

*Full Length Research Paper*

# The economic impact of unemployment and inflation on output growth in South Africa

Leward Jeke<sup>1\*</sup> and Lazarus Zungwe Wanjuu<sup>2</sup>

<sup>1</sup>Department of Economics, Faculty of Business and Economic Sciences, Nelson Mandela University, South Africa.

<sup>2</sup>Department of Social Sciences, College of Administrative and Social Science, Kaduna Polytechnic, Kaduna, Nigeria.

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**Unemployment is not only pertinacious to output growth, but it has other social costs. As economies seek to develop through elimination of inequalities, alleviating poverty and ensuring output growth, inflation and unemployment stand as scarecrows to investors. This research aims to evaluate the economic effects of unemployment and inflation on output growth in South Africa. An ARDL model was employed to estimate short-run and long-run impact of unemployment rates and inflation rate among controlled variables on real GDP in South Africa for the period of 1994-2019. The results show that inflation depresses real GDP; human capital and physical capital promotes real GDP. Based on the findings, unemployment can best be tackled through increase supply of and improvement in the quality of physical capital which increases labour productivity as well as investment in human capital. The results found that an increase in the real GDP will increase investment, which further generates employment.**

**Key words:** Unemployment, inflation, output growth.

## INTRODUCTION

When South Africa became liberated, it inherited an economy that had disadvantaged in many aspects. "South Africa has high level of manpower supply with shortage of critical manpower; low level of physical capital stock, which have resulted in the huge rate of unemployment" (Levinsohn, 2007, p. 1). Unemployment is a term used when "a person desires to work and is taking active steps to find employment but unfortunately is unable to find it" (Barker, 1999, p. 165). Unemployment has negative influence on economic welfare, production, human capital, social exclusion, crime, and social instability that is a matter of serious concern. The high level of unemployment constitutes one of the most

serious threats facing South African society and its governance (Kingdon and Knight, 2016).

South Africa has a serious problem of unemployment because many of her people who are unskilled and are not experienced to drive the economy forward. There is a gap between real wages and productivity which results in limitation of job creation in South Africa. The primary concern is to "reduce the skill shortage that contributes to the gap and therefore making skills development and education a priority" (RSA, National Treasury, 2011, p. 6). Resolving youth unemployment problem requires short and long-term policies, such as public work programs and development of higher critical manpower needs for the

\*Corresponding author. E-mail: lewardjeke@gmail.com.

economy through education system. If the problem of youth unemployment is not dealt with, it may lead to high social and economic costs to the country (Levinsohn, 2007, p. 22). The shortage of resources and the scarcity of critical skills will eventually cripple the South African economy. To solve the critical manpower resources in the short-run, South Africa has resorted to such practices like importing critical skilled manpower as means of corrective measures.

Research evidence has shown that several labour market barriers exist that prevent people from overcoming unemployment and earning a living, "most of which affect mainly the poor and arise from a pool of poverty leading to marginalization, inequality and further poverty" (Fourie, 2011, pp. 10-44). Most importantly, however, is the overall impact of the South African unemployment situation on the economy from a macroeconomic perspective. This is accentuated by the influence of labour market fluctuations on monetary policy, changes in gross domestic product (GDP) as accounted for by unemployment, as well as the relationship between unemployment and inflation in South Africa.

There appears to be a theoretical relationship between unemployment that is caused by critical manpower shortages and scarcity of productive inputs in the form of modern machineries, equipment and other critical inputs. The result is that, the domestic production falls short of required output which has to be met by imported goods and services. The tendency is for the country to demand for more imports than its exports. The consequence is building trade deficit which in the long-run requires devaluation of the 'Rand' with consequential devaluation of the local currency with its attendant inflation implications. To control inflation, South African government has put in place the Inflation Targeting (IT) framework of 3-6%. This further affects people who are employed as their real wages are eroded via inflation. The Phillips Curve was developed to explain the trade-off between unemployment and changes in wages (inflation).

There is scant literature on inflation, unemployment and output growth, which are the three tremendously vital macroeconomics variables in the South African economy. The success of the country's economy is hinged on these variables and they are indispensable fundamentals of the economic policies of a country. Therefore, this study tries to close the literature gap and provide policy recommendations for sustainable development of the South African economy.

Another reason for this particular study is that there are differences in the finding of extant studies of the impact of inflation and unemployment on economic performances in different countries. For instance, Tenzin (2019) has established that unemployment has no impact on output in Bhutan; Muryani and Pamungkas (2018) have demonstrated using ECM that unemployment has significantly contributed to output growth in Indonesia. While Makaringe and Khobai (2018) have shown using

ARDL regression that unemployment has a depressing effect on output in South Africa. In the same South Africa, Banda et al. (2016) have demonstrated that unemployment promotes output growth. In the case of inflation, however, there are more consistent findings that inflation depresses output. For instance, Tenzin (2019), Saidu and Muhammad (2018), Muryani and Pamungkas (2018), and Munyeka (2014), among others, have all established that inflation depresses growth in the studies across different economic settings. The differences in the findings on the impact of unemployment on output may be explained by the nature of data at different time periods. The different impact of unemployment may be caused by non-consideration of omitted variables or incomplete model. This study is designed to avoid the problem of omission of relevant variables by considering the major factors that affect output such as physical and human capital. Labour force has been dropped because of its high correlation with physical capital (a correlation of over 0.94). The reason for dropping labour force is to avoid multi-collinearity. The opinion of this study is that having included most of the variables that affect output, the finding of the impact of unemployment will likely reflect the true relationship in South Africa in the period under review. The paper has also carried out Karl Pearson's correlation test to establish the nature of the relationship among the variables to see how the variables are statistically related, to know the nature of their correlation, apart from the nature of impact one has over the other (their regression coefficients and their t-ratios). Moreover, the knowledge of correlation gives us information about the likely presence of multi-collinearity and how to avoid it. This has the potency of improving the quality regression outcomes. This has the potency of improving the quality regression outcomes. From the foregoing, this study has hypothesized that inflation, unemployment, human capital, and physical capital stock have not significantly influenced output in South Africa.

## LITERATURE REVIEW

In every economy around the world, labour is a driving force that induces consumer spending as well as output, more importantly for companies – ultimately contributing to the total output of a country. Similarly, unemployment represents unused potential that could have contributed to the economic output and thus affects the macro economy to a large extent (Simpson, 2013). Inflation erodes the buying power of the currency and must be harnessed for any economy to function well.

### Theoretical literature review

In pursuit of an investigation between the statistical relationship of unemployment and a country's output

growth, economist Arthur Melvin Okun developed research on the topic which tells us how much of the country's GDP is lost when its unemployment rate is above its natural rate, better known as Okun's law, which is discussed herein.

### ***Okun's law***

Quite simply, Okun's law states that a unit increase in cyclical unemployment is associated with two percentage points of negative growth in real GDP, depending on the country and period that is being considered (Fuhrmann, 2016). Since output of a country is dependent on the labour that it has used, it can be understood that a positive relationship exists between output and employment, which further explains the negative relationship between output and unemployment since the unemployed are not participants of the labour force (Snowdon and Vane, 2005). A positive relationship exists between output and employment because output depends on the amount of labour used in production. Inversely, a negative relationship exists between output and unemployment because unemployment is the labour force minus total employment. According to this principle, a one-percentage point decline in the rate of unemployment in one year produces 2% increase in real GDP growth rate per year. Therefore, if, for instance, the potential rate of GDP growth is 2% per annum, then Okun's law holds that real GDP should grow at approximately 4% a year in order to achieve a two-percentage point fall in the unemployment rate (Fuhrmann, 2016). In order to hold the unemployment rate steady, the growth in GDP rate must usually be twice the growth rate of employment potential. To reduce the unemployment rate, therefore, the economy must grow at a pace indicated above.

### ***Phillips' curve and the augmented Phillips' curve***

The effects of any monetary policy can be divided between output growth and prices. With the role of expectations, and price-stickiness, elected governments have an incentive to conduct its monetary policy with an inflationary bias. The Phillips' curve plots the relationship between the recorded level of unemployment and the rate of change in wages, where the rate of change of money wages is used as a proxy for inflation. As unemployment falls the rate of inflation increases. This means that there is no change in real values, as the rate of inflation adjusts to new pressure demands due to wage increases (Howells and Bain, 2008).

### ***Classical growth theory***

The classical growth theory asserts wages/inflation is

determined at the natural market wage level. Classical economists confess that the economy will decline with the increase in prices. Persistent increases in prices usually erode the value of a currency and lead to decline in growth of the economy. This leads to negative growth being experienced.

### ***Empirical literature***

Tenzin (2019) has investigated the impact of unemployment and inflation on economic growth in Bhutan using data from 1998 to 2016. The study uses autoregressive distributed lag (ARDL) model to estimate the parameters of the regression model. The results show that unemployment has no impact on economic growth in Bhutan, both in the short-run and the long-run. Inflation has impact on economic growth in the long-run. The reason given is that inflation causes uncertainty.

Saidu and Muhammad (2015) have studied the interaction between unemployment, inflation and economic growth in Nigeria. The paper uses Granger causality to investigate the line of causality. Before applying Granger causality, unit root analysis was applied to determine the time-series features of the data to ascertain if the variables applied are stationary. The results show that the data are trending. The results of Granger causality indicate that inflation affects economic growth, but growth does not cause inflation. There is no relationship between economic growth and unemployment.

Muryani and Pamungkas (2018) have explored the impact of unemployment, inflation, government expenditure, labour force and gross fixed capital formation on economic growth in Indonesia. The paper estimates the parameters of the population regression using error correction model (ECM). The results show that unemployment and gross fixed capital formation promote economic growth. Labour force and inflation depress economic growth. Government expenditure has no effect on economic growth.

Munyeka (2014) explored the relationship between inflation and economic growth in South Africa. The study applies quarterly data from 1993 to 2016. The study applies correlation and OLS regression methods. The results of both analytical methods show that there is a negative and a significant relationship between the two variables. Mohseni and Joazaryan (2016) have explored the impact of inflation and unemployment on economic growth in Iran. The paper uses the ARDL regression model to estimate the parameters of the population regression model, using time-series data from 1996 to 2012. The results show that both inflation and unemployment impact negatively on economic growth in the long-run.

Makaringe and Khobai (2018) have investigated the impact of unemployment and economic growth in South Africa, using quarterly data from 1994 to 2016. The study

**Table 1.** Description of variables.

Acronym of variable	Variable	Measurement of variable
INFL	Inflation rate	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified.
RGDP	Real GDP	Annual percentage growth rate of GDP at market prices based on constant US dollar.
UNEMPL	Unemployment rate	Unemployment rate refers to the percentage of the labour force that is without work but available for and seeking employment.
HUCAP	Human capital	This is defined as the mean value of secondary enrolment and life expectancy
KAPSTC	Capital stock	KAPSTC is estimated as the gross fixed capital formation of the country based on a constant US dollar

Source: Researchers' own computations (World Bank data, 2020).

applies ARDL regression model to estimate the coefficients of the regression. The results of the regression show unemployment depresses economic growth in South Africa. Temitope (2013) explores the relationship between employment and economic growth in South Africa. The study uses Toda-Yamamoto causality tests to estimate the relationship. The paper uses quarterly data from 2000Q1 to 2012Q3. The results show that employment does not cause economic growth, but GDP causes employment.

Banda et al. (2016) have explored the effect of log of output, real effective exchange rates, labour productivity, and budget deficit on unemployment in South Africa. The study uses error correction model (ECM) in estimating the parameters of the regression model. The results show that the log of GDP, labour productivity and budget deficit increase unemployment. Real effective exchange rate has no effect on unemployment. Osinubi (2005) has explored the interaction between economic growth, poverty, unemployment, inflation, money supply and saving rates in Nigeria. The paper uses OLS to estimate the relationship. The results show that unemployment significantly promotes growth and saving reduces growth. The results also show that growth has no impact on unemployment.

Mokgola (2015) investigates the effect of inflation on economic growth in South Africa. The paper uses error correction method to estimate the parameters of the population. The paper establishes that inflation has not impacted on economic growth in South Africa. Also, Madito and Khamalo (2014) explored the impact of unemployment and inflation on economic growth in South Africa. The paper uses quarterly data from 1967 to 2013. The study uses Johansen co-integration method to establish the existence of long-run relationship among the variables applied in the study. The paper applied error correction regression model to estimate the coefficients of the regression model. The results show that unemployment has no impact on economic growth in South Africa.

## METHODS

The most extensively famous single equation approach to co-integration is the Engle-Granger two-step procedure. This approach has some limitations. One, it does not indicate which of the variables is a dependent variable and which variable is an independent variable. This issue is important as the determination of the dependent variable can affect the significance of the results. Second, when there are more than two variables, the Engle – Granger model cannot handle this. A more versatile model must be applied because we do not have a unique co-integrating relationship. This second problem explains why this study applies autoregressive distributed lag (ARDL) model by Pesaran et al. (1999, 2001) in this study. The study uses the ARDL to carry-out the empirical study design. The ARDL model can be presented as follows:

$$Y_t = \sum_{j=1}^p \lambda_j Y_{t-j} + \sum_{j=1}^q \delta_j X_{t-j} + \varepsilon_t \quad (1)$$

Where,  $X_{t-j}$  are the  $K \times 1$  vector of explanatory variables; and the  $Y_{t-j}$  are the lagged dependent variable. The above ARDL model can be presented using vector equilibrium or error correction model (VECM) as follows:

$$\Delta Y_t = \theta_j (Y_{t-1} - \beta'_t X_{t-1}) + \sum_{j=1}^p \lambda_j Y_{t-j} + \sum_{j=1}^q \delta_j X_{t-j} + \varepsilon_t \quad (2)$$

In equation, the  $\beta'_t s$  are the estimated long run parameters and the  $\theta_j s$  are the equilibrium error corrections parameters. The ARDL model is also call pool mean group (PMG) and it uses generalized likelihood estimation technique and the lag length are determined by one of the information criterions like the Schwarz Bayesian information criterion.

The data that are used are obtained from the World Bank development indicators and these include 26 observations, starting from 1994 to 2019. The starting period is chosen to coincide with the post-apartheid regime and the ending period reflects the latest data that is available as at the time of the study. Eviews-10 is used in estimating the regression model. Table 1 shows the variables that are used in the study.

Hejase et al. (2012) contend that informed objective decisions are based on facts and numbers, real, realistic and timely information. Furthermore, according to Hejase and Hejase (2013), descriptive statistics deals with describing a collection of data by

**Table 2.** Descriptive statistics-result.

Description	lnRGDP	lnKAPSTC	UNEMP	INFL	HUCAP
Mean	26.52	24.77	27.90	5.83	98.80
Median	26.58	24.93	28.35	5.71	99.23
Std. Dev.	0.22	0.37	2.93	2.35	4.13
Skewness	-0.28	-0.32	-0.09	-0.50	0.13
Kurtosis	1.58	1.45	1.98	3.85	2.75
Jarque-Bera	2.52	3.06	1.15	1.85	0.13
Probability	0.28	0.23	0.56	0.40	0.94

Source: Researchers' own computations (World Bank data, 2020).

**Table 3.** Correlation matrix.

Variable	RGDP	KAPSTC	UNEMPL	INFL
KAPSTC	0.985**	-	-	-
UNEMP	-0.751**	-0.839**	-	-
INFL	-0.300	-0.229	0.039	-
HUCAP	0.804**	0.792**	-0.689**	-0.307

Correlation range between 0-0.19 is very weak; 0.2 -0.39, weak; 0.4-.59, moderate; 0.6-0.79, strong; and 0.8-1.0, is very strong. The guide is suggested by Evans (2002) and Hejase and Hejase (2013). Note: (\*) and (\*\*) indicate significance at 5 and 1% levels, respectively.

condensing the amounts of data into simple representative numerical quantities or plots that can provide a better understanding of the collected data (p. 272). Therefore, results of data analyzed are presented using descriptive statistics, Karl person correlation coefficients, unit root test, Johansen co-integration test and regression model using Pesaran et al. (1999, 2001) (Table 2).

The variables of real GDP (RGDP) and capital stock (KAPSTC) were measured using natural logarithms. While unemployment (UNEMP) and inflation rates (INF) are measured using percentages, human capital is measured using the mean of secondary schools' enrolment and life expectancy. The mean and median logarithm of RGDP and KAPSTC are about 26 and 25, respectively. The mean and median inflation rates, unemployment rates and human capital index are about 7, 28% and 99 units, respectively. The inflation rate of about 7% appears to be slightly above the targeted rate of 6% per annum. The unemployment rate of 28% is very high.

The spread around the mean appears to be low for all the variables as the standard deviation values are low. The low values of the skewness and Kurtosis tend to give evidence in favour of normally distributed variables. While the low values of Jarque Bera statistic and their associated probabilities tend to show that the distributions are not statistically significant.

### Correlation analysis

Table 3 shows the correlation matrix of the variables under study. The correlation matrix was evaluated based on Evans (2002) and Hejase and Hejase (2013) to determine the relationships between the variables.

To determine the relationship among the variables, correlation analysis is employed. Correlation is described as the strength of association between two variables.

Based on the correlation range suggested by Evans (2002) and Hejase and Hejase (2013), unemployment has a very strong

negative relationship with the RGDP, the dependent variable and KAPSTC. Inflation rates (INFL) are weakly correlated with the dependent variable (RGDP) and capital stock (KAPSTC) and unemployment rates (UNEMP). Human capital (HUCAP) is highly correlated with both the dependent variable and the independent variables, except inflation rates.

### Unit root test

It is important for variables to be stationary; this is to avoid problems associated with non-stationarity of a time series, such as spurious regression and persistent of shocks. The unit root tests used in the study is the Augmented Dickey-Fuller (ADF) and Phillips and Perron (PP) tests.

### Unit root results

The analysis of stationary test was carried out with intercepts only as shown in Table 4. Examining the ADF test results at levels, none of the variables are significant and the null hypothesis is rejected. At first difference three of variables which are INFL, UEMPL and HUCAP are significant at 5% level of significance and the null hypothesis of no unit root in the variable is not rejected. The null hypothesis of unit root in the data is rejected in the case of RGDP and KAPSTC. This null hypothesis is not rejected after the second differencing. Looking at the results for PP at levels, none of the variables are significant and the null hypothesis is rejected. At first difference, like in the case of ADF test, three variables of UNEMPL, INFL and HUCAP are significant at 5% level of significance, the null hypothesis that unit root exist in the variable is rejected. In the remaining two variables which are logarithms of RGDP and KAPSTC the null hypothesis cannot be rejected. After the second differencing the null hypothesis is rejected, and this study has

**Table 4.** Intercepts.

Variable	Level			First difference		
	ADF	5% Critical value	Prob.	PP	5% Critical Value	Prob.
lnRGDP	0.467	-3.603	0.99	0.091	-3.603	0.99
$\Delta \ln RGDP$	-3.107	-3.612	0.12	-3.081	-3.612	0.13
$\Delta^2 \ln RGDP$	-5.578	-3.622	0.00	-9.465	-3.622	0.00
lnKAPSTC	-1.309	-3.602	0.86	-0.993	-3.603	0.93
$\Delta \ln KAPSTC$	-3.104	-3.612	0.12	-3.105	-3.612	0.12
$\Delta^2 \ln KAPSTC$	-6.022	-3.622	0.00	-6.531	-3.522	0.00
UNEMP	-1.262	-2.986	0.63	-1.262	-2.986	0.63
$\Delta UNEMP$	-3.673	-2.992	0.01	-3.633	-2.992	0.01
INFLA	-1.377	-1.955	0.15	-1.312	-1.955	0.16
$\Delta INFLA$	-5.047	-2.958	0.00	-6.063	-1.955	0.00
HUCAP	-1.280	-3.004	0.61	-1.571	-3.012	0.47
$\Delta HUCAP$	-3.090	-3.012	0.04	-3.043	-3.3012	0.04

Source: Researchers' own computations. Note: (\*\*\*), (\*\*) and (\*) indicate significance at 1, 5 and 10% levels, respectively.

**Table 5.** Johansen co-integration test.

Maximum Eigenvalue Statistics (ME Stat.)				Trace statistics (T Stat.)			
$H_0$	$H_1$	ME Stat.	5% critical value	$H_0$	$H_1$	T Stat.	5% critical value
$\Gamma = 0$	$\Gamma = 1$	251.42	88.80	$\Gamma = 0$	$\Gamma \geq 1$	121.87	38.33
$\Gamma \leq 1$	$\Gamma = 2$	129.55	63.88	$\Gamma \leq 1$	$\Gamma \geq 2$	55.49	32.12
$\Gamma \leq 2$	$\Gamma = 3$	74.06	42.92	$\Gamma \leq 2$	$\Gamma \geq 3$	36.66	25.82
$\Gamma \leq 3$	$\Gamma = 4$	37.40	25.87	$\Gamma \leq 3$	$\Gamma \geq 4$	25.04	19.39
$\Gamma \leq 4$	$\Gamma = 5$	12.37	12.52	$\Gamma \leq 4$	$\Gamma \geq 5$	12.37	12.52

Source: Researchers' own computations.

concluded the logarithms RGDP and KAPSTC are stationary after the second differencing. Having established that all the variables are trending at a level, this study has tested the existence of co-integration using Johansen co-integrating method.

Table 5 shows that the maximum eigenvalue statistics (ME Stat.) test of co-integration rejects the null hypotheses ( $H_0$ ) of no co-integration from having zero co-integration ( $\Gamma = 0$ ) to having less than or equal to 3 co-integrating relationships ( $\Gamma \leq 3$ ). The null hypotheses of having less than or equal to 4 co-integrating equations ( $\Gamma \leq 3$ ) could not be rejected. The rationale for rejecting the null hypotheses up to  $\Gamma \leq 3$  is that the computed maximum eigenvalue statistics are greater than their 5% critical values; while the reason for accepting the null hypothesis that  $\Gamma \leq 4$  is that the computed 5% critical value is lesser than their 5% critical value. This means that there are one, two, three and four co-integrating equation relationships in the model. Based on the trace statistics, Table 5 also shows that the null hypotheses of having zero co-integrating relationship ( $\Gamma = 0$ ) to having less than 3 co-integrating relationships ( $\Gamma \leq 3$ ) could not be accepted. This implies that the alternative trace hypothesis ( $H_1$ ) that there is 1 co-integrating relation to greater than or equal to 4 co-integrating relationships could not be rejected. Thus, under both methods, there is evidence of having up to four co-integrating relationships among the

variables applied in this study. The reason is that the computed trace statistics are greater than their 5% critical values. Thus, this study applies autoregressive distributed lagged (ARDL) or pooled mean group (PMG) model developed by Pesaran et al. (1999) to estimate both the short-run and the long-run relationship among the variables in Table 6.

### ARDL model results

#### Diagnostic tests

Table 6 shows that the estimated VAR model has a good fit of over 90%. Overall, its explanatory power is high. The high F- statistic with low probability value shows that the overall model is significant. The low values of Ljung-Box (1979) Q-statistics and its high probability values of more than 5% indicate the absence of autoregressive conditional heteroskedasticity (ARCH) in the residuals of the estimated ARDL regression. The Breusch and Godfrey (B-G) Lagrange multiplier (LM) test for serial correlation based on F-statistic test along with its associated probability value could not reject the null hypothesis of no serial correlation in the residuals. The reason for accepting the null hypothesis is predicated on low F-statistic and its associated high probability

**Table 6.** ARDL Regression model (lnRGDP is the dependent variable).

Variable	Long-run relationship			Short-run relationship		
	Coef.	t-Stat.	Prob.	Coef.	t-Stat.	Prob.
ECM	-	-	-	-0.328	-6.780	0.000
Constant	4.600	1.071	0.30	-	-	-
lnRGDP	-0.328	-1.548	0.14	-	-	-
lnKAPSTC	0.154	2.362	0.03	0.471	2.714	0.01
UNEMP	0.003	1.601	0.13	0.009	1.130	0.27
INFLA	-0.004	-2.753	0.01	-0.011	-1.23	0.23
HUCAP	0.002	2.342	0.03	0.007	1.350	0.19
Adjusted R <sup>2</sup>					0.99	
F – Statistics/probability					1591/0.00	
ARCH test: Q - stat. lags 1 to 5					0.939-9.037	
ARCH test Q-stat. prob. Lags 1 to 5					0.33 to 0.11	
B-G Serial Cor. LM test – F- Stat/Prob.					2.218/0.13	
B-P-G Heteroske. Test: F-Stat./Prob.					0.556/0.78	
Residual normality test: Jarque. Bera/ Prob.					1.601/0.45	
Residual Normality test: Skewnes/Kurtosis					-0.608/3.24	
2 highest variance decomposition proportion of the first column					0.512 and 0.146	

Source: Researchers' own computations.

values which are consistent with the null hypothesis. Similarly, the estimated F-statistic of Breusch-Pagan-Godfrey (B-P-G) test along with its associated probability values have confirmed that the null hypothesis that the variances of the ARDL regression model are homoscedastic. The reason for accepting the null hypothesis is that the computed F-statistic value is low giving credence to the null hypothesis. In the same way, the computed probability value is high. Again, this supports the null hypothesis of homoskedasticity of residuals. The estimated correlations of the explanatory variables are not too high as evidenced by the highest two variance decomposition of the first column which are 0.512 and 0.146. Obviously, this is an indication of lack of severe multicollinearity. Thus, these evidences have shown that the estimated ARDL model has not suffered from serial correlation, heteroskedasticity and multicollinearity. It is important to carry out the stability of the estimated coefficients, using cumulative sum (COSUM) of recursive residuals as recommended by Brown et al. (1975) as seen in Figure 1.

Figure 1 shows that the estimated parameters are stable as they have not gone outside the critical lines. Thus, the estimated regression coefficients are stable. Based on all these diagnostic tests, this study uses the estimated ARDL regression model results as demonstrated below as the research findings of this study.

## FINDINGS AND DISCUSSION

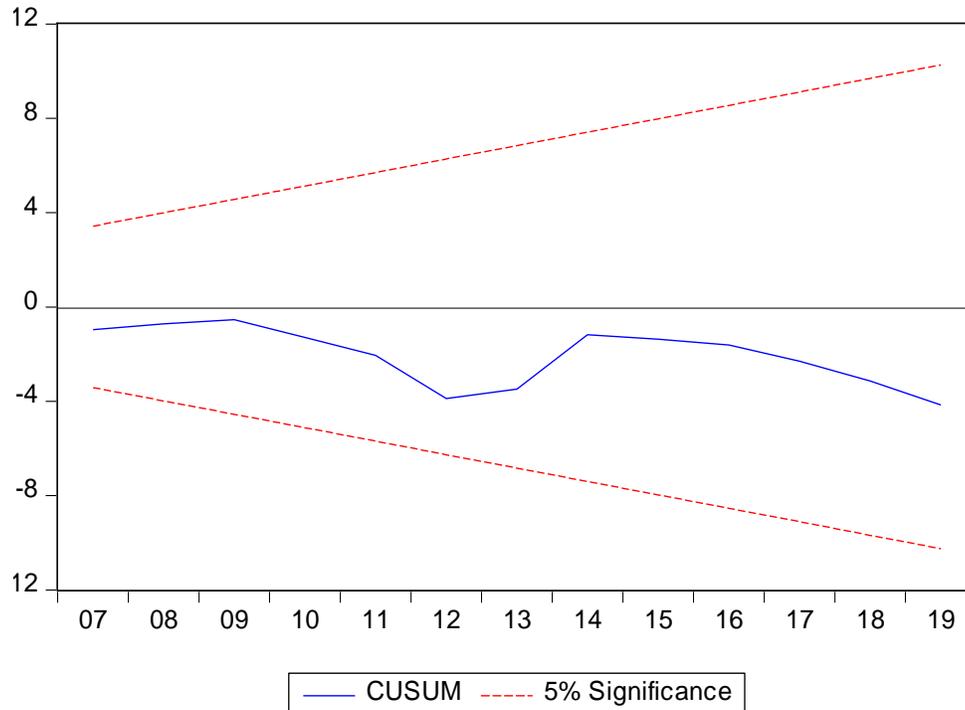
Table 6 results have shown that the logarithm of capital stock and investment in human capital (HUCAP) have significantly stimulating impact on the logarithm of output in South Africa in the long-run. The result shows that a 1% increase in capital stock is liable to increase the real gross domestic by 0.154% in the long-run, holding all other factors constant. A unit increase in human capital investment is susceptible to increase real GDP by 0.003% in the long-run, assuming all other factors are held

constant. Inflation rate, however, has a depressing impact on real GDP in South Africa in the long-run. A 1% increase in inflation is liable to reduce real GDP by 0.004% in the long-run, holding other factors constant. The results have also shown that unemployment (UNEMPL) has no any significant impact on the logarithm of real GDP in the long-run. The reason is that their probability values are greater than 0.05.

The short-run results have shown that if the log real GDP deviates from its long-run; it recovers over 32% in one year. It is likely that it would take about three years for the economy to recover from shock in the system. The results of short-run regression coefficients have also shown that only the logarithm of capital stock (lnKAPSTC) has impact on the logarithm of real GDP (lnRGDP).

This study has investigated the impact of unemployment and inflation on economic performances in South Africa while using the logarithm of capital stock and human capital as control variables. The essence of the study is to find out if after controlling for the above variables, inflation rates and unemployment rates would still impact on logarithm of real GDP in South Africa as shown in extant studies in this area. For instance, Tenzin (2019), Saidu and Muhammad (2018), Muryani and Pamungkas (2018), and Munyeka (2014), to name but a few extant literatures, have found that inflation depressed real GDP. Muryani and Pamungkas (2018) have established that unemployment stimulates real GDP. Makaringe and Khobai (2018) and Mohseni and Jouzaryan (2016) have shown that unemployment depresses real GDP.

This study has established that inflation does significantly depress economic performances in South



**Figure 1.** Estimated coefficients using cumulative sum (COSUM) of recursive residuals.

Africa. This finding has agreed with extant findings in this area such as the finding of Munyeka (2014) in his study of the impact of inflation on economic growth in South Africa, Tenzin (2019) study of the impact of inflation in Bhutan using ARDL, Muryani and Pamungkas (2018) from their study of Indonesia using ECM, among other studies. However, Aubrey has established that inflation has no impact on economic growth in South Africa. The reason inflation negatively impact growth in most studies is that inflation causes uncertainty and reduces investment, employment and consequently output (Tenzin, 2019).

This study has also established that unemployment has not significantly impacted real GDP in South Africa. This finding disagrees with the finding of Maringe and Khobai (2018) who use ARDL regression model to demonstrate that unemployment has reduced economic performance in South Africa. The finding of this study has also contradicted the findings of Babda et al. (2016) who established that unemployment promotes economic growth in South Africa; Saidu and Muhammad (2018) who have also established that unemployment promoted economic performance in Nigeria. The findings of this study are consistent with the finding of Temitope (2013) from his study of South Africa that unemployment has no impact on economic growth; Tenzin (2019) who has studied the impact of unemployment in Bhutan and find no impact of unemployment on real GDP; Saidu and Muhammad (2015) who have also established from their

study that unemployment has no significant impact on economic growth in Nigeria. The possible reasons for unemployment not affecting growth might be attributed to, the use of log of real GDP, the nature of regression model applied and controlling for the possible impact of human capital and physical capital. It is important to note that two of the extant literatures cited above, Temitope (2013) and Saidu and Muhammad (2018) both used causality models, while Tenzin (2019) applies ARDL model with log of real GDP. There is no definitive conclusion predicated on reasons presented above. More investigations need to be done.

The study has established that investment in physical capital and human capital has significantly promoted economic performances in South Africa. The possible reasons are investment in human capital improves productivity of the labour forces and hence increases output; investment in physical capital increases the amount of capital per unit of labour and this has the potency of increasing productivity per worker. The overall effect is the increase in output and therefore economic performance.

The results of the short-run ARDL regression has shown that if output deviates from their long-run pattern, it will take, on average, three years for the economy to return to its long-run path. This is indicated by the ECM value of -0.328, meaning that the output recovers about 33% per year. This figure fall within the ECM estimated by Banda et al. (2016) for South Africa, which fall within

the range of 0.34 to -0.617. It is lower than the estimated recovery of -0.43 from the estimated recovery rate of Iran as reported by Hohseni and Jouzaryan (2016) which is -0.432. The differences from the recovery rate may be explained differences from time period, the type of economy and possibly the variables applied in the regression.

## Conclusion

The study presented the descriptive statistics and correlation matrix with the aim of describing the properties of the data. The correlation matrix coefficients showed that unemployment and inflation rates are negatively correlated with real GDP. While the unemployment is significantly correlated, the inflation rates are insignificantly correlated. The ARDL approach to co-integration was used to estimate the short-run and long-run relationships between the variables. The Johansen co-integration test showed the long-run relationship between GDP and the independent variables. The results are in line with *a priori* expectation as an increase in GDP leads to creation of jobs which lowers unemployment. The ARDL regression analysis in this study has demonstrated that both physical and human investments have significantly promoted the log of real GDP in South Africa. Inflation rates have depressing impact on the log of real GDP. Empirical studies are consistent with the results of this study.

The unemployment problem has no direct effect on the real GDP in South Africa. To tame the problem of unemployment in South Africa requires controlling variables that have direct impact on the real GDP. In this study, two of such variables have been identified that stimulate the real GDP which are investment in physical and human capital. Investment in human capital can enable South Africa to overcome the problem of shortage of critical skills alluded to in the literature review as the major cause of unemployment in South Africa. Availability of physical capital is liable to increase productivity of the workforce and is susceptible to increase not only labour productivity but increase employment which might likely reduce unemployment.

The paper has established that inflation rates have depressing impact on the log real GDP in South Africa. The possible reason advanced for this finding is that inflation creates uncertainty, and this reduces economic growth. The implication is that reducing inflation in South Africa can help engender economic growth and reduce unemployment. The reasoning here is that there may be no direct effect of unemployment on real GDP but there is an indirect impact. Any factor that affects GDP is liable to reduce unemployment. Therefore, monetary policies that reduce inflation are liable to affecting real GDP and hence reduce the unemployment rates.

This research is essential for policy making for South Africa. For instance, the Sustainable Development Goal

number 8 (SDG8) is designed “to promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all”. The results of this paper have shown that to achieve this objective, it is necessary to increase investment into both physical and human capital and to reduce inflationary tendency in the South African economy.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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