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The Impact of Climate Change on Namibia's Inflation

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Abstract: This study examines the impact of climate change on inflation dynamics in Namibia, with an extension to the Southern African Customs Union (SACU) region, using a combination of time-series and panel data approaches. For panel analysis, annual data are employed to assess both short- and long-run inflation responses to climate-related variables and capture potential nonlinearities and asymmetric effects using the nonlinear autoregressive distributed lag (NARDL) framework to evaluate the influence of extreme weather events across SACU member states over the period 2005 to 2023. In addition, the study further employed time series data from 1990 to 2023 for country-level analysis. The results indicate that variations in total emissions do not exert a statistically significant effect on inflation in Namibia. In contrast, declines in global precipitation are associated with a persistent and economically meaningful increase in inflation in the long run. Furthermore, adverse precipitation shocks are found to be a significant driver of inflationary pressures in both Namibia and the broader SACU region. These findings suggest that climate-related supply-side disruptions play an increasingly important role in shaping inflation outcomes. Overall, this study highlights the relevance of climate risks for monetary and fiscal policy. Incorporating climate variables into inflation forecasting frameworks may enhance policy calibration, while targeted fiscal and social interventions can help mitigate inflationary effects following climate shocks.

Keywords: Climate Change, Inflation, Precipitation Shocks, NARDL, SACU

1. Introduction and Background

The impact of climate change on economic performance has become increasingly important for central banks' monitoring of developments in growth and inflation, in their conduct of monetary policy [6]. There is now overwhelming scientific evidence that the climate is changing, weather patterns, rainfall, and rain seasons have become more erratic, and climate-related extreme weather events are on the increase. It is believed that developing countries are the most vulnerable to the effects of climate change, as frequent extreme weather events such as drought, floods, heatwaves, storms, variations in precipitation, and changes in sea level have devastating effects on food production, nutrition, housing, health, infrastructure, and on people's incomes [15]. The impacts of climate change include reduced nutrients in the soil, which means that productivity in the agriculture sector is reduced. It is postulated that the key direct impact of climate change on inflation is through reduced output of food and energy, resulting in high prices for these commodities. In the case of energy, this is especially true for hydro power, which can be affected by changes in weather and precipitation. Since energy is an input in many other sectors of the economy, the scarcity of electricity is expected to result in indirect effects on inflation from other sectors. This indirect channel makes the case for one to test the impact of climate change on overall CPI inflation, in addition to testing the impact on specific CPI components. Like energy, the availability of water is a very important factor for Namibia and would have both direct and indirect effects on inflation. Drought years are most pronounced in the 1950s and early 1960s, with a resurgence of severe droughts in the late 2000s. Extreme rainfall events, though less frequent than droughts, occurred sporadically with notable high-rainfall years in the early 1950s and 2000s. The trend establishes that Namibia has become more vulnerable to catastrophic weather events such as droughts and floods. As Figure 1 below shows, it is clear that Namibia experienced erratic rainfall patterns for the entire period, and this was especially more so during the 1950s and 2010s.

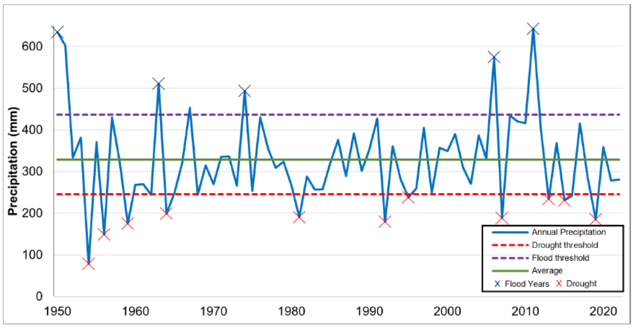

Figure 1. Annual Precipitation and Floods in Namibia Source: World Bank Climate Change Knowledge Portal (2022).

As outlined in [13], climate change mitigation and adaptation measures are implemented over the period 2021?2030, with 2030 set as a single target year. Given Namibia's high vulnerability to climate change, adaptation remains a priority, particularly in the water resources, agriculture, health, biodiversity, and infrastructure sectors, with interventions aimed at reducing vulnerability and enhancing resilience. A prime example of such an adaptation measure is the construction of the Neckartal dam, a critical component of the nation's water resource management. Additional dams include the Cuvelai-Kunene Transboundary River Basins Water Security and Community Resilience Enhancement (CUVKUN) Project, which aims to mitigate the impacts of water scarcity, floods, and droughts within the Cuvelai and Kunene River basins. The project commenced in 2024 and is expected to be completed in 2029. Namibia committed itself to reduce national emissions, mainly through the use of renewable energy, sustainable energy and waste management technologies, the use of low-carbon transportation systems, and the adoption of climate smart technologies. Specifically, Namibia targets to reduce its projected national emissions by 7.669 metric tonnes of carbon dioxide and to increase its carbon removals by 4.233 metric tonnes of carbon dioxide by the year 2030.

1.1. Problem Statement

There is overwhelming evidence that Namibia is experiencing increasingly erratic and extreme weather swings because of climate change. Historically, experienced periods of drought were more correlated with rainfall levels. Nowadays, most floods in Namibia occur due to high rainfall in neighbouring countries. The rainfall pattern in Namibia is becoming more erratic, sea levels are rising, and extreme weather events (droughts, floods, heat waves, storms, etc.) are becoming more frequent. Namibia experienced frequent drought conditions over the last 10 years. The Government declared a state of emergency in 1992/93, 1995/96, 2012/13, 2013/14, 2015/16, 2018/19, and in 2024/25 due to severe droughts. The droughts experienced in 2018/19 and in 2024/25 were charged to be the worst in the last 100 years and have resulted in very low crop production levels, massive livestock deaths, and had livelihoods of many families negatively affected. As outlined in [14], climate variability over the medium and long term is likely to further diminish the productivity of agricultural land and reduce yields from fisheries and forestry. The increased unpredictability of these weather patterns poses serious risks to Namibia's water resources, food security, and economic stability. Two major types of climate-induced weather extremes were recorded in Namibia between 2008 and 2022, i.e., floods and droughts, with drought being the most recurring event, largely affecting the agricultural and energy sectors [11]. While efforts have been made to promote climate-resilient crops, construct dams, and encourage rainwater harvesting, there remains a pressing need to intensify the analysis and enhance the understanding of the impact of climate on the macroeconomy. This would enable governments to devise appropriate climate change policies. It has been noted that climate change and policies to mitigate it could affect the central bank's ability to meet its monetary stability objectives, and this occurs mainly through adverse impacts that climate change has on growth and on inflation. In the short run, higher and rising food prices signal the existence of imbalances in supply and demand driven by supply-related factors such as reduced productivity due to climate change. In the long run, however, population growth is likely to be the primary driver of such imbalances.

1.2. The Main Objective

The impact of climate change on growth appears to have been sufficiently covered in both theoretical and empirical literature. The same can, however, not be said regarding the impact of climate change on inflation. This study, therefore, aims to investigate and quantify the impact of climate on inflation in Namibia, with some extension to the Southern Africa Customs Union (SACU) region. In particular, the study attempts to provide answers to the following questions:

I. What are the short and long run impacts of climate change on inflation in Namibia?

II. What are the channels through which climate change indicators affect inflation in Namibia? Alternatively, what are the direct and indirect impacts of climate change impacts on inflation in Namibia?

III. What are the appropriate policies that can be put in place to mitigate the impacts of climate change on inflation? Alternatively, what can the central bank do to ensure that its ability to ensure price stability is not eroded by climate change?

2. Literature Review

Monetarist economists explained inflation as a monetary phenomenon [9] resulting from a rapid increase in money supply. Through the quantity theory of money, monetarists argued that if money supply outpaces economic activity, this results in a rise in the general price level. Therefore, to curb a rapid rise in inflation levels, it is imperative to increase economic activities. This theory acknowledges that inflationary pressures might arise from a decline in national output (y) caused by weather-related events, such as droughts, floods, storms, and rising sea levels.

$$P = \frac{M \cdot V}{Y} \tag{1}$$

Where P is the price level, M is the quantity of money, V is the velocity of money, and Y is output.

Conversely, some theories explained the transition from climate change to inflation through the demand side. The argument is that output losses due to climate events such as floods and storms lead to excess demand shocks. For example, extreme weather events affect the productive capacity of an economy negatively, resulting in shortages of commodities such as food and energy, which translate into price increases. [10] found a persistent real depreciation for risky countries following natural disasters, which result in high inflation (equation 2). The Phillips curve can be used to explain further the relationship between climate risk to exchange rate, and on inflation.

$$\pi_t = \beta_0 + \beta_1 \pi_{t-1} + (1 - \beta_1) E_t \pi_{t+1} + \beta_2 \, \mathrm{rmc} + \varepsilon_t \tag{2}$$

$$\mathrm{rmc}_t = \beta_3 \gamma_t + (1 - \beta_3) z_t$$

where π_t denotes inflation, rmc_t represents real marginal costs, γ_t is the output gap, z_t is the real exchange rate gap, and ε_t is an error term.

Existing literature [1] examined the short-run effects of the Great East Japan Earthquake on commodity prices in Japan and found that the impact on prices was insignificant. The earthquake, which struck the north-eastern region of Japan on 11 March 2011, was the fourth most powerful earthquake recorded worldwide since the advent of modern seismography in 1900 and resulted in widespread shortages of essential goods. To analyse the short-run effects of the disaster on prices and household purchasing behaviour, the study employed an applied dynamic consumer purchase model with inventory. Using high-frequency panel data on consumer shopping behaviour and retail sales, the authors found that prices increased only marginally following the disaster. This suggests that excess demand was primarily accommodated through quantity adjustments rather than price changes.

Furthermore, [10] investigated the effects of temperature extremes on medium-term inflation, an issue of particular relevance for monetary policy. Employing panel local projection methods across 48 advanced and emerging economies, the study regressed several quarterly price indices?including the consumer price index (CPI) and its food and non-food components, the producer price index (PPI), and the GDP deflator?on country-specific temperature anomaly measures. In addition, the authors developed a simple two-country New Keynesian model to capture the effects of temperature shocks on agricultural productivity and to provide theoretical insights into the transmission of temperature extremes to price dynamics. The results indicate that hot summers lead to an increase in food price inflation in the short term; however, over the medium term, the effects across most price indices are either insignificant or negative. In contrast, a broader strand of the literature suggests that climate change may exert deflationary pressures through various channels, including disruptions to agricultural production, supply chains, and overall economic activity.

[8] assessed the potential impacts of climate change on Europe across eleven sectors, including agriculture and tourism, using a consistent methodological framework that integrates climate and socio-economic projections, sectoral impact models, and economic analysis. Their findings indicate that extreme weather events disrupt economic activity, reduce consumer spending, and contribute to inflationary pressures, while rising temperatures adversely affect labour productivity and agricultural output.

Similarly, [7] examined the asymmetric effects of weather shocks on inflation in the four largest euro area economies. Using country-specific Bayesian Vector Autoregressions (BVARs), the study accounted for the seasonal dependence of climate shocks, allowing for important non-linearities in the climate?inflation relationship. The results suggest that inflation in the euro area tends to decline when temperature shocks occur outside the summer season. However, increased temperature variability exerts significant upward pressure on inflation, particularly for food and services during the summer months. These findings point to potentially stronger inflationary effects of climate change, especially in southern European countries.

In a broader cross-country setting, [5] analysed the macroeconomic effects of climate-related disasters on inflation and economic growth across 173 countries using the local projections framework. Their results show that extreme temperatures are associated with lower inflation, whereas droughts and storms lead to higher inflationary pressures. Moreover, these weather-related shocks affect both core and food inflation, with substantial heterogeneity in magnitude and persistence across country groups. While the study provides robust empirical evidence on the inflationary effects of climate shocks, the channels through which extreme temperatures contribute to lower inflation are not explicitly explored, leaving room for further investigation.

3. Methodology

3.1. Methodology

The paper uses Namibia as a laboratory to quantify the impact of extreme weather events on inflation, and extending the analysis to the SACU region, different econometric techniques are employed i.e., a time series analysis for the country-level and a panel data analysis for the regional level. Using data obtained from the World Bank and National Statistics offices.

Table 1. *Variables and Source.*

Variable	Data Source
Food inflation	National Statistics Offices
Global precipitation	World Bank
Total emissions	World Bank
South Africa's inflation	National Statistical Offices
Annual real GDP growth rate	National Statistics Offices

3.2. Generic Model Specifications

Adapted from the Central Bank of Seychelles on climate change and its implications for inflation in the SADC region (2022), the baseline regression is specified as:

$$\text{Inf}_t = \beta_0 + \beta_1 \,\text{Total\_emm}_t + \beta_2 \,\text{g\_preci}_t + \beta_3 \,\text{SA\_inf}_t + \beta_4 \,\text{RGDP}_t + \varepsilon_t \quad (3)$$

To capture the effects of climate change on food inflation (Inf), total emissions (Total_emm), and global precipitation (g_preci) are used as climate change variables, while South Africa's inflation (SA_inf) and economic growth (RGDP) are used as control variables. Acknowledging limitations in the baseline equation in capturing potential asymmetric relationships between extreme weather events and inflation, the nonlinear autoregressive distributed lag (NARDL) model [21] is employed to decompose variables into partial sums of positive and negative changes. The fully transformed NARDL is given as:

$$\begin{aligned}
&\gamma_1^+ \ln(\text{Total_emm})_{t-1}^+ + \gamma_1^- \ln(\text{Total_emm})_{t-1}^- \\
&+ \gamma_2^+ \ln(\text{g_preci})_{t-1}^+ + \gamma_2^- \ln(\text{g_preci})_{t-1}^- \\
&+ \gamma_3^+ \ln(\text{SA_inf})_{t-1}^+ + \gamma_3^- \ln(\text{SA_inf})_{t-1}^- \\
&+ \gamma_4^+ \ln(\text{RGDP})_{t-1}^+ + \gamma_4^- \ln(\text{RGDP})_{t-1}^-.
\end{aligned} \quad (4)$$

where the superscripts $+$ and $-$ denote positive and negative partial-sum decompositions of the explanatory variables, respectively. The parameters $p_0, \ldots, p_4$ are lag orders. The coefficients $\beta_{i,\cdot}^+$ and $\beta_{i,\cdot}^-$ capture short-run asymmetries, while γ_i^+ and γ_i^- represent the corresponding long-run asymmetric effects.

3.3. Diagnostic Tests

The study performs diagnostic tests to assess the adequacy of the model and to ensure that the classical linear regression rules are not violated. As reported in Table 2, unit root results from ADF and PP tests show a mixture of both I(0) and I(1), which justifies the suitability of the bounds test.

Table 2. *Unit Root Test Results.*

	ADF test			PP test		
Variable	**Level**	**1st Diff**	**I(d)**	**Level**	**1st Diff**	**I(d)**
Inf	-6.69^{***}	–	I(0)	-7.60	–	I(0)
Total_emm	-1.91	-5.31^{***}	I(1)	-1.93	-5.36^{***}	I(1)
g_preci	-5.47^{***}	–	I(0)	-5.39^{***}	–	I(0)
SA_inf	-2.84	-5.87^{***}	I(1)	-2.86	-10.54^{***}	I(1)
RGDP	-4.76^{***}	–	I(0)	-4.75^{***}	–	I(0)

Notes: *** denotes significance at the 1% level. "–" indicates not applicable.

Table 3. *Bounds Test Cointegration Results.*

Dependent	F-Statistic	Lower bound	Upper bound	Outcome
Inf	$\mathbf{4.70^{***}}$	**2.26**	**3.34**	**Cointegrated**
Critical bounds:				
10% level		2.55	3.68	
5% level		2.82	4.02	
1% level		3.15	4.43	

The results report the bound test cointegration (Table 3), which confirms the existence of long-run relationships between the variables, since the computed F statistic of 4.70 is greater than the upper bound critical values at all levels of significance. Therefore, the null hypothesis of no cointegration is rejected at all levels of significance. To prove the validity of the asymmetric relations in the model, the Wald test is applied. Results confirm the existence of long-run asymmetric relationships of climate variables. Therefore, the null hypothesis of symmetric relationships is rejected, justifying the suitability of the NARDL approach in modelling non-linear relationships.

Table 4. *Wald Test Asymmetric Results.*

	Long-run Asymmetric	
Variable	**Value**	**p-value**
Total_emm	2.69	0.0139
Global_preci	-2.08	0.0497

The study also performs a post estimation diagnostic test reported on the lower part of Table 4. Therefore, the Heteroskedasticity test is conducted using the [2] approach, while that of serial correlation is carried out based on the [3] test. Similarly, the [2] normality test and the [20] test are applied. Lastly to check the stability of the model, the CUSUM and CUSUMSQ tests by [12] are carried out.

4. Results and Analysis

4.1. NARDL Results: Country Level

Table 5. *Long-run and Short-run Estimation Results from the NARDL Model.*

Variable: F_infl	Coefficient	T-statistic	P-value
Part A: Long-run results			
D(Total_emm_pos)	-0.42	-1.04	0.3091
D(Total_emm_neg)	0.16	0.46	0.6497
Global_preci_pos	-0.63	-0.47	0.6459
Global_preci_neg	-2.68***	-3.33	0.0033
D(SA_inf_pos)	0.85***	3.04	0.0054
D(SA_inf_neg)	1.79***	3.83	0.0008
GDP_pos	0.55**	2.45	0.0214
GDP_neg	0.13	0.90	0.3770
Part B: Short-run results			
Global_preci_neg	-1.77**	-2.73	0.0114
D(SA_inf_neg)	1.07***	9.40	0.0000
D(SA_inf_neg)(-1)	-0.67***	-4.62	0.0001
GDP_pos	0.31**	2.45	0.0216
GDP_pos(-1)	0.48**	3.39	0.0023
D(Total_emm_pos)	0.23	1.15	0.2570
D(Total_emm_pos)(-1)	0.79***	4.07	0.0004
D(Total_emm_neg)	0.09	0.50	0.6209
D(Total_emm_neg)(-1)	-0.94***	-4.12	0.0004
ECM(-1)	-0.90***	-7.47	0.0000

Table 5 presents the long-run results of the country-level NARDL model, which confirm the asymmetric relationship between extreme weather shocks and food inflation at the country level, as positive and negative changes in climate variables are found to have different magnitudes of effects on food inflation in Namibia. Part A confirms the appropriateness of the NARDL model for investigating this relationship. The long-run results show that although increases and decreases in total emissions (Total_emm_pos and Total_emm_neg) are associated with increases and decreases in food inflation, these effects remain statistically insignificant in influencing food inflation in Namibia. These findings suggest that, as a net importer of crop-based products, Namibia may not experience a direct effect from changes in total emissions [17]. The results are broadly in line with [19], who find that the long-term impact of climate change on prices is negligible.

However, the findings reveal that a decrease in global precipitation is significant in influencing Namibia's food inflation in the long run. In particular, a 1.0 percent decrease in global precipitation leads to a 2.68 percent increase in Namibia's food inflation. Food accounts for 16.4 percent of Namibia's Consumer Price Index (CPI) basket, implying that climate-related food supply shocks can have a pronounced effect on overall inflation through the supply channel. Consequently, conventional monetary policy tools alone may be insufficient to restore price stability under adverse climate conditions. In such contexts, complementary policy measures aimed at smoothing food supply and grain availability during climate-volatile periods are warranted. Other control variables that exhibit a significant long-run impact on Namibia's food inflation include changes in South Africa's inflation (SA_inf_pos and SA_inf_neg) as well as domestic economic performance, proxied by positive and negative movements in RGDP.

Part B of Table 5 presents results on the short-run relationships. The sign of the error correction term (ECM) is negative and statistically significant, indicating that deviations from the long-run equilibrium are corrected in the short run at a speed of approximately 90.0 percent. The results further show that, in the short run, a decline in global precipitation (Global_preci_neg) has a positive and significant effect on Namibia's food inflation. Specifically, a 1.0 percent decline in global precipitation leads to a 1.77 percent increase in food inflation. This highlights the immediate impact of low precipitation on food prices in Namibia. In addition, increases in total emissions (Total_emm_pos) exhibit a significant lagged effect on food inflation, while decreases in total emissions (Total_emm_neg) also exert lagged short-run effects. Similarly, other control variables, including South Africa's inflation and Namibia's real GDP growth, are statistically significant in influencing food inflation in the short run.

Table 6. *Long- and Short-run Results for SACU.*

Variable: F_infl	Coefficient	T-statistic	P-value
Part A: Long-run results			
D(Total_emm_pos)	0.87***	-3.57	0.0000
D(Total_emm_neg)	0.92	0.86	0.3910
Global_preci_pos	-2.37**	-2.50	0.0390
Global_preci_neg	-0.77***	-2.00	0.0450
D(SA_inf_pos)	0.85***	3.04	0.0054
D(SA_inf_neg)	1.12***	11.27	0.0000
GDP_pos	0.62***	2.80	0.0050
GDP_neg	0.45***	2.85	0.0040
Part B: Short-run results			
D(Total_emm_pos)	0.02	0.69	0.4910
D(Total_emm_neg)	0.26	1.10	0.2700
Global_preci_pos	-0.60	1.21	0.2280
Global_preci_neg	1.20***	3.94	0.0000
D(SA_inf_pos)	0.48**	3.39	0.0023
D(SA_inf_neg)	1.20***	6.80	0.0000
GDP_pos	0.26	1.10	0.2700
GDP_neg	1.60**	2.30	0.0210
ECM(-1)	-0.75***	-2.96	0.0030

Long-run results (Panel A). The long-run results reported in Panel A of Table 6 indicate a significant asymmetric relationship between global precipitation and food inflation in the SACU region. Both increases and decreases in global precipitation (*Global_preci_Pos* and *Global_preci_Neg*) exert statistically significant effects on food inflation. Specifically, a one percent increase in global precipitation leads to a 2.37 percent decline in food inflation, while a one percent decrease in global precipitation is associated with a 0.77 percent increase in food inflation in the long run. These findings reflect the region's heavy dependence on rain-fed agricultural production for food security, which accounts for more than 60.0 percent of food supply, thereby increasing vulnerability to climate variability and extreme weather events.

Furthermore, the results show that a one percent increase in total emissions (*Total_emm_Pos*) leads to a 0.87 percent increase in food inflation, suggesting that rising emissions exert direct inflationary pressures at the regional level. These effects may subsequently transmit to Namibia through regional trade linkages. In contrast, a decrease in total emissions is found to have an insignificant impact on regional food inflation in the long run. Other control variables that significantly influence inflation in the SACU region include both increases and decreases in South Africa's inflation, as well as regional economic performance proxied by positive and negative movements in real GDP.

Short-run results (Panel B). Panel B of Table 6 presents the short-run asymmetric results. The findings reveal that, in the short run, a decline in global precipitation has a more pronounced impact on rising food inflation than the effect of increasing global precipitation on lowering inflation. In particular, a one percent decrease in global precipitation leads to a 1.2 percent increase in food inflation in the region. Although increases in global precipitation are negatively related to food inflation, the effect remains statistically insignificant in the short run.

The short-run estimates further indicate that changes in total emissions have no significant effect on food inflation, implying that the inflationary effects of climate change—particularly those associated with emissions—materialise primarily over the long run rather than immediately. Additional variables, including increases and decreases in South Africa's inflation, remain significant determinants of SACU food inflation in the short run, alongside lower economic activity proxied by RGDP_Neg. Finally, the error-correction term (ECM) is negative and statistically significant, indicating that deviations from long-run equilibrium are corrected at an adjustment speed of approximately 75 percent per period.

4.2. Comparison of Country-level and SACU-level Results

The study investigates the asymmetric nexus of adverse weather shocks to food inflation at the country level and for the SACU region. Results confirm an asymmetric relationship between climate variables and food inflation, as positive and negative changes are found to have statistically different effects on food inflation. This confirms the appropriateness of the NARDL model to investigate this relationship. These findings suggest that ignoring non-linearity in modelling adverse weather shocks may lead to misleading conclusions [21]. Comparison of country-level results in Table 4 against SACU results in Table 5 reveals that, in the long run, negative shocks in global precipitation have a more severe impact at the country level compared to the regional level, as one percent decrease in global precipitation leads to a 2.37 percent increase in Namibia's food inflation against a 0.77 percent increase in the regional food inflation. These results suggest that insufficient global precipitation (droughts) highly affect Namibia's food inflation more than the rest of SACU. These findings have significant implications for the central bank's mandate of price stability, given the high weights of food in the CPI baskets for Namibia. Therefore, for the Bank of Namibia, to restore equilibrium prices, additional fiscal measures, as evident by the Government's state of emergency interventions during 1992/93, 1995/96, 2012/13, 2013/14, 2015/16, 2018/19, and in 2024/25 which involves the provision of food to increase supply, are required. Similarly, findings show that increased global precipitation has a positive impact on lowering inflation at the county and regional levels. Precisely, a one percent increase in global precipitation leads to a 0.63 percent decrease in food inflation for Namibia and a 2.37 percent decrease in SACU's inflation. This finding suggests that positive climate shocks give central banks greater flexibility in managing inflationary pressures through adjustments to policy rates. Although changes in total emissions were found to be insignificant in influencing a country's food inflation, increases in total emissions significantly influence regional food inflation in the long run. Therefore, as a net importer of crop-based products, such findings indicate that changes in global emissions have implications to Bank of Namibia's price stability mandate.

5. Conclusions and Recommendations

5.1. Conclusions

The study indicates that changes in total emissions have an insignificant impact on the country's inflation, while decreases in global precipitation significantly impact the country's inflation. The study aimed to ascertain the short and long-term effects of climate change on Namibia's inflation against that of the SACU region. Findings revealed that at a country level, decreases in global precipitation significantly impact the country's inflation in the short and long run. Results suggest that as precipitation declines, the country's food inflation is affected through lower agricultural output, with Namibia being more affected than its regional peers. The study found that a 1.0 percent decrease in global precipitation leads to a 2.37 percent increase in Namibia's food inflation against a 0.77 percent increase in the regional food inflation. The key policy implications of these findings suggest that conventional monetary policy adjustment tools may not be enough to restore equilibrium prices in the presence of adverse weather shock disruptions. Therefore, under unfavourable climate conditions, additional policy interventions are required. Findings further reveal that negative shocks from global precipitation have a significant impact on Namibia's and SACU inflation. Therefore, these findings have significant implications for central banks, particularly in the SACU region, where food plays a crucial role in the CPI. Furthermore, results show that increases in total emissions are significant at influencing regional inflation, implying that climate change as a global phenomenon ultimately affects Namibia's food inflation. Similarly, results suggest that changes in global precipitation significantly affect regional inflation, indicating the high dependency of the region on rainfall for agricultural output.

5.2. Recommendations

1. Given the findings that changes in global precipitation affect Namibia's food inflation in the short and long run through the supply pathway, and that traditional monetary policies may not be sufficient to restore price stability, it is critical that Namibia makes use of complementary policies such as fiscal interventions and other social programmes to restore price stability following climate-related shocks. These include state of emergency interventions where the government provides food aid, water, animal feed, and assesses additional funding requirements to help affected communities. 2. Findings further reveal that increases in total emissions has significant impact on SACU's food inflation. It is therefore important for SACU countries, of which Namibia is a member, to enhance coordination of efforts aimed at reducing global emissions. 3. In light of the findings that negative climatic shocks distort the central bank's mandate (i.e., price stability), it is recommended that central banks in the region, including the Bank of Namibia, incorporate climate change variables in their monetary policy framework.

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Abbreviations

ADF	Augmented Dickey–Fuller
ARDL	Autoregressive Distributed Lag
NARDL	Nonlinear Autoregressive Distributed Lag
CPI	Consumer Price Index
ECM	Error Correction Model
GDP	Gross Domestic Product
RGDP	Real Gross Domestic Product
PP	Phillips–Perron
SACU	Southern African Customs Union
SA	South Africa
UNFCCC	United Nations Framework Convention on Climate Change
BoN	Bank of Namibia
NSA	Namibia Statistics Agency
IMF	International Monetary Fund
WB	World Bank
Total_emm	Total Emissions
g_preci	Global Precipitation
SA_inf	South Africa Inflation
F_infl	Food Inflation

Author Contributions

Gracianu Kavaleka: Data curation, Investigation, Methodology, Formal analysis, Visualization
Vejama Mootu: Conceptualization, Data curation, Formal analysis, Visualization
Rehabeam Shilimela: Conceptualization, Supervision
Postrick Mushendami: Supervision, Writing - review & editing

Conflicts of Interest

The authors declare no conflicts of interest.

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