Research Paper

Impact of Economic Growth on Unemployment in South Africa: A Time-Series Data Analysis

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Abstract

Debates over the relationship between economic growth and unemployment are crucial for monetary policymaking. Unemployment is a major challenge in developing countries. The country's high unemployment rate reflects the poor use of labor resources. Hence, unemployment is a huge economic issue that has a negative influence on individuals and society at large. This nexus has also been associated with drug addiction and criminal activity in numerous countries, including South Africa. Given the importance of this topic, the macroeconomic literature contains several theories and models that examine the connection between economic growth and unemployment. For proper formulation and implementation of effective monetary policy, the relationship between these macroeconomic variables is critical. Using quarterly time series data for South Africa from 2002 to 2020, this study examines the impact of economic growth on unemployment. DOLS assumptions were used to investigate the impact of the two variables; the end results show that there is a negative relationship between economic growth and unemployment, which is consistent with previous studies that follow the hypothesis that unemployment is negatively impacted by economic growth. These findings will assist policymakers in developing strategies to regulate unemployment and promote long-term growth within countries.

Keywords: *Economic Growth; Unemployment; OLS Assumptions; Keynesian Approach; Macroeconomic Variables*

INTRODUCTION

Economic growth and unemployment pose significant issues on a global scale, irrespective of the level of economic and social development (Adanlawo & Nkomo, 2023). Unemployment has emerged as a significant subject of interest among policymakers and scholars, particularly in emerging nations (Ademola & Badiru, 2016). Unemployment is a major challenge in developing countries. The country's high unemployment rate reflects the poor use of labor resources. Hence, unemployment is a huge economic issue that has a negative influence on individuals and society at large. This nexus has also been associated with drug addiction and criminal activity in numerous countries, including South Africa. Unemployment is one of the foremost challenges confronting South Africa. The nation has experienced fluctuating economic development since the economic transition in 1994, while the labor market continues to face significant challenges due to persistently high unemployment rates (Masuku & Nkala, 2021). According to data provided by StatsSA (2021), there was a notable rise in the official unemployment rate, which escalated from 17% in 1994 to 32.6% during the first quarter of 2021. The recorded figure represents the highest value observed since the inception of the Quarterly Labor Force Survey in 2008, as reported by StatsSA in 2021. According to the survey, youth are mostly affected, with a prevalence rate of 74.7%.

The subject of unemployment has garnered significant attention from economists and policymakers in South Africa (Chaka & Adanlawo, 2023). However, the South African government has enacted various policy measures aimed at addressing unemployment as a means to stimulate economic growth. The strategies employed include augmenting government spending and implementing monetary policy tools, such as lowering commercial banks' loan rates to incentivize investment through borrowing (Ndebele et al., 2022; Chinedu & Chidoziem, 2017). In

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contemporary times, there has been a noticeable surge in the popularity of self-employment, commonly referred to as entrepreneurship. The government provides financial support to young entrepreneurs to facilitate the establishment of their own businesses (Utete, 2023; Chaka & Adanlawo, 2022).

According to the National Development Plan 2030, it is imperative for South Africa to achieve a sustainable growth rate that exceeds 5%. However, achieving the targeted growth rate may pose challenges in the context of persistent unemployment. To reduce unemployment, the government implemented the New Growth Path (NGP) framework in 2010 with the aim of stimulating job creation and fostering robust economic growth within the nation (Cwele, 2019). The primary objective of the NGP was to decrease the official unemployment rate from 25% to 14% by 2020 and subsequently to 6% by 2030, as outlined in the National Development Plan (NDP, n.d.). Nevertheless, the unemployment rate in South Africa reached a remarkable level of 32.5% in the fourth quarter of 2020 (Wakefield et al., 2022). Undoubtedly, the economy is currently confronted with a formidable problem characterized by both economic growth and unemployment. Despite the implementation of many measures, the issue of unemployment persists and presents a significant obstacle to economic growth. This study aims to examine the relationship between economic growth and unemployment, with a specific focus on the South African economy. The objective is to provide strategies to enhance the pace of economic growth in South Africa. This study hypothesizes that low economic growth fuel unemployment.

LITERATURE REVIEW

Theoretical background

Okun's law (1962) asserted that unemployment and economic growth have an inverse connection. According to Okun, unemployment diminishes as the economy grows. In the same way, when economic development slows, if the gap between actual and potential economic growth is closed, unemployment rises, the economy grows, and unemployment remains unchanged. Okun's law is a model

$$\Delta y_t = \beta_0 + \beta_1 \Delta un_t + \varepsilon_{t\ldots}(1)$$

Where: actual and potential output is given as $\Delta y_t = (y - y^*)$ and $\Delta un_t = (un - un^*)\ldots(2)$ is actual unemployment and full employment.

In addition to the theory above, the Keynesian theory of unemployment postulated that a deficiency in aggregate demand is the root cause of unemployment (Keynes, 1936). He claimed the conventional wisdom that unemployment can arise as a result of government intervention in the free market through trade unions or minimum wage legislation. He also claimed that there was not enough aggregate demand to meet everyone's need for employment at the going wage rate, which was the root cause of unemployment.

Keynes' theory held that government-imposed minimum wage laws and trade unions were the reasons why wages were rigidly declining. Furthermore, employees will fiercely object, refusing to accept any wage reduction, so workers are hesitant to allow nominal salary reductions. Workers, on the other hand, would accept a wage increase; therefore, wages have tended to rise over time. Keynes (1936) contended that wage rigidity—or the downward inflexibility of wages—is the cause of involuntary unemployment.

In a similar vein, the endogenous growth model highlights the need for the system to pursue economic growth. In opposition to neoclassical growth theory, the "endogenous growth theory" theory was developed (Romer, 1986). Endogenous growth theory states that to attain the ideal growth rate, governments must interfere with the economy (Soylu et al., 2018; Zondi et al., 2023).

Technological development in the model is endogenous. Romer (1986) established the fundamental theory of endogenous growth, which holds that economic growth occurs within the framework of the neoclassical model rather than outside technological advancements that are not governed by the economic forces at work within the market mechanism. In this model, information is treated as a secret public property.

In support of the above-mentioned theories, the Solow model, also known as the neoclassical growth model, aims to address the issues of why certain nations are wealthy while others are impoverished and how long-term economic growth will occur (Nwanzu & Babalola, 2023; Cvetanović et al., 2019). In response to the first query, the model explains that certain nations invest more while experiencing slower population growth. The advancement of technology is the response to the second query. Solow studied how savings, population growth, and technological advancement affect growth and how they affect each other.

The Solow model is primarily named the neoclassical growth model because it is grounded in neoclassical theory. The model considers an economy that produces and uses identical single goods. This indicates the existence of a closed economy. The law of diminishing returns is applicable, and the rates of savings and investments are equal. The market is dominated by full employment and competition. The production function is the constant return on scale. Lastly, technology is not internal. Endogenous growth theories employ various methodologies. The first one is the AK Growth Model. The AK model postulates that capital (K) and total output (Y) have a linear relationship.

Empirical background

Many scholars, such as Louail and Benarous (2021), Soylu et al. (2018), and Ademola and Badiru (2016), have investigated the relationship between economic growth and unemployment using Okun's law; however, different approaches, countries, data, and study periods led to different outcomes. Louail and Benarous (2021) investigated the impact of real GDP on unemployment rates in the Algerian economy from 1991 to 2019. The autoregressive distributed lag (ARDL) bounds testing technique was used. The results indicate that the GDP gap has a negative and significant impact on unemployment rates. Soylu et al. (2018) studied economic growth and unemployment over the period 1992-2014 using OLS. The gross domestic product (GDP) was used as a proxy for economic growth, and the unemployment rate was used as a proxy for unemployment. This study used data from the World Bank. The conclusion indicates that unemployment is positively affected by economic growth. Ademola and Badiru (2016) studied the impact of economic growth on unemployment in Nigeria over the period 1981-2014 using Ordinary Least Squares (OLS). Economic growth was measured using real GDP, and unemployment was measured using the unemployment rate. The results indicate a positive relationship between economic growth and unemployment.

Chand et al. (2017) studied economic growth and unemployment rates. Economic growth was measured using gross domestic product, and unemployment was measured using unemployment. Time series data were obtained from the World Bank Database. The results indicate a strong negative relationship between economic growth and unemployment. Yasmin et al. (2020) analyzed the causal relationship between economic growth and unemployment in Pakistan during 1976–2017. Using the ARDL model, economic growth was measured using GDP. Personal remittances, inflation, exports, and foreign direct investments are used as control variables. Data were obtained using time series data. The results indicate a negative relationship between economic growth and unemployment.

Kreishan (2011) investigated the relationship between economic growth and unemployment over the period 1970–2008 using ADF for unit tests, co-integration tests, and a simple regression

model. Economic growth was measured using the GDP rate, whereas unemployment was measured using the unemployment rate Time series data obtained from the Central Bank of Jordan annual reports and the Department of Statistics was used. The results concluded that Okun's law is unreliable because a lack of growth does not explain the unemployment problem. Onakoya (2020) studied the economic growth and unemployment nexus for the United States, South Africa, and Nigeria from 1980 to 2018 using the ordinary least squares method. Economic growth was measured using GDP, whereas unemployment was measured using the unemployment rate. The World Development Indicators and International Financial Statistics time series data were used. South Africa and the United States both displayed negative relationships, whereas Nigeria displayed a positive relationship.

Kalu (2021) investigated the relationship between unemployment and economic growth in developing nations for the period 1981-2017 using the autoregressive distribution lag model (ARDL) and error correction. GDP growth and unemployment rates were used to measure economic growth and unemployment, respectively. The World Bank and the Central Bank of Nigeria's time series data were used. The findings show that while youth unemployment has a negative impact on GDP, unemployment among women has a positive impact on GDP. Banda et al. (2016) used the Vector Error Correction Model (VECM) to examine how economic growth affected unemployment in South Africa from 1994 to 2012. The real effective exchange rate (REER), labor productivity (LP), budget deficit (BUG), and GDP were used as control variables. GDP was used as a proxy for economic growth. The findings show that while BUG and REER have a positive relationship, labor productivity has a long-term negative impact on unemployment.

RESEARCH METHOD

This study collected quarterly time series data between 2002 and 2020 from Statistics South Africa. The purpose of this study was to examine the relationship between unemployment and economic growth using inflation as a control variable.

Table 1. Variable description, Data, and Expected Signs

Variable Name	Description and measurement	Data Source	Expected sign
Economic growth	Real GDP	World Bank	+
Unemployment	Unemployment rate	Federal Reserve Bank	-
Inflation	Consumer Price Index	Federal Reserve Bank	-

The unit root test was employed to determine the robustness of the model and to assess whether it adheres to the assumptions of ordinary least squares (OLS) regression. To determine whether there are discernible trends in economic growth and unemployment, it is necessary to conduct unit root tests on each variable included in the model. The aforementioned tests are a crucial component of primary analysis and hold significant importance in determining the sequence of variables integration, a prerequisite for conducting co-integration tests. Co-integration tests were also performed to determine the presence of spurious regression. Hence, this study aims to examine the effects of economic growth on unemployment by employing both formal and informal unit root tests. Common unit root tests in econometrics encompass graphical representations of variables at both levels and first differences, and the autocorrelation function (ACF) and correlogram. Additionally, the Augmented Dickey-Fuller (ADF) test was considered as part of the official unit root tests.

If economic growth, unemployment, inflation, and education are integrated into order 1, a co-integration test will be performed. When variables move together over the long-run, this is

known as co-integration (Mveku et al., 2023; Basha et al., 2020). The co-integration test developed by Johansen (1991) is used in this study to check for co-integration in a multivariate framework. This will occur if inflation, unemployment, and economic growth have unit roots and are integrated into a single order. This test displays the number of co-integrating relationships, which gives it an advantage over the Engle-Granger method. An error correction model is applied if there is cointegration between unemployment and economic growth. The model displays both long-term and short-term coefficients.

Model specification

This study employs panel data, which are a time series spanning 2002-2022. The statistics applied in this study were drawn from secondary sources from Statistics South Africa. The emphasis of this study is on the impact of economic growth on unemployment in South Africa. This study was conducted on a nationwide scale in South Africa using the available data set. The annual unemployment rate is derived from the percentage of the labor force in a nation that is out of work and is considered an outcome variable. In this study, the annual real GDP rate is measured in percentages and is used as a proxy for economic growth, whereas the annual percentage inflation rate is handled as an explanatory variable. To estimate the long-run elasticity of parameters, we use the Dynamic Ordinary Least Squares (DOLS) approach given by. This strategy addresses endogeneity bias and autocorrelation by adding leads and lags from first-differenced regressors. Ordinary Least Squares (OLS) is a biased estimator because it does not address regressor endogeneity when cointegration exists. As a result, DOLS is a more robust approach that is ideal for small samples to assess the long-run parameters of higher-order integrated series.

To experimentally assess the impact, the study defined unemployment as the outcome variable and real GDP and inflation as independent variables. To estimate the model, the scholar used the double-log form proposed by economic theories, and the findings were understood as elasticities. The following statistical model is defined below, as adopted from Philips (1958). The model is specified as follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_3 X_3 + \mu_i \ldots(3)$$

Where:

Y_i = unemployment.

X_1= economic growth

X_2 = inflation

μ = random error term

Substituting variables into the equation above yields:

$$Unempl = \beta_0 + \beta_1(RGDP) + \beta_2(\text{Infl}) + \mu_i \ldots(4)$$

Data Transformation

$$Unempl = \beta_0 + \beta_1(RGDP) + \beta_2(\text{Infl}) + \mu_i..(5)$$

The data is converted into natural logarithms with the goal of converting nominal values into real-value terms. The main goal of running logarithmic transformation is to make it easier to express coefficients in elasticity values and to solve problems like serial correlation and

heteroscedasticity in regression.

Diagnostic tests were conducted to examine residual-related regression issues, including auto (serial) correlation, heteroscedasticity, residual normality, misspecification bias, and multicollinearity. First, the model's serial correlation was examined using the Breusch-Pagan test. Second, model's heteroskedasticity was tested using the Breusch-Pagan test. Nkomo and Adanlawo (2023) stated that if a set of random variables has random variances, then the set is heteroskedastic. Third, functional form misspecification bias was tested using the Ramsey RESET test. In order to determine whether the residuals in the model are normally distributed, the Jarque-Bera (JB) test is the last step.

The t- and F-statistics were employed to check the significance of the estimated coefficients. In addition, R^2 was used to test the goodness-of-fit or variations between the variables. A test statistic, or random variable generated from the sample data, is used in hypothesis testing. It can be used to determine whether a hypothesis should be rejected or accepted (Roldan et al., 2023; Adanlawo et al., 2021). We can determine whether we accept or reject the null hypothesis by examining the test statistic values.

$$\boldsymbol{t_z} = \boldsymbol{t_z} = \frac{\hat{\beta}_z - \beta_{Ho}}{se[\beta_z]} (\boldsymbol{z = 1, 2, \ldots \ldots \ldots z}) \ldots (6)$$

$$\boldsymbol{t_z} = \frac{\hat{\beta}_z}{se[\hat{\beta}_z]} (\boldsymbol{z = 1, 2 \ldots \ldots \ldots z}) \ldots (7)$$

Where;

t_z is the test statistic.

$\boldsymbol{\hat{\beta}_z}$ is the estimated regression coefficient of the k^{th} variable

$\boldsymbol{se[\hat{\beta}_z]}$ is the estimated standard error of the $\boldsymbol{\hat{\beta}_z}$

$\boldsymbol{\hat{\beta}H0}$ is the broader value (usually zero) implied by the null hypothesis β_z

F stat is a statistical tool used to assess model R-squared significance. The model is deemed to be well-fitting and substantially superior to the null hypothesis, which predicts a non-linear relationship between the dependent and independent variables, if Probability (F) is less than 0.05.

$$F = \frac{\left[\frac{R^2}{K}\right]}{\left[\frac{1-R^2}{n-K-1}\right]} \ldots (8)$$

The R-squared is a goodness-of-fit metric for linear regression models (Onyutha, 2020). It can be considered a measure of the coefficient of multiple determinations and represents the percentage of the dependent variable's variation that is explained by changes in the independent variable (Cheng and Garg, 2014). The R-squared value lies between 0 and 1. The dependent variable's variance can be better explained, and the predictive power is higher when the R-squared value is near 1.

FINDINGS AND DISCUSSION

Descriptive Statistics

Table 2 presents descriptive coefficients that summarize the dataset of the variables, which includes Gross Domestic Product, unemployment rate, and Consumer Price Index recorded in South Africa from 2002 to 2020.

Table 2. Descriptive Statistics

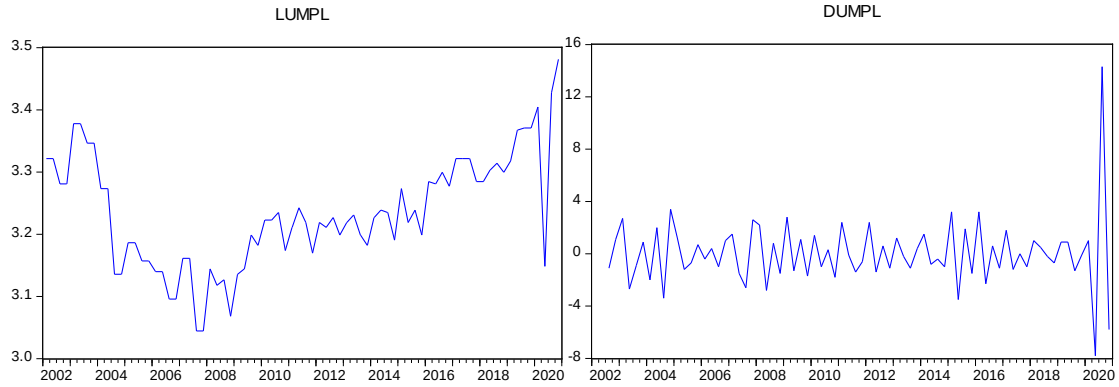
	GDP	UNMPL	CPI
Mean	995590.8	25.50395	77.64896
Median	1018835	25.15	74.98333
Maximum	1172995	32.5	115
Minimum	723732	21	47.52337
Std. Dev.	126260	2.341193	21.0314
Skewness	-0.568963	0.461125	0.260787
Kurtosis	2.149439	3.006972	1.739047
Jarque-Bera	6.391373	2.693546	5.896471
Probability	0.040938	0.260078	0.052432
Observations	76	76	76

The standard deviation measures volatility from the variables. GDP has the highest volatility because it has the highest standard deviation of 12.6260 compared with CPI and unemployment. Unemployment shows right tail (positive skewness) and leptokurtic because 3.0069 is greater than 3. GDP and CPI exhibit left-tail (negative) and platykurtic distributions because 2.14 and 1.73, respectively, are less than 3. Looking at the Jarque-Bera test statistic and the probability of unemployment, unemployment follows a normal distribution, whereas GDP and CPI are not normally distributed.

Stationarity Tests

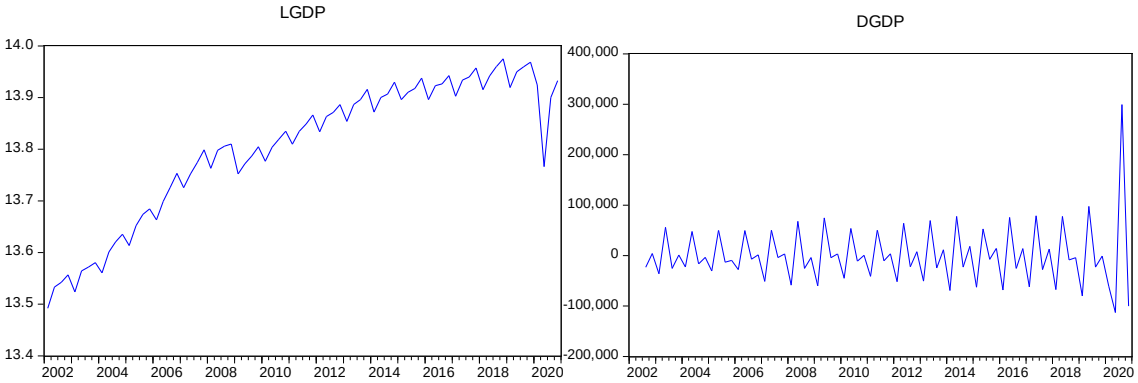
Unit Root Informal Method

Level 1 difference



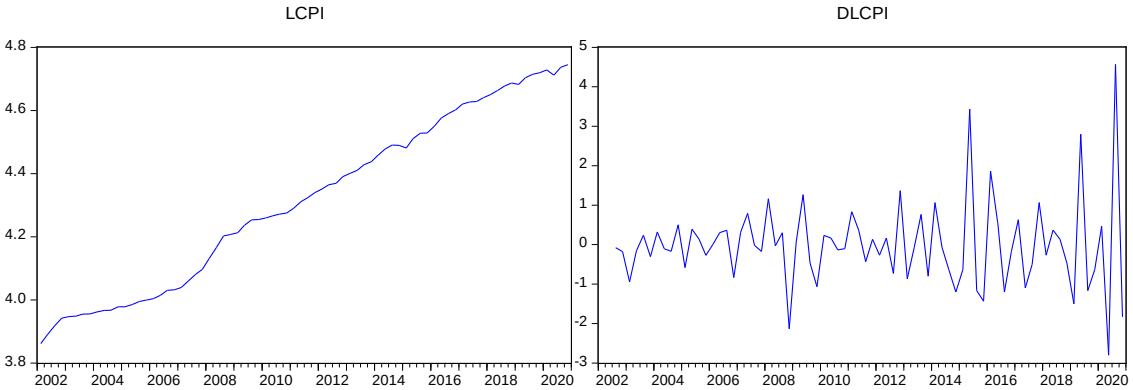
Graph 1. Unemployment rate

Levels First difference



Graph 2. Gross Domestic Product

Levels First difference



Graph 3. Consumer Price Index

The unit root formal method

Table 3. Unit Root Tests Results

Variable	**Model specification**	**ADF Level I(0)**	**ADF First difference I(1)**	**Integration order**
LGDP	None	-2.355287 (0.1581)	-11.65516*** (0.0001)	Stationary at I (1)
LUNMPL	None	-0.586523 (0.8664)	-6.594861*** (0.0000)	Stationary at I(1)
LCPI	None	-0.633503 (0.8560)	-11.05594*** (0.0001)	Stationary at I (1)

Note: figures in parentheses are probability values; *, **, and *** denote that p< 0.1, p<0.05 and p<0.01 respectively.

According to the results of the Augmented Dickey Fuller (ADF) unit root test, the variables LGDP, LCPI, and LUNMPL are all first-difference rather than being stationary at the level. Better stated, all series in this study are integrated in order one, or I (1). As a result, the system's maximum order of integration is 1.

Correlation matrix

Table 4. Correlation Matrix

	GDP	UNMPL	CPI
GDP	1	0.197689	0.895621
UNMPL	0.197689	1	0.491706
CPI	0.895621	0.491706	1

The correlation coefficients for each variable are shown in the above table. The results of the analysis indicate that although the variables are perfectly correlated individually, they are not correlated with one another. Nonetheless, the fact that the statistic is higher than 0.8 indicates a strong statistical correlation between GDP and CPI.

Table 5. Johansen Test for Co-integration Results

Hypothesized no. of CE(s)	Trace Statistic	5% critical values	P-values	Conclusion
None*	48.13771	29.79707	0.0002	Reject null hypothesis
At most 1*	15.83995	15.49471	0.0444	Reject null hypothesis
At most 2	1.074521	3.841466	0.2999	Accept the null hypothesis
Hypothesized no. of CE(s)	Max-Eigen Statistic	5% critical values	P-values	Conclusion
At most 1*	14.76524	14.26460	0.0416	Reject the null hypothesis
At most 2	1.074521	3.841466	0.2999	Accept the null hypothesis

Note: H0: No Co-integration; H1: Co-integration exists. * [**] (***) indicate rejection of the null hypothesis at 10%, 5%, and 1% level of significance. The Co-integration test statistic was computed using the Econometric E-Views Package.

Trace statistics indicates two cointegrating equations at a 0.05 significance level, which means that we reject the null hypothesis at None* and most 1*. Therefore, we accept the null hypothesis, which means that there is no cointegration at most 2 at a 0.05 significance level. The max eigenvalue statistic indicates two co-integrating equations at the 0.05 level, which means that we reject the null hypothesis at the 0.05 level of significance. Since both Trace and Max stats agree with each other, overall, we reject the null hypothesis and accept the alternative hypothesis, which means that there are co-integrating equations. This suggests that the variables have an equilibrium relationship over the long term.

Long-run relationships (Ordinary Least Squares Estimate)

After confirming co-integration between variables in Table 5, we proceeded to the next stage of analysis, which aims to ascertain the long-term relationships between unemployment and economic growth. The results of the Dynamic Ordinary Least Squares Estimates are illustrated in Table 6.

Table 6. Dynamic Least Squares Estimates

Variable	Coefficient	Standard Error	t-statistic	Prob
Constant	4.117005	1.357833	3.0302040	0.0034
LCPI	-0.151699	0.062009	2.446409	0.0169***
LGDP (-1)	-0.660966	0.002877	-5.850455	0.0000***
Diagnostics				
R-squared	0.936650			
Adjusted R-squared	0.933973			
F- statistic	349.9199			
Durbin-Watson stat	2.28923			

According to the study in the table above, a one-percent increase in the inflation rate reduces unemployment by 0.151699% while leaving other variables constant. Phillips (1958) stated that a high inflation rate is caused by increasing aggregate demand, which forces companies to boost production, resulting in additional employment opportunities. As a result, a similar pattern has been observed in South Africa, where the jobless rate declines as inflation rises. Therefore, the Phillips (1958) curve is likely to hold in South Africa over time. The calculated GDP coefficient is also consistent with economic theory, which states that in South Africa, a 1% rise in real GDP will result in a 1.656075 percentage drop in the unemployment rate, assuming all other parameters remain unchanged.

The R-squared value indicates how much the independent variables (economic growth and CPI) can influence the dependent variable (unemployment). 93.66% of the variation in unemployment can be explained by combining economic growth and CPI. We can say this model is a good fit because the R-squared value is greater than 60% and the F-statistic is sufficiently large at 349.919. This was verified by the Durbin–Watson statistic, which is 2.289; it is below the range of 1.5 to 2.5, which means that there is no autocorrelation in this model. The f-statistic's probability is 0.00000, which further proves that the results are not spurious. Furthermore, the Consumer Price Index coefficient is positive and statistically significant at the 1% level. This means that a 1% increase in CPI will lead to a 0.151699 increase in GDP, while the other factors remain constant. In addition, the unemployment coefficient is negative and is not statistically significant at the 1% level. That means that a 1% increase in the unemployment rate will lead to a 0.00344 decrease in GDP.

Error Correction Model

Table 7 shows the results of the error correction model; the complete results of the error correction model are shown in the appendix. GDP was lagged to avoid autocorrelation; it then became an independent variable (X). The error correction term is negative (-0.3997) and lies between 0 and 1. The fact that it is negative proves that there is a long-term relationship between GDP, CPI, and unemployment, which proves that if this model deviates from the long-term equilibrium state, it will return to that equilibrium state. If the model deviates from the long-run equilibrium, 39.9% of the data will be collected each quarter. It is also statistically significant because the probability is less than 0.05 (0.029). There is a negative short-run relationship between unemployment and CPI; a 1% increase in CPI will decrease unemployment by 0.003. Additionally, there is a negative short-term correlation between GDP and the unemployment rate; a 1% increase in economic growth will result in a 0.003261 drop in unemployment. Economic theory, which holds that economic growth and unemployment have a negative relationship, is consistent with the negative relationship between GDP and unemployment. Other studies also supported the negative correlation between unemployment and economic growth (Louail & Benarous, 2021; Chand et al., 2017; Misini & Pantina, 2017).

Table 7. Error correction

Variable	Coefficient	St. Error	t-statistic	Prob
C	-0.007343	0.005859	-1.253233	0.2144
D(LCPI)	-0.003261	0.127719	-0.025531	0.9797
D(LGDP(-1)	-0.000792	0.002779	-0.285053	0.7765
CointE(-1)	-0.399745	0.129487	-3.087154	0.0029
R-squared	0.292662			
Dw	2.104283			
f-statistic	7.137193			
Prob	0.000072			

There is also a positive short-run relationship between CPI and unemployment. Several diagnostic tests were performed, and the results are presented below. The results in Table 8 were obtained using Jarqua-Bera, and the outcome indicates that the data are not normally distributed; the probability is less than 0.05; therefore, we reject the null hypothesis, which states that the residuals are normally distributed. The complete results of the Jarqua-Bera test are presented in the appendix. The study further tested the serial correlation shown in Table 8. In this case, the probability of the F statistic is 0.412, which means that we accept the null hypothesis (H0) and conclude that the model is not serially correlated in the residuals.

Auto correlation is not desirable for the model; hence, to remove auto correlation, we re-estimate the model with white heteroscedasticity and consistent standard errors. Because the probability is greater than 5%, Table 8 demonstrates that the model is not heteroscedastic. Homoskedasticity is the desirable output of the model, which implies that the errors are distributed normally. The complete results of the heteroscedasticity test are presented in the appendix. The model was correctly specified; no variables were omitted. This is demonstrated by the proof of the probability of 0.8571, which is greater than 0.05, indicating that there is no evidence of misspecification.

Table 8. Summary of the Diagnostic Test Results

Test	H0	p-value	Conclusion
Breusch-Godfrey	No-Serial correlation	0.4162	We accept H0 because PV > 0.05. Hence, there is no serial correlation in the model.
Breusch Pagan Godfrey	No Heteroskedasticity	0.41	We accept H0 because the PV is >0.05. Hence, there is no heteroscedasticity in the model.
Jarqua-Bera	Residuals are normally distributed	0.000	We reject H0 since PV <0.05. Hence, residuals are not normally distributed.
Reset test	No misspecification.	0.8571	We accept H0 because PV > 0.05. Therefore, there is no misspecification.

The ADF tests appear to support the model used. For reference, further tables showing the complete results of the analysis can be found in the Appendix at the end of this paper.

CONCLUSIONS

This study explored the effect of economic growth on unemployment in South Africa. The DOLS model was used to examine the effect of economic growth on unemployment. This technique has been utilized in recent econometric time-series literature studies to study the long-run link between South Africa's unemployment rate and real GDP. The empirical research revealed that the long-run real GDP coefficient is -1.656 and the inflation rate is -0.937, with the predicted signs emphasized by the theories, and both are statistically significant at the 5% and 10% levels, respectively, more specifically, the real GDP and inflation rate. Meaning that the gross domestic product (GDP) and inflation rate are statistically significant in affecting unemployment in the long run, especially during the period in question.

This study's primary goal was to determine how economic growth affected South Africa's unemployment rate. To achieve this goal, a thorough literature review was conducted. The goals and objectives of this research were accomplished using a specified model. The results of the OLS estimates, which suggest a long-run relationship, indicate that economic growth has a negative effect on unemployment, whereas the control variable, CPI, also suggests a negative impact. The long-run estimates of economic growth and inflation elasticity were found to be significant and influence unemployment in Tanzania. These results are supported by economic theories, showing that the unemployment rate is negatively related to inflation and economic growth. This might be due to the strong industrialization policy undertaken in the country on sectoral reforms, infrastructure development, and revenue collection reforms, which are believed to create more employment opportunities in the long run.

This study rejects the null hypothesis, which states that there is no relationship between economic growth and unemployment, in favor of the alternative hypothesis, which concludes that there is a negative relationship and impact between economic growth and unemployment. This negative relationship between economic growth and unemployment has also been confirmed by other studies (Louail & Benarous, 2021; Chand et al., 2017; Banda et al., 2016). This result has significant policy implications, one of which is that policymakers should work together to increase productivity to lower unemployment and the cost of goods and services. This study also suggests that governments should produce more goods that require labor-intensive techniques rather than those that require capital. According to this study, the government must act quickly to stop the unanticipated increase in the unemployment rate because it severely impedes social advancement and wastes skilled labor, thereby slowing economic growth. Finally, to support domestic industries that will lower unemployment, boost output, and ultimately spur economic growth, the government should implement policies that drastically reduce imports and promote local production and consumption.

LIMITATION & FURTHER RESEARCH

This study, which focuses on the relationship between unemployment and economic growth in South Africa, has certain limitations. This indicates that the study is exclusive to the South African context and cannot be applied to other areas of the world. Within the context of this study, data are limited to 2002–2020; therefore, future research could use data from 2021 to investigate the impact of economic growth on unemployment.

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