension (N) and long time period (T), thereby enhancing its robustness and applicability to contemporary macroeconomic and financial data analyses.

b. Panel Unit Root Test – CIPS (Pesaran, 2007)

To check the stationarity of the variables in the presence of the CSD, the study employs the Cross-sectionally Augmented Im, Pesaran and Shin (CIPS) test proposed by Pesaran (2007). This second-generation panel unit root test eliminates the shortcomings of first-generation tests by integrating cross-sectional averages into the standard ADF regression. These averages operate as proxies for unobserved common factors that may have an impact on all panel units simultaneously for instance, global shocks. The null hypothesis of the CIPS test suggests that the series has a unit root (i.e., it is non-stationary), whereas the alternative hypothesis proposes that the series is stationary. The rejection of the null hypothesis supports the conclusion that the variable is stationary, or it does not have a unit root and is suitable for further econometric analysis.

c. Panel Cointegration Test – Westerlund (2007)

After confirming the integration order of the variables, the study proceeds to test for the existence of a long-run equilibrium relationship using the Westerlund (2007) panel cointegration test. This method is particularly robust in the presence of cross-sectional dependence and provides strong small-sample properties. The Westerlund test directly assesses whether there exists a valid error correction mechanism (ECM), as this implies that although variables may drift in the short run, they are tied together by a stable long-run relationship. It generates panel-level as well as group mean-level test

statistics and permits heterogeneity in the process of cointegration across countries. The rejection of the no cointegration hypothesis guarantees that there is a long-run relationship between variables, thus satisfying the condition for the application of cointegration methods in subsequent estimation.

(2) Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) − Model 1

To examine the long-run relationship between the RER and its fundamentals, we employ the Cross-Sectionally Augmented Autoregressive Distributed Lag (CS-ARDL) model developed by Chudik and Pesaran (2015). This study adopts the CS-ARDL framework because its structure aligns closely with the characteristics of the dataset and objectives of the study. The panel consists of developing economies that display substantial heterogeneity in economic behaviour, are exposed to common global shocks, and include variables with mixed integration properties. These features make traditional ARDL models unsuitable, since they do not correct for cross-sectional dependence and therefore produce biased estimates when unobserved common factors are present. The CS-ARDL method incorporates cross-sectional averages of the dependent and explanatory variables, following the logic of the dynamic common correlated estimator introduced by Pesaran (2006). This approach enables the model to control for unobserved global influences. It retains the advantages of the ARDL approach, including its ability to accommodate regressors with different integration orders and to estimate both short-run dynamics and long-run equilibrium relations. Their cross-sectionally augmented distributed lag method demonstrates superior performance under these conditions and is robust to residual serial correlation and structural disturbances.

(3) Pooled Mean Group Estimator − Model 2

For Model 2, the Pesaran CD test could not reject the presence of cross-section independence (see Table 2 for results of the CSD test); therefore, to evaluate the effects of CAO and ERF on exchange rate misalignment, this study utilizes the dynamic panel data framework. Within this framework, three econometric techniques are employed for robustness purposes: (i) the Pooled Mean Group (PMG), (ii) the Mean Group (MG), and (iii) the Dynamic Fixed Effects (DFE) estimators. The first technique implies

homogeneity in long-run coefficients while allowing heterogeneity in short-run dynamics across countries. On the other hand, the second technique allows full heterogeneity across both short- and long-run parameters, estimating separate models for each country. Finally, the third technique imposes homogeneity in both short- and long-run coefficients, however incorporates country-specific fixed effects.

To determine the most appropriate estimator for Model 2, the Hausman test is utilized. This test basically compares the efficiency and consistency of the PMG estimator with the MG or DFE. A rejection of the null hypothesis shows that the assumption of homogeneous long-run coefficients may not hold; in this scenario, MG or DFE would be considered a suitable estimation method. If the null hypothesis is accepted, it indicates that the PMG estimator is the preferred choice due to its greater efficiency and consistency. Converserly, if the null hypothesis is rejected, it shows that MG or DFE is more suitable.

These approaches offer distinct methods for evaluating the strength and nature of the relationship between CAO, ERF, and RER misalignment. The use of all three techniques not only enhances the robustness of the results, but also allows for different varying assumptions about cross-country parameter heterogeneity.

IV. Empirical Results and Discussion

1. Preliminary Tests

(1) Cross-Sectional Dependence (CSD)

In any panel data analysis, it is essential to assess the possibility of CSD, particularly when cross-sectional units (in this case, countries) may share common shocks, such as financial crises or global economic changes. This phenomenon can lead to biased estimations and flawed inferences if left unaddressed. The underlying assumption in this study is that the countries in the sample are interconnected through trade, financial integration, and possibly common global factors, thereby necessitating an examination of CSD. Following the recommendations of Pesaran (2015, 2021), we used the Pesaran CD test to assess the presence of CSD in the panel data for both Model 1 and Model 2.

Table 1 presents the results for Model 1. As shown, the null hypothesis of cross-sectional independence is decisively rejected. With a test statistic of 21.79 and a p-value of 0.000, the result indicates strong evidence of the CSD among the sample

countries. This is consistent with the findings of previous studies, including Nouira and Sekkat (2015) and Dakoure et al. (2023), who highlighted the importance of accounting for this issue in panel data analysis.

Table 1. Pesaran (2015, 2021) CD Test for Cross-Sectional Dependence (Model 1)

Test	Residuals	P-value	Decision
CD: Pesaran (2015, 2021)	21.79 ***	0.000	Reject H_0 Evidence of cross-sectional dependence

Note: Null hypothesis: Cross-sectional independence. *** denotes significance at 1% level.

Table 2 presents the CD test result for Model 2. The test statistic value of 0.28 is recorded along with a p-value of 0.781, which is higher than the critical value. The test results indicate that the null hypothesis of cross-sectional independence cannot be rejected. The result indicates the absence of the CSD among the cross sectional units, thereby justifying the use of estimation techniques that do not explicitly account for the CSD in this stage (for Model 2). This finding reinforces the robustness of our empirical strategy and ensures that the estimated relationships are not biased by unobserved common shocks. In other words, Mis, CAO, ERF, FD, Inf, FDI, RR, and GDP are all cross-sectionally independent.

Table 2. Pesaran (2015, 2021) CD test for Cross-Sectional Dependence (Model 2)

Test	Residuals	P-value	Decision
CSD: Pesaran (2015, 2021)	0.28	0.781	Fail to reject H_0 Evidence of cross-sectional independence

Note: Null hypothesis: Cross-sectional independence.

(2) Results of Panel Unit Root Tests

Once the CSD is tested, as reported in Tables 1 and 2, the next logical step is to examine the stationarity properties of the variables to investigate their long-term relationships. It is crucial to use second-generation unit root tests in the presence of CSD for Model 1, as traditional first-generation tests often fail to account for the correlation between units, leading to biased results. In this study, we applied the cross-sectional augmented IPS (CIPS) test proposed by Pesaran (2007) due to its robustness to cross-sectional dependence. The results, summarized in Table 3, show a mixed order of integration for the variables under consideration. The variable RIRD is found to be

stationary at the levels, I(0), while LRER, GE, INV, PROD, NFA, TOT, and TO are non-stationary at levels but become stationary after first differencing, I(1). These findings suggest a combination of I(0) and I(1) variables in the dataset, which is a common feature in macroeconomic time series data.

Table 3. CIPS 2nd Generation Unit Root Test (Model 1)

Variable	Level (Trend)	First Difference (Trend)	1%	5%	10%	Order of Integration
LRER	-2.468	-5.278 ***	-2.72	-2.6	-2.55	I(1)
GE	-1.959	-5.768 ***	-2.72	-2.6	-2.55	I(1)
INV	-2.516	-5.438 ***	-2.72	-2.6	-2.55	I(1)
PROD	-2.525	-5.340 ***	-2.72	-2.6	-2.55	I(1)
NFA	-2.415	-5.322 ***	-2.72	-2.6	-2.55	I(1)
TOT	-1.630	-4.909 ***	-2.72	-2.6	-2.55	I(1)
TO	-2.135	-5.621 ***	-2.72	-2.6	-2.55	I(1)
RIRD	-4.041***	-----	-2.72	-2.6	-2.55	I(0)

Notes: The null hypothesis is homogeneous non-stationary. Columns 2 and 3 refer to the model in levels and first differences. These values are compared to their critical values. *** shows statistical significance at 1%.

Given that the data exhibit no evidence of CSD for Model 2, as shown in Table 2, this study applies first-generation unit root tests to assess the stationarity of the panel series of Model 2. Specifically, the Im Pesaran Shin (IPS) and Breitung tests are employed, both of which test the null hypothesis H_o: Series has a unit root (non-stationary) against the alternative H_1: Series is stationary. As presented in Table 4, the Breitung test results indicate that CAO and FDI are stationary at the level, while variables such as RER misalignment, ERF, financial development, inflation, natural resource rents, and GDP growth are stationary at the first difference, I(1). According to the IPS test, RER misalignment and financial development (FD) are stationary at the first difference, while the remaining variables are stationary at the level. These mixed integration orders with no variable integrated at I(2) confirm that the ARDL approach is suitable and that the analysis can proceed, as ARDL is robust to variables with different integration properties, provided none are I(2).

Table 4. Results of 1st Generation Unit Root Test (Model 2)

Variable	Breitung			IPS		
	Level	First Difference	Order of I	Level	First Difference	Order of I
Mis	-0.072 (0.471)	-2.970 *** (0.002)	I(1)	-1.149 (0.125)	-29.248 *** (0.000)	I(1)
ERF	0.593 (0.723)	-27.560 *** (0.000)	I(1)	-21.897 *** (0.000)	----	I(0)
CAO	-2.413 *** (0.008)	----	I(0)	-1.777 ** (0.038)	----	I(0)
FD	3.304 (0.910)	-11.031 *** (0.000)	I(1)	2.493 (0.994)	-18.00 *** (0.000)	I(1)
Inf	0.163 (0.565)	-25.695 *** (0.000)	I(1)	-17.605 *** (0.000)	----	I(0)
FDI	-4.891 *** (0.000)	----	I(0)	-4.118 *** (0.000)	----	I(0)
RR	1.787 (0.963)	-9.550 *** (0.000)	I(1)	-3.822 *** (0.000)	----	I(0)
GDP	-0.843 (0.200)	-6.556 *** (0.000)	I(1)	-14.372 *** (0.000)	----	I(0)

Notes: Values in parentheses denote probabilities. *** and ** show statistical significance at 1 % and 5 %, respectively.

2. Cointegration Analysis

(1) Westerlund Test (Model 1)

Once the stationarity properties of the variables are established, the next step is to examine whether a long-run relationship exists among the variables. To this end, we employ the Westerlund (2007) panel cointegration test. The results, as displayed in Table 5, indicate that the null hypothesis of no cointegration is rejected at the 5% level for both the “some panel” and “all panel” statistics. The test statistics of 1.788 and 1.728 with p-values of 0.037 and 0.042, respectively, provide strong evidence of a long-term equilibrium relationship between the RER and the explanatory variables in model 1. These findings support the view that the variables in our model exhibit long-run relationships, consistent with the notion of cointegration.

Table 5. Westerlund (2007) Panel Cointegration Tests

Test	Statistic	p-value	Decision
Variance Ratio (some panel)	1.788	0.037 **	Cointegration
Variance Ratio (all panel)	1.728	0.042 **	Cointegration

Note: Null hypothesis: No cointegration. ** denotes statistical significance level at 5 %.

(2) Pedroni Test (Model 2)

Before estimating the main models, it is essential to conduct a cointegration test to determine the existence of a long-run relationship among the variables of interest. Table 6 presents the results of the Pedroni (2004) panel cointegration test. The findings indicate that the null hypothesis of no cointegration is rejected, confirming the presence of a stable long-run relationship between RER misalignment and the explanatory variables specified in Model 2. Therefore, the analysis supports the existence of long-run equilibrium associations among the variables included in Model 2. The three test statistics: Modified Phillips-Perron (MPP), Phillips-Perron (PP), and Augmented Dickey-Fuller (ADF) are all statistically significant at the 5% or 1% level, thereby rejecting the null hypothesis of no cointegration.

Table 6. Estimate of Panel Cointegration Tests

Test	Test Statistic	p-value	Decision
Modified Phillips–Perron t	2.301	0.011 **	Reject the null hypothesis of no cointegration
Phillips–Perron t	-9.018	0.000 ***	Reject the null hypothesis of no cointegration
Augmented Dickey–Fuller t	-5.865	0.000 ***	Reject the null hypothesis of no cointegration

Note: *** and ** denote statistically significant at 1 % and 5 %, respectively.

3. Equilibrium Real Exchange Rate (Model 1)

The results of Model 1 based on CS-ARDL are shown in Table 7 and align with theoretical expectations except for PROD. Using the coefficients from the estimated long-run model, we compute the ELRER and then measure RER misalignment by comparing the actual LRER to its equilibrium counterpart. This process enables the estimation of misalignment, a valuable indicator of economic stability and policy effectiveness.

The estimation results indicate that selected macroeconomic fundamentals significantly influence the RER. For structural variables in the model, an increase in productivity differential with respect to the foreign country depreciates the RER. This finding, although it contradicts the Balassa-Samuelson effect, can be justified for developing countries, where productivity-induced growth may lead to an increase in imports, which puts pressure on the demand for foreign currency and causes RER depreciation. Razin and Collins (1999) also explain that the growth effect on the RER depends on the relative dominance of supply-side or demand-side factors. An increase in Net foreign Assets indicates an increase in capital inflows, lower sovereign risk, and greater financial stability, thereby leading to RER appreciation (Lane and Milesi-Ferretti, 2004). Similarly, an improvement in TOT leads to higher national income and consequent higher demand that puts upward pressure on the domestic prices and thus appreciates the domestic currency (Cashin et al., 2004). An increase in Trade Openness lowers domestic prices of the importable and thus leads to depreciation in the domestic currency. Rogoff (1996) explains that openness causes an increase in RER (depreciation in domestic currency). An increase in domestic investment signals higher growth, attracts foreign direct investment, and capital flows,

Table 7. CS ARDL Estimates of Equilibrium LRER

Dependent Variable: LRER	
Variable	Coefficient
GE	-0.020 * (0.012)
PROD	0.075 ** (0.038)
NFA	-0.005 ** (0.002)
TOT	-0.003 * (0.002)
RIRD	-0.003 ** (0.001)
TO	0.007 *** (0.002)
INV	-0.010 * (0.006)

Notes: ***, **, and * indicate statistical significances at 1%, 5%, and 10% levels, respectively. Values in parentheses display standard errors.

which appreciates the domestic currency. As far as policy variables are concerned, an increase in government expenditures (fiscal expansion) may boost aggregate demand and the relative prices of the non-tradable sector, hence an appreciation of RER is observed. This finding is consistent with the Demand Channel (López-Villavicencio and Mignon, 2011). Similarly, an increase in the domestic interest rate relative to the foreign country (tighter domestic monetary policy) causes an appreciation of RER. This finding is theoretically consistent with uncovered interest parity, as higher domestic interest rates attract foreign capital inflows, increase demand for the domestic currency, and lead to an appreciation of RER (Chinn, 2006).

4. Real Exchange Rate Misalignment (Model 2)

(1) Trends of RER Misalignment

The consolidated average real exchange rate misalignment for 48 developing countries[3] over the period 1980-2021 exhibits a persistent and pronounced pattern of undervaluation, as indicated by consistently negative values throughout the entire sample period. Although the magnitude of misalignment fluctuates over time, the series never crosses into the positive zone, suggesting that undervaluation represents a structural characteristic of the developing economies in the sample rather than a temporary deviation. This pattern reflects common policy choices aimed at maintaining external competitiveness, managing balance-of-payments constraints, and cushioning economies against recurrent external shocks.

During the early 1980s, the average misalignment ranges between approximately −66 and −50 percent, indicating moderate but persistent undervaluation. This period coincides with widespread macroeconomic instability in several developing economies, including Algeria, Brazil, Cameroon, Ghana, and Pakistan. These countries faced high inflation (Hanke and Boger, 2018), rising external debt, and deteriorating terms of trade. Exchange rate controls and fixed or heavily managed regimes were commonly used to stabilise fragile macroeconomic conditions, often resulting in sustained deviations from equilibrium.

A sharp deterioration is observed from the mid-1980s onward, with misalignment deepening substantially between 1985 and 1992, reaching values below −120 percent.

[3] To construct the RER misalignment graph, the annual averages of RER misalignment series have been calculated for each country in the sample.

This period corresponds to the collapse of global commodity prices and the international debt crisis, which severely affected commodity exporters such as Algeria, Gabon, Equatorial Guinea, Zambia, and the Democratic Republic of Congo. Oil- and mineral-dependent economies experienced significant external revenue losses, forcing abrupt exchange rate adjustments and reinforcing undervaluation. By the early 1990s, the average misalignment had worsened further, reflecting the cumulative effects of prolonged macroeconomic stress and limited policy credibility.

The mid-to-late 1990s show continued undervaluation, with misalignment remaining below −130 percent. Although several countries implemented structural adjustment and liberalisation programmes, including Ghana, Uganda, Nicaragua, Mexico, and Pakistan (Heidhues and Obare, 2011), the improvements in exchange rate alignment were limited and short-lived. Currency crises and financial instability, most notably affecting Mexico, Brazil, Romania, and the Philippines, reversed earlier gains and pushed the average misalignment deeper into the negative zone.

From the late 1990s through the early 2000s, undervaluation persisted across economies with diverse structural characteristics. Commodity-dependent non-emerging economies such as Zambia, Papua New Guinea, and the Central African Republic continued to struggle with external shocks, while transition economies, including Armenia, Georgia, Moldova, and Ukraine, faced post-transition instability. At the same time, fast-growing emerging economies such as China, Malaysia, Chile, and Uruguay maintained undervalued currencies (Mahraddika, 2020), partly as a strategy to support export-led growth and partly due to managed exchange rate arrangements.

The period 2000-2007 represents one of the most severe phases of misalignment, with values consistently below −160 percent and reaching nearly −172 percent in 2005. This reflects heightened global imbalances, capital flow volatility, and continued reliance on exchange rate management. A temporary improvement is visible around 2008, when the misalignment narrows to approximately −138 percent, coinciding with global financial turbulence that led some countries to allow partial exchange rate adjustments.

However, the improvement proves short-lived. Between 2010 and 2016, the series again records deep undervaluation, with misalignment remaining close to −150 percent. This period overlaps with the aftermath of the global financial crisis, the Eurozone debt crisis, and the commodity price downturn of 2013-2015. Economies, such as South Africa, Morocco, Tunisia, Lesotho, and the Solomon Islands, faced capital flow

reversals and external financing constraints, while oil exporters, including Saudi Arabia and Bahrain, managed exchange rate pressures amid declining oil revenues.

A modest correction emerges after 2019, with misalignment narrowing slightly during 2020-2021. Several countries, including Pakistan, Ghana, and Zambia, allowed greater exchange rate flexibility during the COVID-19 pandemic, facilitating partial adjustment toward fundamentals. Emergency fiscal measures, multilateral financial support, and temporary current account improvements also contributed to this adjustment. Nevertheless, the average misalignment remains firmly negative by 2021, underscoring the persistence of undervaluation.

Overall, the graph highlights a shared experience across emerging and non-emerging developing economies: prolonged periods of real exchange rate undervaluation shaped by external shocks, commodity cycles, institutional weaknesses, and policy-driven exchange rate management. While the intensity of misalignment varies across time and country groups, the consolidated series reveals a common structural pattern in the developing world.

Figure 1. Trends of RER Misalignment in Developing Economies (1980-2021)

Source: Author's own construction

(2) Empirical Estimates of Real Exchange Rate Misalignment

As the findings from Pesaran CSD test do not report the presence of cross-sectional dependence for Model 2, therefore, to enhance the reliability of the analysis, three estimation techniques are employed within this framework: PMG, MG, and DFE. Based on the results of the Hausman test, the PMG estimator is identified as the most suitable, and thus the discussion and interpretation of the empirical findings primarily focus on the estimates derived from the PMG model. This approach facilitates a thorough examination of both short-run dynamics and long-run relationships, offering valuable insights into the underlying drivers of RER misalignment. Table 8 presents the PMG estimation results, capturing the role of ERF and CAO in RER misalignment.

We start our discussion by analysing the direct impact of ERF and CAO on RER misalignment. Our estimates provide evidence of the significant long-run impact of two central policy variables, namely ERF and CAO, on RER misalignment in developing economies. The results show that the estimated coefficient of ERF appears negative and statistically significant, implying that an increase in the flexibility of ER would reduce the misalignment by −0.187%. This suggests that greater ERF facilitates market-driven realignment of underlying economic fundamentals, thus reducing the persistence of misalignment. These findings are consistent with the Friedman (1953) argument that flexible ER regimes are automatic stabilizers, smoothing external shocks, and minimizing economic distortions. Hyder and Mahboob (2006) also noted that the transition towards a more flexible regime reduced levels of misalignment in Pakistan; Slimani and Ben Allem (2018) also found similar effects in MENA economies. In particular, Libman (2018) and Mahraddika (2020) argue that flexible ER regimes limit the degree of RER misalignment by allowing the ER to effectively respond to external shocks and changes in market conditions. This view is further supported by Coudert and Couharde (2009), who noted that the misalignment is more apparent in economies with fixed ER regimes since the systems are not as responsive in reaction to external economic changes. Other studies also reported that higher ERF diminishes the chance of misalignment and the risk of currency crisis (Hoffmann, 2007; Coudert and Couharde, 2009; Holtemoller and Mallick, 2013; Dakoure et al., 2023).

Similarly, the impact of CAO on RER misalignment appears negative and statistically significant, indicating that greater openness to cross-border capital flows is associated with a reduction in exchange rate misalignment in these economies. CAO helps in reducing RER misalignment through various channels. For instance, an increased CAO enhances the efficiency of capital allocation and fosters deeper financial integration.

Table 8. Estimates of RER Misalignment

	PMG	MG	DFE
Variable	Coefficient	Coefficient	Coefficient
	Long Run Coefficient		
ERF	-0.187 *** (0.033)	-0.095 ** (0.047)	-0.118 *** (0.020)
CAO	-0.327 *** (0.040)	-0.145 * (0.076)	-0.083 ** (0.037)
FD	-0.058 ** (0.026)	-0.004 *** (0.001)	-0.113 ** (0.049)
Inf	0.029 *** (0.009)	0.008 (0.009)	0.253 *** (0.041)
FDI	-0.144 *** (0.036)	-0.029 (0.070)	0.037 (0.150)
RR	0.094 *** (0.035)	0.047 ** (0.022)	0.134 (0.282)
GDP	-0.135 *** (0.047)	-0.105 *** (0.022)	-0.204 * (0.114)
	Short Run Coefficient		
ΔERF	-0.078 (0.117)	-0.003 (0.004)	-0.027 (0.280)
ΔCAO	-0.018 ** (0.008)	-0.014 (0.013)	-0.009 *** (0.003)
ΔFD	-0.109 *** (0.026)	0.056 * (0.032)	-0.126 (0.395)
ΔInf	0.038 (0.036)	0.049 * (0.025)	0.190 (1.050)
ΔFDI	-0.064 (0.247)	-0.001 (0.001)	-0.027 * (0.015)
ΔRR	0.009 * (0.005)	-0.006 ** (0.003)	-0.004 (0.007)
ΔGDP	-0.087 (0.080)	-0.083 (1.394)	-0.052 ** (0.022)
C	0.803 ** (0.407)	-0.572 *** (0.113)	-0.526 (0.238)
ECT(-1)	-0.465 *** (0.079)	-0.606 *** (0.093)	-0.721 *** (0.109)
Hausman chi² **P-value in bracket**		5.422[a] (0.609)	1.330[b] (0.988)

Notes: ***, **, *indicate significance at 1%, 5%, and 10%, respectively. Values in parentheses represent standard errors.

[a]PMG is a more efficient estimation than MG under the null Hypothesis;

[b]PMG is a more efficient estimation than DFE under the null Hypothesis

These developments, in turn, facilitate a more accurate and market-driven determination of the exchange rate, help align RER with macroeconomic fundamentals, and decrease the chances of prolonged RER disequilibrium (Montecino, 2018). In a similar vein, Saadaoui et al. (2013) contend that CAO enables markets to respond more efficiently to external shocks, assuring that ERs accurately reflect economic conditions.

Hence, our analysis exhibits that both policies significantly reduce RER misalignment, thereby confirming their complementary role, which is aligned with the theoretical underpinnings proposed by Mundell-Flemming models through Impossible Trinity, and Optimum Currency Area (Mundell, 1961), highlighting the significance of flexible exchange rates and capital mobility for developing countries. Empirically, the findings are consistent with Mahraddika (2020), who finds that ERF and CAO jointly reduce RER misalignment.

Notably, the higher coefficient of CAO than ERF suggests that, on average, the long-run association between CAO and RER misalignment is stronger in the selected sample of developing countries. It is pertinent to mention here that due to differences in the scales of both variables, we may not be able to make direct comparisons of their impact; however, the consistent results across all estimators, namely PMG, MG, and DFE, call for critical investigation into the underlying factors that influence the impact of ERF and CAO on RER determination.

These findings reflect important policy-oriented and structural factors that, respectively, govern the impact of ERF and CAO on RER misalignment. In developing countries, CAO acts as a disciplining force for any structural change. Under open capital and financial markets, capital flows respond (capital inflows/outflows) immediately to undervaluation/overvaluation of RER, hence acting as a stabilising tool. Moreover, open capital markets also attract capital inflows from various origins and of different types, which in turn improve the diversification, volume, and liquidity of foreign exchange, improve the shock absorptive capacity of foreign exchange markets, and reduce the chances of central bank interventions in the FEM. Additionally, CAO also facilitates the development of hedging instruments (Forward contracts, derivatives, Futures, Options, and Swaps, etc.), which allow firms to hedge against foreign exchange risks, and lower the probability of RER misalignment or deviation of RER from its target. Furthermore, the commitment to CAO also assures implementation of market-oriented policies and improves policy credibility, a commitment which helps attract long-term capital flows, improve macroeconomic fundamentals, and maintain RER closer to its equilibrium point.

As far as ERF is concerned, although flexible ER regimes do act as automatic stabilizers by responding to shocks (Friedman, 1953; Libman, 2018), in many developing economies, specifically non-emerging, foreign exchange markets are characterized as small, weak, and volatile; therefore, large fluctuations in the RER are expected. Moreover, the effectiveness and efficiency of ERF to prevent or to reduce the extent of misalignment are also constrained by various structural bottlenecks in developing countries. For instance, fear of floating, weak monetary policy transmission mechanism, thin financial markets, underdeveloped hedging markets and hedging tools, and most importantly, political pressures of keeping ERF overvalued. Such factors reduce the credibility of flexible regimes and often transform flexibility into volatility rather than smooth adjustment.

Moreover, the short-run results, indicating insignificant impact of ERF but a significant negative impact of CAO, also refer to temporal differences in their impact and the channels through which both variables operate. This may refer to the fact that flexible exchange rates in developing countries often overshoot in response to volatility, while capital openness fosters smoother and more sustainable adjustments by linking domestic currencies to broader global markets.

In conclusion, the movement towards CAO changes the underlying structure of the economy and works as an automatic stabiliser of misalignment. By integrating into global capital markets, these countries are compelled to adopt sounder macroeconomic and fiscal policies to maintain credibility and competitiveness, thereby minimizing policy-induced distortions in ER management. On the other hand, ERF is a complementary element to this process. However, in isolation, ERF may operate weakly due to structural bottlenecks as stated above.

Concerning the control variables, GDP growth, FDI, and financial development demonstrate a negative relationship with ER misalignment, whereas inflation and natural resource rent are positively related to misalignment, in the long run. Specifically, in the long run, developed financial markets promote RER stability by enhancing economic adjustments to external shocks. This finding is supported by the existing studies, including Dubas (2009), Devereux and Lane (2003), Dubas (2009), Nouira and Sekkat (2015), Slimani and Ben Allem (2018), Mahraddika (2020), and Carrera et al. (2021). Similarly, FDI (−0.144) plays a crucial role in stabilizing ERs by increasing capital inflows. These inflows strengthen the external balance and facilitate better alignment with economic fundamentals. GDP growth (−0.135) also has a negative impact, suggesting that higher economic growth contributes to reducing ER misalignment, supporting the

notion that strong economic performance fosters stability in ER (Elfaki, 2018; Nguyen et al., 2024). On the other hand, the positive relationship is observed for inflation (0.029) and natural rent resources (0.094), implying that higher inflation and a reliance on natural rent resources lead to greater RER misalignment. Inflation reduces the purchasing power of the domestic currency (Nouira and Sekkat, 2015; Dakoure et al., 2023). While resource dependence often results in volatility and challenges in managing ER policies, exacerbating misalignments (Mahraddika, 2020). In the short run, CAO (−0.018), FD (−0.109), and RR (0.009) are significant, with CAO and financial development having a negative impact on ER misalignment, while rent resources have a positive impact. This supports the view that liberalized capital accounts and improved financial development contribute to ER stability, while dependence on rent resources can exacerbate misalignment. The rest of the variables do not have a significant impact on ER misalignment in the short run.

The negative and significant lagged error correction term ECT (−1) at the 1% level confirms a stable long-run relationship between RER misalignment and all the explanatory variables of Model 2. The estimated coefficient of −0.465 suggests that 46.5% of deviations from equilibrium are corrected each period, indicating a moderate speed of adjustment. This implies that short-term shocks, such as policy changes or financial crises, do not cause persistent misalignment, as the system gradually reverts to equilibrium.

5. Robustness Checks

To ensure the reliability of the findings, several robustness checks are conducted: First, alternative proxies are employed for the key policy variables, namely ERF and CAO. Secondly, to assess whether the findings hold across different economic setups, the sample is divided into emerging and non-emerging developing economies.

(1) Alternative Proxies

For testing the robustness of our findings, we have used alternative proxies for both of our policy variables. ERF is measured by using the ER regime classification dataset developed by Ilzetzki et al. (2019), for CAO, we have employed the Financial Liberalization Index constructed by Lane and Milesi-Ferretti (2018). The results from the PMG estimation (see Table 9) remained consistent, reinforcing the robustness of the primary findings.

Table 9. PMG Estimation Results (Alternative Measures of ERF and CAO)

Variable	Long Run Coefficient	Variable	Short Run Coefficient
ERF	-0.341 ** (0.148)	ΔERF	-0.109 (0.200)
CAO	-0.438 *** (0.040)	ΔCAO	-0.008 * (0.004)
FD	-0.082 ** (0.037)	ΔFD	-0.007 (0.007)
Inf	0.007 ** (0.003)	ΔInf	0.020 (0.019)
FDI	-0.007 (0.488)	ΔFDI	-0.004 (0.011)
RR	0.124 *** (0.028)	ΔRR	0.004** (0.002)
GDP	-0.205 *** (0.058)	ΔGDP	-0.007 (0.005)
		C	0.165 ** (0.073)
		ECT(-1)	-0.500 *** (0.077)

Notes: ***, **, * indicate significance at 1 %, 5 %, and 10%, respectively. Values in parentheses denote standard errors.

(2) Comparative Analysis of Emerging and Non-emerging Developing Economies

In order to examine the robustness of our findings across different economic groups, we have split the sample of developing economies into emerging and non-emerging groups. The findings (see Table 10) are interesting in several ways. The findings confirm that ERF and CAO appear negative and statistically significant, implying that higher levels of ERF and CAO are associated with lower RER misalignment in emerging and non-emerging economies. Hence, we once again confirm the complementary role of ERF and CAO in reducing the misalignment. However, the interesting aspect of the findings is the size of the impact of ERF and CAO across both samples. We observe that the ERF has a relatively larger negative impact on misalignment in emerging economies as compared to their non-emerging counterparts, while CAO appears to have a larger effect in the case of non-emerging economies than for the emerging economies.

These differences in the relative impact of ERF and CAO reflect the differences in structural, institutional, and financial characteristics of the two groups. Emerging economies exhibit more developed financial markets, higher trade integration, and

better credibility of adjustment policies as compared to non-emerging developing economies. Therefore, flexible ER regimes in these countries act as effective shock absorbers, hence facilitating the alignment of RER with its fundamentals when external shocks such as commodity price volatility, capital inflows/outflows, or global monetary tightening occur. The relatively stronger institutional frameworks and more autonomous central banks in emerging markets also enhance the credibility of flexible ER regimes. These findings are also supported by the shock-absorber hypothesis of Friedman (1953), which suggests that flexible ER can stabilize the economy by allowing autonomous adjustments to external shocks. This mechanism works better in emerging economies because they have more organised capital markets, relatively diversified exports, and a higher capacity to manage volatility through hedging instruments and reserves. Emerging economies, including East Asian economies, have accumulated financial depth and macroeconomic credibility, which collectively enable ERF to have a stronger effect in reducing misalignment. In addition, Brazil and South Africa have a significant degree of capital account openness; any further increase in CAO may have a smaller effect in correcting RER misalignment as the disciplining mechanism is already operational. Moreover, the capital flows towards emerging economies are relatively more complex and often consist of short-term portfolio investments, which may cause excessive undervaluation or overvaluation during uncertain times. Finally, emerging economies are more likely to be involved in the active use of capital flow management policies and macroprudential policies such as reserve requirements on foreign currency liabilities, taxes on short-term capital flows, and sterilization to mediate the effect on RER misalignment.

On the other hand, in non-emerging economies that are usually at the initial stages of CAO, capital inflows usually comprise long-term FDI flows or long-term portfolio investments. These flows are relatively more stable and linked to long term equilibrium, thus work as a correcting force for RER misalignment. It is pertinent to state that mostly non-emerging developing countries implement CAO as part of stabilization and structural adjustment programs of the IMF/WB, which mandate fiscal consolidation, central bank independence, and trade liberalization policies. Hence, the overall effect of CAO combined with structural and policy shifts appears stronger for reducing RER misalignment. In these economies, ERF alone cannot adequately align ERs with macroeconomic fundamentals because volatility is instigated by weak institutions, speculative pressures, and unorganized markets. Instead, CAO helps by channeling

foreign capital inflows, improving allocation efficiency, and anchoring exchange rates through greater integration into global financial markets.

Hence, the findings suggest that emerging developing economies derive greater benefits from ERF than CAO, likely due to more advanced institutional frameworks

Table 10. PMG Estimation Results
(Emerging and Non-emerging Developing Economies)

	Emerging	Non-emerging
Variable	Long Run Coefficient	Long Run Coefficient
ERF	-0.319 *** (0.070)	-0.062 *** (0.011)
CAO	-0.141 *** (0.015)	-0.278 *** (0.057)
FD	-0.154 *** (0.042)	-0.179 *** (0.039)
Inf	0.054 ** (0.028)	0.056 *** (0.021)
FDI	-0.140 *** (0.023)	-0.099 *** (0.014)
RR	0.004 *** (0.002)	0.229 *** (0.070)
GDP	-0.419 ** (0.186)	-0.148 ** (0.064)
	Short Run Coefficient	Short Run Coefficient
ΔERF	-0.009 (0.061)	-0.005 (0.004)
ΔCAO	-0.006 ** (0.003)	-0.004 (0.007)
ΔFD	-0.011 ** (0.005)	-0.033 (0.409)
ΔInf	-0.002 (0.009)	-0.004 (0.004)
ΔFDI	-0.002 (0.011)	-0.001 (0.004)
ΔRR	0.001 *** (0.000)	0.005 (0.005)
ΔGDP	-0.026 *** (0.005)	-0.007** (0.003)
C	0.855 (0.900)	0.465 ** (0.204)
ECT(-1)	-0.183 *** (0.067)	-0.490 *** (0.135)

Notes: ***, ** indicate significance at 1% and 5%, respectively. Values in parentheses denote standard errors.

and deeper financial markets. Conversely, non-emerging developing economies exhibited heightened vulnerability to short-run volatility, highlighting the necessity of a gradual and well-managed liberalization process. Our findings support this framework on both theoretical and empirical grounds. Theoretically, the impossible trinity explains that higher capital account openness is complemented by greater ERF to manage expected fluctuations created by CAO. Moreover, the dominant effect of CAO in the full sample can be termed as an enabling condition for ensuring efficiency in ERF. The different sizes of CAO and ERF in emerging and non-emerging economies reflect the differences in their structural factors, institutional frameworks, financial development, and designs of foreign exchange markets, and shock absorption capacities.

Overall, the robustness checks confirm that the observed relationship between ERF, CAO, and ER misalignment is not driven by the choice of proxies or regional differences. These results strengthen the study's empirical validity and align with best practices in applied economic research, ensuring the reliability of the conclusions.

V. Conclusion and Recommendations

This paper presents an empirical analysis of the determinants of RER misalignment in developing countries, focusing on the impact of CAO and ERF. Adopting a sound methodology with a panel of 48 developing countries over the period 1980 to 2021, the findings stress the influence of the policy variable on reducing the RER misalignment. In doing so, the study has contributed to the existing literature in the following three ways. Firstly, given the sample of developing countries that experience common external shocks and share various similar features, the study has employed the CS-ARDL technique to estimate the ERER that addresses the cross-sectional dependence robustly. Secondly, to compare the role of each policy variable, namely ERF and CAO, in reducing misalignment beyond just reporting the direction of their impact. Thirdly, by comparing the estimates of emerging and non-emerging economies, it covers the heterogeneity in the impacts of CAO and ERF on the misalignment. Our findings play a crucial role in redefining the debate from whether each policy matters to how much and under what conditions they matter most.

The findings of the study show that ER misalignment is a widespread phenomenon in developing countries, characterised by significant heterogeneity across regions and over time. The empirical result indicates that exchange rate flexibility is a critical mechanism for reducing misalignment. Flexible ER regimes facilitate market-driven

adjustments to changes in economic fundamentals, leading to a considerable decline in the extent of misalignment. This outcome is consistent with the theoretical perspective that flexible regimes play the role of automatic stabilizers, dampening external shocks and promoting alignment with equilibrium exchange rates. Similarly, CAO is also found to be an important policy variable in bringing down the RER misalignment. Greater openness to cross-border capital flows improves the efficiency of financial intermediation, fosters more accurate price signals in currency markets, and supports long-term alignment with economic fundamentals. In addition to ERF and CAO, the study identifies several structural and macroeconomic drivers of exchange rate misalignment. Financial development plays a stabilizing role by improving the depth and responsiveness of domestic financial markets. Foreign direct investment contributes to long term exchange rate stability through enhanced capital formation and productivity gains. Higher economic growth rates are associated with improved exchange rate alignment, reflecting stronger fundamentals and greater macroeconomic credibility. Conversely, inflation is found to increase misalignment, likely due to erosion of external competitiveness and real appreciation pressures. Dependence on natural resource rents is also positively associated with misalignment, consistent with the Dutch disease hypothesis, whereby commodity windfalls distort relative prices and undermine the tradable sector.

This paper recognizes the fact that, although dynamic panel estimates like the Pooled Mean Group estimator, which includes lagged variables and an error-correction factor to avoid simultaneity bias, are used, the possibility of reverse causality between exchange-rate misalignment and the primary policy variables (exchange-rate flexibility and capital-account openness) has not yet been ruled out. As a result, although we are empirically able to show strong and theoretically sound relations, one must take such results with caution. Future studies would be advantageous as they would utilize the advantage of the panel IV approaches to add more weight to the relationships identified in this study.

This study underscores the critical influence of exchange rate flexibility and capital account openness in mitigating real exchange rate misalignment across developing economies. The findings provide a solid ground for policymakers and academics to further investigate the dynamic interactions between ER policies and macroeconomic stability in the context of developing economies.

The findings of the study, specifically the heterogeneous effect of EFR and CAO across country groups, imply specific policy prescriptions instead of generic policy

guidelines. Moreover, both policy measures, ERF and CAO, should be treated as complementary policy instruments in all groups of countries to manage RER misalignment.

Policymakers in developing economies should adopt a flexible ER regime in order to enhance their ability to absorb external shocks and to reduce the persistence of misalignments. Flexible regimes provide an adjustment mechanism for realignment in response to changing economic conditions, thereby supporting greater trade competitiveness and overall macroeconomic stability. Secondly, while CAO helps to alleviate long-term misalignments, it should be pursued gradually in economies with underdeveloped financial systems. Strong regulatory frameworks and a phased liberalization strategy can reduce the risks associated with speculative flows and ensure sustainable benefits.

In the case of emerging economies, the findings indicate that the prerequisites, such as stable financial and foreign exchange markets, prevail and build the case to prioritize ERF, with the exchange rate serving as a primary shock absorber. However, to ensure the effectiveness and efficiency of ERF, these countries should work on improving the institutional credibility by enhancing central bank independence and transparency in the monetary policy framework. Secondly, these countries may shift the focus from broadening CAO towards managing the quality, composition, and stability of the existing openness to support the flexible exchange rate regime and to avoid inflows of hot money, which may create RER misalignment instead of correcting it. This may involve adopting counter-cyclical macroprudential policies, including reserve requirements on foreign currency liabilities during a boom to prevent excessive appreciation.

For non-emerging economies, it is feasible to prioritize strategic sequencing and managed capital account openness before moving towards a fully flexible exchange rate. By prioritizing the liberalization of stable, long-term capital flows over the short-term volatile flows, CAO operates as an external disciplining mechanism through two channels: it imposes a binding constraint on domestic policy discretion, thereby anchoring RER closer to its fundamental equilibrium; it functions as a catalyst for financial market deepening, fostering the institutional prerequisites for a future shift toward greater exchange rate flexibility. In addition, these countries may adopt a managed rather than fully flexible exchange rate system, as under shallow foreign exchange and weak monetary policy transmission, ERF may lead to exchange rate volatility, which would increase misalignment instead of reducing it. Moreover, a transparent and announced band would allow the central banks to anchor market

expectations and build their credibility. Finally, it helps market forces to learn to manage foreign exchange risks and prepare for a more flexible exchange rate regime in the future.

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APPENDIX

Table A1. Variables' Description, Transformation and Data Sources

Variable	Description	Sources
LRER	Log of real bilateral exchange rate (local currency units per USD) $[RER = OER * (\frac{CPIus}{CPI\ home})\ ]$ OER = Official Exchange Rate (local currency units per USD, period average)	WDIs
GE	General government final consumption expenditure (% of GDP)	WDIs
TOT	Commodity Terms of Trade measured as the ratio between the price level of exports and price level of imports.	WDIs
NFA	Net Foreign Assets as a percentage of GDP	WDIs
PROD	The ratio of the country's GDP per capita with US GDP per capita.	WDIs
RIRD	The difference between domestic and US real interest rate	WDIs
INV	Domestic Investment measured through Gross Fixed Capital Formation (% of GDP)	WDIs
TO	Sum of exports and imports (% of GDP)	WDIs
Mis	$mis_{it} = \frac{RER_{it} - ERER_{it}}{ERER_{it}} \times 100$ Author's on calculation based on BEER approach and CS ARDL technique	
ERF	We use 2 proxies to measure exchange rate flexibility 1) EMP as a proxy for ERF. EMP = $\%\Delta ER_{it}$ /($\%\Delta ER_{it} + \%\Delta TR_{it}$) $\Delta ER_{it} = abs\left(\frac{ER_{it} - ER_{it-1}}{ER_{it-1}}\right) \times 100$ $\Delta TR_{it} = abs\left(\frac{TR_{it} - TR_{it-1}}{TR_{it-1}}\right) \times 100$ TR = Total Reserves (includes gold, current USD) ER = Official Exchange Rate (LCU per USD, period average) 2) Ilzetzski et al. (2019) rank the de facto ER flexibility of countries using 15 different categories. IRR index rang is 0 to 15. 1–4 Strict exchange rate control with very limited flexibility. 5–8 Slightly flexible regimes; often use bands or pre-announced adjustments. 9–11 More flexible regimes with wider bands and larger adjustments over time. 12 Managed float: central bank intervenes frequently to stabilize the currency without a fixed target. 13 Free float: no central bank intervention; exchange rate is fully market-determined. 14 Freely falling regime: rapid depreciation, often due to severe instability or hyperinflation. 15 Dual market with insufficient data; often indicates lack of transparency or very poor economic conditions.	1. WDIs 2. Ilzetzski et al. (2019)

Table A1. Continued

Variable	Description	Sources
CAO	Two proxies are used to measure capital account openness (CAO) 1) Chinn-Ito-Index (2006) continuous variable approach. The value of this index lies between -2.5 and 2.5. A higher value indicates greater capital account openness. 2) Financial Openness Index developed by Lane and Milesi-Ferretti (2018)	1. Chinn-Ito Index (2006) 2. Lane and Milesi-Ferretti (2018)
FD	Domestic credit to private sector by banks (% of GDP)	WDIs
Inf	Inflation, GDP deflator (annual %)	WDIs
FDI	Foreign direct investment, net inflow (% of GDP)	WDIs
RR	The sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents and forest rents as a percentage of GDP.	WDIs
GDP	GDP growth (annual %)	WDIs

Table A2. List of Developing Countries

No	Country Name	No	Country Name
	Emerging		Non-Emerging
1	Algeria	29	Bahamas
2	Armenia	30	Bolivia
3	Bahrain	31	Burundi
4	Brazil	32	Cameroon
5	Bulgaria	33	Central African Republic
6	Chile	34	Congo, Dem. Rep.
7	China	35	Dominica
8	Colombia	36	Equatorial Guinea
9	Costa Rica	37	Gabon
10	Dominican	38	Gambia
11	Fiji	39	Ghana
12	Georgia	40	Lesotho
13	Guyana	41	Moldova
14	Iran	42	Nicaragua
15	Malaysia	43	Papua New Guinea
16	Mexico	44	Samoa
17	Morocco	45	Solomon Islands
18	Macedonia	46	Togo
19	Pakistan	47	Uganda
20	Paraguay	48	Zambia

Table A2. Continued

No	Country Name	No	Country Name
	Emerging		Non-Emerging
21	Philippines		
22	Poland		
23	Romania		
24	Saudia Arabia		
25	South Africa		
26	Tunisia		
27	Ukraine		
28	Uruguay		

Table A3. Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
Mis	1596	-129.304	167.893	-417.482	421.765
EMP	1822	0.487	0.263	0.002	1
ERR	2016	7.138	4.442	1	15
CAO	1902	-3.445	1.403	-1.931	2.299
FD	1884	30.925	24.656	0.449	179.104
Inf	1947	44.488	529.227	-31.566	15444.42
FDI	1909	3.136	6.006	-11.965	161.824