Testing The Validity of Okuns` Law If It Holds In The COMESA Region (1984-2019)

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Abstract: *Okun`s Law explains an indirect relationship between unemployment rate and GDP growth rate. This research therefore, investigates the relationship between Unemployment rate and real GDP per capita in a panel of 11 COMESA countries. A complete econometrics procedure was conducted on the variables; Real GDP per capita, Unemployment rate, Money supply, Consumption Expenditure and population. A Granger Causality test was used to confirm the influence of Okun`s law in COMESA. The findings show that Unemployment rate has a negative but insignificant effect on real GDP per capita in the short run and a positive significant effect in the long run. Okun`s law therefore does not hold in COMESA. The recommendations given are to restructure the Agricultural sector to facilitate enormous volumes of output exports, restrictions on outflow of raw material essential to Gross capital formation in the form of an export quota and loosen of labour Protection laws to reduce size of service sector, promote formation of firms and markets relevant to the processing of finished goods and enhance the responsiveness of unemployment rate to economic growth respectively.*

Key words: *GDP per capita, unemployment, Okun's Law, COMESA and granger causality*

I. INTRODUCTION

According to Keynes` economic theory of employment, interest rates and money, economic growth is induced by demand pull factors and that the agents in the economy are self-seeking in nature in their pursuit of their interest Keynes (1936). Over the past few years sub Saharan African regions have witnessed steady per capita growth after recovering from a sharp regional decline that lasted for 2 years from 2007 – 2009, emanating from the ripples of the 2008 global crisis (World Bank, 2019). Unemployment is a sensitive macroeconomic phenomena especially during a recession. Employment rate reflects the confidence economic agents (individuals, households, firms, the government and external world) have in the economy of a region or country.

As economic agents gain confidence in the economy`s growth, this is reflected through the hiring of labour for productive use thereby reflecting a higher GDP output. Thus an increasing unemployment rate can tarnish confidence in expenditure on labour as well as the use and purchase of goods and services especially in developing countries such as those in COMESA. This goes on to decrease profits, rents and other factor payments. As spending and profits decline companies cut spending by reducing their cost of productions firing staff becomes their first strategic decision. This goes on to increase unemployment and diminish confidence in the economy. It is a domino effect and if not controlled and regulated it sparks a recession similar to that of the 1930 great depression.

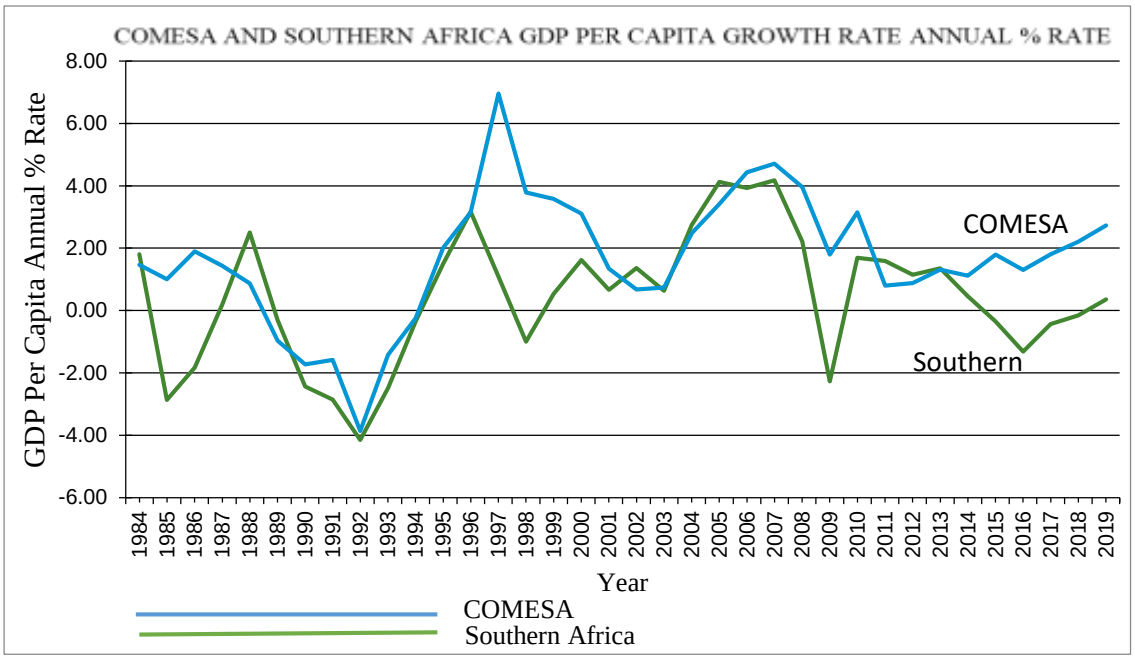
As such, once people lose their jobs the loss in income for occupants in Least Developed Countries (LDC) that do not receive unemployment benefits, it decreases their consumption spending. Consumption as a component of GDP (economic measure). The decrease in consumption also leads to a decrease in GDP due to decreased consumption demand caused by absence of disposable income which can be spent on consumption. Economic theory of this magnitude has been experience before during the great depression of 1930.

As seen in **Error! Reference source not found.**.1, economic growth in the Southern region of Africa has experienced a gradual yet significant decrease[1]. The sectors contributing to Southern Africa regional GDP as of 2016 are; the agriculture sector contributing 28.7%, Industrial sector contributing 11.9 % and the service sector contributing 59.4% SADC (2020).

Per Capita GDP is known to be the measurement of a country or region`s output taking into account the number of occupants it has at the particular time Blanchard (2013). Reference is made to figure 1.1. As the data shows, the growth rate fluctuates sporadically between 2011 and 2015 but normalizes from 2016 to 2019. In COMESA the service industry continues to grow it currently contributes 53% of COMESA`s GDP while the industrial sector contributes 7% and the agricultural sector contributes 40% approximately Council (2016). COMSTAT provides a summarized visualization that captures the state of affairs of the aggregate growth rate in COMESA region.

[1] Southern Africa development indicators, Economic growth, 2020 January 11th.

As it can be seen in the figure below, COMESA real per capita GDP growth rate and current GDP ($ US) stand at higher projections than that of Southern Africa. This growth comes after a rehabilitation from a growth and GDP decline that purged both regions from 2013 to 2016 due to adjustments in global market prices in the produce from the mining sector World Bank (2019).



Source: AFDB Socio Economic Database 2018 indicators

As stated previously, GDP in terms of jobs and income is made up of the industrial sector, agricultural sector and service sector. Each sector has different labour absorption rates (the rate at which jobseekers are hired). In developing countries, the agriculture and industrial sector have the height labour absorption rate while the service sector has the lowest. This means that the capacity of the service industry to create jobs is low and according to statistics it is the fasters growing sector. Pulling jobs away from agricultural and industrial sector thereby increasing unemployment.

GDP represents the capacity of the economy that capacity is able to grow or diminish based on the variations of income contributions of productive capable persons in agriculture, mining, services industry and manufacturing industry. Each of the above mentioned sectors grow as unemployment in respective sectors decreases thereby leading to consequential economic growth.

Owing to the ramifications of unemployment and the magnitude of its effects on the standard of living, many researchers have undertaken the investigation on the relationship between unemployment and economic growth. The economic term for this phenomena has been coined as Okun`s Law. It postulates that if unemployment rate falls, GDP growth rate raises and if unemployment rate increases consequentially GDP growth rate declines Kenton (2018). Several studies have confirmed their aforementioned result and these studies include a study conducted in Pakistan which was conducted by Qazi (2011) and another conducted in Scotland by Leat (2012).

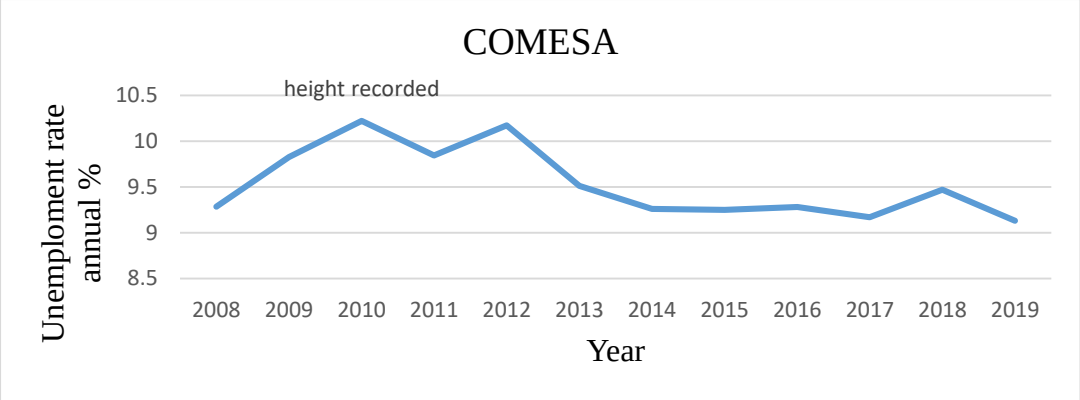
Statement of the problem

Figure 1.1 shows a snap shot of COMESA unemployment rate from 2008 to 2019. This period is of great significance because it is the period after the 2008 global economic crisis caused by the housing market. The dimensions of unemployment as a problem in COMESA is illustrated statistically in Figure 1.1. Currently unemployment is showing a downwards trend as of 2019 stands at 9.13% approximately.[2]

Yet this value is still significantly higher than the recorded global unemployment rate of 6.67% and the sub-Saharan region which stands at 6.113% World Bank (2019). In spite of the regional per capita growth rate that has been observed as illustrated in figure 1 the general oscillation continues to pivot around 6.96 to -2.10 while global growth has fluctuated between 3.1 and 1.8, a more stable predictable rate World Bank (2019).

Figure 1.1 COMESA Unemployment Rate estimates 2008 – 2019

[2] COMSTAT, Unemployment Trends, 2020 January 27th updates.



Source AFDB Socio Economic Database 1960 – 2019

Many researchers undertake this empirical analysis as to investigate why is fluctuating or high unemployment rate a problem. This paragraph dissects the theoretical extraction to the imposed question. Employment is a component of production in the form of labour. This relationship is depicted in the Cobb Douglas production function $Q = AK^aL^b$ Solow (1956).

Fluctuating and high unemployment rate on a regional scene such as COMESA causes inefficiencies in the industrial, agricultural and service sectors. Prolonged inefficiencies in these sectors as historical data has shown paves way for recession and increased poverty in spite of rapid economic growth rate. That is why this study is so ostentatious. Many research works have been carried out on individual countries and advanced economies for the impact of unemployment on GDP such as OECD, G20, G15, and G7.

Research objectives

1. To analyse the impact of Unemployment on GDP in the short run.
2. To investigate the impact of Unemployment on GDP in the long run.

II. LITERATURE REVIEW

Theoretical literature review

Okun's law

Arthur Okun stated that full employment is an act of a policy goal and which ought to be coupled to a corresponding target of aggregate demand and production (Okun, 1962). Okun's law endeavors to explain the variations that exit between annual unemployment and annual GDP in order to attain the highest possible output. This output is the highest level of GDP output at the maximum employment and Okun`s Law is the degree of measure of this output coupled with the available human capable in the region of study. He postulated that GDP needs to rises by 3% in order to lower unemployment but this percentage rate is not constant as it is dependent on the country`s employment power and permeability of their employment market. Okun further says that a 1% decrease in unemployment will on average lead to a 3% increase in GNP. There are 2 widely used approaches which are employed to the development of Okun's constant elasticity and they are;

Output gap technique

$$\boldsymbol{Xt - Xt* = b\,(Zt - Zt*)}$$

Where; Xt is normal unemployment, Xt* is possible unemployment, b is Okun's constant, Zt is actual production and Zt* is the possible production

First difference approach

$$\boldsymbol{\Delta X = \alpha - b\,(\Delta Z/Z)}$$

Estimation of b will give the Okun's coefficient which illuminates the relationship between the rate of unemployment and GDP. It is determined to be negative.

Classical unemployment

It postulates that unemployment is a short run occurrence which will later be adjusted by free market forces and return unemployment to its natural state in the medium run. Keynesians undoubtedly do not agree with this line of thinking, they harmonize that unemployment persists due to demand deficiencies in the market for labour and that the government must play a leading role in the stabilization of unemployment through central banks by the use of fiscal policy.

Marxist theory of unemployment

It postulates that unemployment is an after effect of the capitalist system and the increase in unemployment is directly proportionate to the increased use in capital for labour saving purpose leading to the obsoleting of labour skills like 20 diggers replaced by compound harvesters Kakari, et al.(2019).

Keynesian theory

Their view is that unemployment continues to persists due to demand deficiencies in the market for labour over specific periods of time and that the government must play a leading role in the stabilization of unemployment through central banks by the use of fiscal policy. It is seen by Keynesians that a change in GDP will reciprocate an inverse change in unemployment. The rate of unemployment of a country is measured as a percentage of the total number of unemployed divided by total labour force in that year. Keynesians categories unemployment in various forms based on their ignition key elements these are voluntary and involuntary, frictional and cyclical phenomena, seasonal and technological, structural and hidden Soylu, et al (2017).

Empirical literature review

Meidani (2011), Conducted a research of the validity of Okun's law in Iran using the Auto regression disturbance lag. The findings of the research showed that unemployment rate exhibited a significant and negative effect on GDP.

Umair (2013) tested Okun`s law in Pakistan using the t test and ANOVA model. The results showed that unemployment had a negative yet insignificant effect on GDP at 10% level of significance. But another study done by Javeid (2005) when the difference version of Okun`s law was used with the Engle Granger Cointegration Technique (EGCT) and the Error Correction Model (ECM) performed with time series data in Stata package software, findings showed that Unemployment and GDP exhibited a significant negative relationship in the long run.

Alamaro (2014) By using the ARDL and Error Correction Model (ECM) on a research in Algeria which implemented Okun`s gap model coupled with the Hodrick Prescott filter reviewed that Unemployment had a weak but significant effect on GDP in both the short run and long run.

Christopoulos (2004) Analyses Okun's law in Greece at regional level from 1971 to 1993 using time series data and the ARDL model, the results indicated that there is a long run relationship in 6 out of 13 regions.

However Moosa (2008) after conducting a panel data analysis on Algeria, Tunisia, Egypt and Morocco on data for the period 1970 to 2005 using the Augmented Dickey Fuller model (ADF). The findings showed that Unemployment in this region had no effect on GDP. Based on available literature we know that Unemployment rate has statistical impact on output in some regions and does not in other regions. This is dependent on the estimation technique and methodology used.

The gap this research tries to fill is to undertake a study that others have not on whether the inability to acquire jobs under COMESA hampers the regions` potential output and to determine why unemployment and GDP do not at certain points in times behave in a nature indicated by economic theory. Take for instance theory states that as GDP raises Unemployment should fall and as unemployment rate raises GDP should fall and yet after a much closer look at data provided in figure 1.1, in 2010 both GDP and Unemployment were quite high in comparison to sub-Saharan. Unemployment stood at 10.2% and GDP at 3.65%. The other points in time showing peculiarities are 2014 and 2018. In 2014 there was a decline in regional output (GDP) to a low rate of 1.12% and a decrease in regional Unemployment of 9.26% recorded in 2014, while 2018 experienced a significant increase in GDP and Unemployment simultaneously. These three economic phenomena in the COMSEA region are unaccounted for and unexplained. This research seeks to utilize quantitative tools to breach this information gap and provide useful policy recommendations to limit, contain and resolve such abnormalities in both the short run and long run in the COMESA region.

III. METHODOLOGY

Research Design

It deduces a quantitative analysis as it tries to determine the impact of unemployment on GDP in COMESA regions. Panel data will be used in the study because the observations of the dependent variable (Real GDP "economic growth") and independent variables (X's- Unemployment rate), data from sources such as Central Statistical Offices, AFDB social Economic Database, COMSTAT, SADC, IMF and World Bank.

Theoretical Framework

Okun (1962). Took in to consideration 2 classical models:

The first difference model

Equation one

$$y_t - y_{t-1} = \alpha + \beta\left(u_t - u_{t-1}\right) + \varepsilon_t$$

Where; У is Logarithm of real output, U is logarithm of unemployment rate, α is the intercept, B is Okun's coefficient and expected to be less than zero, ε is the error term

The gap model

Equation 2

$$y_t - y_{t-1} = \alpha + \beta\left(u_t - u_{t-1}\right) + \varepsilon_t$$

Where; $Y_t - Y_{t-1}$ is output gap and $U_t - U_{t-1}$ is unemployment gap

Panel form representation of Okun's Law

$$ln\left(\frac{y_{it}}{y_{it}^*}\right) = \beta_i ln\left(\frac{u_{it}}{u_{it}^*}\right) + \varepsilon_{it}\ i = 1,2,\ldots\ldots,N;\ t = 1,2$$

Where the value of Y_{it} and U_{it} must be available. This difficult is what lead Prachowny to formulate the fourth and final equation.

Prachowny alternative model relating to Okun's law

$$lny_{it} = \alpha_i + \gamma_i t + \beta_i lnu_{it} + \varepsilon_{it}$$

t is the time which explains long run economic growth.
Yit is real GDP
Uit is unemployment rate

Model Specification

A log Model is used in the estimation of the impact of Unemployment rate on real GDP per capita based on findings by Okun (1962) and concepual framework guided by Wooldridge (2013). A regression model produces unit changes in the dependent variables and independent variables, where a single unit change in the independent variable coincides with a constant change in the dependent. Taking the log of one or more variables will effectively change the case from a unit change to a percentage which is exactly what we are testing for in Okun`s relation of output and Unemployment rate. This is especially important when dealing with large datasets (Wooldridge, 2013). Log models are also convenient in transforming a highly skewed variable into a more normalized dataset as will be shown in chapter 4 under the Multivariate normality test. Log models are wel known to have the ability to produce small errors without the risk of overfitting the regression model.[3]

The Model used in this research adopts the Prachowny alternative model relating to Okun's law and is presented as:

$$Log\ realGDPpercapita_{it} = \beta 0 + \beta 1 Unemploymentrate_{it} + \beta 2 LogMoneysupply_{it} + \beta 3 Log\ ConsumptionExpenditure_{it} + \beta 4 Log\ Population_{it} + \varepsilon_{it}\quad i = 1\ldots N;\ t = 1\ldots T$$

Okun (1962) predicts and postulates that $\beta_1<0$ in both the short run and long run. Blanchard (2013) predicts and postulates that $\beta_2>0$ in the short run and long run but $\beta_2=0$ in the medium run[4] , Ahuja (2017)

[3] Overfitting occurs when there are too many variables in play that it does not have enough generalization of the dataset to make a valid prediction (Andy, 2019)

[4] Neutrality of Money (Blanchard & Johnson, 2013)

predicts and postulates $\beta_3>0$ in both short run and long run while Malthus (1798) predicts and postulates that $\beta_4<0$ in both short run and long run.

Measurement of variables

To investigate the impact of Unemployment rate on real GDP per capita, a panel dataset of annual observations is utilized. A Panel of 11 of the 19 COMESA countries namely Burundi, Congo DR, Egypt, Kenya, Madagascar, Malawi, Mauritius, Uganda, Rwanda, Zambia and Zimbabwe with data captured over a period of 36 years from 1984 to 2019 has been employed. Unfortunately Comoros, Djibouti, Sudan, Ethiopia, Eritrea, Swaziland, Libya and Seychelles where not included in this study reason for which are further specified under limitations of the study. The choice of the countries and the period was because no such study has been undertaken in this region and the time period is when nations in that region begun to gain both political and economic free will. The data used in this study for both unemployment and real GDP was collected from World Bank Development Indicators as of 2018 and 2019 update.

Real GDP per capita is an inflation adjusted measure of the economy that depicts the value of all goods and services produced in an economy in a given year taking each person into account. It makes use of base year prices Blanchard (2013). It measures the actual increase in goods and services and excludes the impact of ever rising prices. Real GDP per capita will be measured in billions of current US dollars.

Unemployment rate is measured by taking the numerical count of unemployed persons divided by the total population in active participation of the labour for (the employment and unemployed) and then converted to a percentage as a unit of measurement.

Money Supply is measured as M2. M2 is the calculation of money composed of M1 + saving deposits + time deposits + mutual funds + money market securities. The reason for the inclusion of money supply in the form of M2 is because Money Supply has many different effects on the economy and related economic variables.

Money supply is in itself a control variable used by Central Banks in the form of Monetary policy. One such control measure Money supply possess is its ability to affect prices. As Money supply changes the relative prices of goods and services change. These changes in prices affect the Consumer Price Index (CPI). As workers form expectations of higher prices of commodities, they demand higher wages. These higher wages are passed on to consumers in the form of even higher prices which lead firms to demand less labour from the labour market (fewer to no people getting hired). This changes the pattern of employment and higher prices, both of which affect output (GDP).

However, the higher wage means an increase in supply of labour by the labour market as the higher wage is above the reservation wage, this entices more people to work. As such this is why Money supply is included in the model to avoid endogeneity and problems of misspecification on the estimators in the OLS model.

Consumption expenditure is the spending of goods and services by households and firms. Authors like Arnold (2008) have proven the existence of a strong relationship betweeen consumption expoenditure and developed countries. Keynes (1936) in the 20th century cited that t constitutes a large portion for GDP and is a significant economic driver in both developed and developing countries . It is measured in billions of US dollar.

Population is measured mathematically using the prinicple of Numeric number developed by Aryabhata and Brahmagupta in the 5th and 6th century . In the dataset used it is qauntified in millions using the de facto Population definition.

Estimation techniques

The estimation techniques implemented in this study uses a seven-step procedure. In step 1, the stationarity of the variables Real GDP per capita, unemployment rate, Money Supply, Consumption Expenditure and Population is examined. Step 2 conducts a Hausman test to determine the use of fixed effects verses random effects model. Step 3 involves the use of the Ramsey REST test to check for misspecification. Step 4 consists of performing serial correlation tests to determine the presence of first order Autocorrelation. Step involves the use of Westerlund and Pedroni tests to determine the cointegration of variables in panel cointegration. Step 5 involves the Granger Causality test using the Dumitrescu-Hurlin test.

In step 6 the Breusch-Pagan / Cook-Weisberg test is used to determine the presence of for heteroscedasticity. Step 6 constitutes of the Multivariate normality test using the Doornik-Hansen Test. Step 7 checks for Multicollinearity using the *pwcorr* and *vif* command in stata15. Then final cross sectional dependency is determined using the Breusch-Pagan LM test of independence.

Unit root test

The panel unit root test we used in this study is the first generation panel unit root test as shown below as the ADF fisher:

$$p_\lambda = -2\sum_{i=1}^{N} \log_e \pi_i$$

This test is done by combining the P values of the test statistic unit root in each cross section unit. It is asymptotically χ^2 possessing 2N degree of freedom. This test has the capabilities to overcome unbalanced panels.

Panel Cointegration test

To determine the long run relationship between the variables this research made use of Pedroni (1999), Kao (1999) and Johannsen Fisher cointegration method is prudent. For the existence and direction of the causal relationship between the variables Dumitrescu-Hurlin test is used because cointegration tests do not make this information available. Dumitrescu-Hurlin test, commonly referred to as the DH test confirms the directional effect of Okun`s law in COMESA.

Fixed, Random and Pooled models

These three different models are used to estimate OLS coefficients.

Pooled OLS

The pooled model specifies constant coefficients, the usual assumptions for cross-sectional analysis. It is still the most restrictive panel data model thus is rarely used in practical literature.

$$y_{it} = \alpha + \mathbf{x}_{it}^{'}\beta + u_{it}$$

Fixed Effect Model

The FE model allows the individual-specific effects α_i to be correlated with the regressors, x. α_i is included as the intercept. Each individual has a different intercept term and the same slope parameters.

$$y_{it} = \alpha_i + \mathbf{x}_{it}^{'}\beta + u_{it}$$

Recovering the individual specific effects after estimation is done through the following equation:

$$\hat{\alpha}_i = \bar{y}_i - \bar{\mathbf{x}}_i^{'}\hat{\beta}$$

The individual-specific effects are the leftover variation in the dependent
Variable that cannot be explained by the regressors.

Random Effects Model

The RE model assumes that the individual-specific effects α_i are distributed independently of the regressors. α_i is include in the error term.
Each individual has the same slope parameters and a composite error term

$$\alpha_i + e_{it}.$$

$$y_{it} = \mathbf{x}_{it}^{'}\beta + (\alpha_i + e_{it})$$

Hausman Test

Hausman test helps the research determine which model to use between Fixed and Random Effects. It does so by checking if there is a correlation between the unique errors and the regressors in the model.

Heteroscedasticity

Heteroscedasticity is problematic in that it increases the variance of β distributions meaning OLS will underestimate the standard errors and overstate the results of t-statistics of the estimated coefficients thereby inferring a false level of significance on insignificant estimates of coefficients.

Misspecification test

According to Wooldridge (2013) a multiple regression model suffers from functional form misspecification when it does not properly account for the relationship between the dependent and the observed explanatory variables. This will lead to biased estimators

Multicollinearity

Multicollinearity is a phenomena when correlation is present among independent variables. Multicollinearity is a problem because independent variables are supposed to be independent but when Multicollinearity is present once the model is fitted the interpretation is bias.

Data sources

Panel data from 1984 to 2019 was used. This period was chosen decisively due to data availability and it is the period at which majority of the countries in the region started to gain more authority in political will and economic freedom. The data used was sourced from Central Statistical Office (CSO), Central Intelligence Agency (CIA), World Bank, and International Labour Organization (ILO).

IV. PRESENTATION AND DISCUSSION OF RESULTS

Summary of the variables

Table 4.1 below shows a summary of the variables with their general statistics.

Table 4.1 summary of the variables

Variable		Obs	Mean	Std Dev
logGDPpercapita	Y	396	6.655767	0.9068268
Unemployment rate	X_1	396	5.318015	4.180369
Logmoneysupplym2	X_2	396	3.231512	0.7228281
Logconsumption expenditure	X_3	396	22.61744	1.136194
Logpopulation	X_4	396	16.2229	1.087256

Statistics obtained from Stata 15 simulations

The mean is the measure of central tendency equal to the sum of all the values in the data set divided by the number of values in the data set. The standard deviation is used to tell how spread out the data is from the mean. A low standard deviation implies that most of the numbers are close to the average as can been seen in the variable Y, X_2, X_3 and X_4 whilst a high standard deviation means that the numbers are more spread out as observable in X_1.

Panel Unit Root Tests

Most macroeconomic variables are non-stationary (Davidson, et al., 2010), this research makes use of panel unit root tests to ascertain whether variables are stationary or not. A trend is suspected in the data set, prompting the inclusion of a time trend in the test. As per LLC test, the AR parameter was assumed to be common in the panel. The cross section effect was removed via demeaning so as to mitigate cross sectional dependence complications. The lags was chosen via the Akaike Information Criteria. Table 4.2 shows the results of the LLC unit root test with time trend at level, first and second difference.

Table 4.2: UnitPanel Root Tests

Variable	P Value at level	P Value at 1st difference	P Value at 2nd difference
LogGDPpercapita	0.9948	0.9917	0.0000
Unemployment rate	0.0000		
Logmoneysupplym2	0.0016		
Logconsumption expenditure	0.0389		
Logpopulation	0.0000		

Statistics obtained from Stata 15 simulations

The summary devised from stata15 output above show varying results of stationarity and non-stationarity. LogGDPpercapita, Unemployment rate, Logmoneysupplym2, and Logpopulation are found to be stationary intergrated of order 0,1 (0). Logconsumption expenditure on the other hand fail to reject the null hypothesis proving that it is non-stationary hence moving forward to the LLC panel test after 1st difference. After the 1st difference test LogGDP per capita is found not to be statiionary or intergrated of order 1, I (1). At second difference test LogGDP per capita is found to be stationary and intergrated of order 2.

Table 4.5: Various Econometrics Tests

Hausman test	Ramsey RESET test	Autocorrelation test	Westerlund test
Prob>chi2 = 0.000	Prob > F = 0.0000	Prob > F = 0.0461	P-value =0.0181

Results obtained from Stata15

The results of the Hausman test will indicate which model among Pooled OLS, Fixed Effects and Random Effects Model will be used. The Prob>chi2 = 0.0000 implies that the null hypothesis is rejected since it is significant, implying that the fixed effect model is the best fit. One advantage of using the fixed effect in our model is that it removes the effect of time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable. According to Wooldridge (2013) a multiple regression model suffers from functional form misspecification when it does not properly account for the relationship between the dependent and the observed explanatory variables. This will lead to biased estimators

At 5% level of significance we reject H_0 meaning the OLS model suffers from misspecification and yet this is to be expected in our analysis because the focus was placed on examining the relation of Unemployment on GDP in the short run and long run as such certain variables necessary to the analysis of real GDP per capita have not been included.

Other variables such as inflation, Government expenditure, Domestic Investments and level of Education were purposefully omitted from the regression due to unavailability of data and inconsistency in data entry as well as poor data collection techniques on the said variables by 73 % of countries in COMESA. Lastly, the null hypothesis of no serial correlation is rejected as the Prob > F = 0.0461<0.05 The errors in one time period therefore, do affect the errors in the other time periods in the panel data set for this research.

In accordance with the objectives of this research, establishing the long run relationship between real GDP per capita and Unemployment rate, Money supply, Consumption Expenditure & Population. The Westerlund error correction panel based cointegration test was employed in this manner. The table 4.8 shows the results of the test after running in Stata.

The p-value of 0.0181<0.05 means that the null hypothesis of no cointegration is strongly rejected. There is therefore, strong cointegration between real GDP and Unemployment rate, Money supply, Consumption Expenditure & Population. Evidence of long run relationship is present. However the P Value is not so higher in other tests such as the Pedroni test and Kao test because they take into account for heteroscedasticity and autocorrelation both of which are present.

Granger Causality Test Results

The test for granger causality was conducted using the Dumitrescu-Hurlin test, commonly referred to as the DH test in order to confirm the direct effect of Okun`s law in COMESA and the direction it follows. The following were the results.

Table 4.9: Dumitrescu-Hurlin test

Regressand	W-bar	Z-bar	Z-bar tilde	Decision
Unemployment rate	1.8343	1.9567 p-value =(0.0504)	1.6041 p-value =(0.1087)	No Causality
Log real GDP per capita	2.3748	3.2242 p-value =(0.0013)	2.7334 p-value =(0.0063)	Unemployment rate ⟹ Log real GDP per capita

Results obtained from Stata15

As it can be seen from the table 4.9 above, the results when Unemployment rate is taken as the regressand had the null hypothesis that real GDP per capita does not granger cause Unemployment rate. Since the p-values are insignificant, the hypothesis cannot be rejected. Simply put, it means that real GDP per capita does not granger cause Unemployment rate. Taking real GDP per capita as the regressand or dependent variable had the null hypothesis that Unemployment rate does not granger cause real GDP per capita. Since both the Z-bar and Z-bar tilde had significant values, this hypothesis was rejected. This therefore means that causality runs from Unemployment rate to real GDP for at least one of the panels.

Table 4.10: Diagnostic Tests

Cook-Weisberg test	Breusch-pagan LM test of independency
Prob > chi2 = 0.0073	Pr = 1.9322

Results obtained from Stata15

From the results depicted in Table 4.10 we reject the null hypothesis and conclude that heteroscedasticity is present in our panel data. The Breusch-pagan LM test of independency is used to check if there is presence of cross sectional dependency. Because the data is panel in nature, a cross sectional dependence test was conducted using the Breusch-Pagan statistic for cross-sectional independence in the residuals of a fixed effect regression model. The null hypothesis for this test is that of cross-sectional

independence, meaning that the residuals across entities are not correlated. After running the simulations in Stata, results indicated that the Breusch-Pagan LM test of independence: Probability = 1.9322.Since the Pr>0.05, we fail to reject the null hypothesis of cross sectional dependence at 5%. This means that the residuals across our panel data are not correlated.

Multivariate normality test

In essence, it is a means of testing if a vector in multiple normally distributed variables in which any linear combination of the variable is normally distributed.

Table 4.11: Doornik-Hansen Test

Variable	P Value	Decision
Log GDP per capita	0.0000	Not normally distributed
Unemployment rate	0.0000	Not normally distributed
Log Money supply	0.2056	Normally distributed
Log Consumption Expenditure	0.0013	Not normally distributed
Log Population	0.0080	Not normally distributed

Results obtained from Stata15

At 5% level of significance we reject H_0 for Log GDP per capita, Unemployment rate, Log Consumption Expenditure and Log Population, therefore conclude that the respective variables are not normally distributed. At 5% level of significance we fail reject H_0 and hence fore surmise that Log Money supply is normally distributed.

Multicollinearity

Multicollinearity is a phenomena when correlation is present among independent variables. Multicollinearity is a problem because independent variables are supposed to be independent but when Multicollinearity is present once the model is fitted the interpretation is bias. Multicollinearity arises if the correlation coefficients between two or more variables is in excess of 0.8. In referral to table 4.12 below, Stata has shown that no variable has a value in excess of 0.8 implying that there is no correlation.

Table 4.12: Multicollinearity

	Log GDP per capita	Unemployment rate	Log Money Supply	Log Consumption expenditure	Log Population
Log GDP per capita	1.0000				
Unemployment rate	0.5767	1.0000			
Log Money Supply	0.7617	0.3982	1.0000		
Log Consumption expenditure	0.4091	0.3541	0.2859	1.0000	
Log Population	0.1424	0.0010	0.1579	0.5414	1.0000

Estimation

This step involves the estimation of coefficients with the dependent variable being Log of GDP Per capita while the independent variables are Unemployment rate, Log of Money supply, Log of consumption expenditure, Log of population. Table 4.14 shows the results of the fixed effect estimation, the results are

biased due to the presence of heteroscedasticity and autocorrelation (ar1) with the panel in different time periods.

Table 4.14: GLS and OLS Estimate Results

	OLS Fixed Effect Estimates	GLS Estimates Short Run	GLS Estimates Long Run
Regression	Coefficient	Coefficient	Coefficient
Unemployment rate	-0.0198903 (0.022)	-0.0034936 (0.219)	0.0402861 (0.000)
Log Money Supply	0.275044 (0.000)	-0.0068014 (0.632)	0.3674917 (0.000)
Log Consumption Expenditure	0.1724169 (0.000)	0.0282555 (0.007)	0.2691292 (0.000)
Log Population	-0.2363209 (0.013)	-0.7772191 (0.006)	-0.2423264 (0.000)

Results obtained from Stata15

The Generalized Least Square method (GLS) is used as the alternative to Ordinary Least Squares (OLS) as it resolves the problem of heteroscedasticity, non-normal variables, autocorrelation and outliners present in the OLS model. With the GLS estimator there is better control for common ´trends´ such as the Great Recession in 2008, the Golden Age in the 70s and 80s, the Oil crises from 1973 and 1979 and also the bursting of the Dotcom bubble in 2000 as elaborated by Martin et al (2015). Furthermore, the GLS method is consistent and asymptotically more efficient than our previous OLS estimation in table 4.14 even if heteroscedasticity does not cause bias or inconsistency when using OLS, the usual standard errors and t statistics are no longer valid even after running robust standard errors control for heteroscedasticity. Another reason is that GLS gives more economically sensible estimates because it is similar to first differencing, GLS has the advantage of approximately eliminating unit roots (Wooldridge, 2013) considering that Log GDP per capita showed the presence of unit roots at level and first difference.

The results of Generalized Least Square Estimates in the short run show the coefficient -0.0034936 of Unemployment rate is negative as expected but is statistically insignificant, this means that a 1% increase in Unemployment rate results in a 0.34936% decrease in real per capita GDP while holding all other factors constant but P= (0.219)>0.05, meaning Unemployment rate insignificantly affects real per capita GDP in the COMESA region at 5% level of significance in the short run. These results are consistent with Umair (2013) in Pakistan when Okun`s law was tested using t test and ANOVA model. The results showed that unemployment had a negative yet insignificant effect on GDP at 10% level of significance.

The coefficient -0.0068014 of Money supply is negative but is statistically insignificant, this means that a 1% increase in Money supply results in a 0.68014% decrease in real per capita GDP while holding all other factors constant but P value= (0.632)>0.05, meaning Money supply insignificantly affects real per capita GDP in the COMESA region at 5% level of significance in the short run. The coefficient 0.0282555 of Consumption Expenditure is positive and statistically significant, this means that a 1% increase in Consumption Expenditure results in a 2.82555% increase in real per capita GDP while holding all other factors constant with P value= (0.007) <0.05, meaning Money supply significantly affects real per capita GDP in the COMESA region at 5% level of significance in the short run.

The coefficient -0.7772191 of Population is negative as expected and is statistically significant, this means that a 1% increase in Population results in a 77.72191% decrease in real per capita GDP while holding all other factors constant with P value= (0.006) < 0.05, meaning Population significantly affects real per capita GDP in the COMESA region at 5% level of significance in the short run.

Furthermore, the results of Generalized Least Square Estimates in the Long run show that the coefficient 0.0402861 of Unemployment rate is positive and is statistically significant, this means that a 1% increase in Unemployment rate results in a 4.02861% increase in real per capita GDP while holding all other factors constant with P value = (0.00) <0.05, meaning Unemployment rate significantly affects real per capita GDP in the COMESA region at 5% level of significance in the Long run.

The coefficient 0.3674917 of money supply is positive and statistically significant, this means that a 1% increase in Money supply results in a 36.74917% increase in real per capita GDP while holding all other factors constant but P value= (0.00) <0.05, meaning Money supply significantly affects real per capita GDP in the COMESA region at 5% level of significance in the Long run. The coefficient 0.2691292 of Consumption Expenditure is positive and statistically significant, this means that a 1% increase in Consumption Expenditure results in a 26.91292% increase in real per capita GDP while holding all other

factors constant with P value= (0.000) <0.05, meaning Money supply significantly affects real per capita GDP in the COMESA region at 5% level of significance in the long run.

The coefficient -0.2423264 of Population is negative as expected and is statistically significant, this means that a 1% increase in Population results in a 24.23264% decrease in real per capita GDP while holding all other factors constant with P value= (0.000) < 0.05, meaning Population significantly affects real per capita GDP in the COMESA region at 5% level of significance in the long run.

V. CONCLUSION AND RECOMMENDATIONS

Conclusion

This study examines the impact of unemployment rate on real GDP per capita in COMESA using panel data covering a period from 1984-2019. The control variables used alongside Unemployment rate are Money supply, Consumption Expenditure and Population.

The Levin, Lin and Chu (LLC) is used to test for stationarity to avoid issues of spurious regression. The variable real GDP per capita is found to be stationary at second difference. Unemployment rate, Money supply, Consumption Expenditure and Population are found to be stationary at level. After performing the Hausman test, the fixed effect model is preferred over Random effects model. Due to the presence of heteroscedasticity and misspecification the results of the fixed effect estimation were biased thus favouring the use of the Generalized Least Square model.

The results of GLS estimation in the short run show that sign for Unemployment rate is negative as expected but insignificant while positive in the long run and statistically significant. Meaning that Okun's law doesn't not hold in COMESA neither in the short run nor long run. In the short run, the results of GLS estimation show that sign for Money supply is negative but insignificant while positive and significant in the Long run. Meaning an increase in Money supply not does affect real GDP per capita in the short run but does affect real GDP per capita in the long run in COMESA.

Limitations

The first significant limitation of the study of the Impact of Unemployment on real GDP per capita was the omission of other significant variables that affect real GD per capita such as Gross fixed capital formation, Foreign Direct Investments inflows, Domestic credit to private sector, Openness and inflation rate. This was shown evidently in the misspecification test the major reason these variables were not included was due to the inability of certain member countries of COMESA to account for them. The second limitation of the study was poor estimation techniques in certain countries showed signs of biased values. The limitation of the study was the omission of 8 COMESA countries from the study due to poor and inconsistent data records. As well as high levels of political instability in the case of Libya and South Sudan as well as frequent civil unrests succumbing in Ethiopia.

Recommendations

COMESA operates in an open economy structure this is proportionately different from the European Union`s Economic structure in the form of Non-Tariff Trade Barriers such as health regulations and import quotas (Salvator, 2013). This open economic structure gives rise to foreign investments but the lack of production efficiency and skilled labour facilitates an excuse for the out flow of capital and inflow of qualified labour this hampers the ability of increased output to have any significant effect on Unemployment in the short run and vice versa.

The best approach COMESA can take is to limit the outflow of raw material and other sources of capital and focus on government expenditure that channels funds into the establishment of refined markets and firms whose goal is to create finished goods tradable with other nations and regions in order to enhance service sector which is better suited to absorb stagnant labour (ILO, 2019).

Restructuring of Agricultural sector to facilitate large quantities of agriculture output exports so as to reduce the percentage of subsistent farming and increase the percentage of commercial farming and thereby increase the low run demand for local production of capital good therefore facilitating employment in the long run.

COMESA members should consider loosening Labour protection laws to induce the incentive of firms to higher more labour in the presence of economic booms. In most Low income countries, output is determined by external factors and labour markets are restricted by internal factors such as; minimum wage laws, strong trade unions floor prices and price ceilings and yet in these economies the exchange rate is allowed to float, commodity prices are allowed to float but labour markets are restricted. They should also be allowed to float. This will increase the responsiveness of economic output to Unemployment and vice versa.

Future areas of study

When a new method of measuring Labour informality and the shadow economy is devised it will abide in an accurate estimate of Real GDP per capita. Inclusion of level of education, Openness and a balance

dataset of Foreign Direct Investment will help future researchers in adding more policy recommendations in COMESA.

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