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Exploring The Effect of Climate change on Unemployment in Somalia: Evidence from ARDL Approach. (1990 – 2023)

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Abstract
This study investigates the impact of climate change on unemployment in Somalia over the period 1990–2023 using the Autoregressive Distributed Lag (ARDL) bounds testing approach. The dependent variable is unemployment, while key climate variables average temperature and annual rainfall are complemented with macroeconomic controls including GDP growth, agriculture's share in GDP, and inflation. The long-run results indicated that temperature exerts a statistically significant negative effect on unemployment. Rainfall changes show no significant long-run effect; however, lagged rainfall positively influences short-run job creation. GDP growth significantly reduces unemployment in both the long and short run, while inflation has a modest but significant negative long-run impact. Agriculture's share, although negative, is not statistically significant in the long term. The error correction term confirms a stable long-run equilibrium, with approximately 61% of deviations from equilibrium corrected annually. These findings highlight the complex and time-dependent interplay between climate and labor market outcomes in Somalia. The study recommends integrating climate adaptation into employment policy, enhancing agricultural resilience, diversifying the economy, and strengthening data systems to support climate–employment decision-making.

Keywords: Climate change, Unemployment, GDP growth, Temperature, Rainfall, ARDL, Somalia.

1. Introduction

Somalia is dealing with a severe climate catastrophe as a result of frequent and severe climatic shocks, mostly droughts and floods, which have a significant impact on lives and economic stability. Climate scientists have concluded that anthropogenic climate change is directly responsible for the 2020–2023 Horn of Africa drought that devastated southern Somalia. Without human-induced warming, such an event would have been extremely rare (Philip et al., 2023). Somalia's economy was badly damaged by this drought, which devastated the country's cattle and agricultural industries. Up to one-third of livestock died in the most affected areas, while agricultural yields dropped by as much as 70% in southern Somalia, where agriculture makes up to 26% of GDP, employs 90% of the rural labor force, and accounts for 90% of exports (FAO, 2022).

Significant effects on the labor market result from such pervasive economic disruption. Decreases in livestock losses and agricultural production exacerbate structural unemployment, reduce chances for earning a living, and undermine informal employment. Evidence from fragile agrarian economies indicates that climate-induced shocks impair economic performance and jeopardize progress toward Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth) and SDG 13 (Climate Action), even though direct econometric studies on the relationship between climate change and unemployment in Somalia are still scarce (World Bank, 2022). Additionally, internal migration and displacement are fueled by climate stress, which destabilizes labor markets. In Somalia, displacement has become the main factor driving internal migration, uprooting pastoralist livelihoods and decreasing involvement in traditional rural economies (Refugees International, 2021). These factors worsen unemployment, especially among rural and displaced people, limit the local labor supply, and discourage entrepreneurship.

For a number of reasons, it is both pertinent and essential to comprehend the relationship between climate change and unemployment in Somalia. First, Somalia's economy is especially susceptible to environmental shocks since it is heavily reliant on climate-sensitive industries like agriculture and livestock. Household incomes, job stability, and means of subsistence are all directly impacted by any interruption in these areas. Second, unemployment has broad social and political ramifications in fragile governments; it can worsen inequality, intensify poverty, and raise the likelihood of instability or war, particularly in situations when governance institutions are already under stress. Lastly, there is a pressing policy need for evidence-based initiatives that combine climate adaptation with job development in the framework of the Sustainable Development Goals, especially SDGs 8 and 13. The aim of this study is to better understand how climate change affects labor market outcomes in Somalia by using the ARDL (Autoregressive Distributed Lag) approach from 1990 to 2023. The findings will be translated into practical strategies that will protect livelihoods, increase employment resilience, and align national development priorities with international climate and sustainability goals.

2. Literature And Theoretical Framework

The relationship between climate change and unemployment can be examined through multiple theoretical lenses in environmental economics, labor market theory, and development studies.

Environmental Kuznets Curve (EKC) Hypothesis: According to the EKC, if a particular income threshold is reached, environmental deterioration starts to decrease after initially rising with economic expansion (Grossman & Krueger, 1995). The early-stage EKC relationship indicates that environmental degradation, which is made worse by climate change, may still be getting worse in Somalia, where economic activity is highly resource-dependent and per capita income is low. This puts climate-sensitive employment sectors like agriculture and pastoralism at risk.

Labor Market Hysteresis Theory: According to the theory of "hysteresis in unemployment" (Blanchard & Summers, 1986), short-term shocks, such droughts brought on by climate change, can have a lasting impact on unemployment rates because relocated workers lose their skills, motivation, or loyalty to the labor market. Extreme weather disasters have the potential to completely destroy livelihood systems in fragile economies like Somalia, making it more difficult for impacted communities to find new jobs even following recovery periods.

Sustainable Livelihoods Framework (SLF): The SLF emphasizes how access to natural, human, social, financial, and physical capital is essential for individuals to maintain their standard of living (Chambers & Conway, 1992). These capitals, especially natural and physical capital, are eroded by climate change, which results in less economic prospects and heightened susceptibility to unemployment. In Somalia, where rural households rely on pastoralism and rain-fed agriculture, this is especially pertinent.

In recent years, the connection between unemployment and climate change has gained more attention. Adekunle (2024) used annual time series data from 1986 to 2021 to examine the relationship between unemployment and climate change in South Africa. The long-run coefficient of climate change was positive and statistically significant at the 5% level, according to the study, which used the ARDL econometric technique. This suggests that climate change has a long-term beneficial effect on unemployment. Yunus et al. (2024) used secondary data from Statistics Indonesia to examine how climate change affected Indonesia's cyclical unemployment rate. The Phillips curve framework was used to estimate cyclical unemployment, and the simultaneous equation approach was used to analyze it. Although the possibility of hysteresis merits more research, the study concluded that rising temperatures had no direct impact on cyclical unemployment. Rujiwattanapong & Yoshida (2025) used monthly unemployment statistics from 1990 to 2019 and detailed daily weather data across counties to examine how climate change affected the seasonality of unemployment in the US. According to the study, days with extremely high temperatures resulted in fewer hiring and layoffs, which raised the number of insurance claims and increased unemployment. According to estimates, climate change is responsible for 13% of the decrease in volatility in the overall non-seasonally-adjusted unemployment rate and 40% of the decline in seasonality in unemployment. Berger et al. (2019) looked into how youth unemployment in Greece and southern Spain could be decreased by utilizing climate protection and the energy transition. The study evaluated job prospects in renewable energy, energy efficiency, and related vocational training using field research, stakeholder interviews, and labor market analysis in Athens and the province of Cadiz. According to the results, there is a great deal of room for job creation, especially for young people who are qualified, through focused training in skills connected to the energy transition, aided by private sector involvement, EU funding, and municipal collaboration. investigated, using annual time series data from 1991 to 2023, the effects of anomalies in temperature and precipitation on unemployment in Nigeria. The study used econometric analysis and discovered that, in the short term, unemployment increased by 0.006% for every 1% increase in temperature anomalies and 0.008% for every 1% increase in precipitation anomalies. Over an extended period, the impacts were more noticeable, with equivalent increases of 0.7% and 0.28%. The effect of annual temperature on productivity can also differ significantly between nations, according to Zhao et al. (2018). They examine the relationship between temperature and economic growth using global subnational short panel data and show that the adverse effects of climate change can vary by region. A temperature shock has a strong negative and statistically significant impact on labor productivity, production, and total factor productivity, as empirically shown by Dnadelli et al. (2017). According to Rasson and Van der Mensbrugghe (2012), the rise in temperature may result in both structural and frictional unemployment. In the near term, high temperatures may have an impact on some jobs, which could lead to issues like seasonal labor shortages and employee turnover. In a similar vein, Kjellstronm et al. (2009) discovered that persons may be impacted by hot weather, as an increase in job search expenses raises the likelihood of unemployment. This further supported the idea that, over time, global warming may result in lower labor productivity in certain sectors of the economy, like mining and agriculture, as well as higher labor costs for them, which would cause a long-term decline in industry employment rates (Dun et al., 2023).

3. Methodology

3.1 Data

This study investigates the effect of climate change on unemployment in Somalia using annual time series data from 1990 to 2023. The data are sourced from credible and internationally recognized databases, including the World Bank (WB), the National Oceanic and Atmospheric Administration (NOAA), and the Statistical, Economic, and Social Research and Training Centre for Islamic Countries (SESRIC). These sources ensure methodological consistency, reliability, and cross-country comparability, which strengthens the validity of the empirical results. Somalia is selected as the case study due to its heightened vulnerability to climate change impacts and its economic dependence on climate-sensitive sectors such as agriculture. The Autoregressive Distributed Lag (ARDL) bounds testing approach is applied, as it is suitable for small sample sizes and can handle variables with different integration orders, I (0) and I (1). This makes ARDL particularly appropriate for exploring macroeconomic and environmental interactions in fragile economies.

The dependent variable is unemployment (UN), measured as the percentage of the total labor force (ILO-modeled estimate). The key climate-related explanatory variables are temperature (TEMP), expressed as the annual average in degrees Celsius, and rainfall (RAIN), measured as annual total precipitation. These variables capture the direct influence of climatic factors on labor market outcomes. To control for broader macroeconomic influences, the study incorporates additional variables: Gross Domestic Product growth (GDP) – annual percentage change. Agriculture (AGR) – share in total value added (% at current prices). Inflation (INF) – measured by the GDP deflator (annual %). Table 1 shows the data source and variable descriptions.

Table 1. Variables and the data source.

Variable	Symbol	Measurement	Source
Unemployment	UN	% of total labor force (modeled ILO estimate)	WD
Temperature	TEMP	Annual average temperature in degrees Celsius	NOAA
Rainfall	RAIN	Annual total precipitation.	NOAA
Gross Domestic Product	GDP	GDP growth (annual %)	WB
Agriculture	AGR	Share in Total Value Added (% Current Prices)	SESRIC
Inflation	INF	GDP deflator (annual %)	WB

3.2 Model Specification

This study utilizes the Autoregressive Distributed Lag (ARDL) bounds testing approach, following the framework introduced by (Pesaran et al., 2001), to assess both the short-run and long-run effects of climate change (temperature and rainfall), economic growth, agriculture, inflation on unemployment in Somalia.

The ARDL method was chosen for its ability to handle regressors with mixed integration orders specifically, variables that are either level stationary (I (0)) or first-difference stationary (I (1)). Unlike traditional cointegration techniques such as the Johansen method, which require all variables to be integrated at the same level, the ARDL model accommodates a mixture of I (0) and I (1) variables, making it particularly suitable for macroeconomic data in developing countries like Somalia where data often exhibit irregular integration properties.

Additionally, the ARDL model is robust in small sample contexts and addresses endogeneity concerns by including lagged terms of the dependent and explanatory variables. This autoregressive feature enhances the consistency and reliability of the estimated parameters, especially when analyzing dynamic relationships among variables in a developing country setting.

In this study, Unemployment (UN) is the dependent variable. The explanatory variables are Temperature (TEMP), Rainfall (RAIN), GDP growth (GDP), Agricultural share (AGR), and Inflation (INF).

Long-run ARDL Model Specification:

$$UN_t = \beta_0 + \beta_1 TEMP_t + \beta_2 RAIN_t + \beta_3 GDP_t + \beta_4 AGR_t + \beta_5 INF_t + \varepsilon_t$$

Where: β_0 is the intercept term, ε_t is the error term, $\beta_1 - \beta_5$ are the long-run coefficients that capture the responsiveness of unemployment to changes in each explanatory variable.

ARDL Bounds Testing Model:

$$\Delta UN_t = \beta_0 + \beta_1 TEMP_t + \beta_2 RAIN_t + \beta_3 GDP_t + \beta_4 AGR_t + \beta_5 INF_t + + \sum_{i=0}^{n} \delta_{1i} \Delta UN_{t-i} + \sum_{i=0}^{n} \delta_{2i} \Delta TEMP_{t-i} + \sum_{i=0}^{n} \delta_{3i} \Delta RAIN_{t-i} + \sum_{i=0}^{n} \delta_{4i} \Delta GDP_{t-i} + \sum_{i=0}^{n} \delta_{5i} \Delta AGR_{t-i} + \sum_{i=0}^{n} \delta_{6i} \Delta INF_{t-i} + \varepsilon_t$$

where: β_0 Is constants, $\beta_1 - \beta_5$ represent short-run coefficients, and $\delta_1 - \delta_6$ Are long-run coefficients. Δ is the difference operator, and n is the lag length.

4. Results And Discussions

4.1 Descriptive statistics

Tables 2 and 3 present the descriptive statistics and correlation results for the variables used in this study. The analysis was conducted using EViews 10 software on the original dataset covering the period 1990–2023.

According to **Table 2**, Rainfall (RAIN) records the highest mean value (291.90 mm), reflecting the overall average annual precipitation in Somalia, while Unemployment (UN) shows the lowest mean (19.12%), indicating relatively small fluctuations in the unemployment rate over time compared to other variables. The Gross Domestic Product (GDP) registers the lowest minimum value (-21.89%), representing a severe contraction during specific years, whereas RAIN reaches the highest maximum (649.45 mm), highlighting years of unusually high precipitation.

The largest standard deviation is observed in RAIN (94.05), indicating significant variability in rainfall patterns over the study period. In contrast, UN has the smallest standard deviation (0.33), suggesting a relatively stable unemployment rate. The Jarque-Bera test results reveal that most variables are normally distributed, except GDP, RAIN, AGR, and INF, which deviate from normality.

Table 3 presents the correlation coefficients among the study variables. The results reveal several noteworthy relationships. Unemployment (UN) has a negative correlation with both Temperature (TEMP) (-0.4703) and GDP growth (-0.6057), indicating that higher temperatures and stronger economic growth are generally associated with lower unemployment rates. In contrast, UN exhibits a strong positive correlation with Inflation (INF) (0.6663), suggesting that periods of high inflation tend to coincide with higher unemployment, possibly reflecting macroeconomic instability.

Rainfall (RAIN) shows a very weak positive relationship with UN (0.0197), implying little direct association between precipitation levels and unemployment over the study period. However, rainfall is negatively correlated with TEMP (-0.2566) and GDP (-0.2699), consistent with the notion that extreme climate variability may dampen economic performance.

Agriculture's share in GDP (AGR) displays a moderate positive correlation with UN (0.3182) and INF (0.5040), indicating that higher agricultural dependence might coincide with greater unemployment and price volatility, possibly due to vulnerability to climate shocks. AGR's correlations with TEMP (-0.2624) and GDP (-0.0904) are both negative, reflecting the sector's sensitivity to adverse climatic and economic conditions.

These correlations suggest that Somalia's labor market outcomes are shaped by a complex interplay of climate and macroeconomic variables, with temperature, inflation, and GDP growth playing particularly significant roles in explaining unemployment dynamics.

Table2. Descriptive statistics.

	UN	TEMP	GDP	INFL	RAIN	AGR
Mean	19.11821	26.57273	1.942365	12.21163	291.8997	60.41333
Median	19.05000	26.51000	3.236371	7.387893	265.9500	60.18000
Maximum	19.97400	27.09000	10.36770	55.81475	649.4500	64.27000

Minimum	18.52300	26.06000	-21.88517	-15.34690	143.6600	60.09000
Std. Dev.	0.333457	0.277492	5.447974	16.19777	94.04700	0.818278
Skewness	0.616727	0.083723	-2.603357	1.102813	1.703768	3.668394
Kurtosis	3.231555	1.917206	12.32011	4.086757	7.446648	16.59818
Jarque-Bera	2.165665	1.650663	156.7146	8.313015	43.15297	328.2659
Probability	0.338635	0.438090	0.000000	0.015662	0.000000	0.000000
Sum	630.9010	876.9000	64.09803	402.9837	9632.690	1993.640
Sum Sq. Dev	3.558202	2.464055	949.7733	8395.770	283034.8	21.42653
Observations	33	33	33	33	33	33

Table3. Correlation.

	UN	TEMP	GDP	INFL	RAIN	AGR
UN	1					
TEMP	-0.4703	1				
GDP	-0.6057	0.2296	1			
INFL	0.6663	-0.5581	-0.5337	1		
RAIN	0.0197	-0.2566	-0.2699	0.1647	1	
AGR	0.3182	-0.2624	-0.0904	0.5040	-0.0590	1

4.2. Lag Length Criteria

The optimal lag order was selected using five criteria: the Sequential Modified Likelihood Ratio (LR) test, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SC), and Hannan Quinn (HQ). As reported in **Table4**, all criteria attain their optima at lag 3 (indicated by the asterisks). Accordingly, the analysis adopts three lags for the ARDL specification, ensuring that the model captures the relevant short-run dynamics while maintaining an improved overall fit relative to lower lag orders.

Table4. Lag order selection criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-352.8296	NA	987.1888	23.92198	24.20221	24.01163
1	-276.7468	116.6604	71.88474	21.24978	23.21146	21.87734
2	-224.9657	58.68522	34.41080	20.19771	23.84083	21.36318
3	-145.5996	58.20177*	5.170297*	17.30664*	22.63119*	19.01001*

4.3 Unit Root Test

The stationarity properties of the variables were assessed using the Augmented Dickey–Fuller (ADF) test. The test's null hypothesis (**H_0**) assumes that the series contains a unit root, meaning it is non-stationary, while the alternative hypothesis (**H_a**) suggests that the series is stationary. As indicated in **Table 5**, only rainfall and agriculture were found to be stationary in their level form. All other variables exhibited non-stationarity at level but achieved stationarity after first differencing, indicating that they are integrated of order one, **I (1)**. This combination of **I (0)** and **I (1)** variables justifies the application of the ARDL bounds testing approach in this study. **Table5** presents the Augmented Dickey–Fuller (ADF) test results for stationarity. Under the null hypothesis, a variable is assumed to have a unit root (non-stationary), while the alternative suggests it is stationary. The findings reveal that RAIN and AGR are stationary at level, significant at the 1% level. The remaining variables—UN, TEMP, GDP, and INFL—are non-stationary at level but become stationary after first differencing, implying they are integrated of order one, I (1).

The presence of both I (0) and I (1) series in the dataset confirms the suitability of the Autoregressive Distributed Lag (ARDL) bounds testing framework for this study, as the approach accommodates variables with mixed integration orders without requiring all to be stationary at the same level.

Table5 Unit root test

Variables	ADF	
	Level Intercept	**First Difference**
UN	-2.328892	-3.301414**
TEMP	-0.039576	-4.392782***
GDP	-2.429310	-4.303453***
INFL	-2.664595*	-10.20105***
RAIN	-4.133680***	-4.196702***
AGR	-6.577243***	-3.021636**

Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.

4.4. Cointegration Test

The ARDL bounds testing approach was applied to determine whether a long-run equilibrium relationship exists among unemployment, climate variables, and selected macroeconomic indicators. As shown in **Table 6,** the computed F-statistic is 6.742159, which is well above the upper bound critical value of 3.79 at the 5% significance level. This result provides strong evidence to reject the null hypothesis of no levels relationship, confirming the presence of cointegration among the variables. In other words, despite potential short-run fluctuations, the variables move together in the long run, indicating that climatic and macroeconomic factors exert lasting impacts on unemployment in Somalia.

Table6: ARDL Bound Test for Co-integration

F-Bound Test		Null Hypothesis: No levels relationship		
Test- statistic	Value	Sig. Level	I (0)	I (1)
F-statistic	6.742159	10%	2.26	3.35
K	5	5%	2.62	3.79
		2.5%	2.96	4.18
		1%	3.41	4.68

4.4. Long-Run ARDL Estimation Results

The long-run coefficients from the ARDL model are presented in Table 7. Among the climate variables, temperature (TEMP) has a statistically significant negative effect on unemployment at the 5% level, with a coefficient of -1.202187. This suggests that a one-degree Celsius rise in average temperature is associated with a 1.20 percentage point decline in unemployment in the long run, possibly reflecting short-term boosts to certain climate-sensitive economic activities. Rainfall (RAIN) also has a negative coefficient (-0.001040), but its effect is statistically insignificant ($p = 0.5287$), indicating that precipitation changes do not have a measurable direct impact on long-run unemployment levels.

Turning to the macroeconomic variables, GDP growth significantly reduces unemployment (-0.180887, $p = 0.0127$), supporting the view that economic expansion creates more jobs. Inflation (INFL) also shows a significant negative effect (-0.045565, $p = 0.0456$), suggesting that modest price increases may coincide with stronger economic activity and job creation. Agriculture’s share in GDP (AGR) carries a negative but statistically insignificant coefficient (-2.162110, $p = 0.1768$), implying that structural changes in the agricultural sector do not have a robust long-term influence on unemployment.

Table7. long-run results.

Variables	Coefficients	Standard errors	t-statistics	Prob
TEMP	-1.202187	0.438682	-2.740451	0.0208
GDP	-0.180887	0.059685	-3.030678	0.0127
INFL	-0.045565	0.019962	-2.282653	0.0456
RAIN	-0.001040	0.001593	-0.652582	0.5287
AGR	-2.162110	1.487659	-1.453364	0.1768

4.5. Short-Run ARDL Estimation Results

The short-run dynamic results of the ARDL model are shown in Table 8. Although temperature (TEMP) does not appear in the differenced short-run specification, the climate variable rainfall (RAIN) plays a notable role. The contemporaneous change in rainfall is negative but statistically insignificant (-0.000363, p = 0.1937), while the first lag of rainfall is positive and significant (0.000704, p = 0.0113), suggesting that increased precipitation in the previous period tends to reduce unemployment in the short run, possibly by boosting agricultural and related labor demand. Turning to the macroeconomic variables, GDP growth shows a significant contemporaneous negative effect (-0.024552, p = 0.0095), consistent with job creation during periods of expansion. However, GDP growth two periods earlier also have a strong negative effect (-0.029581, p = 0.0008), while the first lag is insignificant. Inflation (INFL) displays mixed effects: the contemporaneous change is negative and significant (-0.007121, p = 0.0123), the first lag is positive and significant (0.013754, p = 0.0029), and the second lag remains positive but only marginally significant (0.005228, p = 0.0584). This pattern may reflect short-term price adjustments influencing employment differently over time. For the agricultural sector (AGR), the immediate effect is negative and marginally significant (-0.361294, p = 0.0733), suggesting that sudden changes in agricultural output share can raise unemployment, possibly due to structural shifts or volatility. The second lag is highly negative and strongly significant (-1.002319, p = 0.0000), while the first lag is positive but insignificant.

The error correction term (ECT) is negative and highly significant (-0.609706, p = 0.0000), confirming the presence of a stable long-run relationship among the variables. The magnitude indicates that approximately 61% of any short-term disequilibrium is corrected within one period, implying a relatively quick adjustment back to the long-run path.

Table8. Short-run results.

Variables	Coefficients	Standard errors	t-statistics	Prob.
C	111.1155	14.26640	7.788616	0.0000
D (UN (-1))	-0.315170	0.106295	-2.965041	0.0142
D (UN (-2))	-0.566461	0.117374	-4.826135	0.0007
D(GDP)	-0.024552	0.007680	-3.196764	0.0095
D (GDP (-1))	0.004540	0.008393	0.540984	0.6004
D (GDP (-2))	-0.029581	0.006301	-4.694525	0.0008
D(INFL)	-0.007121	0.002336	-3.048062	0.0123
D(INFL (-1))	0.013754	0.003522	3.904626	0.0029
D (INFL (-2))	0.005228	0.002447	2.136725	0.0584
D(RAIN)	-0.000363	0.000260	-1.393541	0.1937
D(RAIN (-1))	0.000704	0.000227	3.099479	0.0113
D(AGR)	-0.361294	0.180571	-2.000847	0.0733
D(AGR (-1))	0.338403	0.193293	1.750726	0.1106

D(AGR (-2))	-1.002319	0.144892	-6.917690	0.0000
ECT (-1) *	-0.609706	0.078271	-7.789701	0.0000

4.6 Diagnostic Tests

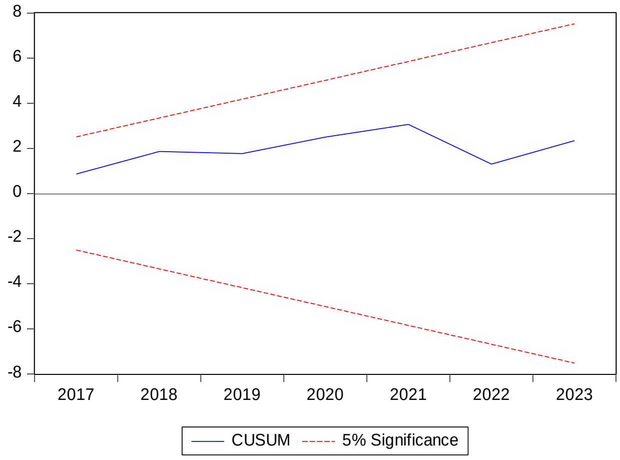
To ensure the robustness and reliability of the ARDL model estimates, several post-estimation diagnostic checks were conducted. The results are summarized in Table 8. The Breusch–Godfrey LM test was conducted to detect the presence of serial correlation in the model's residuals. The test produced a statistic of 1.970741 with a p-value of 0.2014, which is greater than the 5% significance threshold. This indicates that we fail to reject the null hypothesis of no serial correlation. Therefore, the residuals are free from autocorrelation, suggesting that the model's dynamic structure is correctly specified in this respect. The Jarque–Bera normality test produces a p-value of 0.861666, confirming that the residuals are normally distributed. The Breusch–Pagan–Godfrey (BPG) test for heteroskedasticity reports a statistic of 1.403695 (p = 0.2968), suggesting constant variance in the error terms. Finally, the Ramsey RESET test returns a statistic of 1.550663 (p = 0.1554), implying that the model is correctly specified with no signs of omitted variable bias or misspecification.

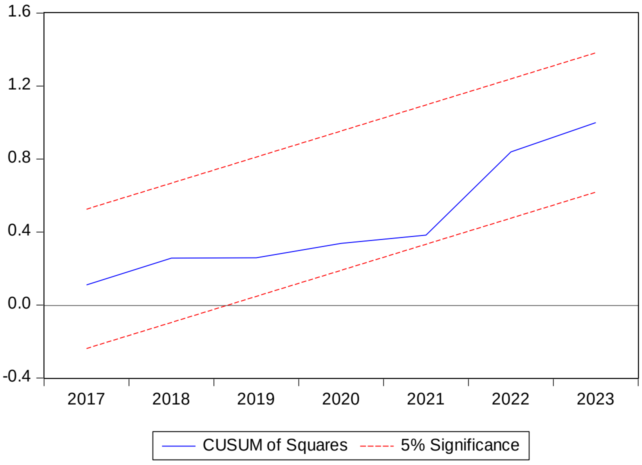
Overall, these diagnostic results confirm that the estimated ARDL model is well-specified, stable, and free from common econometric problems, strengthening confidence in the validity of the results.

Table8. Diagnostic Test

Test	Statistic	P-value	Conclusion
Serial correlation-LM test	1.970741	0.2014	No serial correlation
Normality - JB test	0.297776	0.861666	Residuals are normally distributed
Heteroskedasticity-BPG test	1.403695	0.2968	No evidence of heteroskedasticity
Ramsey RESET Test	1.550663	0.1554	Model is correctly specified

The stability of the ARDL model parameters was assessed using the CUSUM and CUSUM of Squares (CUSUMSQ) tests. In both cases, the plotted statistics remained within the 5% significance boundaries. This indicates that the model parameters are stable over time and that there is no evidence of structural instability in the estimated relationships. The results suggest that the model is reliable for both short-run and long-run inference.





5. Conclusion And Policy Implications

The study examined the effect of climate change on unemployment in Somalia. The long-run results showed that temperature is statistically significant and negatively associated with unemployment, with a 1°C increase linked to a 1.20 percentage point reduction in the unemployment rate. Though it's unknown if these benefits will continue, climate-sensitive industries like agriculture and livestock production may see short-term gains in this. Lagged rainfall had a favorable influence on the creation of jobs in the short run, probably because it increased demand for seasonal agricultural labor, but fluctuations in rainfall had no noticeable long-term consequences. By sharply reducing unemployment, GDP growth validated the importance of economic expansion in generating jobs. Furthermore, inflation had a minor but significant negative long-term effect, suggesting that stable economic activity can coexist with moderate price increases. Agriculture had a negative proportion, albeit a statistically modest one, indicating that structural changes in the sector alone are insufficient to lower unemployment in the long term. Additionally, there is less evidence of a consistent short-term association between temperature changes and unemployment since climatic impacts appear to operate through sector-specific channels and lagged effects. This suggests that although certain climate changes can benefit employment in the long run, their immediate implications are more complicated, and rises in unemployment might not always lead to labor market changes that can be attributed to climate change.

Based on these empirical findings, the following policy implications are suggested for Somalia: The Somalia government must integrate climate adaptation into employment policy through the promotion of climate-resilient sectors, such as drought-tolerant agriculture, renewable energy, and green infrastructure. Policymakers must enhance agricultural productivity and value addition by investing in irrigation systems, post-harvest storage, and market linkages to reduce the volatility of agricultural jobs caused by rainfall variability. Economic diversification should be prioritized to expand employment opportunities in manufacturing, services, and technology sectors that are less vulnerable to climate shocks. Investment in human capital via vocational training, technical education, and health services is essential to equip the workforce for emerging climate-adaptive industries. Government and development partners should strengthen climate and labor market data systems to improve monitoring, early warning, and evidence-based policy responses. Good governance, reduced corruption, and institutional capacity building are necessary to ensure the effective use of climate adaptation funds and employment-related investments.

This study investigates the relationship between Somalia's unemployment rate and climate change. A small number of macroeconomic and climatic factors were employed in the study to investigate their impact on unemployment. Additionally, not every aspect of the labor market or the environment was taken into account in the study. Therefore, the researchers advise that future research concentrate on how climate change affects employment in certain sectors, such manufacturing, services, and agriculture. Examine how migration and displacement affect labor market outcomes in the context of climatic stress. To get more general regional insights, compare Somalia's employment and climatic dynamics to those of other Horn of Africa nations. Analyze how green investment and technical advancement might lessen the negative consequences of climate variability on employment.

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