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Macroeconomic Conditions and Exchange Rate Misalignment: A Comparative Analysis of Malawi and South Africa

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Abstract: This study investigates the effects of macroeconomic indicators on exchange rate misalignment in South Africa and Malawi under bull and bear market conditions. Given the importance of exchange rate stability in open economies, persistent misalignment can distort resource allocation and hinder economic growth. The study employs a Markov regime-switching model using annual time series data from 1986 to 2024. The results reveal distinct country-specific and regime-dependent effects. In Malawi, the trade balance growth rate negatively influences exchange rate misalignment, while the interest rate differential has a positive and significant effect in the bull regime. In South Africa, during the bull regime, the growth rates of the trade balance, terms of trade, GDP, and interest rate differential all positively and significantly affect exchange rate misalignment. In the bear regime, the determinants differ. For Malawi, terms of trade, inflation, and trade balance growth rates have a negative and significant impact on exchange rate misalignment. In contrast, for South Africa, only the interest rate differential remains statistically significant. Overall, the findings highlight that exchange rate misalignment is influenced by varying macroeconomic factors across countries and market regimes, suggesting the need for context-specific and adaptive exchange rate policies to ensure stability.

Keywords: Exchange rate misalignment; macroeconomic variables; Malawi, Markov regime-switching model; South Africa

JEL Classification: F31; F41

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1. Introduction

The exchange rate continues to be one of the most widely scrutinised economic indicators by researchers, financial market players, policymakers, and sectors that participate in international trade. Moreover, the exchange rate is an important factor that influences the economic performance of a country, primarily through its influence on the external sector, as it determines the country's competitiveness in international trade (Khomo & Aziakpono, 2020). Therefore, the exchange rate is a key affair for policymakers, since exchange rate regimes directly enable countries to capitalise on the full potential of international trade (Essien et al., 2017). In addition, exchange rate management is considered a vital macroeconomic policy. This is because the monetary authority in a country aims to align exchange rate fluctuations with the state of crucial macroeconomic indicators, such as inflation, trade balance, and economic growth.

According to Essien et al. (2017), effective exchange rate management should stimulate both domestic and international economic equilibrium, a condition that defines exchange rate equilibrium. However, an exchange rate may not be in an equilibrium state. When this occurs, the exchange rate is said to be misaligned. The exchange rate misalignment is defined as a state in which the actual exchange rate deviates from its long-run equilibrium (Heriqbaldi et al., 2020; Nouira & Sekkat, 2015). The exchange rate misalignment leads to an undervalue or overvalue of the currency. The undervalue of the currency occurs when it significantly depreciates more than its equilibrium value and overvalue occurs when it significantly appreciates more than its equilibrium value.

According to Fiaz et al. (2023) an overvalued exchange rate weakens economic competitiveness. This situation is marked by falling exports, de-industrialization, high capital flight, growing imports, and heightened currency speculation. Despite these negative effects of overvaluation in the economy, political players often advocate for overvalued currency because of political benefits. Conversely, people believe that an undervalued exchange rate enhances competitiveness and fosters economic growth. Nonetheless, currency undervaluation may have a negative impact on taxpayers, costs for local firms, local prices, and foreign reserves (Chen et al., 2025). As a result, the exchange rate misalignment influences economic conditions differently.

The exchange rate misalignment is often connected to the exchange rate regime, specifically after the Bretton Woods system collapsed in the early 1970s (Nouira & Sekkat, 2015). Both South Africa and Malawi have had several exchange rate regimes throughout their respective histories. For instance, South African Rand was attached to sterling in June 1972, after it was devalued by 12.28% against the U.S. dollar, and it was later reattached to the dollar in October 1972 (Eun et al., 2012). Similarly, the Malawi Kwacha was pegged to sterling in 1971, and it was later pegged to a weighted average of the Pound and the U.S. dollar in 1973 (Simwaka, 2004). The debt crisis occurred in the 1980s because the political tension and apartheid period in South Africa resulted in the exchange rate volatility. As a result, the hybrid exchange rate regime was introduced from 1985 to 1995 (Mtonga, 2011). From 1984 to 1994, the Kwacha was pegged to a trade-weighted basket of seven currencies; during this period, the Kwacha encountered episodes of devaluation (Chunga & Yu, 2024).

In 1994, the Kwacha was floated, resulting in a 62% devaluation of the currency, and the state implemented a managed floating regime in 1995 to manage the exchange rate, but it was withdrawn in 1998 and reestablished in 2006 with narrow flexibility in 2006 (Mangani, 2019; Munthali et al., 2010). From 1995 to 2000, the South African monetary policy authorities implemented unitary exchange rate regime under a managed floating currency and after 2000, a unitary exchange rate regime under a free-

floating currency was implemented (Mtonga, 2011). This period was faced with economic shocks such as the Asian currency crisis in 1997, the Brazilian crisis in 1999, the global financial crisis of 2007, COVID-19, and the Russia-Ukraine war; all these had a significant impact on the exchange rate volatility of developing countries such as South Africa and Malawi. These events underline how sensitive an open economy is to foreign shocks. South Africa and Malawi frequently engage in international trade; hence, they are characterised as an open economy, and therefore, it is important to maintain a stable exchange rate.

Global economic disparities have prompted policymakers and researchers to focus on the exchange rate misalignment issue. These disparities are assumed to be associated with exchange rate policies in developing countries. Despite the growing amount of research on the exchange rate misalignment and its determinants, a significant gap is still present regarding the determinants of exchange rate misalignment at the country-specific level in African countries. Most recent research is conducted for Asian countries (Panday, 2014; Toulaboe, 2017; Heriqbaldi et al., 2020). Some studies have focused on a panel of countries, such as the Euro area, developing countries, and developed countries (Libman, 2018; Nouira & Sekkat, 2015; Fidora et al., 2021). Limited studies have investigated the exchange misalignment in African countries, particularly for Nigeria and South Africa (Essien et al., 2017; Khomo & Aziakpono, 2020). While these studies in African countries have considered the structural break, they fail to consider the recent development, especially considering economic interruptions such as COVID-19 and the Russia-Ukraine war. As a result, the discussion on the exchange rate misalignment and its determinants in African countries is still ongoing. Furthermore, there has been limited comparative analysis on this topic. In the light of this, the current study aims to fill in the gap by determining the level of the exchange rate misalignment in South Africa and Malawi. In addition, this study seeks to compare the determinants of the exchange rate misalignment in South Africa and Malawi.

The main reason for choosing these countries is because of different economic structures. For instance, South Africa is regarded as an upper-middle-income and financially integrated economy with active financial markets. On the other hand, Malawi is regarded as a low-income and less financially integrated economy. Moreover, these countries provide a sample of economies with distinct sizes, economic fundamentals, and forms of exchange rate policies. Therefore, it is of interest to compare the exchange rate misalignment in these two countries. In addition, the findings of this study will offer beneficial perception for policymakers and investors in both South Africa and Malawi, allowing them to make thoughtful decisions concerning the exchange rate policy and management. This study will also provide economic implications of the exchange rate misalignment and its determinants, thus providing insights into the effective approach to control the exchange rate misalignment.

Therefore, this study contributes to the body of empirical research in a couple of ways: First, it significantly enhances the existing literature on exchange rate misalignment in developing countries by offering a country-specific comparative analysis of Malawi and South Africa, two economies with structurally distinct characteristics, exchange rate regimes, and levels of financial integration. This is in clear contrast to previous research that focuses on either single-country cases or extensive cross-regional panels. This enables the study to identify regime-specific and context-dependent factors contributing to misalignment that are frequently overlooked in existing panel studies. Second, the study includes global shocks that happened after 2019, such as COVID-19 and the war between Russia and Ukraine. This is a significant improvement over earlier studies that only used data from before the pandemic. The study effectively captures the evolving dynamics of exchange rate fluctuations amid

heightened global uncertainty. Third, the study enhances the empirical literature by utilizing a Markov Regime-Switching Model, which facilitates the detection of nonlinearities, structural breaks, and varying macroeconomic behaviours in stable and volatile regimes. This methodological approach yields more profound insights compared to conventional linear models typically employed in prior African studies. Fourth, this study provides policy-relevant comparative evidence of the differential impact of macroeconomic fundamentals on misalignment across economies with varying sizes, openness, and institutional contexts. These insights help policymakers in Malawi and South Africa develop plans for managing exchange rates that align with their economic structures, instead of using broad policy guidelines.

The remaining sections of this study are categorized as follows: Section 2 discusses existing literature in relation to the exchange rate misalignment. Section 3 delineates the methodology and data description. Section 4 discusses the results and provides an interpretation of them. Section 5 offers conclusions, policy, and future study recommendations.

2. Literature Review

2.1. Theoretical Conceptualization

Theoretical strands on exchange rate misalignment date back to Cassel (1918) where the absolute Purchasing Power Parity (PPP) posits that the nominal exchange rate should equalize price levels between countries. Thus, PPP implies that in the absence of transaction costs, competitive arbitrage should force the same good to sell for the same price, expressed in a given currency, across countries (Lafrance & Schembri, 2010). The law of one price argues that if we let P_i and P_i^* be the domestic and foreign currency prices of commodity i and E be the exchange rate, expressed as the price of foreign exchange. Therefore, the law of one price implies that:

$$P_i = EP_i^* \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Extending the illustration to *PPP,* then let *P* and P^* to be the domestic and foreign price levels, which are constructed by taking a weighted average of the prices of *n* commodities of national production or consumption baskets as:

$$P = \sum_{i=i}^{n} w_i P_i \text{ and } P^* = \sum_{i=1}^{n} w_i P_i^* \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Where w_i and w_i^* represent the weights of commodity i in the basket. If the weights are assumed identical and the law of one price holds for all commodities, then:

$$EP^* = P \; or \; E = P/P^* \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

Thus, exchange rate will adjust to equalize price levels. Literature already confirmed PPP as the plausible model for exchange rate determination (Ca' Zorzi et al., 2019). The implication is that in nominal terms, PPP model checks if nominal exchange rate dynamics move with movements in prices, both domestic and foreign, while the real concept of PPP implies that real exchange rates are mean reverting.

Therefore, literature on equilibrium exchange rate discusses variable that affect the exchange rate such as net foreign assets, terms of trade, interest rate differentials or fiscal and demographic variables among others. Thus, equilibrium exchange rate models aim to decompose the real exchange rate rer $(or\ EX\_CH_{to})$ into its equilibrium value rer^{eq} (or EC_CH_{t1}) and misalignment component as $Miss_t$.

However, Rogoff (1996) invalidated PPP as a short-term equilibrium measure but affirmed its role as a long-run anchor since mean reversion of exchange rates, occurred at a very slow pace, prompting several plausible explanations that could justify the sluggishness of the process called behavioural equilibrium exchange rate (Ca' Zorzi et al., 2019; Taylor, Peel & Sarno, 2001). This proposition entails why policy makers have for a long time been interested in the concept of equilibrium exchange rate with the strong proposition that real exchange rates and macroeconomic fundamentals are linked at long horizons; such that strong and persistent departures of exchange rate from their equilibrium levels tend to have significant implications on trade competitiveness, capital flows, inflation dynamics, growth prospects and the stability of the financial sector.

Another sign of the official exchange rate's misalignment is the premium of the parallel market rate over the official rate (Kubota, 2009). This approach claims that the price of foreign exchange in the parallel market is created through free trading among agents. Hence, this 'freely' set unofficial exchange rate has been readily accepted as an indicator of the value that the official exchange rate would acquire if left to market forces and, thus, as an estimate of the long-run ERER (Hinkle & Montiel, 1999). However, Ghei and Kamin (1999) believe that the unified long-run RER should not necessarily be equal to the floating parallel market rate since like an asset price, the floating rate's spot value is based on both its predicted future worth and the quantity of foreign currency that occupants currently own. Therefore, negative expectations may push the parallel exchange rate to values significantly more depreciated than the unified long-run RER that would prevail when macroeconomic conditions and policy are volatile, as is often the case in such settings. Foreign exchange scarcity and excess demand in the parallel market may result from the same factors that give rise to a parallel market: an overvalued official exchange rate coupled with foreign exchange rationing. Critics of using parallel market currency have used an asset market model to explicitly address smuggling and second-economy activities since both real and nominal parallel market exchange rates may overshoot in response to events in the products market, in addition to overshooting in response to present or future foreign currency market reforms (Goldberg & Karimov, 1997).

2.2. Empirical Review

Considering developing countries like Malawi and South Africa, empirical evidence on exchange rate misalignment has gained prominence recently, where policy constraints and vulnerabilities often exacerbate misalignment effects. In South Africa, for instance, Buthelezi (2023) used quarterly data from 1960 to 2022 and analysed the exchange rate misalignment and economic growth, employing GARCH and VEC models. The findings indicate that although short-term misalignment affects economic growth negatively, long-term effects are, however, mixed, with some evidence suggesting that undervaluation may stimulate economic growth. Similarly, the cointegration and VECM techniques were employed in South Africa by Pasi (2020), who investigated real exchange rate misalignment in exports. Findings revealed that long-term misalignment affects total exports negatively, specifically in the manufacturing and machinery sectors.

Additionally, Zwedala (2013) estimated the equilibrium exchange rate. The study used the Behavioral Equilibrium Exchange Rate (BEER) approach. The findings revealed that long-term growth is affected by misalignment because this leads to reduced international competitiveness, particularly in countries like South Africa, which is an export-dependent country. Similarly, Khomo and Aziakpono (2020) used the BEER framework and the Markov-switching model in South Africa to analyse the real

effective exchange rate. The findings confirmed that internal political and economic shocks are linked to constant misalignments and periods of undervaluation. The study emphasized the significance of exchange rate alignment for macroeconomic stability.

Furthermore, Chikwira and Jahed (2024) used the OLS regression method in South Africa to analyse exchange rate stability. The results showed that although exchange rate stability positively influences economic growth, the effects of FDI and political risk are, however, stronger. The study, therefore, emphasizes that specifically in volatile environments, stable exchange rate policies can support long-term growth.

In contrast, Malawi's vulnerability to external shocks shapes its exchange rate misalignment. For instance, the impact of monetary policy responses to exchange rate misalignment was investigated by Chikonda et al. (2022) using the general equilibrium framework in Malawi. The findings suggest that the external sector is enhanced by the incorporation of exchange rate targets into monetary policy; however, this could compromise output growth and inflation. The study highlights the trade-off faced by small open economies in managing exchange rate regimes. Munthali et al. (2010) examined the transmission mechanism, concentrating on Malawi's real exchange rate and economic growth. The findings revealed that exchange rate volatility affects economic growth negatively, while the appreciation of the real exchange rate is positively correlated with output and savings. The findings suggest that exchange rate stability could enhance macroeconomic performance.

Furthermore, Chiphwanya (2023) analysed the impact of currency misalignment on the performance of Small and Medium Enterprises (SMEs) in Malawi. The findings of the study indicated that misalignment leads to a reduction in profits while also increasing import costs and restricting access to credit. Furthermore, the study draws attention to the need for financial sector development and exchange rate policy reforms to address exchange rate misalignment. Moreover, external shocks, volatility, and market efficiency in Malawi's foreign exchange market were analysed by Chunga and Yu (2024) using the GARCH model. Their findings reveal that negative external shocks lead to reduced market efficiency and increased volatility. The study underscores the difficulties Malawi encounters in preserving exchange rate stability in the face of external vulnerabilities.

Additionally, a comparative analysis across 37 African countries was conducted by Diabaté et al. (2025), indicating that flexible exchange rate regimes help contain misalignments while fixed regimes tend to exacerbate them. This study finds particular relevance in comparing South Africa's flexible exchange rate regime to Malawi's managed approach. Foster-McGregor and Spinola (2024) also highlight the role of economic complexity and export diversification, which are directly linked with exchange rate misalignment. The research emphasizes the value of structural transformation in shaping the effects of misalignment.

Furthermore, in Sub-Saharan Africa, Zongo et al. (2024) found that exchange rate misalignment affects FDI, with undervaluation encouraging investment. Mazorodze (2021) also contributes to the body of knowledge, where the study indicates that state fragility increases the negative effects of misalignment on growth, which is a serious concern for Malawi. As such, the empirical findings of this study collectively suggest that although exchange misalignment can have positive and negative effects, depending on regime types, context, and sectoral composition, it is, however, important to manage these misalignments to ensure macroeconomic stability and growth, particularly in countries like Malawi and South Africa.

3. Methodology

3.1. Data

In achieving the desired objective of the study, yearly data for the period 1988 to 2024 were collected. The choice of the data frequency and sample period was dictated by the availability of data and incorporated key historical events such as the inflation-targeting regime in South Africa in 2000; the 2002 currency crisis 2007/2008 global financial crisis, and the COVID-19 pandemic. These events are essential for the estimation of the Markov regime-switching model as it assists in determining the bullish and bearish periods, which increases the robustness of the model (Moodley et al., 2024). The dependent variable consisted of the US/Rand and US/MWK exchange rate for South Africa and Malawi, respectively. The independent variables consisted of the interest rate differential between South Africa and Malawi, as well as inflation (CPI), GDP, terms of trade and trade balances for each country. The selection of the explanatory variables followed studies by Yiheyis and Cleeve (2016); Kampanie (2022); Dagume (2022); Olamide et al. (2022); Agyei et al. (2022), and theoretical literature that articulates a direct relationship between the said explanatory variables and exchange rates. The variables associated with Malawi and South Africa were collected from the reserve banks for each country, and the percentage change was taken to account for the properties of the Markov regime-switching model.

3.2. Empirical Model

3.2.1. Exchange Rate Misalignment Estimation

The estimation of the exchange rate misalignment follows the fundamental approach by firstly estimating the factors that affect the exchange rate in Malawi and South Africa (Buthelezi, 2023). This involves using a single equation model given by:

$$EX\_CH_{t1} = C_t + \alpha_0 \Delta CPI_t + \alpha_1 \Delta GDP_t + \alpha_2 \Delta TM\_RM_t + \alpha_3 \Delta TR\_B_t + \alpha_4 \Delta LT\_INT_t \quad (4)$$

Where EX_CH_{t1} is the proposed exchange rate, and C_t is the intercept. The set of factors influencing exchange rates is inflation growth rate (ΔCPI), gross domestic product growth rate (ΔGDP, terms of trade growth rate (ΔTM_RM), trade balance growth rate (ΔTR_B) and interest growth rate differential (ΔLT_INT).

The second step under the fundamental approach entails estimating the exchange rate misalignment equilibrium ($Miss_t$) by subtracting the observed exchange rate (EX_CH_{t0}) from the forecasted exchange rate (EX_CH_{t1}) as given by:

$$Miss_t = EX\_CH_{t0} - EX\_CH_{t1} \quad (5)$$

3.2.2. Markov Regime-Switching Model

To assess how macroeconomic variables influence exchange rate misalignment in Malawi and South Africa under varying economic conditions, it is necessary to apply a model that allows parameters to shift across different regimes. For this purpose, the study adopts a Markov regime-switching framework, following the approach used by Aziakpono (2020). In contrast with other nonlinear techniques, the Markov regime-switching model accommodates structural breaks, enabling parameters to change across different time periods, whereas alternative models typically account only for fixed,

exogenously determined shifts (Moodley et al., 2025). The constant-duration Markov regime-switching model with fixed transition probabilities can therefore be expressed as follows:

$$Miss_t = C_{yt} + \alpha_{0iyt}\Delta CPI + \alpha_{1iyt}\Delta GDP + \alpha_{2iyt}\Delta TM\_RM + \alpha_{3iyt}\Delta TR\_B + \alpha_{4iyt}\Delta LT\_INT + \varepsilon_{y_{t,t}} \quad (6)$$

Where $Miss_t$ is the exchange rate misalignment associated with Malawi and South Africa, C_{yt} is the state-dependent mean, which follows two regimes, bull (0) or bear (1), given by y_t. The state-dependent explanatory variables associated with Malawi and South Africa are inflation growth rate (ΔCPI), gross domestic product growth rate (ΔGDP, terms of trade growth rate (ΔTM_RM), trade balance growth rate (ΔTR_B) and interest growth rate differential (ΔLT_INT). $\varepsilon_{c_{tt}}$ is the error term which captures the variance of each regime.

Each regime is assumed to follow a first-order Markov process, represented through a transition probability matrix. In such a process, the probability of the system being in a particular regime depends solely on its most recent state. This relationship can be expressed as follows:

$$Prob(y_{t-1} = i) = Prob_{ij}(t) \quad (7)$$

Where ij is the probability of switching from a regime denoted as 0 in a period denoted $t-1$ to a regime *1* in a specific period (*t*), where the probability is given to be constant for all periods, so that $Prob(t) = Prob_{ij}$. Hence, the matrix for a two-regime model is given by:

$$Prob = \lfloor Prob(y_t = 0/y_{t-1} = 0)\ Prob(y_t = 1/y_{t-1} = 0)\ Prob(y_t = 0/y_{t-1} = 1)\ Prob(y_t = 1/y_{t-1} = 1) \rfloor = \lfloor Prob_{00}\ Prob_{01}\ Prob_{10}\ Prob_{11} \quad (8)$$

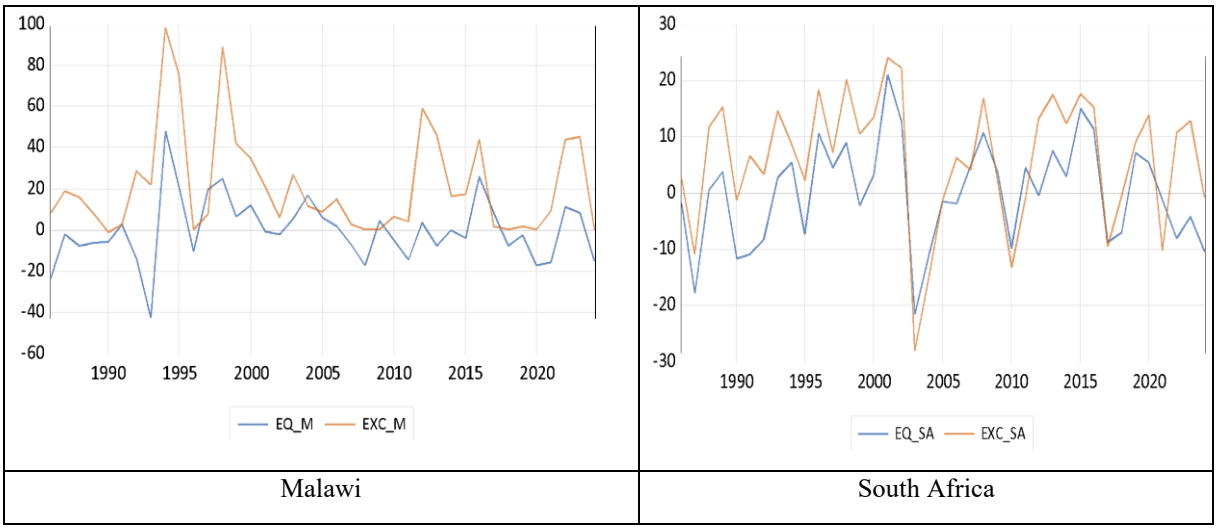
In this framework, $Prob_{00}$ denotes the probability that the exchange rate misalignment is in regime 0 at time $t-1$ and remains in that regime at time t. Likewise, $Prob_{01}$ is the probability that the system moves from regime 0 at $t-1$ to regime 1 at time t. Similarly, $Prob_{10}$ represents the probability of transitioning from regime 1 at $t-1$ to regime 0 at$t$, while $Prob_{11}$ is the probability that the system stays in regime 1 across both periods (Moodley et al., 2024).

4. Results

4.1. Preliminary Results

4.1.1. Graphical Representation

Figure 1 reveals stark contrasts in the exchange rate dynamics between Malawi and South Africa. For Malawi, the figure shows large, frequent and persistent gaps between the actual and equilibrium exchange rates, with the actual exchange rate often exceeding the equilibrium rate. This indicates repeated episodes of overvaluation and with deviations lasting longer for several years before adjustment occurs, a behaviour often consistent with shallow foreign exchange markets, limited reserve buffers, administrative controls on foreign exchange allocation and delayed policy responses to external imbalances (IMF, 2025; AfDB, World Bank & UN, 2025). This is in contrast to South Africa, where a close co-movement between the actual and equilibrium exchange rates occurs, with deviations between the exchange rate and equilibrium being smaller in magnitude, such that misalignments are short-lived. Episodes of overvaluation and undervaluation occur symmetrically, and the equilibrium exchange rate evolves smoothly, reflecting more stable fundamentals.



Malawi | South Africa

Figure 1. Actual vs Equilibrium Level of Exchange Rates

Source: Authors' own depiction (2025)

4.1.2. Descriptive Statistics

Tables 1 and 2 below provide the summary statistics for the dependent and explanatory variables associated with South Africa and Malawi, respectively. In Table 1, the calculated misalignment exchange growth rate for Malawi presents the highest average figure, followed by the trade balance growth rate, GDP growth rate, interest differential growth rate and inflation growth rate. The high average growth rates attained by Malawi's exchange rate misalignment suggest that, on average, the values exceed the equilibrium level and are overvalued, which is corroborated by the findings in 4.1.1. Similarly, Malawi's trade balance growth rate attains the highest maximum and minimum values, whereas the interest differential growth rate attains the lowest maximum and minimum values. The former suggests that trade balances in Malawi tend to fluctuate extensively from their equilibrium level, making it highly volatile, as confirmed by the standard deviation figure. The latter demonstrates that the interest rate differential between South Africa and Malawi is not at heightened levels and is controlled effectively, as supported by the low standard deviation figure.

The skewness associated with the calculated misalignment exchange growth rate for Malawi, terms of trade growth rate, trade balance growth rate and interest differential growth rate are all positive. However, for Malawi's inflation growth rate and GDP growth rate, it is negative. The positive (negative) figures reveal that the mean is greater (less) than the median, suggesting that the figures lie to the right (left) of the mean. Similarly, the kurtosis for all Malawi's variables, except the calculated misalignment exchange growth rate, is positive and greater than 3, which suggests that the variables do not follow a normal bell shape. This is further confirmed by the Jarque-Bera statistics as the null hypothesis for all variables, except the calculated misalignment exchange growth rate and interest differential growth rate, is rejected.

Table 1. Descriptive Statistics of Malawi

	MISS_M	ΔCPI_M	ΔGDP_M	ΔTM_TR_M	ΔTR_B_M	ΔLT_INT
Mean	21.56127	-12.05058	0.781055	-0.075214	26.44138	0.035311
Median	17.90585	2.771043	1.602997	-0.984252	5.598113	-0.008554
Maximum	64.88174	69.28482	18.36179	36.67426	679.6991	0.526882
Minimum	-12.18540	-311.5201	-42.03315	-21.72956	-199.4611	-0.376838

Std. Dev.	19.53048	70.00505	8.129859	11.32095	122.6862	0.195866
Skewness	0.609192	-2.383712	-3.575838	1.100854	3.904917	0.760475
Kurtosis	2.733129	10.20315	21.43919	5.228524	22.15318	3.332270
Jarque-Bera	2.527981	121.2472	635.6189	15.94749	695.2366	3.938501
Probability	0.282524	0.000000	0.000000	0.000344	0.000000	0.139561

Source: Authors' own estimation (2025)

If one turns to the summary statistics of South Africa, trade balances attain the highest average growth rate. This suggests that, on average, South Africa's trade balance exceeds the equilibrium level, demonstrating a positive outlook for foreign investments. On the contrary, South Africa's GDP has the lowest average growth rate, demonstrating the stagnant nature of growth in GDP. Similarly, South Africa's trade balance growth rate has the highest maximum and minimum values, demonstrating its volatile nature, as supported by the higher standard deviation. These high maximum, minimum and volatility figures correspond to the COVID-19 initiated lock down in South Africa, which halted international trade, causing trade balances to decrease extensively and then increase again after the lockdown was removed. South African GDP growth rate attained the lowest maximum and minimum values, confirming the findings of the stagnant growth rates, as it is in proximity to the equilibrium level. This is further confirmed by the lower standard deviation figure which demonstrates limited fluctuations from the equilibrium level.

The calculated misalignment exchange growth rate for South Africa, inflation growth rate, and trade balance growth rate are positively skewed, whereas GDP growth rate and terms of trade growth rate are negatively skewed. These positive and negative figures demonstrate that the average growth rates lie to the left or to the right of the median. The kurtosis of all variables except inflation growth rate and terms of trade growth rate is greater than 3. Thus, the rest of the variables do not follow a normal bell curve, which deviates from the normality assumption. This is further confirmed by the Jarque-Bera tests.

Table 2. Descriptive Statistics of South Africa

	MISS_SA	ΔCPI_SA	ΔGDP_SA	ΔTM_TR_SA	ΔTR_B_SA
Mean	21.56127	7.291186	0.283039	0.722685	40.42028
Median	13.62732	5.600000	0.283358	0.900000	-4.779829
Maximum	92.98244	17.97753	4.363217	7.500000	1112.494
Minimum	-10.38380	0.208768	-7.419838	-8.548387	-293.5137
Std. Dev.	26.20961	4.301248	2.354012	3.620475	223.1051
Skewness	1.088481	0.889969	-0.782005	-0.252082	3.465870
Kurtosis	3.507235	2.920319	4.600687	2.890648	16.51921
Jarque-Bera	8.119235	5.158611	8.138532	0.432477	375.0792
Probability	0.017256	0.075827	0.017090	0.805543	0.000000

Source: Authors' own estimation (2025)

It is interesting to note that the majority of Malawi's and South Africa's variables present extensive outliers, as supported by the high maximum, minimum and standard deviation figures. These outliers occur due to external shocks caused by historical market conditions like the 2007/2008 global financial crisis and the implementation of exchange rate regimes in both countries. Given that the study uses the Markov regime-switching model, these outliers do not affect the robustness of the results as the model can cater for larger outliers due to its regime-switching abilities (Hamilton, 1989). Thus, these figures do not possess any concerns as the model robustness will be further evaluated to confirm these properties.

4.1.3. Unit Root and Stationarity Tests

A key requirement of the Markov regime-switching model is that the variables used in the estimation of the model must exhibit stationarity properties in levels and in the presence of structural breaks. Accordingly, the Augmented Dicky-Fuller (ADF) and ADF breakpoint test are administered, and the results are presented in Table 3. The ADF test statistic for all variables associated with South Africa and Malawi is more negative than the critical values at all levels of significance. Thus, the null hypothesis of the series containing a unit root can be rejected in favour of the alternative hypothesis that the series is stationary. Similarly, the ADF breakpoint test confirms that the series is stationary in the presence of structural breaks as the ADF test statistic is more negative than the critical values, which allows for the rejection of the null hypothesis that the series exhibits unit root properties in the presence of structural breaks. Collectively, the ADF test and ADF breakpoint test confirm that the variables are stationary in levels and in the presence of structural breaks, thereby satisfying the properties of the Markov regime-switching model.

Table 3. Unit Root and Stationarity Results

Variable	ADF	ADF-Break
Panel A: Malawi		
Miss_M	-4.138517**	-4.541989**
ΔCPI_M	-5.653295***	-8.917566***
ΔGDP_M	-7.092283***	-8.388034***
ΔTM_TR_M	-4.563068***	-6.101670***
ΔTR_B_M	-6.397288***	-8.734531***
Panel B: South Africa		
Miss_SA	-4.974827***	-5.568116***
ΔCPI_SA	-3.395879**	-5.661202***
ΔGDP_SA	-4.409803***	-5.363993***
ΔTM_TR_SA	-4.841911***	-6.420532***
ΔTR_B_SA	-6.077532***	-9.681665***
Panel C: Interest rate differential between Malawi and South Africa		
ΔLT_INT	-4.329836***	-5.276910***

*Notes:1. The critical values associated with the KPSS test at a 1%, 5% and 10% significance level are 0.7390, 0.4630 and 0.3470, respectively. 2. ***, ** and * indicate a 1%, 5% and 10% significance level, respectively.*

Source: Authors' own estimation (2025)

4.1.4. Variance Inflation Factor Tests

In addition to determining the stationarity properties of the dependent and independent variables, it is important to examine the levels of multicollinearity among the independent variables. To this extent, the variance inflation factor (VIF) test is considered, and the results are presented in Table 4. The centred VIF figures for all variables besides Malawi's GDP growth rates attain values below 3. This suggests that there exists no collinear relationship among the explanatory variables, except Malawi's GDP growth rate. Malawi's GDP growth rate presents figures that are in excess of 3, which indicates the possibility that it has a collinear relationship with other explanatory variables in this study. Consequently, this will be tested when the Markov regime-switching model is administered, and if such is found, Malawi's GDP growth rate will be removed.

Table 4. VIF Results for Malawi and South Africa

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Panel A: Malawi			
C	10.10224	1.350341	NA
ΔCPI_M	0.002706	1.779406	1.726889
ΔGDP_M	0.359831	3.126831	3.097489
ΔTM_TR_M	0.072144	1.204290	1.204235
ΔTR_B_M	0.001507	3.094919	2.954093
ΔLT_INT	297.8574	1.537878	1.488234
Panel B: South Africa			
C	12.22229	4.824962	NA
ΔCPI_SA	0.155577	4.372126	1.107122
ΔGDP_SA	0.521093	1.127170	1.110690
ΔTM_TR_SA	0.291944	1.532136	1.471944
ΔTR_B_SA	5.97E-05	1.181385	1.142885
ΔLT_INT	88.88356	1.355347	1.311596

Source: Authors' own estimation (2025)

4.2. Empirical Model Results

4.2.1. Markov Regime-Switching Model

In Table 5, the Markov regime-switching results are presented for Malawi and South Africa in relation to two regimes, bull and bear. The model was first estimated, including Malawi's GDP growth rate, and it presented an error known as "singular matrix". This error is associated with excessive multicollinearity among the explanatory variables, which is consistent with the VIF results. Accordingly, Malawi's GDP growth rate was omitted, and the model was re-estimated, thereby removing the error. Thus, the study proceeds without Malawi's GDP growth rate as an explanatory variable.

It is evident that the volatility (ε) associated with regime 2 is much higher and significant than regime 1. To this extent, regime 2 can be categorized as the volatile regime (bear regime), whereas regime 1 can be considered the stable regime (bull regime). Similarly, it is observed that the mean exchange rate misalignment (C) for both countries is positive and significant under a bull and bear regime, indicating that, on average, the misalignment is above the equilibrium level. These findings do not come as a shock, as it is evident that the original exchange rates for both countries exceed the equilibrium levels, see section 4.1.1. Accordingly, the exchange rates tend to be overvalued under bull and bear regimes, suggesting that market conditions, stable or volatile, do not contribute to undervaluing exchange rates in Malawi and South Africa.

If one turns to the findings of Malawi, it is seen that in a bull regime, trade balance growth rate has a significantly negative effect on exchange rate misalignment, whereas interest growth rate differential has a positive effect on exchange rate misalignment. Similarly, in a bear regime, inflation growth rate, terms of trade growth rate and trade balance growth rate have a significant and negative effect on exchange rate misalignment. However, the interest growth rate differential has a significantly positive effect. These findings suggest that when the Malawi economy is stable, trade balances will decrease

exchange rate misalignment, restoring it closer to equilibrium, whereas interest rate differential will enhance exchange rate misalignment, taking it further away from the equilibrium level. These findings are further evident when the Malawi economy is volatile; however, inflation and terms of trade will also reduce the misalignment.

In relation to South Africa, terms of trade growth rate, trade balance growth rate, GDP growth rate and interest growth rate differential has a positive and significant effect on exchange rate misalignment in a bull regime. However, the inflation growth rate has a significantly negative effect. In a bull regime, only the interest growth rate differential has a significant effect, which is positive. Accordingly, these findings indicate that terms of trade, trade balance, GDP and interest rate differential will enhance exchange rate misalignment further away from the equilibrium level when the South African economy is stable, but inflation growth rate will reduce the exchange rate misalignment. Conversely, when the South African economy is marked by volatility, the interest rate differential will enhance the exchange rate misalignment.

If one does a comparative analysis, it is evident that in a stable market condition, inflation, terms of trade and trade balances have opposite effects on exchange rate misalignment in Malawi and South Africa. That being, in Malawi (South Africa), inflation is positive (negative), terms of trade and trade balance are negative (positive). Moreover, in a volatile market condition, all variables influence Malawi's exchange rate misalignment, but only the interest rate differential affects South Africa's exchange rate misalignment. However, the common findings here in is that the interest rate differential has the same constant effect in each market condition and for each country.

The robustness of the findings is further confirmed by the Durbin-Watson test and Breusch-Godfrey test. The Dubbin-Watson test statistic for Malawi and South Africa is 2, suggesting there is no presence of autocorrelation in the residuals of the model. These findings are further supported by the Breusch-Godfrey serial correlation test, as we fail to reject the null hypothesis of no serial correlation.

Table 5. Markov Regime-Switching Results

	Malawi			South Africa		
Variables	Coefficient	T-statistic	Prob	Coefficient	T-statistic	Prob
Panel A: Regime 1						
C	17.96509	7.191019	0.0000	39.04404	108.2744	0.0000
ΔCPI	0.039251	1.479990	0.1389	-0.623739	-16.86200	0.0000
ΔTM_TR	-0.223377	-0.716734	0.4735	2.077193	36.60573	0.0000
ΔTR_B	-0.029607	-4.478548	0.0000	0.018657	6.898165	0.0000
ΔLT_INT	162.0208	7.515002	0.0000	94.56172	180.3448	0.0000
ΔGDP	-	-	-	1.733058	25.99080	0.0000
ε	0.878278	2.249033	0.0245	-1.363879	-4.227599	0.0000
Panel A: Regime 2						
C	20.25371	32.17307	0.0000	16.62383	1.602740	0.1090
ΔCPI	-0.018511	-1.715561	0.0862	-0.290385	-0.246925	0.8050
ΔTM_TR	-0.879806	-16.89108	0.0000	-0.905550	-0.589328	0.5556
ΔTR_B	-0.088513	-8.883447	0.0000	-0.001419	-0.068523	0.9454
ΔLT_INT	88.59990	25.73849	0.0000	84.18197	2.706313	0.0068
ΔGDP	-	-	-	0.602880	0.294583	0.7683
ε	0.943181	6.004151	0.0000	2.961858	17.70683	0.0000
Panel C: Diagnostic Tests						
DW-STAT	2.088025	-	--	2.084130	-	-
F-Stat	0.384081	-	0.6842	1.083488	-	0.3509

Notes:1. The F-stat is associated with the Breusch-Godfrey Serial Correlation LM Test.

Source: Authors' own estimation (2025)

4.2.2. Constant Transition Probabilities and Expected Duration

In Table 6, the constant transition probabilities and expected duration associated with each regime is provided. In Malawi, it is evident that the probability of the exchange rate misalignment remaining in a bull regime (0.770878) is lower than that of a bear regime (0.940558). Similarly, in South Africa, the probability of the exchange rate misalignment remaining in a bull regime is 0.207523, whereas in a bear regime it is 0.776399. These findings suggest that the exchange rate misalignment tends to be bearish over the sample period. However, we see that for Malawi that bear market condition is highly persistent as the probability is closer to 1 than that of South Africa. This suggests that Malawi's exchange rate misalignment stayed for a prolonged period in a bearish condition, whereas South Africa's exchange rate misalignment moved constantly in and out of bullish and bearish conditions. The findings are further supported by the duration figures as the Malawi exchange rate misalignment stayed in a bearish condition for 16.82310 years and a bullish condition for 4.364487 years. In South Africa, the exchange rate misalignment stayed in a bullish condition for 1.261886 years and in a bearish condition for 4.472261 years. Collectively, the bearish condition dominates Malawi's and South Africa's exchange rate misalignment.

Table 6. Constant Transition Probabilities and Expected Duration Results

	Malawi		South Africa	
	P1	P2	P1	P2
P1	0.770878	0.229122	0.207523	0.792477
P2	0.059442	0.940558	0.223601	0.776399
T	4.364487	16.82310	1.261866	4.472261

Notes:1. P and T reflect the transition probabilities and duration associated with each regime, respectively.

Source: Authors' own estimation (2025)

4.2.3. Smooth Regime Graphs

Figure 2 shows the regime probability graphs for Malawi and South Africa. It is visualized for Malawi that there are fewer spikes than in South Africa. These findings are supported by section 4.2.2, as the persistence is much higher in Malawi than in South Africa. In Malawi, the bullish period is only present in 1986-1990 and 2015-2019, whereas the bullish period is persistent from 1991-2014. In South Africa, the bearish period is persistent from 2005-2015 and 2017-2024. The findings align with the duration figures in 4.2.2 as the bearish market prevailed for the longest period. The alternating bullish and bearish periods are further supported by the graphical representation in section 3.1.1. That being, it is evident that the deviation from equilibrium levels changes over time; at certain instances it increases, whereas it decreases. These increases and decreases correspond to the bullish (increase) and bearish (decrease) conditions as supported by Figure 2 below. Collectively, the findings suggest that the exchange rate misalignment tends to be bearish, which indicates that it decreases to the equilibrium level most often, suggesting it is in proximity to the equilibrium level. Again, this is further corroborated by Figure 1 as the actual exchange rate is close to the equilibrium level, meaning that the misalignment is bearish.

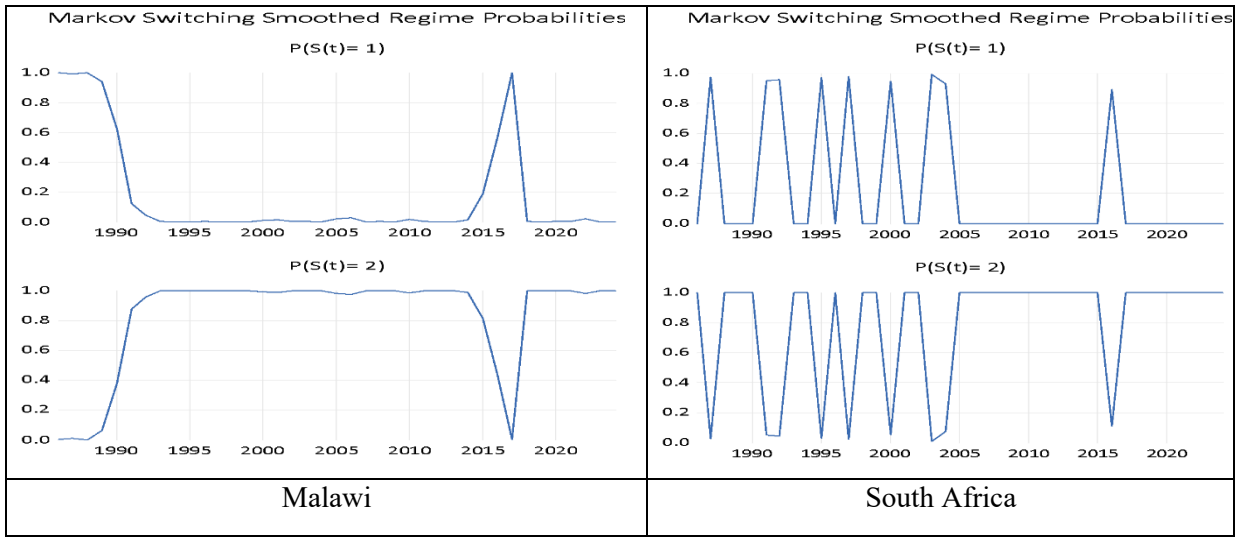


Figure 2. Smooth Regime Probability Graphs of Malawi and South Africa Exchange Rate Misalignment

Source: Authors' own depiction (2025)

5. Discussion of Results

It is evident from the findings that the effects of macroeconomic variables on South Africa's and Malawi's exchange rate misalignments are regime-specific and vary across bull and bear periods. Inflation growth rate has a negative effect on both countries' exchange rate misalignments, but this is evident only in a bear regime for Malawi and a bull regime for South Africa. Thus, changes in inflation growth rate will reduce the misalignment, thereby restoring it close to the equilibrium level during periods marked by stability and volatility. These findings align with the robustness of the inflation target regime proposed by South Africa and Malawi, as the new proposed target of 3 percent for South Africa and 5 percent for Malawi is not influenced by unstable conditions, as supported by the reduction in exchange rate misalignment. Similarly, the findings align with a study by Ambaw et al. (2023), who demonstrate that effective control of the inflation rate in any country will ensure exchange rate stability. Interesting to note that higher levels of GDP result in an increase in exchange rate misalignment in South Africa, irrespective of the market condition. These findings align with Munthali et al. (2010) and Sibanda et al. (2013), which suggests that enhancements in GDP illustrates a well-functioning economy, which causes an appreciation in exchange rates and overvaluation.

Similar findings are evident for terms of trade growth rate, such that it increases South Africa's exchange rate misalignment in a bull condition, but it reduces Malawi's exchange rate misalignment in a bear regime. The increase underscores that enhanced exports drive exchange rate appreciation, whereas heightened imports result in exchange rate depreciation, contributing positively or negatively to exchange rate misalignment. These findings align with Msomi (2015), who found that the level of imports and exports dictate over valuation and undervaluation of exchange rates, which contributes to the overall exchange rate equilibrium levels. Long-term interest growth rate is found to exert a positive effect on South Africa's and Malawi's exchange rate misalignment in both bull and bear conditions. These findings align with studies by Bonga-Bonga (2010), Chiumia and Palamuleni (2019), and Orcan et al. (2022), who found that changes in interest rates will cause exchange rates to appreciate, resulting

in overvaluation. This is owing to a greater demand for investments in the domestic country due to the higher interest rates offered, which causes domestic currency to appreciate and be overvalued.

6. Conclusions and Implications

At the commencement of this study, the objective was to examine the effect of macroeconomic variables on exchange rate misalignment in South Africa and Malawi under bull and bear market conditions. In doing so, the study used yearly data for the period 1986 to 2024 to estimate the Markov regime-switching model. The dependent variable was the calculated exchange rate misalignment using exchange rates, and the dependent variables consisted of growth rates in inflation, GDP, long-term interest rate, terms of trade and trade balances. The findings revealed that macroeconomic variables have a time-varying and state-dependent effect on exchange rate misalignment in South Africa and Malawi. For instance, in a bull regime, trade balance growth rate has a significantly negative effect on Malawi's exchange rate misalignment, whereas interest growth rate differential has a positive effect. Similarly, terms of trade growth rate, trade balance growth rate, GDP growth rate and interest growth rate differential have a positive and significant effect on South African exchange rate misalignment in a bull regime. In a bear regime, inflation growth rate, terms of trade growth rate and trade balance growth rate have a significant and negative effect on Malawi's exchange rate misalignment. However, only the interest rate differential has a significant effect on South Africa's exchange rate misalignment in a bear regime. Moreover, it was found that the bearish condition dominated South Africa's and Malawi's exchange rate misalignment, suggesting that, on average, the exchange rate was undervalued.

These findings have important implications for policymakers and investors. Firstly, policymakers must revisit existing policies governing exchange rates in South Africa and Malawi, as such is not effective in controlling exchange rate deviations. This is clear from the findings, as it is seen that changes in macroeconomic variables could either increase or decrease the said misalignment. Furthermore, the state of the economy, bullish or bearish, will dictate the type of effect, being positive or negative, thereby causing exchange rates to be over- or undervalued for both countries. For example, when the economy is in a stable state, changes in trade balance will reduce exchange rate misalignment in Malawi, whereas changes in interest rate differential will enhance Malawi's exchange rate misalignment, causing the exchange rate to be undervalued and overvalued, respectively. Conversely, when the economy is in a volatile condition, changes in inflation and terms of trade will decrease Malawi's exchange rate misalignment, restoring it to the equilibrium level. Collectively, policymakers must develop policy reforms to capture the findings of the study, as failure to do so could significantly hamper exchange rate stability in South Africa and Malawi.

Secondly, foreign investors wanting to invest in South Africa and Malawi must consider the findings of the study if they wish to maximize their total investments. That being said, macroeconomic variables and market conditions dictate the exchange rate that exists on a specific day, which will either enhance or deflate the amount of domestic currency that can be invested in the said country. For instance, in a stable market condition, terms of trade, trade balance, GDP and interest growth rate deferential has a significant positive effect on South African exchange rate misalignment. Thus, it will cause the exchange rate to be overvalued, resulting in foreign investors paying more for a unit of domestic currency. Thus, if foreign investors want to enhance total investments, they should factor

into their investment decisions exchange rate misalignment and the factors that dictate such a misalignment.

Despite the novelty of the study, it is not without limitations. The study only selects certain key macroeconomic variables for the analysis. Future research can extend the analysis to incorporate additional macroeconomic factors like unemployment, money supply and real effective exchange rate. Moreover, the study isolates the analysis to South Africa and Malawi to cater to the objective of the study; future research can enhance the analysis by considering other African countries like Nigeria, Ghana and Zimbabwe. Lastly, a comparative analysis can be done from the perspective of developed and developing nations to understand the exchange rate misalignment fundamentals and the resilient nature of developing countries to changes in macroeconomy and market conditions.

In sum, this study provides new evidence on exchange rate misalignment in South Africa and Malawi, such that macroeconomic variables coupled with market conditions determine the levels of misalignment in both countries. These new insights contribute significantly to the enhancement of empirical literature as it controls the trajectory of future research, which should be nonlinear. Similarly, it makes valuable practical contributions from the perspective of investors and policymakers, thereby mitigating the negative effects caused by exchange rate misalignment.

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