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Macroeconomic Impact of Climate Change and the Role of Central Banks

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Abstract

Climate change is increasingly recognized as a complex and evolving phenomenon with broad macroeconomic implications. This study employed a Structural Vector Autoregression methodology to analyze the impact of climate-related shocks on key macroeconomic variables in Mauritius using quarterly data from 2005Q1 to 2022Q4. Rainfall and temperature are used as climate change indicators. Empirical results indicate that rainfall shocks exert adverse effect on output and prices. Temperature shocks generate a slightly different response, which is nevertheless aligned with broader empirical evidence. Output gap initially rises but subsequently declines and remains persistently negative, while inflation declines. The underlying results highlight the importance of timely monetary policy response to safeguard price stability. More broadly, the macroeconomic consequences of climate change underscore the need to accelerate the transition to a green economy through well-designed adequate climate policies aimed at bolstering economic resilience and supporting sustainable economic growth.

JEL Keywords: Climate Change, Monetary Policy, Financial Stability, Structural Vector Autoregressive

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I. Introduction

Climate change has turned out to be a dominant concern worldwide, representing the greatest global challenge due to its manifold, long-lasting and profound impact. As climate change gathers momentum, the occurrence and severity of climate-related hazards are anticipated to intensify. The projected rise in global temperatures and associated changes in climate, notably variations in rainfall or storm characteristics, as well as the transition to a low-carbon economy implied by the Paris Agreement have far-reaching consequences for the macroeconomy and, subsequently, on monetary policy.[1] Assessing the macroeconomic impact of climate change on the economy is thus considered as one of the most pressing issues, (NGFS, 2020). As such, central banks across the world have been increasingly incorporating climate change considerations into their policies as these can be major hurdles in achieving their price stability and economic development mandates.

Climate-related calamities and their erratic patterns have taken a toll on many economies including Mauritius. Indeed, as a small island developing state (SIDS) and tropical island, Mauritius is highly vulnerable to the vagaries of nature, particularly, cyclones and heavy rains in spite of contributing less than 0.01 per cent of global greenhouse gas (GHG) emissions.[2]

While Mauritius is vulnerable to climate change, the extent to which weather-related shocks influence macroeconomic outcomes, particularly inflation and output, is not clear. Inflation and economic growth are key policy variables directly linked to the mandate of the Bank of Mauritius, which is to maintain price stability and promote orderly and balanced economic development. Although inflation has generally remained moderate over time, bouts of unexpected price volatility could have implications for the cost of living and overall welfare of the population, posing challenges for monetary authorities. Similarly, output, particularly in the agricultural sector, is highly sensitive to climate change. Having a clear understanding of the role of climate-related shocks in shaping these macroeconomic outcomes is therefore crucial for designing effective fiscal and monetary policies. This study does not assume that climate-related shocks directly drive macroeconomic outcomes but tests the hypothesis that these shocks, proxied by rainfall and temperature variations may influence inflation and growth dynamics in Mauritius.

Thus, the contribution of this study is two-fold. Firstly, SIDS are highly exposed and susceptible to the hazardous consequences of climate change on the macroeconomy but there is a paucity of research relating climate change to key economic variables in SIDS as most studies are overwhelmingly geared towards developed economies as opposed to their developing and SIDS counterparts. This study, therefore, attempts to fill the research gap by providing empirical evidence on Mauritius. In the same vein, while there is substantial empirical evidence on the consequences of extreme climate-related events such as floods and drought, research is relatively lacking in terms of less acute climatic shocks, for instance, evolving rainfall pattern and rise in temperature, which equally have detrimental effects on the economy.

Despite numerous global studies on the impact of climate change on macroeconomic outcomes, there is essentially no prior empirical research for Mauritius which examines the interaction

[1] In December 2015, 196 Parties adopted the Paris Agreement to set a goal of limiting global warming to well below 2ºC compared to pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5ºC above pre-industrial levels.
[2] As per the Update of the Nationally Determined Contributions of the Republic of Mauritius, October 2021.

between these two indicators. Existing studies focus on developed economies or extreme climate events, leaving a gap in gauging the role of climatic shocks on inflation, growth and monetary policy in a small island context. The current study addresses this gap by analyzing the impact of climate shocks, specifically, rainfall and temperature variations on output, inflation, exchange rate, and interest rate in Mauritius using a Structural Vector Autoregression framework, with quarterly data spanning from 2005Q1 to 2022Q4.

The remainder of the paper is organized as follows. The next section focuses on climate indicators for Mauritius and measures taken by the authorities to address climate change. Section three provides a review of the empirical literature on the link between climate change and economic growth, inflation and monetary policy. Section four describes the data and econometric methodology used and discusses the empirical results while the last section provide conclusions of the study policy recommendations.

II. Climate Change and the Mauritian Economy

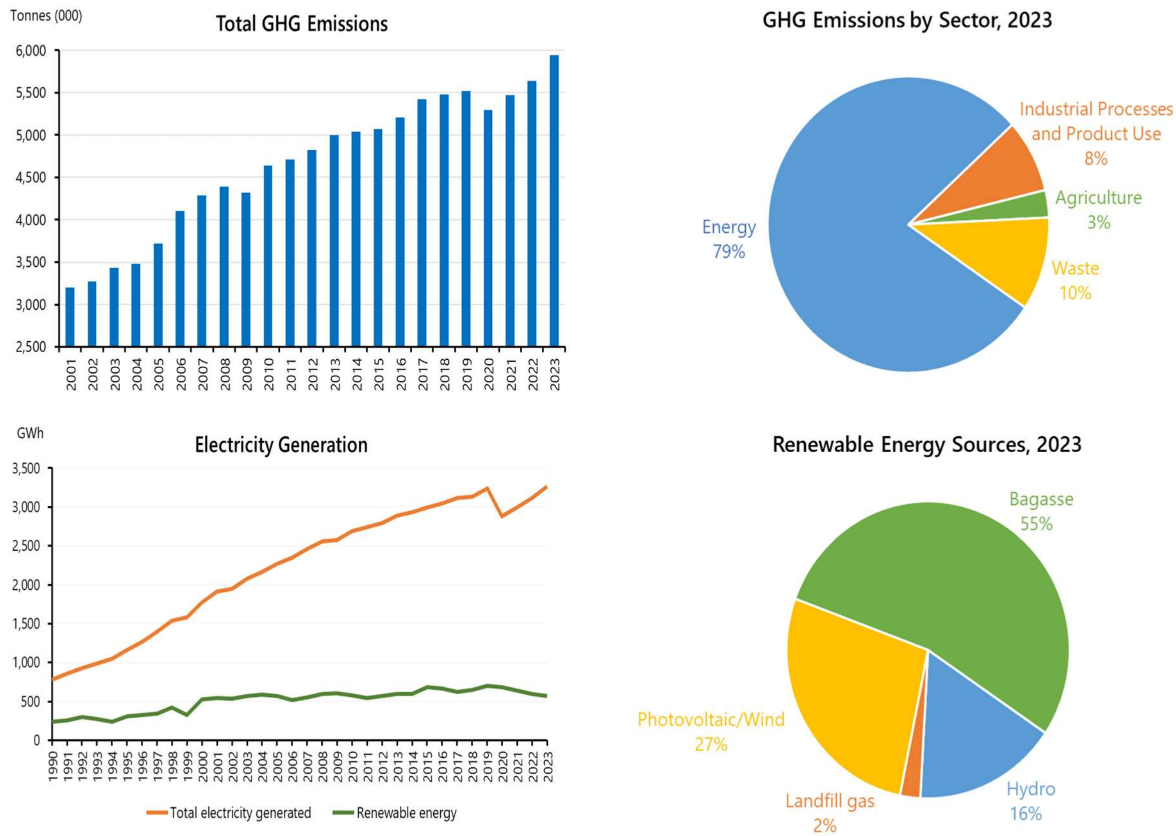
As a tropical island, Mauritius is highly exposed to the harmful consequences of climate change and resulting extreme weather events. Torrential rains, floods and the frequency and intensity of tropical cyclones have increased markedly over the past three decades. According to the UN Report, (2020), describes Mauritius as being exceptionally vulnerable to rising temperatures/sea levels/beach erosion and loss of biodiversity.[3] Annual temperature is projected to rise by as much as 3.8°C by 2100, based on temperature trends. The country's disaster risk profile indicates that flooding is the second-largest risk after cyclones. Indeed, Mauritius is experiencing a rise in the frequency of occurrence of high intensity rainfall events, resulting in flash floods on several occasions.

2.1 Evolution of Climate Change Indicators and Inflation and Output

Greenhouse gas emissions (GHG) induced by human activities are considered as the main driver intensifying the greenhouse effect and contributing to climate change. Data for Mauritius point to an increase in total GHG emissions over time, with the energy sector remaining the largest contributor (79 per cent), followed by waste (10 per cent) and industrial processes and product use (8 per cent) as depicted in Figure 1. It can further be observed from Figure 1 that in Mauritius, 17.6 per cent of electricity generated was from renewable sources in 2023, indicating that the energy mix is still dominated by diesel, fuel oil and coal. Bagasse is currently the leading source of renewable energy (55 per cent), followed by photovoltaic/wind (27 per cent), hydro (16 per cent) and landfill gas (2 per cent).

[3] The disaster risk management: A capacity diagnosis Report (2020), highlights the findings and recommendations of the diagnosis of national and local capacities to manage disaster risk in the Republic of Mauritius conducted in 2019.

Figure 1: GHG Emissions and Renewable Energy Sources

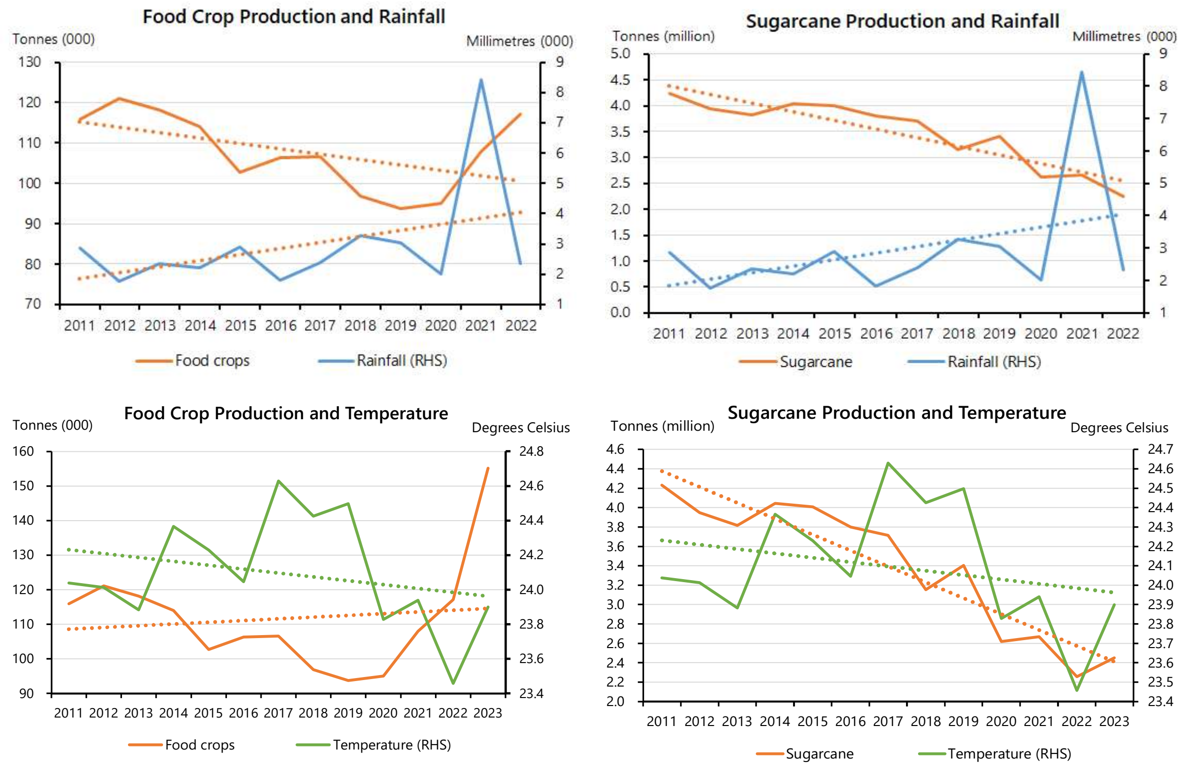


Mauritius, as a small island economy, is highly dependent on agriculture and therefore vulnerable to fluctuations in weather conditions. Data from the Ministry of Environment's database on risk drivers of climate change indicate that the frequency and intensity of extreme weather events, such as heavy rains, storms of tropical cyclone strength and periods of dry spells, have increased significantly over the past two decades. This trend heightens the exposure of the agricultural sector to climate-related risks and amplifies risks of inflationary shocks. While the immediate impact of weather-related disturbances on inflation may not always be apparent, the long-terms effects of climate change are expected to forge a more persistent link between environmental variability and price stability in the Mauritius. Erratic weather patterns, including increase in the frequency of rainfall as well as rising temperatures, strain agricultural production and reduce the quality of farm outputs. Such shocks can diminish crop yields, interrupt supply chains and raise production costs. These higher costs are often passed on to consumers, directly contributing to inflation.

Furthermore, according to the Ministry of Environment, Solid Waste Management and Climate Change, Mauritius may become a water-scarce region by 2030. Limited water availability can curtail agricultural production and increase reliance on imported food. These constraints can raise production costs and reduce supply, pushing prices up and contributing to overall inflation. As climate change exacerbates both rainfall variability and water scarcity, the economy may experience more frequent and persistent inflationary pressures.

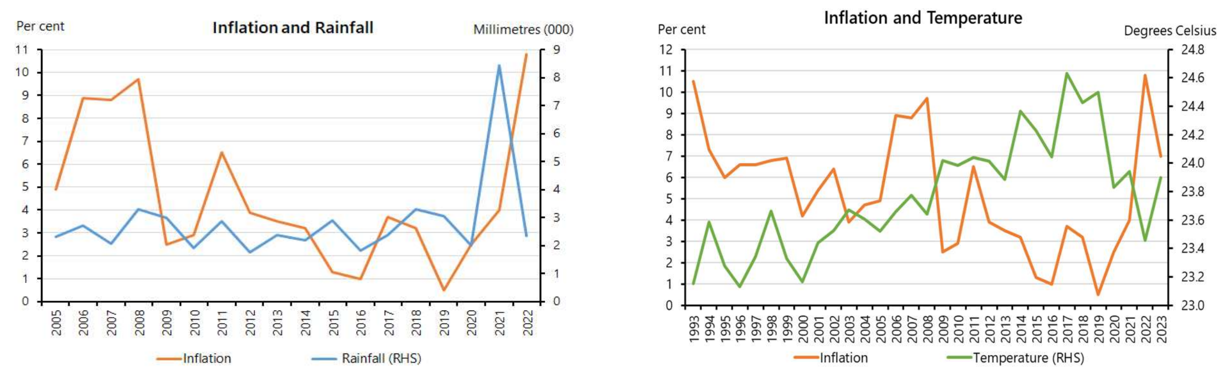
A visual inspection of rainfall patterns alongside the production of food crops and sugarcane suggests co-movements between rainfall and output (Figure 2). Additionally, declines in temperature seems to benefit food crop production. In Contrast, sugarcane yields seem to decrease when temperatures fall, indicating that higher temperatures may be favourable for sugarcane cultivation.

Figure 2: Production of Food Crops/Sugarcane and Rainfall /Temperature



Decline in agricultural production stemming from weather-related events tends to exert upward pressure on prices, ultimately leading to a rise in inflation. This is reflected in Figure 3, which shows a positive relationship between rainfall and inflation. However, the relationship between temperature and inflation seems to be counter-intuitive. Over the period 1993 to 2023, a rise in temperature is associated with receding inflation, suggesting that inflation is dominantly influenced by factors other than temperature.

Figure 3: Inflation and Rainfall and Temperature



In Mauritius, food is a key driver of inflationary as it accounts for about 25 per cent of the consumer basket. Climate-related events can raise food inflation by damaging agricultural output. Food inflation seems to move closely with rainfall patterns, but its link with temperature is less clear (Figure 4). Severe tropical cyclones also disrupt activity at the port, as shown by temporary drops in container movement although these effects generally do not last long (Figure 5).

Figure 4: Food Inflation and Rainfall and Temperature

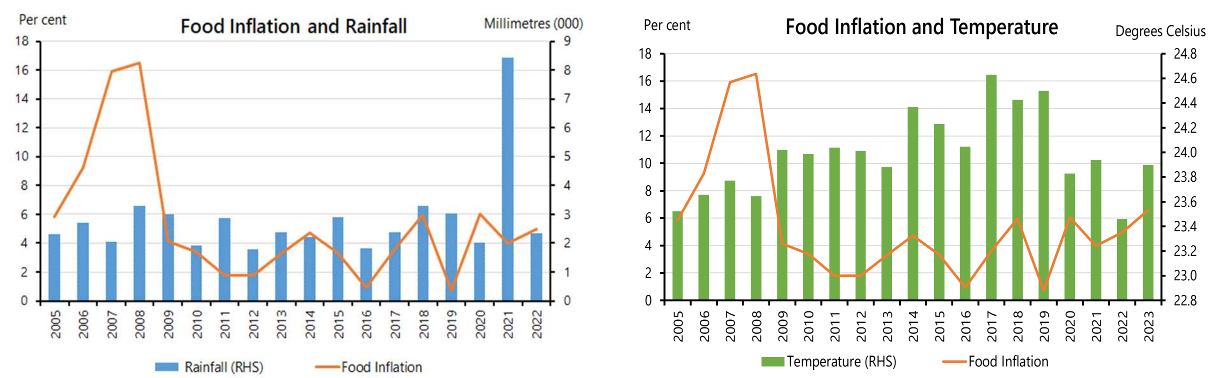
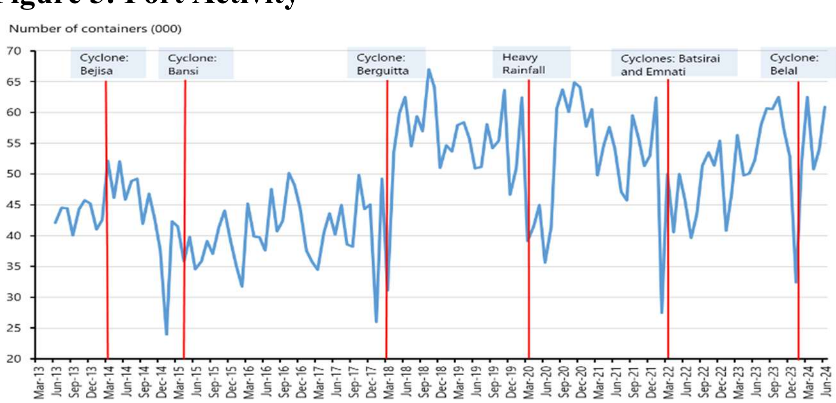


Figure 5: Port Activity

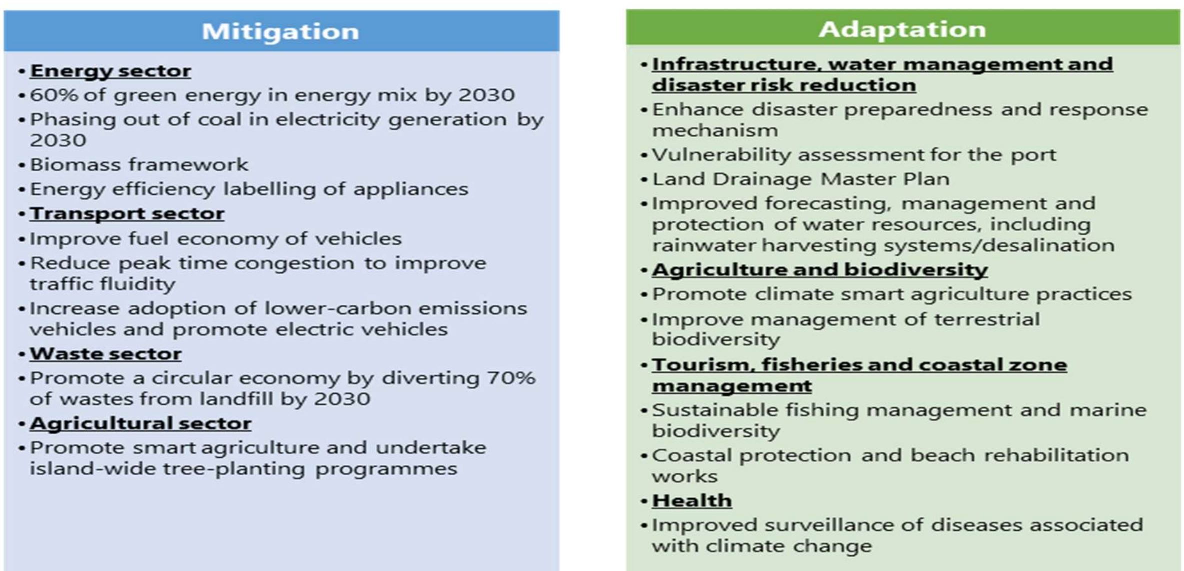


Note: Vertical lines pertain to severe cyclones and heavy rainfall.

2.2 Climate Change Response Measures by the Government of Mauritius

Mitigation and adaptation strategies are instrumental to achieve the goals set under the Paris Agreement. Mauritius has committed to combating climate change through the implementation of comprehensive strategies and policies on climate change mitigation and adaptation. The Climate Change Act 2020, in force as from April 2021, provides a legal framework towards making Mauritius a climate resilient and low emission country by defining the tasks and functions of institutions regarding climate change governance. Furthermore, in its Nationally Determined Contributions (NDCs), the Government of Mauritius has set ambitious objectives, notably reduction of its GHG emissions by 40 per cent by 2030. The total financial requirements to meet such obligations are estimated at USD6.5 billion – of which USD2 billion are earmarked for mitigation actions and USD4.5 billion for adaptation strategies. The multi-fold strategy on climate change mitigation and adaptation aimed at achieving the goals set in the NDCs is summarized in Figure 6.

Figure 6: Summary of NDCs Goals



Source: Ministry of Environment, Solid Waste Management and Climate Change.

2.3 Climate Change Response Measures by Bank of Mauritius

The Bank of Mauritius has also taken several initiatives on the climate front. In June 2020, it engaged with financial institutions to raise awareness on climate-related risks and the opportunities associated with the transition to net-zero emissions. In July 2020, the Bank further strengthened its commitment by joining the NGFS, enabling closer collaboration with central banks on sustainability-related research and technical resources.

The sustainable bond market has witnessed rapid growth in recent years, and Mauritius is likewise promoting investment in green technologies and renewable energy, recognizing of their critical role in the transition towards a greener and more sustainable economy. In June 2021, the Bank published its *Guide for the Issue of Sustainable Bonds in Mauritius*, which the framework for issuing Green, Blue, Social, Climate and Sustainability Bonds in the country. The Guide sets out the requirements that issuers must meet, including pre-issuance arrangements, use of proceeds and reporting obligations. It also seeks to safeguard the integrity of the sustainable finance ecosystem in Mauritius and prevent greenwashing. To enhance Mauritius' appeal to foreign sustainable finance investors, the Guide recommends aligning bond issuances with global benchmarks and standards.[4]

In October 2021, the Bank established the Climate Change Centre with the objective of integrating climate-related and environmental financial risks into its regulatory, supervisory and monetary policy frameworks. The Climate Change Centre also supports the development of sustainable finance and reviews the Bank's internal operations with a view to reducing its carbon footprint. The Bank has also embedded sustainability considerations into its internal investment strategy in the area of reserves management.

In April 2022, the Bank issued the *Guideline on Climate-related and Environmental Financial Risk Management*, which calls for financial institutions to integrate climate risks into every stage of their decision-making processes and operations. The Guideline also introduces disclosure requirements aimed at enhancing market transparency and supporting businesses and investors in evaluating and pricing risks associated with green projects. Its key components include governance, strategy, risk management, data, measurement and disclosure. By providing this framework, the Guideline enables financial institutions to better assess and manage climate-related risks in their lending and investment activities, thereby reducing the potential for losses resulting from adverse impacts of climate change.

Further, the Climate Change Centre is currently collaborating with international institutions to develop a high-integrity carbon trading framework covering both blue and green credits. The Bank is also advancing its climate agenda through multiple stakeholders' partnerships. For example, it is working with various government agencies to develop a National Green Taxonomy, considered essential for strengthening investor confidence, stimulating climate-related investments in Mauritius, and addressing concerns around greenwashing. In addition, the Bank collaborates with the Financial Services Commission, the regulator for the non-bank financial services sector and

[4] Green Bond Principles of the International Capital Market Association and the International Climate Bonds Standards of the Climate Bonds Initiative.

global business, through a Coordination Committee that examines, among other matters, the implications of climate change on the Mauritian financial system. Collectively, these initiatives aim to foster a robust and trustworthy sustainable finance ecosystem in Mauritius and, through the Mauritius International Financial Centre across the region.

The measures introduced by the Bank have begun to yield results, as reflected in the growing momentum of sustainable finance within the banking sector. According to a survey conducted by the Bank in August 2023, bank exposures to sustainable projects increased by 64 per cent between June 2022 and June 2023, while loan applications for sustainable project financing rose by more than 50 per cent over the same period. The survey further shows that, of the 19 banks operating in Mauritius, 11 offer sustainable financial products. In addition, several banks are financing mitigation projects, even though these projects often present less attractive risk–reward profiles. Many banks have also established strategies and action plans aimed at supporting sustainable growth.

The Bank, in collaboration with the Ministry of Finance, Economic Planning and Development, devised the Sustainable Finance Framework for Mauritius and established the regulatory framework for the issue of sustainable bonds by Government. The framework, published in August 2023, outlined, among other things, the specific types of sustainable debt instruments Government can issue in order to reinforce the country's sustainability strategy. The proceeds from these instruments will be directed towards ESG-related projects, including renewable energy and improved access to essential services such as education, healthcare and social housing.

III. Literature Review

The study provides both theoretical and empirical literature highlighting the linkages between climate-related events, policies, and shifts in environmental conditions and the evolution of key macroeconomic variables such as output, inflation, interest rates and exchange rates, amongst others and associated effects on the broader economy.

3.1 Theoretical Review

Generally, climate change affects both inflation and economic growth through complex demand- and supply-side channels. Extreme weather and rising temperatures increase the frequency of shocks, complicating monetary policy. On the demand side, reduced investment, lower household wealth, and disrupted trade can weaken economic activity. On the supply side, climate shocks raise production costs and create upward pressure on prices, challenging central banks' price stability mandates. Moreover, climate change may limit central banks' policy space and increase trade-offs between stabilizing inflation and output. While demand shocks typically affect growth and inflation in the same direction, supply shocks push growth down and prices up. Frequent and uncertain climate-related supply shocks make it harder to distinguish temporary from permanent effects, complicating monetary policy, forecasting, and communication (NGFS, 2020).

Climate shocks can spread through the broader economy via linkages with the real, external, and monetary sectors. On the supply side, extreme weather events directly reduce agricultural and industrial output, as declining crop yields and disrupted production depress overall output (Parker, 2018). These shocks also cause substantial infrastructural damage, weakening productive capital accumulation and constraining a country's long-term growth prospects. This occurs through several channels, including reduced labour supply due to higher mortality and migration, lower labour productivity, and the diversion of investment towards climate-resilient infrastructure and technologies and away from potentially more productive, innovation-enhancing activities (Fankhauser and Tol, 2005; Dell et al., 2014; Hallegatte et al., 2017).

In parallel, the demand side of the economy is affected through weaker domestic demand resulting from lower employment and income. On the external front, climate shocks influence both exports and imports. Reduced domestic output can constrain exports of both goods and services, in particular, tourism activities, thereby weakening foreign exchange earnings (Dell et al., 2014). At the same time, reconstruction and adaptation efforts require substantial investment, much of which imported materials and machinery. This increases imports and worsens the trade balance, and exerts downward pressure on the domestic currency (Parker, 2018). Currency depreciation, in turn, raises the cost of imported goods, including essential production inputs, which feeds into domestic inflation (Mukherjee and Ouattara, 2021).

Climate-related events are increasing in relevance for central banks' price stability mandates (Parker, 2018; Faccia et al., 2021; Mukherjee and Ouattara, 2021; Natoli, 2022; Kotz et al., 2023). Rising food and energy prices, exchange rate pass-through and supply chain disruptions arising from climate-related disturbances, create inflationary pressures that may prompt tighten monetary policy. The agriculture sectors is particularly vulnerable as climatic shocks reduce crop yields and raise food prices. In developing economies, where food has a large share in the consumption basket, these shocks lead to higher and more volatile inflation.

The transition to net zero may lead to sharp increases in carbon prices, which can raise electricity, gas and petrol costs and increase production expenses, thereby fueling inflation. However, Andersson et al. (2020) argue that ongoing innovation in renewable energy and improvements in energy efficiency would lower renewable energy costs, reducing the share of energy in the consumption basket. If inflation rises above the target, central banks may respond by raising interest rates.

3.2 Empirical Review

Climate change is a negative externality that threatens economic output. Temperature fluctuations and extreme weather generally reduce growth both in developed and developing countries, with the effects strongest in low-income economies (Dell et al., 2012; 2014; Burke et al., 2015; Hsiang, 2013; Tol, 2022). Dell et al. (2009) finds that higher temperatures significantly lower growth in poor countries, while rich countries are less affected. However, Colacito et al. (2019) find a contrasting result - higher temperatures are a drag on growth in the US. Dell et al (2012) estimate that climate change could reduce growth in poor by 0.6-2.9 percentage points.

The literature on climate change and inflation is limited (Heinen et al., 2016; Parker, 2018). Heinen et al. (2016) report a strong inflationary effect of extreme weather in developing countries, later confirmed by Parker (2018). Faccia et al. (2021) show that extreme summer temperatures can have lasting effects on inflation. Kabundi et al. (2022) find that the impact of climate shocks on consumer prices depends on the shock type and intensity, country income, and monetary policy. Ciccarelli et al. (2023) temperature shocks on prices that rising average temperature and summer temperature variability increase inflation in the four largest Euro area economies, especially in warmer countries.

IV. Empirical Methodology

4.1 Data Sources and Description

The study used quarterly data from 2005Q1 to 2022Q4 on GDP, alternative CPI measures (headline, core and food), climate indicators (rainfall and temperature), nominal short-term interest rate (interbank rate and 91-Day Bills yield) and exchange rate indicators (MUR/USD and nominal effective exchange rate, NEER). A detailed description of the data and their sources is provided in Table 1, while Annex 2 presents the trends over the sample period. Descriptive statistics are included in Annex 3. The selection of variables is guided by the standard macroeconomic transmission mechanism and by their established linkages between climatic conditions and economic activity. Rainfall and temperature serve as key indicators of climate shocks, as they directly influence agricultural output, food supply and consequently domestic price pressures. Inflation reflects overall price level response, while the output gap is a proxy for economic growth. The interest rate represents the monetary policy response, which in turn influences the exchange rate. Together, these variables provide a coherent framework for analyzing how climate shocks propagate through the economy and how policy responds to such disturbances.

Table 1: Data Description

Variable	Transformation	Denomination
GDP	Output gap (Current GDP-Potential GDP)	*OUTPUT_GAP*
Headline CPI	Log of Seasonally adjusted (SA) CPI	*LCPI*
Core CPI	Log of SA Core	*LCORE*
Food CPI	Log of SA CPI Food	*LFOODCPI*
Exchange rate	Current log of nominal effective exchange rate (NEER) - trend NEER	*NEER_GAP*
Interest rate	Current 91-Day Bills yield - trend 91-Day Bills yield	*YIELD_GAP*
Rainfall	Log of SA rainfall	*LRAINFALL*
Temperature	Log of SA temperature	*LTEMP*

4.2 Estimation Approach

This study employs a Structural Vector Autoregressive (SVAR) framework to investigate the effects of climate shocks, measured through variations in rainfall and temperature, on growth and inflation and their broader macroeconomic linkages. The SVAR approach is particularly appropriate for this analysis because it enables the structural identification of exogenous shocks and allows tracing of their dynamic impacts on interconnected macroeconomic variables. Unlike reduced-form VAR models, SVARs incorporate economically meaningful restrictions, making it possible to disentangle supply, demand, and climate-related disturbances in a theoretically consistent manner (Sims, 1980).

As described in Bwire (2019), the SVAR model is specified as follows:

$$AY_t = C(L)Y_{t-1} + Bu_t; \qquad \mu_t \sim N(0, I) \qquad (1)$$

where Y_t represents a n×1 vector of endogenous variables. The structural shocks vector, u_t, is assumed to be normally distributed, i.e., $u_t \sim N(0, \Sigma)$, where Σ is specified as a diagonal matrix and is usually normalized such that $E(u_t u'_t) = \Sigma = I_n$ and $u_t \sim N(0, I)$. A and B refer to n×n parameter matrices while C is the matrix of lagged coefficients of interactions in Y_t. The reduced-form structural model is given as:

$$Y_t = A^{-1}C(L)Y_{t-1} + A^{-1} Bu_t; \quad u_t \sim IID(0, I) \qquad (2)$$

The structural model in equation (2) cannot be estimated directly due to identification issues (Enders, 2015), and must be recovered from the unrestricted VAR counterpart in equation (3).

$$Y_t = F_1 Y_{t-1} + F_2 Y_{t-2} + \cdots F_p Y_{t-p} + \varepsilon_t \quad (3)$$

with Y_t being a nxn vector of endogenous variables, ε_t is a nxn vector of normally and independently distributed disturbance terms, with zero mean and non-diagonal covariance matrix, Σ. Parameter restrictions using Cholesky decomposition are introduced on A and B (Sims, 1980) as follows:

$$A\varepsilon_t = B\mathrm{u}_t \quad (4)$$

where,

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{12} & 1 & 0 & 0 & 0 \\ a_{13} & a_{23} & 1 & 0 & 0 \\ a_{14} & a_{24} & a_{34} & 1 & 0 \\ a_{15} & a_{25} & a_{35} & a_{45} & 1 \end{pmatrix} \quad B = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \varepsilon_t = \begin{pmatrix} \varepsilon_{1t}^{clim} \\ \varepsilon_{2t}^{gdp} \\ \varepsilon_{3t}^{cpi} \\ \varepsilon_{4t}^{int} \\ \varepsilon_{5t}^{exch} \end{pmatrix} \mathrm{u}_t \begin{pmatrix} \mathrm{u}_{1t}^{clim} \\ \mathrm{u}_{2t}^{gdp} \\ \mathrm{u}_{3t}^{cpi} \\ \mathrm{u}_{4t}^{int} \\ \mathrm{u}_{5t}^{exch} \end{pmatrix}$$

The SVAR strategy is implemented in three phases: (1) specify and estimate the reduced-form VAR, (2) identify the structural shocks; and (3) generate impulse response functions (IRFs). In the first phase, an important decision concerns the number of variables to include in the model.[5] This study adopts a 5-variable model, consisting of GDP (gdp_t), CPI (cpi_t), nominal short-term interest rate (int_t), exchange rate ($exch_t$) and the climate indicator ($clim_t$). The vector Y_t is thus given as follows:

$$Y_t = [gdp_t, cpi_t, int_t, exch_t\ clim_t] \quad (5)$$

The variables evolve over time with a trend-like behavior, except for the output gap, suggesting that they may be non-stationary in levels (Annex 2). The study conducted tests for stationarity using the Augmented Dickey Fuller (ADF) unit root test (Dickey and Fuller, 1979). The variables were transformed into either gaps or logs to make them stationary, and the results of the stationarity tests are provided in Annex 4. The study used the Schwarz (SC) and Hannan–Quinn (HQ) criteria to determine the appropriate lag length and conducted additional robustness checks to validate the specification. The model passed all standard diagnostic tests, indicating that the residuals show no signs of serial correlation, heteroskedasticity, or instability over the sample period.

[5] While a VAR with a large number of variables would enable ample interactions, a relatively more parsimonious model with higher degrees of freedom is likely to be simpler to estimate and more stable.

The second phase of the SVAR strategy involves imposing restrictions on contemporaneous relationships among the variables. Since ordering of variables is crucial in a SVAR framework, we arrange them in such a way that isolates the climate shock from other disturbances affecting the economy. Accordingly, Thus, the climate indicator, considered the most exogenous variable, is placed first, followed by the output gap, inflation, interest rate and exchange rate. This ordering implies that the climate shock, viewed as a supply-side disturbance, can affect all other variables contemporaneously, while it is itself not influenced by movements in the other macroeconomic variables.

Based on the above ordering, Equation (4), which can be re-written as $\varepsilon_t = A^{-1}Bu_t$, is represented in matrix form as follows:

$$\begin{pmatrix} \varepsilon_t^{clim} \\ \varepsilon_t^{gdp} \\ \varepsilon_t^{inf} \\ \varepsilon_t^{int} \\ \varepsilon_t^{exch} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{12} & 1 & 0 & 0 & 0 \\ a_{13} & a_{23} & 1 & 0 & 0 \\ a_{14} & a_{24} & a_{34} & 1 & 0 \\ a_{15} & a_{25} & a_{35} & a_{45} & 1 \end{pmatrix}' \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \begin{pmatrix} u_t^{clim} \\ u_t^{gdp} \\ u_t^{inf} \\ u_t^{int} \\ u_t^{exch} \end{pmatrix}$$

where u_t^{clim} denotes climate (supply) shock, u_t^{gdp} is output gap (demand) shock; u_t^{inf} is inflation shock; u_t^{int} is interest rate (monetary policy) shock; and u_t^{exch} is exchange rate (external) shock.

Identification requires that $(3k^2 - k)/2$ restrictions in matrices A and B be imposed, where k is the number of variables. For recursive identification, restrictions are imposed on the A matrix for it to become lower triangular, and for the structural shocks to be uncorrelated. Thus, with five variables, a total of 35 restrictions need to be imposed, comprising 10 zero restrictions in matrix A, 20 zero restrictions in matrix B and 5 normalisation restrictions from the diagonal of matrix A.

V. Discussion of Findings

In this section, we report findings of impulse response functions using rainfall and temperature as proxies for climate indicators and three measures of inflation to capture prices (Headline inflation, core inflation and food inflation). Figure 7 illustrates the impulse response functions from the SVAR model in which rainfall serves as the climate indicator and headline inflation as the indicator of prices. The figure evaluates how rainfall shocks affect the output gap, CPI inflation, the yield gap, and the NEER gap.

The first graph shows how a rainfall shock affects rainfall itself. The shock has an initial magnitude of roughly 50mm, but its effect gradually dissipates after four quarters. Although the rainfall shock exerts a slightly positive influence on the output gap in first period, it has a negative lasting effect up to the sixth quarter, after which the output gap returns to broadly neutral levels. Conversely, the effect on inflation is positive on impact but steadily declines in the following quarter and converges to the actual inflation rate thereafter. The relatively volatile responses of interest rate and exchange rate suggest that these variables may be more sensitive to factors other than the climate shock. Figures 8 and 9 illustrate the IRFs from the same model specification using core and food inflation, respectively, and their patterns are broadly similar to with those in Figure 8. Although the impulse response functions appear statistically insignificant, as noted by Kim et al. (2024), economic intuition and theoretical coherence can still offer meaningful interpretation, even when statistical insignificance is limited.

Figure 7: Impulse Response Functions of Shock to Rainfall (Headline inflation)

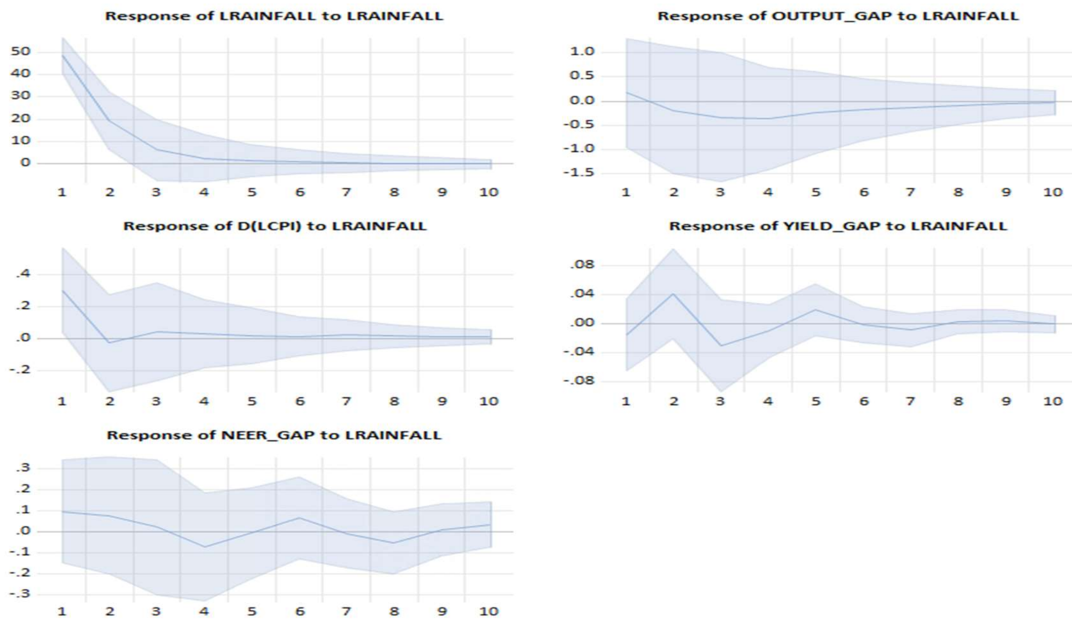


Figure 8: Impulse Response Functions of Shock to Rainfall (Core inflation)

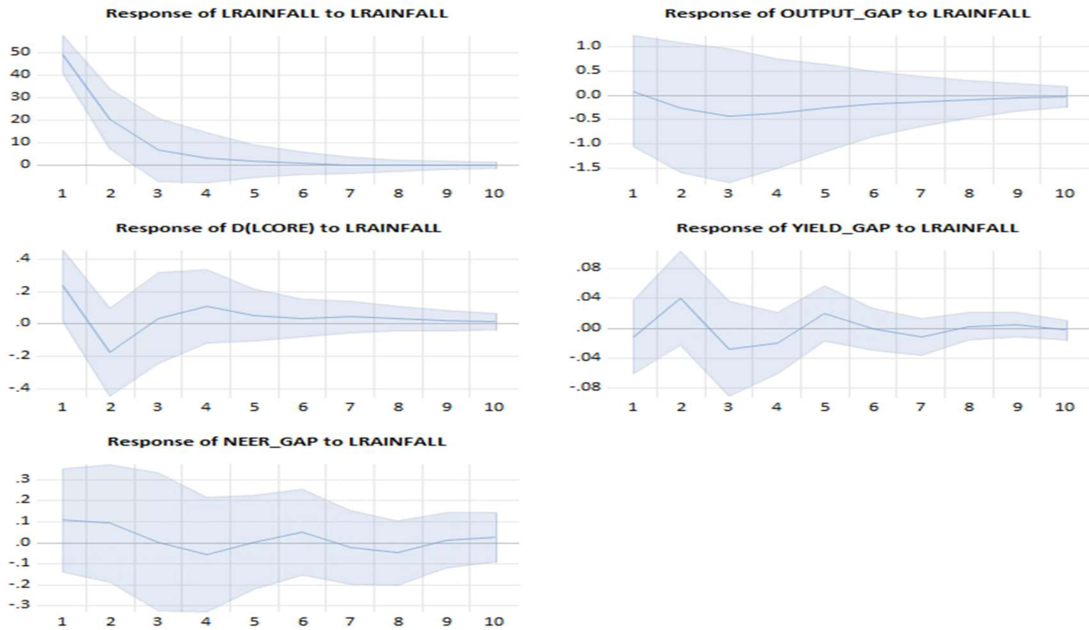
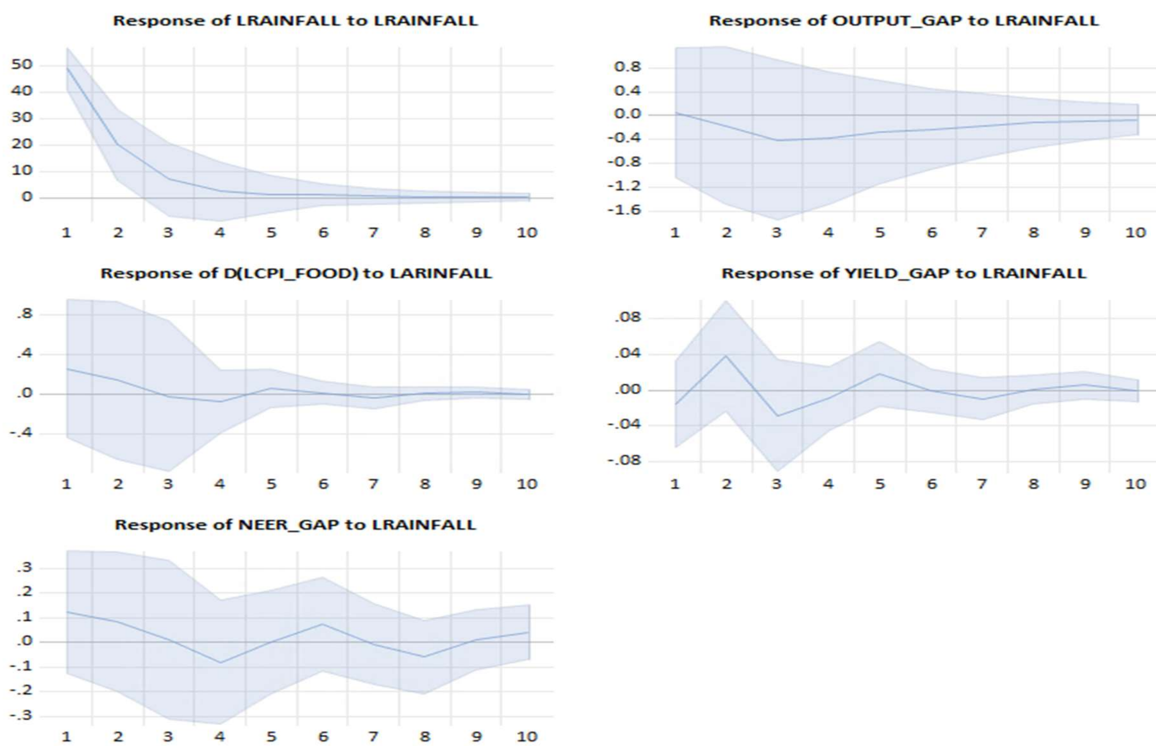


Figure 9: Impulse Response Functions of Shock to Rainfall (Food inflation)



In Figures 10-12, temperature shock was used as a proxy for climate change. The temperature shock has an initial magnitude of around 1.3 degrees Celsius but on impact gradually dissipates over the forecast period. The IRFs for model specifications using CPI inflation, core inflation and food inflation, shown in Figures 10 to 12, indicate that the output gap rises in the initial periods before eventually declining, while inflation responds negatively to the temperature shock. These results are broadly consistent with the findings of Eltayb et al. (2024). As in the previous set of IRFs, the interest rate and exchange rate exhibit comparatively volatile trajectories.

Figure 10: Impulse Response Functions of Shock to Temperature (Headline inflation)

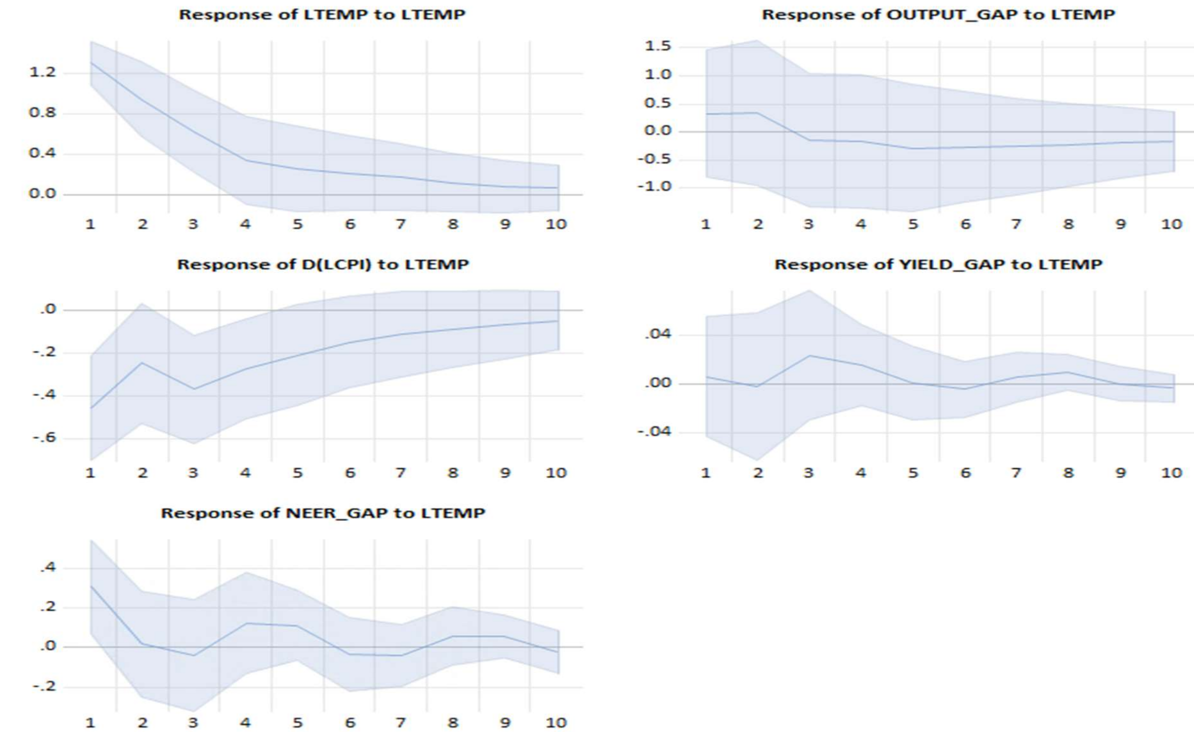


Figure 11: Impulse Response Functions of Shock to Temperature (Core inflation)

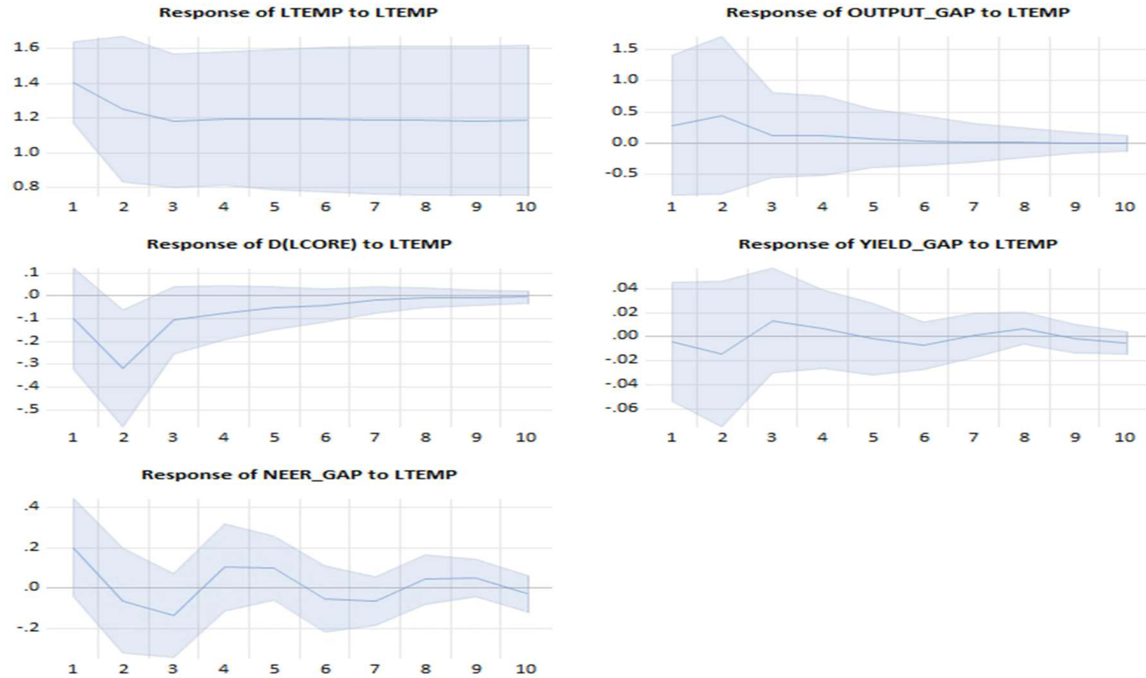
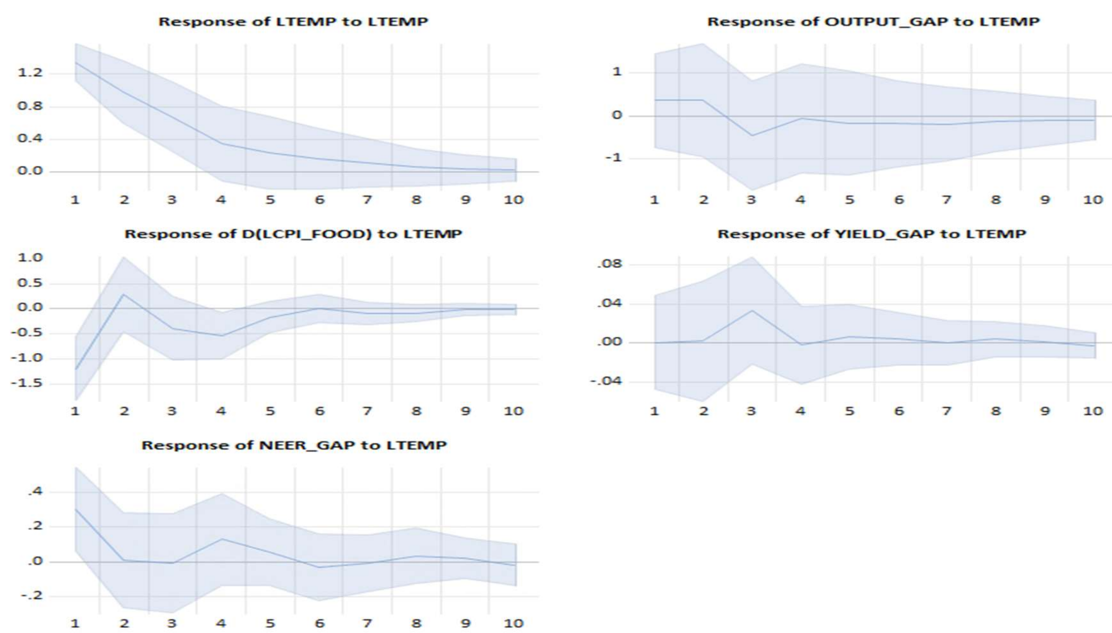


Figure 12: Impulse Response Functions of Shock to Temperature (Food inflation)

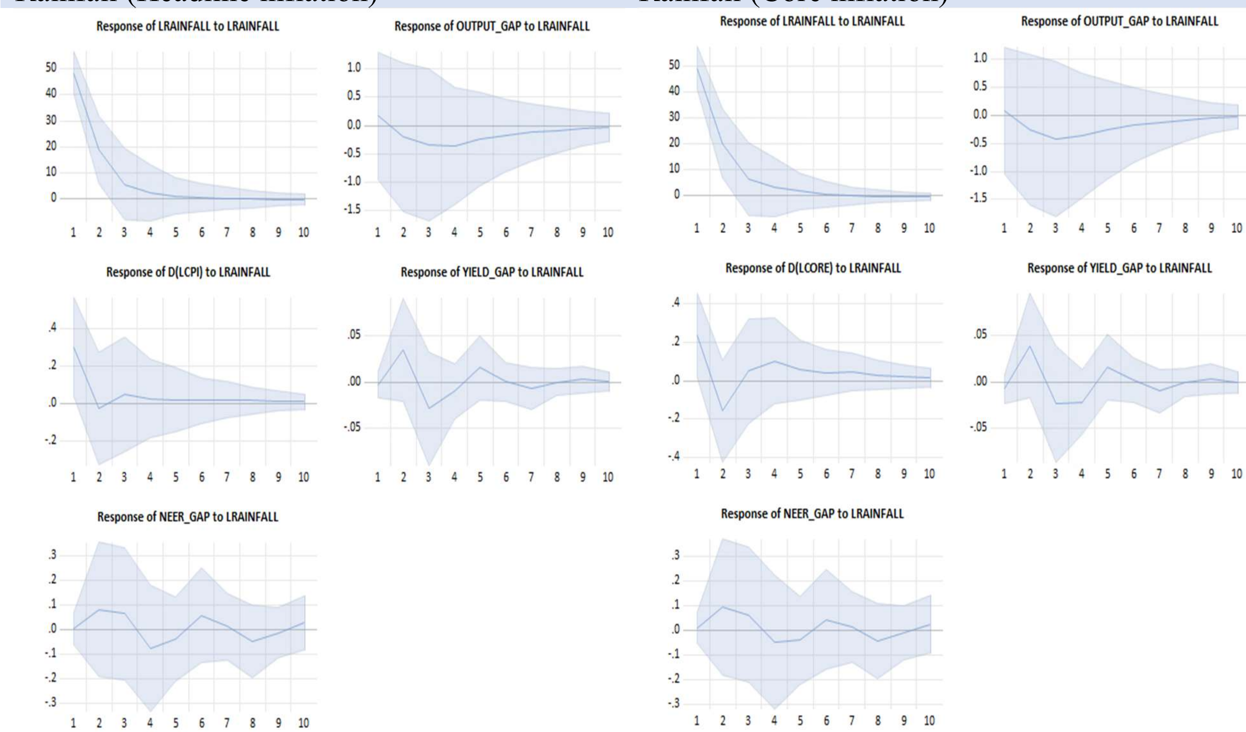


As a robustness check, alternative identifications were estimated by varying the contemporaneous restrictions in the A matrix. The baseline specification relied on a Cholesky decomposition, which provides a convenient just-identified structure but is often criticized for its limited theoretical underpinning and sensitivity to variable ordering.

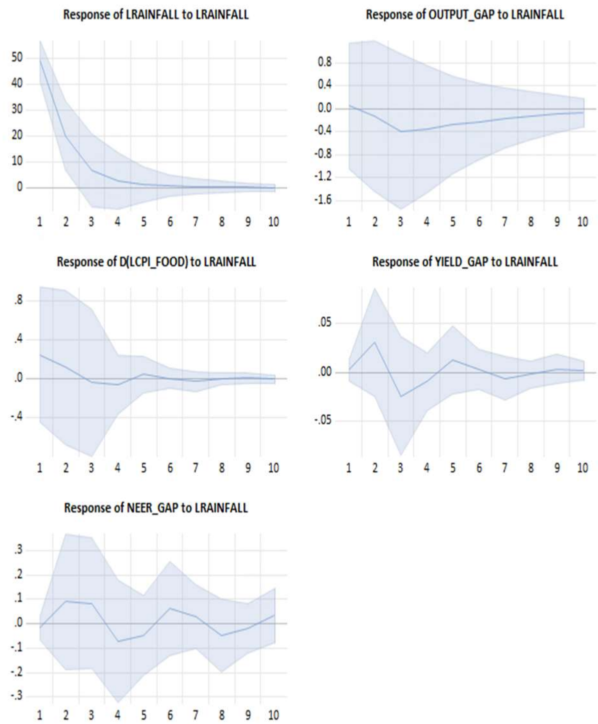
To address this concern, the model was re-estimated using alternative variable orderings to assess the stability of the results. The re-estimated A matrix is presented in Annex 5. Across these specifications, the impulse response functions remained broadly unchanged (Figure 13), both in sign and magnitude. This consistency suggests that the main conclusions are not dependent on the specific recursive structure imposed, but instead reflect robust underlying relationships among the variables in the system.

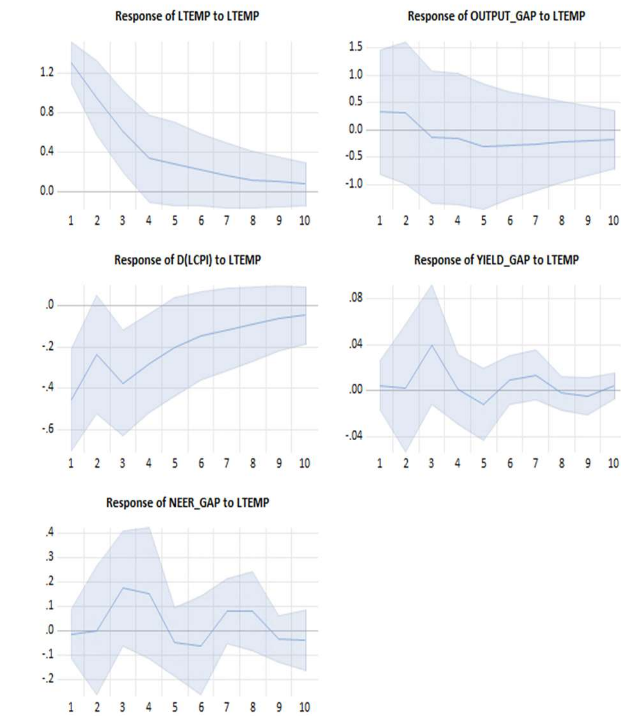
Figure 13: Impulse Response Functions (Over-identified Model)

Impulse Response Functions of Shock to Rainfall (Headline inflation)	Impulse Response Functions of Shock to Rainfall (Core inflation)

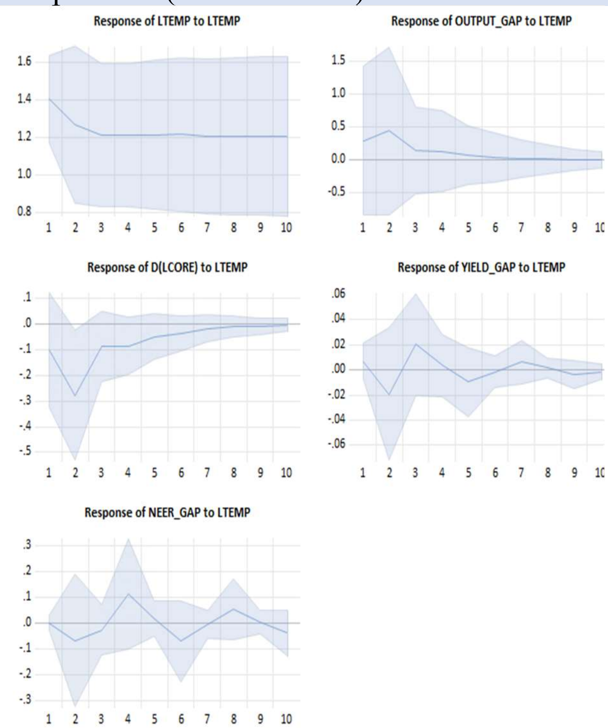


Impulse Response Functions of Shock to Rainfall (Food inflation)	Impulse Response Functions of Shock to Temperature (Headline inflation)

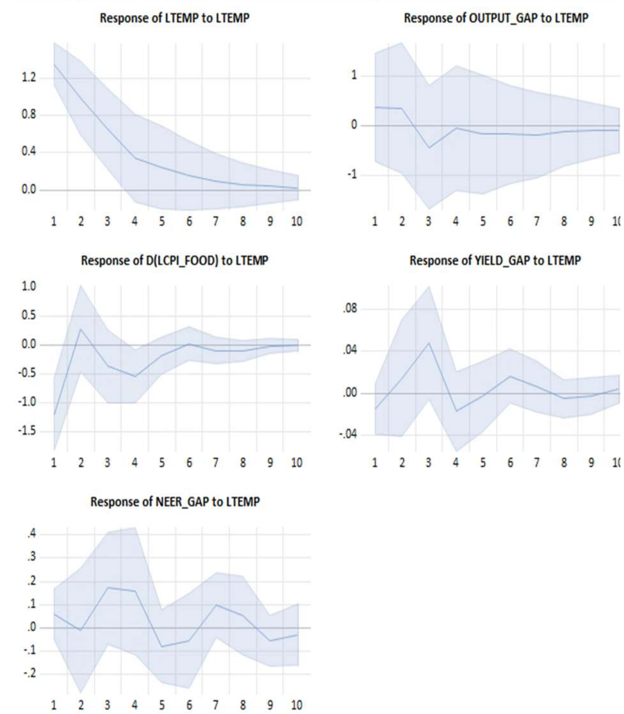




Impulse Response Functions of Shock to Temperature (Core inflation)



Impulse Response Functions of Shock to Temperature (Food inflation)



VI. Concluding Remarks and Policy Recommendations

The study examines how weather-related shocks, specifically, rainfall and temperature, affect key macroeconomic variables, in particular, growth and inflation. The analysis used the SVAR methodology based on quarterly data from 2005Q1 to 2022Q4. The results suggest that rainfall shocks have negative effects on economic activity and the shocks are inflationary. However, the shocks have statistically insignificant effects on the Mauritian economy. The effects of temperature shocks differ slightly differ but still align with broader empirical evidence. Output initially increases but then declines and remains persistently negative, while inflation tends to fall.

Given Mauritius' geographic exposure to tropical cyclones, heavy rainfall, and coastal flooding, the government needs to take proactive steps to strengthen climate adaptation and mitigation. Priorities include investing in resilient coastal protection, restoring and conserving coral reefs and mangroves, improving water management, diversifying agricultural production, and upgrading infrastructure to withstand extreme weather events. Accelerating the transition to clean energy is also critical. In addition, strong institutional coordination, climate-informed planning, and expanded access to climate finance will be essential to safeguard long-term economic stability and support sustainable development.

Additionally, given the potential implications of climate change on inflation, it may be important for the central bank to integrate climate-related shocks into the monetary policy framework to better assess their impact on the broader economy. This would include promotion green financial instruments, such as green bonds, to help finance sustainable projects and support the transition to a low-carbon economy. Moreover, greening monetary policy operations would involve directing asset purchases and collateral towards low-carbon assets, thereby lowering the cost of capital for environmentally friendly sectors relative to high-carbon ones. Implementation of all the suggested recommendation require a concerted effort of both fiscal and monetary interventions. The results are also robust to alternative model specifications. Future research could explore the use of sign restrictions and more advanced modelling approaches, such as Dynamic Stochastic General Equilibrium (DSGE) models to further assess the influence of climate change on the macroeconomy.

References

Andersson, M., Claudio, B. & Julian, M. (2020). Climate change and the macro economy. *Occasional Paper Series*, 243, Frankfurt am Main: European Central Bank.

Batten, S., Sowerbutts, R. & Tanaka, M. (2016). Let's talk about the weather: The impact of climate change on central banks. Working Papers, 603, London: Bank of England.

Burke, M., Hsiang, S. & Miguel, E. (2015). Global non-linear effect of temperature on economic production. *Nature*, 527(7577), 235–239.

Bwire, T. (2019), *Vector Autoregressions and Structural VARs for Monetary Policy Analysis Using Eviews, (Unpublished User Guide),* Nairobi: COMESA Monetary Institute.

Ciccarelli, M., Kuik, F. & Martínez Hernández., C. (2023). The asymmetric effects of weather shocks on Euro area inflation, *Working Paper Series*, 2798, Frankfurt am Main: European Central Bank.

Colacito, R., Hoffmann, B. & Phan, T. (2019). Temperature and growth: A panel analysis of the United States. *Journal of Money, Credit and Banking*, 51(2), 313-368.

Dell, M., Jones, B. & Olken, A. (2014). What do we learn from the weather? The new climate-economy literature. *Journal of Economic Literature*, 52(3), 740-798.

Dell, M., Jones, B. & Olken, A. (2012). Temperature shocks and economic growth: Evidence from the last half century. *American Economic Journal: Macroeconomics*, 4 (3), 66–95.

Dell, M., Jones, B. & Olken, A. (2009). Temperature and income: Reconciling new cross-sectional and panel estimates. *American Economic Review*, 99 (2), 198–204.

Dickey, D. & Fuller, W. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366) 427-431.

Enders, W. (2015). *Applied econometric time series* (4th ed.). Wiley.

Faccia, D., Parker, M. & Stracca, L. (2021). Feeling the heat: extreme temperatures and price stability. *Working Paper Series*, 2626, Frankfurt am Main: European Central Bank.

Fankhauser, S. & Tol, R. (2005). On climate change and economic growth. *Resource and Energy Economics*, 27 (1), 1-17.

Hallegatte, S. et al. (2017). *Unbreakable: Building the resilience of the poor in the face of natural disasters.* Climate change and development series. available at http://library.unccd.int/Details/books/789 World Bank.

Heinen, A., Khadan, J. & Strobl E. (2016). The price impact of extreme weather in developing countries. *Economic Journal*, 129(619), 327-1342.

Hsiang S. (2013). Temperatures and cyclones strongly associated with economic production in the Caribbean and Central America. *Proceedings of the National Academy of Sciences*, 107(35), 15367–15372.

Kabundi, A. Mlachila, M. & Yao. J. (2022), How persistent are climate-related price shocks? Implications for monetary policy. IMF Working Papers, WP/22/207, Washington DC: International Monetary Fund.

Kim, Y. and Kim T. (2024). Generalized impulse and its measure. *Working Papers*, rwp-226, Yonsei University, Yonsei Economics Research Institute.

Kotz, M. et al. (2023). The impact of global warming on inflation: Averages, seasonality and extremes. *Working Paper Series*, 2821, Frankfurt am Main: European Central Bank.

Mukherjee, K. & Ouattara, B. (2021). Climate and monetary policy: Do temperature shocks lead to inflationary pressures? *Climatic Change*, 167(3), 1-21.

Natoli, F. (2022). Temperature surprise shocks, MPRA Paper, 112568, Germany: University Library of Munich.

NGFS (2020), The macroeconomic and financial stability impacts of climate change-research priorities. France: Network for Greening the Financial System

Parker, M. (2018). The impact of disasters on inflation. Economics of Disasters and Climate Change, 2(1), 21-48.

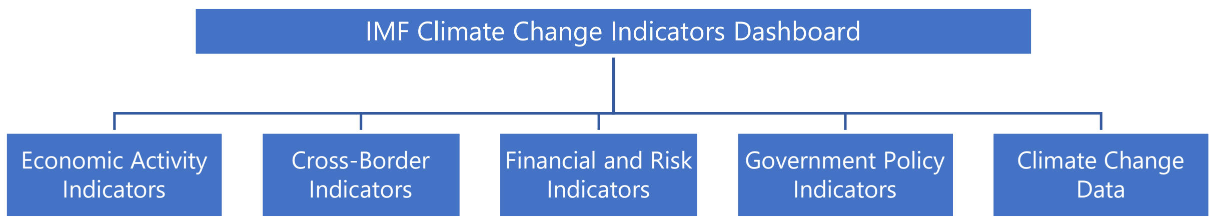
Sims, A. (1980). Macroeconomics and reality. *Econometrica*, 48(1), 1–48.

Tol, R. (2024), A meta-analysis of the total economic impact of climate change. Energy Policy, 185(2024), 113922.

Annexes

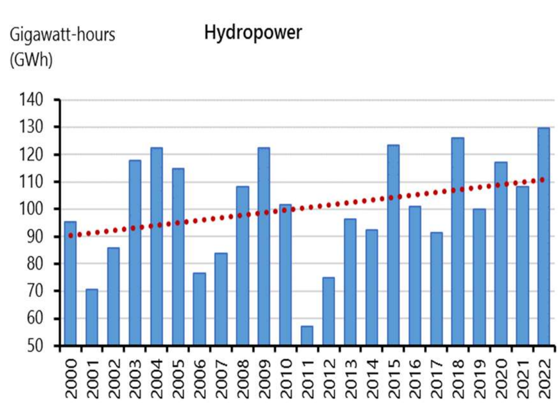
Annex 1: IMF Climate Change Indicators Dashboard – Data for Mauritius

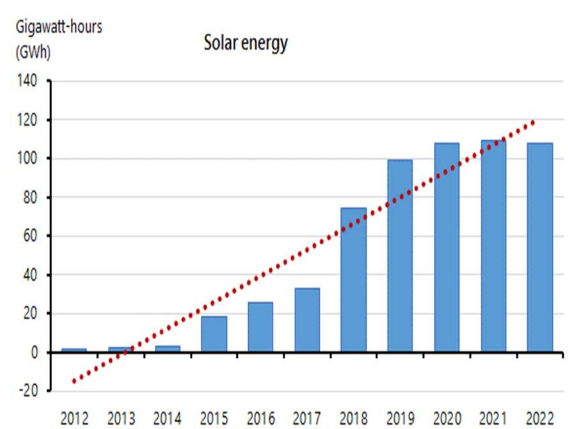
The IMF has launched a climate change indicators dashboard to address the growing need for climate-related data used in macroeconomic and financial policy analysis. The data, developed in collaboration with other international organizations, are classified into five categories, and further into indicator groups and a number of indicators within the group. The broad categories are illustrated as follows.



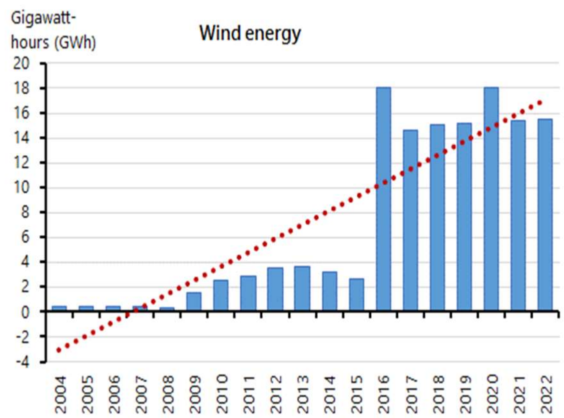
Mauritius is gradually transitioning its energy sector, with the share of total renewable energy increasing over time. Nevertheless, the economy remains heavily dependent on imported energy sources. According to the IMF dashboard, the Climate-driven INFORM Risk index, which measures exposure to natural disasters, has remained broadly stable at around 2.5 in recent years.[6] Government policy indicators show progress: both environmental taxes and public spending on environmental protection have risen over time. Climate data also point to a long-term warming trend, with annual surface temperatures generally increasing since 1961. Between 1982 and 2022, Mauritius experienced 14 recorded disasters, including 12 storms, one drought, and one flood.

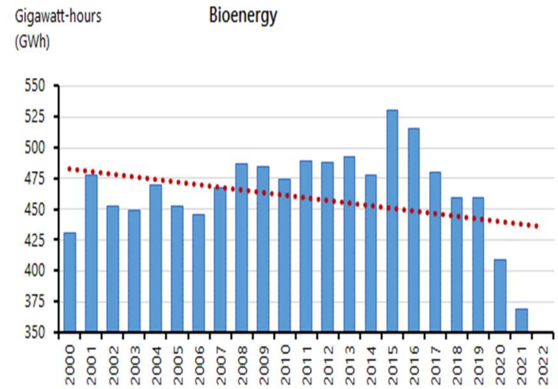
Annex 1a: Energy Transition

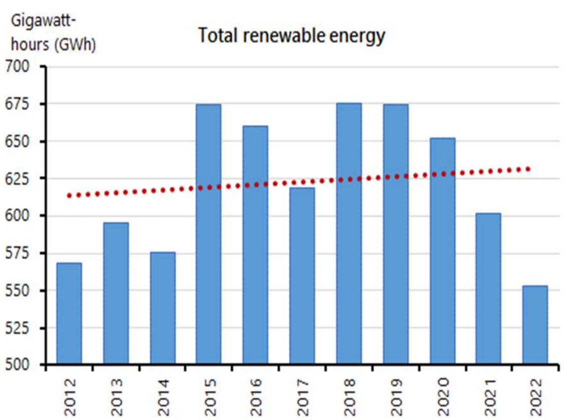


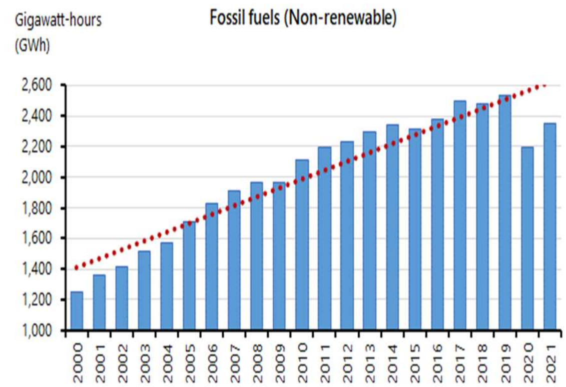


6 *The indicator has three dimensions - climate-driven hazard and exposure, vulnerability, and lack of coping capacity.*

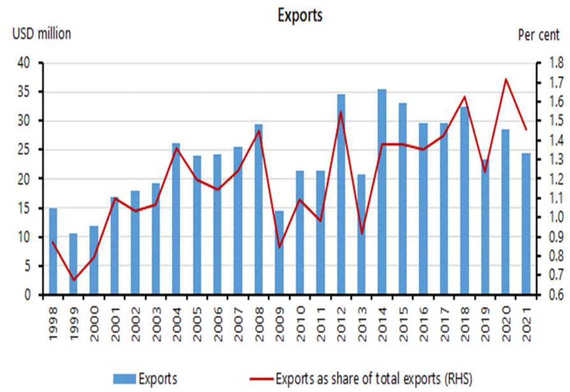

Gigawatt-hours (GWh)
Wind energy

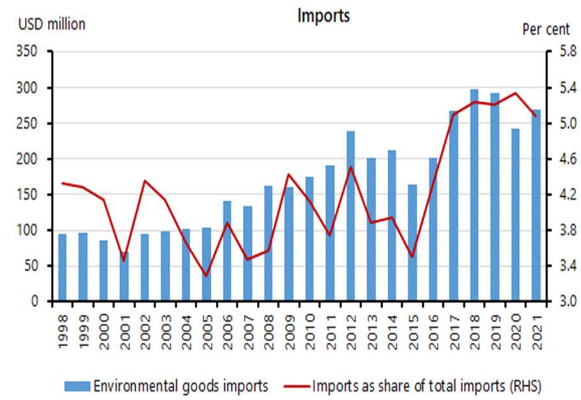

Gigawatt-hours (GWh)
Bioenergy

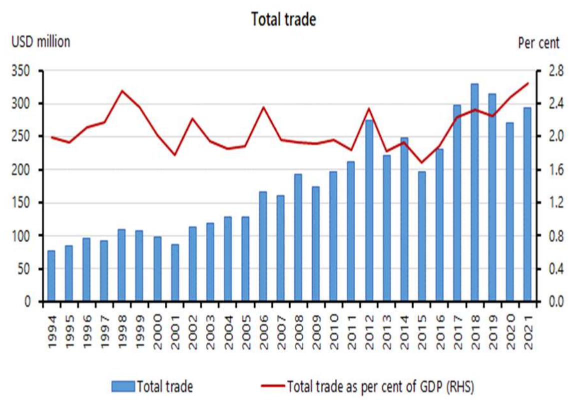

Gigawatt-hours (GWh)
Total renewable energy

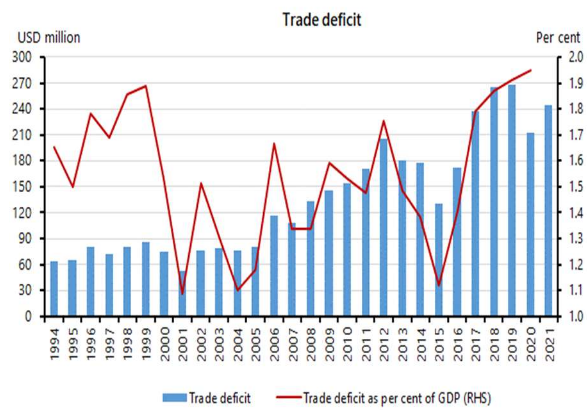

Gigawatt-hours (GWh)
Fossil fuels (Non-renewable)

Annex 1b: Trade in Environmental Goods

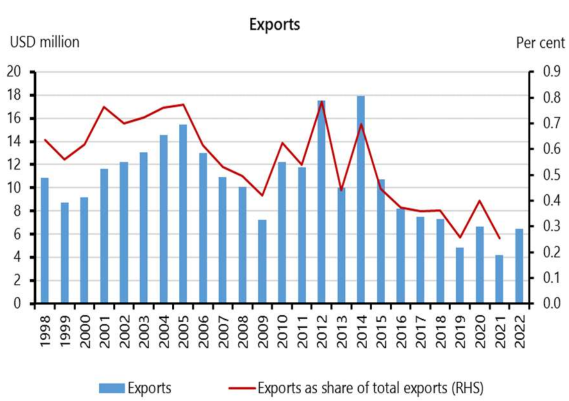


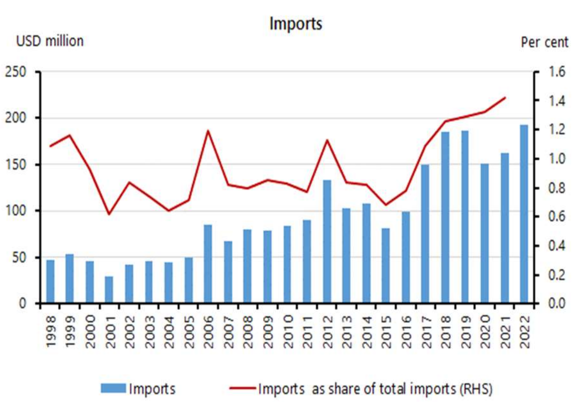


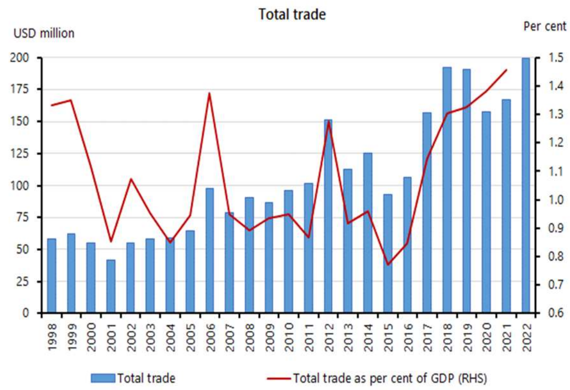


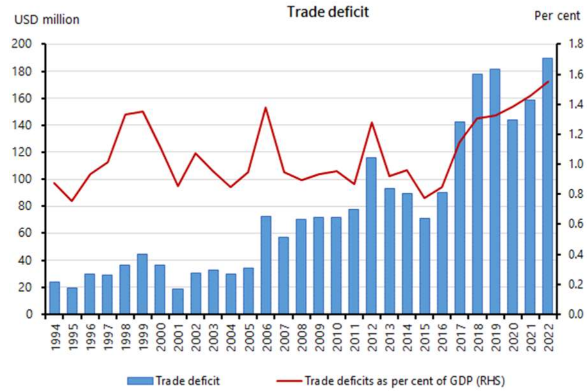


Annex 1c: Trade in Low Carbon Technology Products

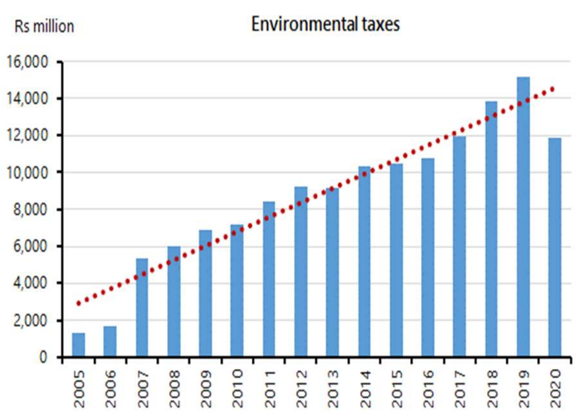


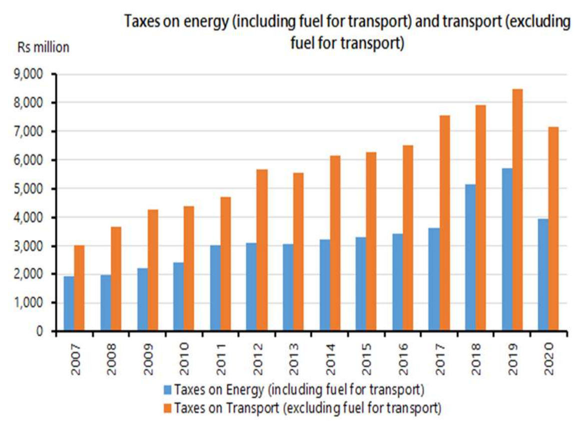


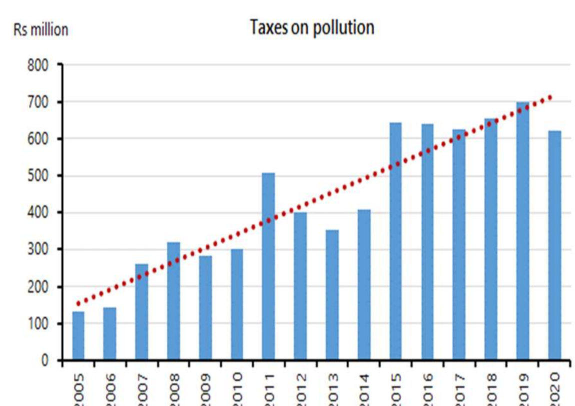


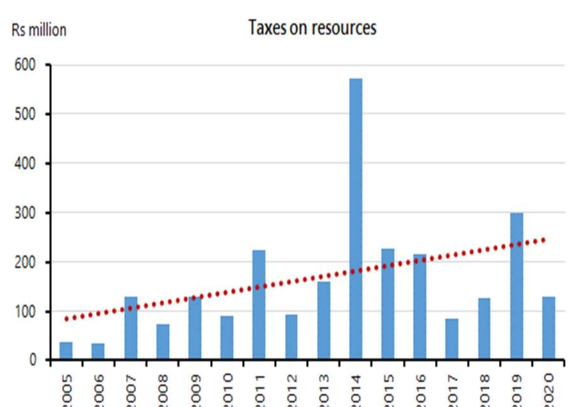


Annex 1d: Environmental Taxes

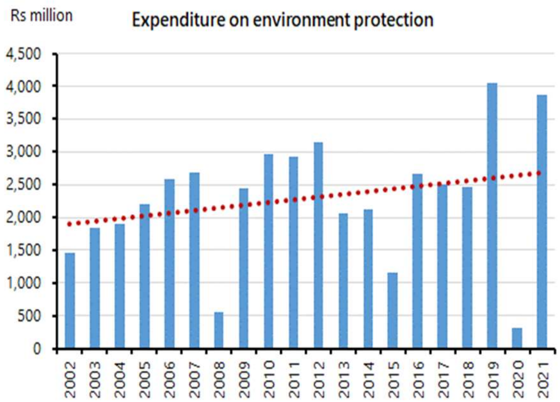


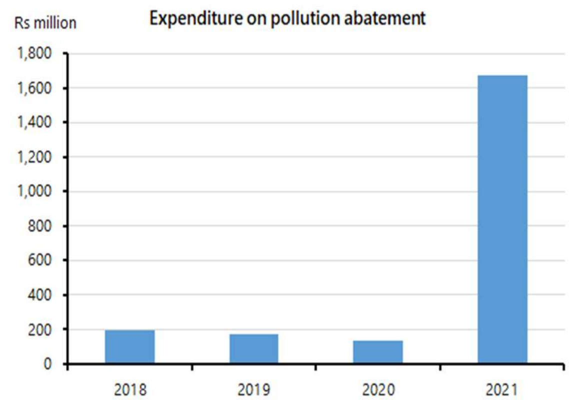


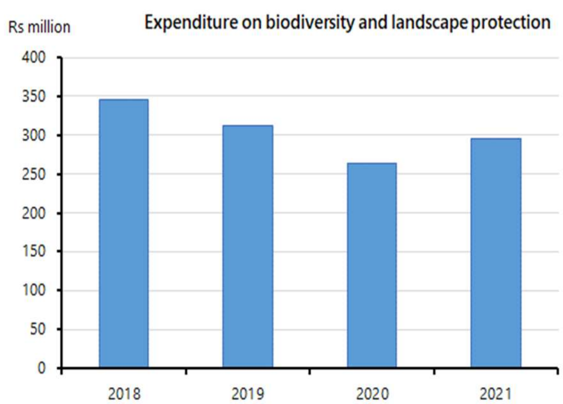




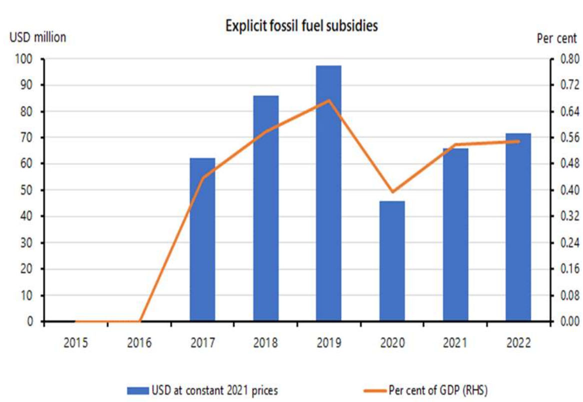
Annex 1e: Environmental Protection

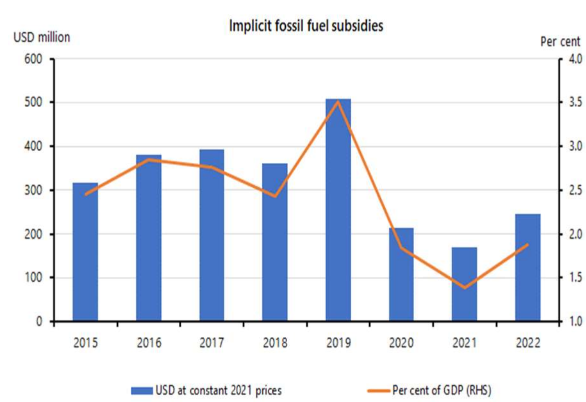






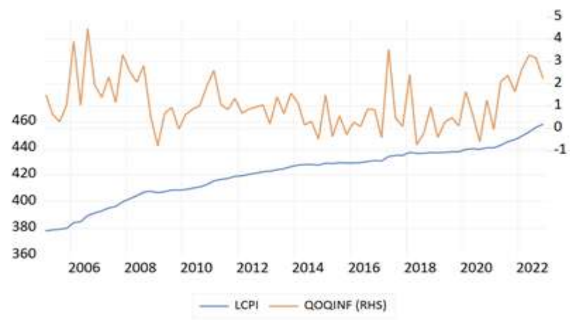
Annex 1f: Fossil Fuel Subsidies

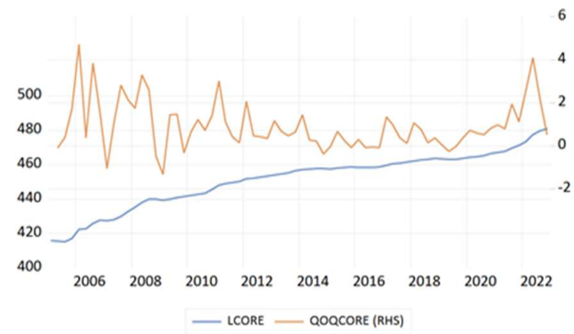




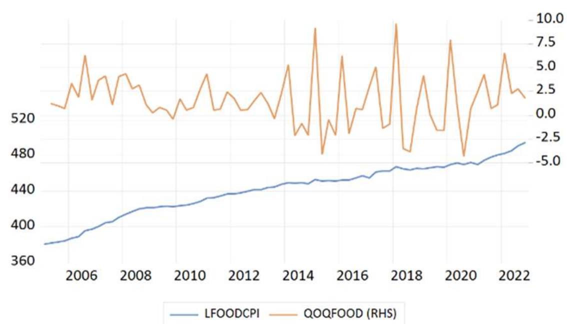
Annex 2: Data Trends

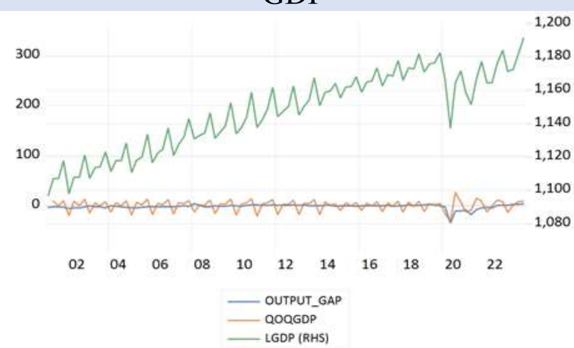
Headline CPI	CORE CPI



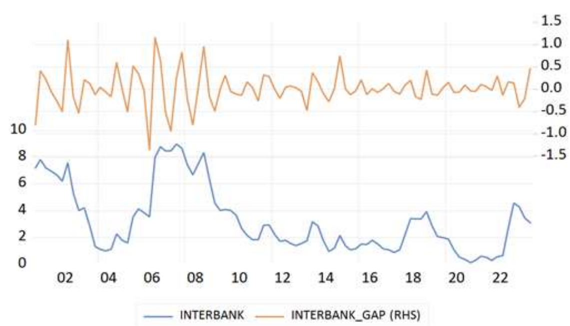


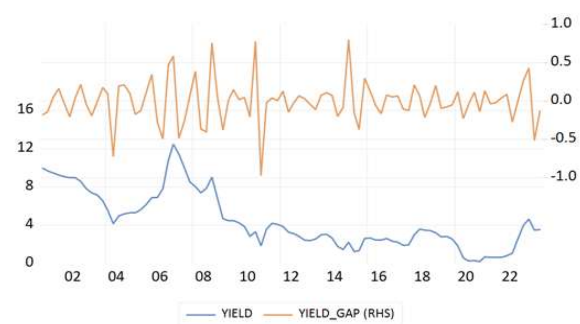
FOOD CPI	GDP



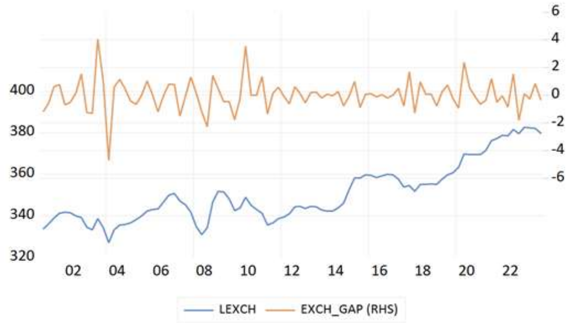


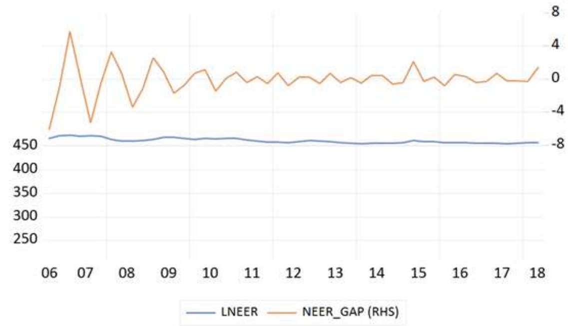
Interbank Rate	91-Day Bills Yield



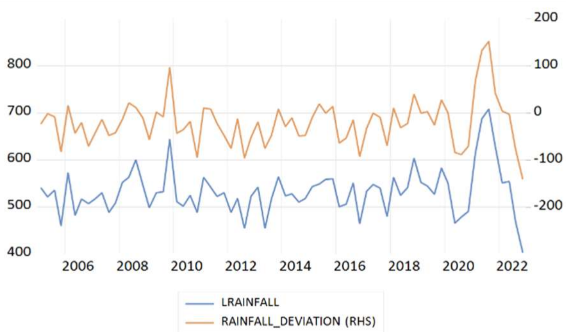


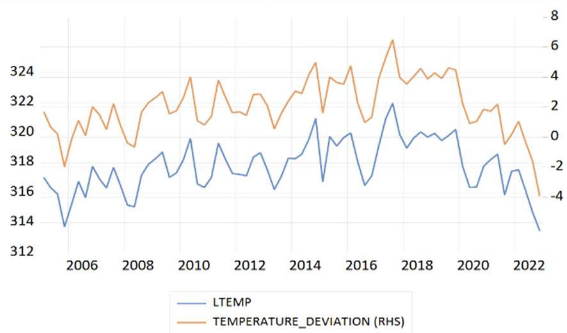
MUR/USD Exchange Rate	Nominal Effective Exchange Rate





Rainfall	Temperature





Annex 3: Descriptive Statistics

	Output gap	Headline inflation	Core inflation	Food inflation	Yield gap	NEER gap	Rainfall deviation	Temperature deviation
Mean	-1.14	421.07	441.55	451.13	0.00	0.12	-20.38	2.08
Median	0.16	426.84	447.97	456.69	0.00	-0.11	-18.40	1.94
Maximum	3.92	457.78	494.28	480.65	0.80	20.24	151.85	6.50
Minimum	-33.99	378.22	380.73	415.26	-0.98	-6.09	-140.32	-3.88
Std. Dev.	5.14	19.61	28.76	16.00	0.28	3.06	49.21	1.84
Skewness	-4.27	-0.53	-0.45	-0.62	0.27	3.82	0.83	-0.35
Kurtosis	25.60	2.58	2.42	2.69	5.57	27.62	5.22	3.57
Jarque-Bera	1750.65	3.96	3.44	4.88	20.73	1993.76	23.16	2.41
Probability	0.00	0.14	0.18	0.09	0.00	0.00	0.00	0.30
Sum	-82.30	30316.84	31791.67	32481.43	-0.27	8.95	-1467.43	149.69
Sum Sq. Dev.	1875.64	27307.95	58729.49	18168.16	5.65	666.67	171930.62	239.93
Observations	72	72	72	72	72	72	72	72

Annex 4: Unit Root Test Results

Variables	Levels		First Difference		Order of
	T-statistics	Probability	T-statistics	Probability	Integration
LRAINFALL	-5.0024	0.0006			I(0)
LTEMP	-3.1733	0.0982			I(0)
OUTPUT_GAP	-5.1657	0.0003			I(0)
LCPI	-3.7381	0.0263			I(0)
LCORE	-2.7470	0.2218	-5.5591	0.0001	I(0)
LFOODCPI	-2.2410	0.4599	-8.9559	0.0000	I(0)
NEER_GAP	-22.8864	0.0001			I(0)
YIELD_GAP	-10.4312	0.0000			I(0)

Annex 5: Alternative Model

$$\begin{pmatrix} \varepsilon_t^{clim} \\ \varepsilon_t^{gdp} \\ \varepsilon_t^{inf} \\ \varepsilon_t^{int} \\ \varepsilon_t^{exch} \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ a_{12} & 1 & 0 & 0 & 0 \\ a_{13} & a_{23} & 1 & 0 & 0 \\ 0 & a_{24} & a_{34} & 1 & 0 \\ 0 & 0 & a_{35} & a_{45} & 1 \end{pmatrix}' \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 \\ 0 & 0 & 0 & 0 & b_{55} \end{pmatrix} \begin{pmatrix} u_t^{clim} \\ u_t^{gdp} \\ u_t^{inf} \\ u_t^{int} \\ u_t^{ex} \end{pmatrix}$$