EXPLORING THE PREDICTIVE POWER OF UNEMPLOYMENT RATES ON INFLATION IN EMERGING ECONOMIES IN AFRICA: A QUANTITATIVE APPROACH.

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Abstract:

This study explores the predictive power of unemployment rates on inflation in emerging economies, with a focus on African regions. Using a quantitative approach, we analyzed data on unemployment and inflation rates across five distinct African regions: Eastern, Middle, Northern, Southern, and Western Africa. Descriptive statistics reveal notable regional disparities, with Southern Africa exhibiting the highest mean values for both unemployment (*2.08*) and inflation (*1.90*), while Western Africa showed lower inflation rates. The data analysis indicates that unemployment rates tend to have a negative skew and are somewhat platykurtic across regions, while inflation rates exhibit moderate negative skewness and leptokurtic distributions, suggesting more extreme values than expected. The ANOVA tests confirm significant differences in mean unemployment and inflation rates across the regions ($p < 0.05$). Further, regression analysis demonstrates a significant relationship between unemployment and inflation rates, with the log of unemployment rate positively predicting the log of inflation rate ($\beta = 0.148$, $p = 0.000$). However, the low R^2 value (*0.016*) suggests that while the relationship exists, it only explains a small portion of the variation in inflation rates. Overall, this study highlights regional variations in unemployment and inflation dynamics across Africa and provides empirical evidence of a positive though weak relationship between unemployment and inflation contributing valuable insights to economic policymaking in emerging economies.

Keywords: Unemployment rate, Inflation rate, Emerging economies, African regions, Quantitative analysis, Economic disparities.

1.0 Introduction

Inflation and unemployment are pivotal macroeconomic variables with profound implications for the socioeconomic stability of nations. Their intricate relationship, particularly in emerging economies, has been the focus of extensive academic and policy discourse. Emerging economies, characterized by dynamic but often volatile markets, face unique challenges in balancing economic growth, price stability, and employment levels. Understanding how unemployment rates predict inflation in these economies offers valuable insights into their economic dynamics and informs more effective policy-making (Olayiwola, 2019 & Anyanwu, 2020). The interplay between unemployment rates and inflation has long captured the attention of econometricians, particularly

in the context of emerging economies. These economies often exhibit unique characteristics, such as high market volatility, structural unemployment, and varying levels of inflationary pressures. Understanding this relationship is crucial for crafting effective monetary and fiscal policies aimed at achieving macroeconomic stability (Hassan and Oluwole, 2023). This study explores recent theoretical and empirical contributions to this subject, shedding light on regional disparities across Africa, methodological advancements, and the influence of global and domestic factors on the unemployment-inflation nexus.

Understanding the interplay between unemployment rates and inflation in emerging economies has been a central theme in economic research. Mostly, the relationship between unemployment and inflation is typically explored within the framework of the Phillips Curve. Recent studies, such as Arestis and Sawyer (2021), argued that the Phillips Curve remains relevant but requires adjustments to account for structural changes in labour markets and globalization's influence. Similarly, Blanchard (2022) emphasizes the importance of inflation expectations and their anchoring in determining the curve's slope and intercept in emerging markets. Emerging economies often exhibit unique characteristics in unemployment-inflation dynamics due to structural rigidities and economic volatility. According to Ahmed *et al*. (2023), high informality rates in labour markets and fiscal constraints significantly influence inflation responses to unemployment changes in these economies. Moreover, Eze and Okonkwo (2023) highlight the role of currency fluctuations in mediating the unemployment-inflation relationship.

Empirical studies have identified significant regional disparities in unemployment and inflation trends within emerging economies. For instance, Olayemi and Musa (2021) investigated unemployment and inflation interplay in sub-Saharan Africa, finding that inflation tends to be more volatile in regions with higher unemployment variability. The study by Chang *et al.* (2022) supports this observation, noting that South Asian economies often exhibit a steeper Phillips Curve due to more rigid labour markets. Regional disparities in economic structures also play a pivotal role. In a comparative analysis, Alabi *et al.* (2023) demonstrated that Southern Africa's higher unemployment and inflation rates are linked to structural unemployment and limited diversification. Conversely, Middle Africa's relatively low inflation is attributed to external financial support and commodity-driven economies.

Recent methodological advances have improved the modeling of unemployment-inflation dynamics. GARCH models, for example, have been used to explore the volatility of inflation rates in relation to unemployment (Kumar *et al.*, 2021). Machine learning approaches are also gaining traction. According to Li *et al.* (2023), neural networks outperform traditional econometric models in forecasting inflation using labour market indicators. The inclusion of macroeconomic policy variables has further enhanced model accuracy. Bello and Adeoye (2023) emphasized the importance of incorporating fiscal and monetary policies to account for policy-induced inflationary pressures. In addition, Bayesian regression methods have been employed to estimate uncertainties in predicting inflation (Adebayo *et al.,* 2022). Inflation expectations significantly influence the relationship between unemployment and inflation. Studies like that of Hassan and Oluwole (2023) showed that inflation targeting frameworks help anchor expectations, mitigating the trade-off between inflation and unemployment. However, this mechanism's effectiveness is reduced in economies with weak institutional frameworks. Furthermore, policy coordination between monetary and fiscal authorities has been recommended to stabilize inflation without exacerbating unemployment (Nguyen *et al.,* 2021). Central bank independence also emerges as a crucial factor in maintaining price stability, as argued by Singh and Patel (2023). The susceptibility of emerging economies to external shocks adds complexity to the unemployment-inflation nexus. For instance, oil price shocks have been shown to disproportionately affect inflation in these economies (Akpan and Udoh, 2022). Similarly, global financial crises exacerbate unemployment, further complicating inflation control, as evidenced by Mensah *et al.* (2023).

Exploring the predictive power of unemployment rates on inflation in emerging African economies is not only a matter of academic interest but also a pressing policy concern. It has far-reaching implications for employment strategies, economic growth, and inflation management, highlighting the necessity for targeted interventions that can foster sustainable economic development while mitigating the adverse effects of inflation and unemployment on the populace as far as Africa is concern.

2.0 Material and Methods

This study employs a quantitative research approach to explore the predictive power of unemployment rates on inflation in emerging economies. Descriptive statistics, correlation, and regression models were used to examine the relationship between these macroeconomic variables.

The dataset consists of unemployment and inflation rates collected from African regions, offering a comprehensive representation of economic dynamics across diverse settings (Müller and Hothorn, 2020; & Zhang and Liu, 2023).

2.1 Research Design

The study adopted a correlational design to investigate the strength and direction of the relationship between unemployment and inflation. This design is appropriate for identifying whether variations in unemployment rates can predict changes in inflation rates, as indicated by empirical data (Lee and Kang, 2020 & Sharma and Gupta, 2021). The emphasis on quantitative analysis ensures objectivity and replicability, providing robust evidence for the research hypothesis.

2.2. Data Source

The data used were downloaded from the world bank (www.world.org/indicators) offering detailed statistics on inflation and unemployment rates from 2003 to 2023. As stated by Alemho and Adenemon (2022), most macroeconomic data are not stationary and non-normally distributed. Owing to this, the dataset used were transformed whereby log of inflation and unemployment were used.

2.3 Model Specification

In evaluating the predictive power of unemployment rates on inflation, the study employs the following regression model:

Core Linear Regression Model:

$$\Pi_t = \beta_0 + \beta_1 u_t + \epsilon_t \quad (1)$$

This is the simplest regression model, where inflation (Π_t) is regressed on unemployment (u_t). It assumes a linear relationship and captures the immediate impact of unemployment on inflation (Sharma & Gupta, 2021; Kaur & Gupta, 2023). Thus; the dependent variable representing the inflation rate, the independent variable representing the unemployment rate, the slope coefficient, indicating the impact of unemployment on inflation and the error term accounting for unexplained variability.

Extended Regression Model:

$$\Pi_t = \beta_0 + \beta_1 u_t + \beta_2 \Pi_{t-1} + \beta_3 Z_t + \epsilon_t \quad (2)$$

This regression includes:

Lagged inflation (Π_{t-1}): To account for inflation persistence.

Control variables (Z_t): Other factors that could influence inflation (Unemployment). It is still a regression model but incorporates more predictors if needed (Choi & Lee, 2022, Zhang & Liu, 2023).

3.0 Results and Discussion

Table 1: Descriptive Statistics

	N	Range	Min	Max	Mean	Std. Dev.	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
log_ Unemployment Rate	1113	4	-1	3	1.809	0.934	0.873	-0.361	0.073	-0.463	0.147
log_Inflation Rate	1113	9	-3	6	1.603	1.102	1.214	-0.488	0.073	1.813	0.147
Valid N (listwise)	1113										

Table 1 above reveals that the log Unemployment Rate has a Range of 4, minimum and maximum values of -1 and 3 respectively. The skewness is -0.361which indicates a slight negative skew, meaning the distribution is just a bit more concentrated on the higher end (to the right) with a kurtosis of -0.463. The distribution has a kurtosis less than 0, meaning it is somewhat platykurtic (flatter than a normal distribution), indicating fewer extreme values than a normal distribution. For the log Inflation Rate, the skewness is -0.488. The inflation data has a moderate negative skew, indicating a slightly higher concentration of values toward the right side (lower values). While the

kurtosis is 1.813: The distribution has a positive kurtosis, indicating it is leptokurtic (with a higher peak and fatter tails than a normal distribution), meaning there are more extreme values than would be expected in a normal distribution.

It is observed that the log_Unemployment Rate has a smaller spread (smaller standard deviation and variance) compared to log_Inflation Rate, and the distribution is fairly close to normal (slightly negatively skewed and flat). While the log_Inflation Rate shows more spread (larger standard deviation and variance) and has a moderate negative skew and a leptokurtic distribution, indicating more frequent extreme values compared to a normal distribution.

Table 2: Descriptive Statistics for Unemployment rates and Inflation Rates across the Five Regions

	Eastern Africa		**Middle Africa**		**Northern Africa**		**Southern Africa**		**Western Africa**	
	log unemp	log Inf	log unemp	log Inf	log unemp	log Inf	log unemp	log Inf	log unemp	log Inf
Mean	1.6698	1.5396	1.9577	1.7619	1.9405	1.7381	2.0762	1.8952	1.7054	1.4137
Std. Deviation	0.8663	1.2289	0.8369	1.0113	0.9004	1.0396	0.8285	0.9085	1.0535	1.0755
Minimum	-1	-2	0	-2	-1	-2	1	-1	-1	-3
Maximum	3	6	3	5	3	4	3	4	3	4
Range	4	8	3	7	4	6	2	5	4	7
Variance	0.751	1.51	0.7	1.023	0.811	1.081	0.686	0.825	1.11	1.157
Kurtosis	-0.539	1.469	-0.832	2.111	-0.341	1.785	-1.531	1.374	-0.529	2.054
Skewness	-0.105	0.312	-0.25	-0.754	-0.48	-1.042	-0.144	-0.338	-0.436	-1.143
Median	2	2	2	2	2	2	2	2	2	2

- Log unemp is Log of unemployment * log Inf is Log of Inflation

Table 2 reveals the data for unemployment rate (log_Unemployment Rate) and inflation rate (log_Inflation Rate) is summarized across five African regions (Eastern, Middle, Northern, Southern, and Western Africa). The highest mean unemployment rate is in Southern Africa (2.08), while the lowest is in Eastern Africa (1.67). The highest mean inflation rate is also in Southern Africa (1.90), while the lowest is in Western Africa (1.41). For unemployment rate, the variability is highest in Western Africa (1.05) and lowest in Southern Africa (0.83). For inflation rate, variability is highest in Eastern Africa (1.23) and lowest in Southern Africa (0.91). The range for unemployment rate is consistent across most regions, with the highest range in Eastern, Northern, and Western Africa (4 units). Inflation rate shows the widest range in Eastern Africa (8 units) and

the smallest in Southern Africa (5 units). Most kurtosis values for unemployment rate are negative, suggesting flat distributions compared to a normal curve. The kurtosis values of Inflation rate are mostly positive, indicating distributions with heavier tails compared to a normal curve. Skewness for unemployment rate is generally slightly negative, implying a slight left skew. Inflation rate skewness values vary more, with some regions having positive and others negative skew. For both variables, the median value across all regions is consistent at 2.00.

Table 3: ANOVA TABLE

ANOVA Table[a]

			Sum of Squares	Df	Mean Square	F	Sig.
log_Unemployment Rate * Region	Between Groups	(Combined)	24.287	4	6.072	7.112	.000
	Within Groups		945.950	1108	.854		
	Total		970.237	1112			
log_Inflation Rate * Region	Between Groups	(Combined)	30.110	4	7.528	6.317	.000
	Within Groups		1320.361	1108	1.192		
	Total		1350.471	1112			

a. The grouping variable Region is a string, so the test for linearity cannot be computed.

Table 3 is the analysis of variance (ANOVA) tests for the difference in means of unemployment and inflation rates across the five regions. For the unemployment rate, the F-statistic is 7.112 and $p < 0.000$. There is a significant difference in the mean unemployment rates across the five regions ($p < 0.05$). For inflation rate, the F-statistic is 6.317 and $p < 0.000$. There is a significant difference in the mean inflation rates across the five regions ($p < 0.05$).

Both unemployment and inflation rates exhibit significant differences across the regions, as shown by the ANOVA results. Southern Africa has the highest average unemployment and inflation rates, suggesting potential economic challenges in this region. Western Africa shows relatively lower inflation rates but higher variability in unemployment rates. The data distribution, indicated by skewness and kurtosis, shows deviations from normality, with variations across regions.

Table 4: Regression

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.125[a]	.016	.015	1.0938

a. Predictors: (Constant), log_Unemployment Rate

Table 4 is the model summary that provides some key statistical information about the relationship between the predictors and the dependent variable in the regression model. The correlation coefficient = 0.125 which indicates a very weak positive relationship between the two variables. The value of R^2 = 0.016 suggests that the model does not explain much of the variation in the dependent variable while $\bar{R}^2$ = 0.015. Since the value is close to R^2, it reinforces that the model doesn't explain much of the variation.

Table 5: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.336	.071		18.685	.000
	log_Unemployment Rate	.148	.035	.125	4.209	.000

a. Dependent Variable: log_Inflation Rate

Table 5 reveals that both the constant (intercept) and the log_unemployment Rate have significant relationships with the log inflation Rate. The positive coefficient for log unemployment Rate suggests that as unemployment increases, inflation also tends to rise, which is consistent with the idea that there may be a positive relationship between unemployment and inflation, depending on the model and economic context. The p-values for both the constant and the coefficient of log unemployment Rate are very low (less than 0.05), indicating strong statistical significance.

4.0 Summary of Findings

The descriptive statistics revealed that the unemployment rates (log_Unemployment Rate) exhibit a slightly negative skew and platykurtic distribution, indicating a slight concentration of values at the higher end with fewer extreme deviations. Also, Inflation rates (log_Inflation Rate) showed a

moderate negative skew and leptokurtic distribution, implying a concentration of values at the lower end and more frequent extreme deviations compared to a normal distribution.

Southern Africa recorded the highest mean unemployment and inflation rates, while Eastern and Western Africa showed the lowest, respectively. Variability in unemployment rates was highest in Western Africa, whereas inflation rate variability peaked in Eastern Africa. These disparities highlight the influence of regional economic structures and labor market rigidities on unemployment-inflation dynamics.

On the significant regional differences, ANOVA results indicate significant differences in mean unemployment and inflation rates across regions. Both unemployment ($F = 7.112$, $p = 0.000$) and inflation rates ($F = 6.317$, $p = 0.000$) vary significantly by region, reflecting diverse macroeconomic conditions.

The regression coefficient for unemployment ($B = 0.148$, $p = 0.000$) indicates that unemployment positively and significantly influenced inflation. This finding aligns with economic theories linking labour market tightness to price level changes.

5.0 Conclusion and Recommendations

The study confirmed a significant, albeit weak, relationship between unemployment and inflation in emerging economies. While regional disparities influence these dynamics, Southern Africa's high unemployment and inflation rates underscore the structural and policy challenges in this region. The findings suggest that unemployment partially explains inflation trends, emphasizing the need for tailored macroeconomic interventions.

Based on the findings of the research, the following encompassing recommendations were made.

1. Policymakers should adopt region-specific strategies to address unemployment and inflation disparities. For instance, labour market reforms and job creation initiatives could alleviate unemployment in regions like Southern Africa.
2. Governments in emerging economies should prioritize economic diversification to reduce reliance on volatile sectors and stabilize inflationary pressures.

3. Central banks should implement robust inflation-targeting frameworks to anchor expectations, particularly in regions with high inflation variability.
4. Enhanced data collection and statistical modeling are recommended to refine predictive capabilities and improve understanding of unemployment-inflation dynamics.
5. Collaboration between regional bodies, international organizations, and governments is essential to address structural unemployment and inflation challenges comprehensively.

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