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Macroeconomic Determinants of Unemployment In the East African Community

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Abstract

Due to the increasing concern regarding the unemployment problem in the East African Community (EAC), this study examines the macroeconomic determinants of unemployment using panel data approaches. The study used annual data for the period 1996 to 2017, which was obtained from the International Labour Organization (ILO) and the World Bank database of the World Development Indicators of 2018. The study estimated the random effects and fixed effects models. Importantly, instrumental variable-fixed effects regression was estimated to control for the potential endogeneity in the regression. The study findings indicate that unemployment in the EAC is likely to decrease with sustained economic growth and increased supply and access to private sector credit while, on the other hand, increased trade openness and gross national expenditure are likely to exacerbate the unemployment problem. Therefore, the study recommends measures to increase economic growth (such as promoting high productivity industries with high employment intensity), enhance competitiveness and reasonable protection of infant firms (e.g., through subsidized credit), and enhance supply and access to credit by the private sector (such as risk insurance and reduction of interest rates).

Keywords: unemployment, panel data, East African Community.

JEL Code: E24, J01 J2.

1. Motivation.

Unemployment[1] is one of the major problems facing underdeveloped as well as developing nations of the world. Global unemployment was estimated at 188m as of 2019, and it is projected to increase by 2.5m annually owing to labour force growth (ILO, 2020). The global unemployment rate also slightly increased from 5.0 percent in 2018 to 5.4 percent in 2019 (with a high incidence of females at 5.6 percent and the youths[2] at 13.6 percent), implying that the world economy is not generating enough jobs to absorb new labour market entrants (ibid.). Notably, the unemployment rate in Sub-Saharan Africa (SSA) is even higher than the global average; and it is estimated at 5.9 percent with over 25.8m unemployed individuals in 2019 (ibid.). It is estimated that globally about 734m new jobs are needed between 2010 and 2030 to accommodate the current labour force patterns, account for likely fluctuations in the labour force participation rates and attain target

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[1]According to ILO, the unemployed comprise all persons of working age who are: (a) without work, i.e., are not in paid employment or self-employment; (b) currently available for work, i.e., are available for paid employment or self-employment; and (c) seeking employment.

[2]According to the ILO, the youth comprise of all persons of age 15-24 years.

unemployment rates at or below 4 percent and 8 percent for adults and youths, respectively (Bloom & McKenna, 2015). Of the total new jobs created, 91 percent will be required in low and lower-middle-income countries, which are still grappling with a problem of indecent employment (Bloom & McKenna, 2015).

The East African Community (EAC) is a regional intergovernmental organisation of six partner states, comprising Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda that was established in 1999. In the EAC, unemployment varies across countries; with Rwanda having the highest rate at 15.2 percent, followed by Kenya with 11.5 percent, Uganda with 10 percent, Tanzania with 2.3 percent, and Burundi with 1.5 percent as of 2018 (ILO, 2019). Although the numbers do not seem alarming, they are projected to increase owing to increasing population and job seeker-oriented education systems (ADB, 2018). More so, youth unemployment, and the quality and quantity of employment remain issues of great concern in the region. For instance, youth unemployment was estimated at an average of 13.5 percent in 2017 (AUC/OECD, 2018), with countries such as Rwanda having as high as 20.6 percent, and Uganda 15.3 percent. Youth unemployment is expected to continue rising as many young graduates from higher institutions of learning continue to join the labour market whose capacity to absorb the labour force is already constrained.

The inability of job seekers to secure gainful employment has a number of adverse implications (both social and economic) for the economy. From the social perspective, unemployment creates disaffection among people and causes some of them, especially the youth, to resort to social vices such as robbery, prostitution, and political unrest (Baah-Boateng, 2014; Sabir & Naz, 2015). In addition, unemployment creates a loss of income and exacerbates poverty, which increases social problems such as family instability (Alrabba, 2017). Economically, unemployment hinders economic growth. As put forward by Baah-Boateng (2014), an increase in the number of unemployed people hinders resource utilization; and consequently, the total productivity of a country falls below its potential. Given the problems associated with unemployment, it is paramount to reduce it. However, to achieve this, it is necessary to understand the determinants of unemployment in the EAC region.

To understand the unemployment problem, economics identifies several strands of theories, which include: the aggregate demand (Keynesian theory); demand and supply for labour (classical theory), output growth (Okun's law (Okun, 1962)), and inflation (Phillips curve (Phillips, 1958)). However, the unemployment debate is inconclusive as empirical results are not only mixed but some are contrary to other theories (see, e.g., Akeju & Olanipekun (2014) who invalidate Okun's law in Nigeria). Thus, given the numerous unemployment theories that have yielded mixed and inconclusive empirical results elsewhere, it is worthwhile to contribute to this debate by investigating empirically the macroeconomic determinants of unemployment in the EAC countries of Burundi, Kenya, Rwanda, Tanzania, and Uganda.[3]

[3]South Sudan joined the EAC in April 2016, and since the study period is from 1996 to 2017, South Sudan is excluded in the analysis due to data gaps.

Available empirical studies on the EAC are largely country-specific and micro in nature (Kipesha & Msigwa, 2013; Kaminchia, 2014; Myovella, 2018); and focus on specific groups such as the youth (Semboja, 2007; Kipesha & Msigwa, 2013), and gender (Vuluku et al, 2013). To the best of our knowledge, no study has so far considered the EAC as a whole. Furthermore, studies conducted in other world regions/countries that have explored the determinants of unemployment have mixed findings. Their findings vary depending on the level of development of the region/country, the scope of the study, and the methodology applied. Thus, the current study contributes to the debate by examining macroeconomic determinants of unemployment in the EAC.

As mentioned above, the general objective of this study is to examine macroeconomic determinants of unemployment in the EAC. The key research question addressed here is: "What drives unemployment at a macroeconomic level in the EAC?" Therefore, in this regard the paper: (i) examines the macroeconomic determinants of the overall unemployment rate in the East African Community; (ii) examines the unemployment determinants from a regional perspective, using the most recent data set; and (iii) accounts for the possible endogeneity between employment and economic growth using instrumental variable techniques, which previous studies have largely overlooked.

2. Theoretical Literature Review

Several theories explain unemployment. These include the classical theory of unemployment, the Keynesian theory of unemployment, the Phillips curve hypothesis, and the Okun's law. According to the classical theory, unemployment is explained by labour demand and labour supply. It argues that labour demand is derived demand (depends on the demand for products produced by labour) that decreases as wage rate increases. On the other hand, labour supply is a function of labour force, which increases as real wage rises. The classical theory is anchored on assumptions of a free market and perfect competition. Consequently, the intersection of labour demand and labour supply produces an equilibrium level of wages and employment. Therefore, according to classical economists, unemployment arises when there are distortions in the free labour market resulting in excess labour supply. However, the theory assumes that real wages adjust quickly to restore equilibrium in the labour market. Consequently, involuntary unemployment is a temporary phenomenon, though frictional and structural unemployment may still exist.

The Keynesian theory asserts that unemployment is determined by aggregate demand for goods and services produced by firms. The key argument is that high aggregate demand enables firms to expand and thus employ more workers (Raifu, 2017). The theory implies that unemployment arises due to a deficiency in aggregate demand. Unlike classical economists, Keynesian economists assert that the economy is characterized by involuntary unemployment. However, this has been faulted for being unable to explain labour market failure given that the involuntarily unemployed people are willing to work at less than the market wage rate (Yellen, 1984). In response

to this weakness, Yellen (1984) discussed the efficiency wage hypothesis, which explains why firms are not willing to cut wages and employ more workers. The hypothesis identifies four benefits of higher wage payments: reduced shirking by employees due to a higher cost of job loss; lower turnover; an improvement in the average quality of job applicants; and improved morale (Yellen, 1984).

Regarding the linkage between unemployment and certain macroeconomic variables, the Phillips curve (Phillips, 1958) and Okun's law (Okun, 1962) provide the basic theoretical connections. Phillips (1958) reported evidence of an inverse relationship between the growth rate of wages and the unemployment rate in Britain. He found out that between 1861 and 1957, nominal wages rose more rapidly with the tightening of the labour market and the fall in the unemployment rate. This relationship was widely accepted as the inflation-unemployment trade-off since price increases were highly correlated with wage increases. This implied that policymakers could guarantee a lower unemployment rate at the cost of a higher inflation rate. Theoretically, it has been argued that an unemployment-inflation trade-off depends on excess demand because unemployment rate tends to fall when aggregate demand exceeds economic capacity. In addition, when demand exceeds supply, wages and prices tend to increase: thus, rising prices tend to be correlated with falling unemployment.

Similarly, Okun's (1962) work, which formed the theoretical basis for the demand side explanation to unemployment, studied the adjustment of real gross national product in response to unemployment variations. His findings showed that real gross national product variations and unemployment changes have an inverse relationship, and that any percentage change in unemployment exceeding four percent was associated with an approximately three percent fall in real GDP. Alternatively, Okun hypothesized that an unemployment rate that exceeds the natural rate of unemployment is directly correlated to a percentage gross national product gap. This correlation indicates that, to realize a decrease in unemployment, the growth rate of real GDP must exceed the growth rate of potential output.

3. Empirical Literature

Empirically, different scholars have examined the relationship between unemployment and different economic variables. One strand of literature focuses on verifying Okun's and Phillips' curve hypotheses. For instance, Akeju and Olanipekun (2014), who used the error correction model (ECM) and Johansen cointegration, found that Okun's law is not valid in Nigeria. The study found an inverse relationship between employment and economic growth in Nigeria, implying that high economic growth did not necessarily result in high employment levels. On the other hand, a study by Gur (2015) found that Okun's law was valid for Brazil, Russia, India and China (BRIC countries). On the contrary, Kreishan (2011) asserts that there was no significant relationship between economic growth and unemployment in Jordan between 1970 and 2008. Regarding Phillips' curve, Macharia and Otieno (2015) used a cointegration methodology to show that inflation had a significant negative influence on unemployment in Kenya in the

short- and long-run (thus supporting the Phillips' curve hypothesis). Afzal and Awais (2012), who examined the inflation-unemployment trade-off in Pakistan, found further support for the Phillips' curve hypothesis.

The other strand of empirical literature goes beyond the traditional unemployment, inflation and economic growth dynamics by exploring other macroeconomic factors such as budget deficit, external debt, wages, foreign direct investment, and domestic investment, among others. For instance, Eita (2010) found that, in Namibia, inflation and investment tend to decrease unemployment; whereas an increase in wages increases unemployment. The negative relationship between inflation and unemployment signifies that mild inflation promotes production in the economy: hence job-creation. The positive relationship between wage and unemployment points to the faults of efficiency wage in an economy. Similarly, for Pakistan, Arslan and Zaman (2014) observed that an increase in foreign direct investment, GDP growth rate, and inflation rate had a reducing effect on unemployment; while an increase in population growth rate exacerbated the unemployment problem. Regarding the relationship between GDP growth and unemployment, Maqbool et al. (2013) also had similar results.

Unlike the studies highlighted above, Gur (2015) controlled for the volume of trade in addition to other economic factors. Contrary to Eita (2010), the study found that inflation tends to increase an unemployment rate, signifying that inflation deters production, which hinders job-creation. According to Gur (2015), the volume of trade and economic growth had a negative relationship with the unemployment rate, while population growth had a positive impact on unemployment in those countries. Similarly, Sabir and Naz (2015)—who studied economic determinants of unemployment in Pakistan—found that population growth and literacy rates had a positive impact on unemployment rate. Their study further indicates that inflation and unemployment are negatively related, which implies that the Phillips' curve theory holds for Pakistan in the particular study period.

In Nigeria, Ogbeide et al. (2015) found that private credit and growth in natural resources rent had a positive impact on unemployment rate. The positive relationship between unemployment and private credit is unexpected, though the authors relate the results to the negative relationship between financial development and economic growth. The positive impact of the natural resource rent on unemployment rate was attributed to the resource curse argument. The authors observed that foreign direct investment had a negative impact on unemployment rate, which was attributed to the spill-over effect of FDI that promotes job-creation. While focusing on current account balance and trade openness, Raifu (2017) showed that an improvement in current account balance in the short-run exacerbated the unemployment problem in Nigeria. However, the author found that an improvement in the current account balance tends to reduce unemployment in the long-run. The argument is that increased inflow of foreign exchange would stimulate domestic investment, thereby generating more employment. In the same study, he observed that there was a positive relationship between trade openness and unemployment rate.

In Jordan, Alrabba (2017) used a multivariate approach to explore the determinants of unemployment rate in Jordan. He found that an increase in private investment is associated with a fall in the level of unemployment rate, whereas the relationship between inflation rate and unemployment rate was positive, thus contradicting the Phillips' curve hypothesis. In Palestine, Abugamea (2018) analysed unemployment determinants using ordinary least squares; and observed that GDP growth had a negative effect on unemployment rate. However, labour movement restrictions, labour force growth, and inflation rate (in the short-run), increase unemployment rate. He argued that the Phillips curve prediction did not hold because Palestine experienced imported inflation through imports from Israel.

Considering the ECOWAS region, Folawewo and Adeboje (2017) indicated that a weak negative relationship exists between gross domestic product growth, foreign direct investments, and unemployment in the region. However, they found that inflation and population growth positively affected unemployment. Similarly, Garang et al. (2018) found that foreign direct investments did not significantly influence unemployment reduction in Uganda between 1993 and 2015. This is, however, contrary to conventional wisdom that foreign direct investments stimulate employment creation.

Based on the literature, scholars that have examined determinants of unemployment in different countries and regions have come up with polarized results. It is difficult to find agreeable determinants of unemployment in the literature. The findings are influenced by factors such as the level of development of a country, research methodologies, as well as the scope of a study. As indicated earlier, studies conducted on a regional level have focused on other regions other than East Africa. As mentioned earlier, studies in the East Africa region are country-specific, micro in nature (using cross-section data), or focus on particular groups (such as the youth, or gender). Micro-level studies do not account for variations in determinants over time. As such, they reveal determinants of unemployment only at a particular point in time. Studies focusing on particular groups, such as the youths and gender, are also limited in that such determinants may not apply to other sections of the population. Moreover, by moving away from country-specific studies to panel data, this study is presumed to provide estimates that are more efficient since it contains more degrees of freedom and less collinearity.

Theoretical Framework

Following Dornbusch et al. (2011) and Folawewo and Adeboje (2017), the theoretical framework for the study is derived by combining the Phillips curve theory and Okun's law. The Phillips curve theory spells out a negative relationship between the level of unemployment and the rate of change of wages (trade-off between unemployment and inflation). In the short-run, this trade-off is anchored on information asymmetry in that the unanticipated inflationary shock reduces real wages and expands output and employment beyond their full employment level. The simple Phillips curve is therefore expressed as:

$$W_g = -\alpha(u - u^*) \qquad (1)$$

Where; W_g is the rate of growth of the money wage, u is the unemployment rate, and u^* is the natural rate of unemployment.

From equation (1), wages are decreasing ($W_g < 0$) when unemployment rate surpasses the natural rate of unemployment. When the actual unemployment rate is less than the natural rate of unemployment, money wages increase ($W_g > 0$).

According to the new Keynesians, inflation expectations are crucial as bargaining about wages between workers and firms is usually in terms of real wages. Consequently, the wage change-unemployment relationship of the Phillips curve was later translated into a price change-unemployment relationship. Therefore, equation (1) is modified by adjusting the nominal wage growth rate for the expected changes in price over the contract period.

$$W_g - \pi^e = -\alpha(u - u^*) \qquad (2)$$

Where π^e is the level of expected price inflation defined as:

$$\pi^e = \frac{p^e_{t+1} - p_t}{p_t} \qquad (3)$$

Assuming that wage changes are fully reflected in price changes after allowing for productivity increases, actual inflation will equal to wage inflation. Thus, the modern version of the Phillips curve can be written as:

$$\pi = \pi^e - \alpha(u - u^*) \qquad (4)$$

Where:

$$\pi = \frac{p_{t+1} - p_t}{p_t} \qquad (5)$$

Equation (4) shows that actual unemployment equals the natural rate when actual inflation equals expected inflation ($\pi = \pi^e$). After establishing the relationship between inflation and unemployment, we then embark on deriving the linkage between unemployment and output. Okun's law, as expressed below, illustrates this relationship:

$$\frac{Y - Y^*}{Y^*} = -\theta(u - u^*) \qquad (6)$$

Where Y is the actual gross domestic product, Y^* is the potential gross domestic product, and θ is the adjustment parameter.

Combining the Phillips curve (equation 4) and Okun's law (equation 6), we obtain the aggregate supply curve expressed by equation (7):

$$P_{t+1} = P^e_{t+1}[1 + \psi(Y - Y^*)] \qquad (7)$$

Where:

$$\psi = \left(\frac{P_t}{Y^* P_{t+1}^e}\right)\frac{\alpha}{\theta} \qquad (8)$$

From equation 7 and equation 6, the equation relating GDP, inflation and unemployment is derived as:

$$(u - u^*) = -(\pi - \pi^e)\frac{1}{\psi Y^* \theta} \qquad (9)$$

Equation (9) shows that unemployment has an inverse relationship with both inflation and output, which reflects the Phillips curve and Okun's law, respectively. However, from a practical point of view, and taking in the context of the developing world, the drivers of unemployment might go beyond inflation and output. Therefore, we augment the model in equation (9) with a general term (Φ), which captures the other factors. Some of the factors are directly related to unemployment, while others are inversely related to unemployment. Therefore, Φ_d captures factors that are directly related to unemployment; while Φ_i captures factors that are inversely related to unemployment. Equation (9) is thus modified to equation (10a):

$$(u - u^*) = (\pi^e - \pi)\left(\frac{\Phi_d}{\psi Y^* \theta}\right)\left(\frac{1}{\Phi_i}\right) \qquad (10a)$$

Log-linearizing equation (10a) gives rise to a linear model (10b):

$$\ln(u - u^*) = \ln(\pi^e - \pi) + ln\Phi_d - lnY^* - ln\Phi_i + \Omega \qquad (10b)$$

Where, $\Omega = (-ln\psi - ln\theta)$, which is a constant since both ψ and θ are parameters.

4. Empirical Model

As already indicated, a number of other variables (Φ) determine unemployment alongside inflation and output growth. In our empirical analysis, we take Φ to comprise of: population size, trade openness, credit to the private sector, and external debt. Following Dogan (2012) and Folawewo and Adeboje (2017), we adopt a linear empirical model linking unemployment to inflation, GDP, and the other determinants.

Given the geographical scope of the study, panel data techniques were applied. According to Hsiao (2007), panel data have several advantages compared to other types of data. First, it allows one to cater for a country's heterogeneity. Second, it gives more degrees of freedom and a more efficient estimator. Third, it allows one to test models that are more complicated. Thus, the empirical model is specified as:

$$LUEMP_{it} = \alpha + \phi_2 GDPg_{it} + \phi_7 LDEBT_{it} + \phi_1 INF_{it} + \phi_4 PSCg_{it} + \phi_3 OPEN_{it} + \phi_8 LPOP_{it} + LGNE_{it} + \mu_i + \varepsilon_{it} \qquad (11)$$

In equation (11), $LUEMP$ is a log of unemployed labour. Where unemployment here is defined as people in the labour force that are without jobs but available for, and seeking employment (Maqbool et al., 2013), $GDPg$ is the annual percentage growth rate of GDP at constant market prices. $LDEBT$ is the log of external debt stock. It involves publically guaranteed and privately non-guaranteed long-term debt. INF is the inflation rate, measured as the annual percentage changes in the prices of goods and services. $PSCg$ is the private sector credit growth. It is proxied by the growth rate of domestic credit to the private sector. $OPEN$ is trade openness, computed as the ratio of the sum of imports and exports to GDP. $LPOP$ is the log of the total population. $LGNE$ is the log of gross national expenditure.

5. Estimation Issues

Given that the study covers a small number of countries (only five countries, i.e., Burundi, Kenya, Tanzania, Rwanda and Uganda), and more years, i.e., $T > N$, then it qualifies to be a macro panel. According to Baltagi (2005), some macro panels may be stationary while others are not, thus necessitating stationarity tests. The study adopted the Levin, Lin and Chu (LLC) test, which assumes that all panels have the same autoregressive parameter; and the Im, Pesaran and Shin (IPS) test that relaxes the assumption of having the same autoregressive parameter by allowing panels to have different parameters. Because of the two opposite assumptions, it is important to use both tests to compare the power of the tests.

The setup of the model in equation (10) allows for the use of pooled ordinary least squares (OLS), random-effects (RE), and fixed-effects (FE) techniques. The pooled OLS model assumes that for a given country, observations are serially uncorrelated; and across individuals and time, errors are homoscedastic (Baltagi, 2005). Although this estimation method is the easiest, it is often not appropriate since it ignores a country's heterogeneity, which may result in inconsistent and inefficient estimators (Kunst, 2010).

With random-effects modelling, μ_i is viewed as an unobserved random variable and not as a parameter to be estimated. The model is based on the assumption of zero covariance between μ_i the predictor variables; $cov(x_{it}\mu_i) = 0$. In this case, the FE estimator is consistent but not efficient. Fixed effects modelling is based on the assumption that the unobserved country heterogeneity (μ_i) is correlated with the explanatory variables such that $cov(x_{it}\mu_i) \neq 0$. In this case, a random-effects estimator is now inconsistent (Baltagi, 2005). The Hausmann test determines whether the fixed effects or the random effects is a better model. The Hausman test examines whether individual specific effects (μ_i) are uncorrelated with other regressors in the model, with a null hypothesis in favour of the random effects model.

The results obtained from the fixed effects and random effects estimation are likely to be biased by the problem of endogeneity arising from the fact that employment growth may induce economic growth through the 'aggregate demand effect', thus making economic growth a consequence of employment growth rather than a cause.

Whereas there are more sophisticated panel data techniques for addressing endogeneity (such as difference GMM and system GMM), the small number of countries does not allow us to apply these techniques. Instead, we opt for the instrumental variable techniques (IV-FE) to solve the problem. The technique requires instruments that are uncorrelated with the error term, but are highly correlated with the endogenous covariate. While such instruments have proved difficult to find, lagged values of GDP growth have been widely used since the current level of employment cannot determine the lagged level of economic growth. However, the validity of the instruments is tested using the Sargan-Hansen over-identification test.

6. Data

The study used secondary data for the period 1996 to 2017 because of its availability (especially on unemployment) at the time of conducting research. The data for unemployment were obtained from the ILO database (ILO, 2019), while the data for the other explanatory variables (GDP growth, external debt, inflation, credit to the private sector, trade openness, gross national expenditure, and population) were obtained from the World Bank database for World Development Indicators of 2018 (World Bank, 2018). (See Table A1 in the Appendix on how the variables are defined). The data from the ILO and the World Bank are reliable because several studies have employed these data. Note that, due to data gaps arising from time lags in the collection of data about employment and unemployment, some data points for employment and unemployment are imputed by ILO experts (modelled estimates). Nonetheless, it remains the most credible source of information about employment and unemployment.

7. Findings

Before carrying out the regression analysis, the data were analysed using descriptive statistics. The results of this analysis are presented in Table 1.

Table 1: Descriptive Statistics

`	Observs.	Mean	Standard Deviation	Min	Max
Unemployment	110	542,000	579,000	17,068	2,220,000
GDP growth	110	5.354	3.164	-3.921	13.85
External Debt (US$m)	110	6,680	5,260	408	20,700
Inflation	110	8.606	5.463	-2.406	31.112
Credit to the private sector (US$m)	110	3,360	4,450	1,280	1,810
Trade openness	110	38.49	7.822	20.242	57.712
Gross national expenditure (US$)	110	19,400	16,700	1,640	6,4800
Population (million)	110	25.70	15.50	6.04	57.30

The results show that the average number of unemployed people in the five countries in the study period was 542,000; with the minimum being 17,068, and maximum being 2,220,000. The GDP growth averaged at 5.35 percent, total

external debt averaged at US$6.68bn, inflation averaged at 8.6 percent, private sector credit at US$3.4bn, trade openness at 38.5, gross national expenditure at US$19.4bn, and population averaged at 25.7m.

A preliminary country-level analysis shows that Burundi had the lowest average number of unemployed labour at 54,108; and Kenya had the highest average number of unemployed labour at 1,489,391 (Tables A2 to A6). Regarding GDP growth and inflation, Rwanda had the highest GDP growth rate (8.2 percent); while Burundi had the lowest averaged GDP growth rate (1.8 percent). Uganda and Rwanda had the least averaged inflation rate (at about 6.6 percent), while Burundi had the highest rate of inflation (11.5 percent).

For any econometric analysis, it is important to examine the extent of multicollinearity since severe multicollinearity results in inconsistent and inefficient estimators. In the study, we carried out a correlation analysis to determine the extent of the linear relationship between any two variables in the analysis. The results of this analysis are presented in the correlation matrix (Table A7). The results show that whereas the correlation between the other variables is less than 0.8 (in absolute terms), that for public debt and population is greater than 0.8, which suggest that the estimation of relationships with the two variables in the same model would cause multicollinearity. Accordingly, the two variables appear in the models once at a time. The pairwise correlation matrix also shows that at a 5 percent level of significance, external debt, trade openness, and population size have a strong positive linear association with unemployment.

As earlier indicated, panel unit root tests were also conducted to ascertain the stationarity properties of the data series. Two-unit root tests (IPS and LLC) were used in the study. Table 2 presents the results.

Table 2: Panel Unit Root Tests

	Level		First Difference		
Variables	**LLC**	**IPS**	**LLC**	**IPS**	**Order**
Log of unemployment	-1.9802**	-1.7599**	n/a	n/a	I(0)
GDP growth	-2.9641***	-3.9670***	n/a	n/a	I(0)
Log of external debt	0.8295	1.2537	-3.777***	-5.1679***	I(1)
Inflation	-3.1413***	-3.7577***	n/a	n/a	I(0)
Log of credit to the private sector	3.4132	5.6998	-3.3729***	-3.5989***	I(1)
Trade openness	-2.8542***	-2.5032***	n/a	n/a	I(0)
Log of gross national expenditure	0.0714	3.6942	-3.9177***	-6.0352***	I(1)
Log of total population	-0.0367	6.1813	-9.2773***	-3.7269***	I(1)

Note: $^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$.

The results in Table 2 show that the log of unemployment, GDP growth, inflation and trade openness can be considered stationary since the p-values associated with test

statistics for these variables are less than 0.05. The log of external debt, log of private sector credit and population are not stationary at level necessitating testing at the first difference. The results for the first difference indicate that external debt, private sector credit, and population can be considered stationary at first difference at least by one of the tests. Therefore, the data is comprised of both I(0) and I(1) variables.

Although some of the variables in the dataset are integrated of order one, Kao (1999) showed that as long as none of the variables is integrated of order two, the point estimations of the value of parameters are consistent, unlike in the time series analysis. Accordingly, we proceed to estimate the relationship using the traditional panel data techniques. The empirical model was first estimated using the fixed effects and random effects estimation techniques (Table A8).

The Hausman test results suggest the existence of fixed effects across the countries under consideration since the reported p-value leads to a rejection of the null hypothesis 'difference in coefficients not systematic' at 5 percent (Table A8). Therefore, this implies that the fixed effects model is preferred. Accordingly, the instrumental variable technique was applied to the fixed effects estimator (Table 3). Also, note that all the subsequent discussions are based on the fixed effects models.

Table 3: Regression Analysis
(Dependent variable: Log of unemployed population)

Variables	(1) Iv-Fe	(2) Iv-Fe
GDP growth rate	-0.125**	-0.141**
	(0.049)	(0.058)
Inflation	0.004	0.005
	(0.007)	(0.008)
Log of private sector credit	-0.442**	-0.334*
	(0.188)	(0.200)
Trade openness	0.021***	0.015**
	(0.007)	(0.007)
Log of gross national expenditure	1.875***	1.167***
	(0.541)	(0.369)
Log of total population	-1.142	
	(0.739)	
Log of external debt		-0.081
		(0.115)
Constant	-2.643	-5.641
	(5.627)	(5.780)
Observations	110	110
R-squared	0.843	0.842
Number of countries	5	5
F-test (P-value)	0.000	0.000
Exogeneity test (p-value)	0.013	0.035
Sargan Hansen statistic	0.000	0.008

Note: Standard errors in parentheses.
$^{*}p< 0.10$, $^{**}p< 0.05$, $^{***}p< 0.01$.

The exogeneity test applied on the fixed effects estimator shows that GDP growth is indeed endogenous concerning unemployment (p-value is less than 0.05). The Sargan-Hansen statistic also confirms the validity of the instruments, suggesting that (Iv-Fe) equations are exactly identified. As such, the results of the instrumental variable technique are superior to those of the ordinary fixed effects model.

The result of the fixed effect models (models 1 and 2) indicate that unemployment in East Africa is influenced by GDP growth, private sector credit, trade openness, and gross national expenditures. Specifically, unemployment reduces by a range of 12.5 to 14.1 percent for every one percent increase in the economic growth rate, keeping other factors constant. The results suggest that when the economy grows, employment opportunities are boosted, and eventually unemployment rate falls. Such results, therefore, validate the existence of Okun's law of relationship in the East Africa region. Studies that have found similar results include Ogbeide et al., (2015), Maqbool et al., (2013) and Abugamea (2018), among others; but differ from those of Aurangzeb and Khola (2013) who find GDP growth to increase unemployment, and Folawewo and Adeboje (2017) who found evidence for 'jobless growth' in the ECOWAS region.

Similar to Haruna et al. (2013), Shabbir et al. (2012) advance that credit to the private sector plays a significant role in reducing unemployment in the region. A one percent increase in credit to the private sector reduces unemployment by a range of 0.3 to 0.4 percent, keeping other factors constant. The result corroborates the economic theory, which suggests that an increase in private sector credit boosts investment and job creation in a country. Succinctly, access to affordable private sector credit is fundamental for the survival and expansion of business in the EAC; and supports innovation, especially for SMEs, which are major employers in the region.

The study finds that trade openness tends to worsen the unemployment problem in East Africa. The coefficient of trade openness is positive and significant in all the models. The results of the IV-fixed effects models imply that a one percent increase in trade openness increases unemployment by a range of 1.5 to 2.1 percent, keeping other factors constant (models 1 and 2). This finding is akin to Raifu (2017) and Nwaka et al. (2015), who found that trade openness exacerbates unemployment in Nigeria. The results, however, contradict with Ogbeide et al. (2015) who find trade openness to dampen unemployment. The findings possibly allude to the stiff competition that foreign firms subject to local infant industries, which ultimately hinders their survival and growth, thus limiting job-creation. These results contradict the classical trade theories, which postulate that trade openness reduces unemployment. These theories argue that trade increases the productivity of labour in the economy resulting from an increase in efficiency, which ultimately leads to an increase in investment and more job-creation, thereby reducing unemployment (Raifu, 2017). Our results further differ from the Hecksher-Ohlin model, which asserts that trade reduces unemployment in labour-abundant economies (like the East African economies). Ogbeide et al. (2015) and

Cheema and Atta (2014) also find contrary results as they argue that trade openness helps to reduce unemployment in Nigeria and Pakistan, respectively. Nonetheless, from an economic point of view, and given the context of the EAC, it is plausible that trade openness worsens unemployment. For instance, the region is characterized by a less competitive business environment. Specifically, in countries like Uganda, the high cost of electricity remains one of the biggest challenges for businesses albeit increased production. In addition, the regulatory environment remains poor as it is characterized by high bureaucracy and corruption (ADB, 2018; WEF, 2017).

Our analysis also shows that a percentage increase in the gross national expenditure worsens unemployment by a range of 1.2 percent (model 2) to 1.9 percent (model 1). This is rather contradictory and unexpected since government expenditure aims to expand the productive capacity of an economy, and thus expand employment. Our results also contradict with Matsumae and Hasumi (2016) who find that an increase in government expenditure reduces unemployment. Nonetheless, such results could allude to several issues. First, there could be a possibility of the differential impact of government expenditure between the short- and long-run, especially if the expenditure is skewed towards infrastructure projects (as is the case in most EAC countries). Secondly, the effectiveness of government expenditure in stimulating the economy may depend on institutional quality, which remains a challenge for some EAC countries. Thirdly, the composition of the expenditure (defence and national security, and debt repayment) could also matter.

Conclusion

In this study, we investigated the macroeconomic determinants of unemployment in the EAC, while controlling for potential endogeneity. Our findings reveal that unemployment in East Africa is likely to decrease with sustained GDP growth, suggesting the promotion of GDP growth through supporting highly productive industries with high employment intensity. Similarly, measures to increase private sector credit are paramount. On the other hand, increased trade openness is likely to exacerbate the unemployment problem in the region, possibly suggesting that pursuing a liberalization policy with a less competitive environment is harmful to the EAC in terms of employment.

Our study, therefore, recommends a set of three interrelated measures to boost employment in the region. First, the promotion of GDP growth should be pursued with greater emphasis on labour-intensive industries. Succinctly, there is a need to reform investment incentives (such as tax incentives) to attract more investments in labour-intensive industries, and also devote more resources to labour-intensive sectors. This needs to be complemented by measures to address other structural bottlenecks such as a stable supply of utilities, and a reduction in their costs. Secondly, measures to expand private sector credit are of immense importance. This calls for measures to increase both supply and access to credit. On the supply side, expanding insurance to risky sectors, and credit guarantee

schemes, are paramount. On the access side, the EAC countries need to adopt proactive measures to lower interest rates. Recent trends suggest that in countries such as Uganda, lending rates have been less responsive to central bank rates, suggesting a need for innovative approaches to reduce operational costs (such e-banking). Thirdly, the EAC countries need to improve their competitiveness if they are to benefit from the liberalization policy. They should address salient business environment challenges such as high electricity costs, power outages and bureaucracy. Better still, proactive ways of supporting local industries (such as the provision of subsidized credit), as a part of the import substitution strategy, could be explored.

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Appendices

Table A1: Variable definition and sources

Variable	Definition	Source
Log of unemployed population	The unemployed comprise all persons of working age who are: a) without work i.e. are not in paid employment or self-employment; b) currently available for work, i.e. are available for paid employment or self-employment; and c) seeking employment. The total unemployed population is expressed in logarithms.	ILOSTAT - International Labour Organisation
GDP growth rate	Annual percentage growth rate of GDP at market prices based on constant local currency. Aggregates are based on constant local currency units. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.	Word Bank - World Development Indicators database
Inflation	This is also defined as [Inflation, consumer prices (annual %)]. 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 intervals, such as yearly. The Laspeyres formula is generally used.	Word Bank - World Development Indicators database
Log of private sector credit	Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of nonequity securities, and trade credits and other accounts receivable, that establish a claim for repayment. The financial corporations include monetary authorities and deposit money banks, as well as other financial corporations where data are available (including corporations that do not accept transferable deposits but do incur such liabilities as time and savings deposits). The private sector credit is expressed in logarithms.	Word Bank - World Development Indicators database
Trade openness	This is measured as the sum of a country's exports and imports as a share of that country's GDP. Data are in current U.S. dollars.	Word Bank - World Development Indicators database
Log of gross national expenditure	Gross national expenditure (formerly domestic absorption) is the sum of household final consumption expenditure (formerly private consumption), general government final consumption expenditure (formerly general government consumption), and gross capital formation (formerly gross domestic investment).	Word Bank - World Development Indicators database

	The gross national expenditure is expressed in logarithms.	
Log of total population	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates. The total population is expressed in logarithms.	Word Bank - World Development Indicators database
Log of external debt	Total external debt is debt owed to non-residents repayable in currency, goods, or services. Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Data are in current U.S. dollars. The external debt is expressed in logarithms.	Word Bank - World Development Indicators database

Table A2: Descriptive Statistics for Uganda

Variable	Obs	Mean	Std.Dev.	Min	Max
Unemployment	22	419,000	260,000	147,000	1,110,000
GDP growth	22	6.358	2.142	3.142	10.785
Debt stock	22	4.40e+09	2.62e+09	9.53e+08	9.95e+09
Inflation	22	6.495	4.19	-.288	16.194
Credit to private sector (%)	22	13.074	14.345	-12.46	47.697
Trade openness	22	38.575	6.157	27.434	48.736
Population	22	3.08e+07	6760000	2.12e+07	4.29e+07

Table A3: Descriptive Statistics for Kenya

Variable	Obs	Mean	Std.Dev.	Min	Max
Unemployment	22	1,490,000	459,000	630,000	2,220,000
GDP growth	22	4.215	2.289	.232	8.406
Debt stock	22	3.84e+09	3.44e+09	6.99e+08	9.77e+09
Inflation	22	9.211	4.873	1.961	26.24
Credit to private sector (%)	22	5.363	8.175	-12.526	19.138
Trade openness	22	45.567	6.148	30.801	57.712
Population	22	3.81e+07	6690000	2.81e+07	4.97e+07

Table A4: Descriptive Statistics for Tanzania

Variable	Obs	Mean	Std.Dev.	Min	Max
Unemployment	22	668,000	101,000	506,000	861,000
GDP growth	22	6.197	1.445	3.525	8.464
Debt stock	22	8.71e+09	3.47e+09	3.91e+09	1.65e+10
Inflation	22	9.208	4.794	4.736	20.977
Credit to private sector (%)	22	18.541	35.297	-51.402	154.789
Trade openness	22	37.644	7.449	24.795	49.051
Population	22	4.23e+07	8260000	3.08e+07	5.73e+07

Table A5: Descriptive Statistics for Rwanda

Variable	Obs	Mean	Std.Dev.	Min	Max
Unemployment	22	77,089	45,374	17,068	155,000
GDP growth	22	8.198	2.833	2.202	13.85
Debt stock	22	1.73e+09	1.91e+09	4.34e+08	9.93e+09
Inflation	22	6.619	4.496	-2.406	15.438
Credit to private sector (%)	22	13.37	12.342	-12.177	40.244
Openness	22	36.135	7.124	24.184	49.13
Population	22	9400000	1730000	6120000	1.22e+07

Table A6: Descriptive Statistics for Burundi

Variable	Obs	Mean	Std.Dev.	Min	Max
Unemployment	22	54,108	10,964	34,290	73,199
GDP growth	22	1.804	2.677	-3.921	5.385
Debt stock	22	1.02e+09	3.10e+08	6.04e+08	1.41e+09
Inflation	22	11.498	7.216	2.745	31.112
Credit to private sector (%)	22	3.088	12.877	-17.079	26.423
Trade openness	22	34.53	7.755	20.242	48.096
Population	22	8020000	1560000	6040000	1.09e+07

Table A7: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Log of unemployed	1.000						
(2) GDP growth	0.001	1.000					
(3) Log of debt	0.821*	0.030	1.000				
(4) Inflation	-0.005	-0.231*	-0.075	1.000			
(5) Credit to private sector	0.052	0.322*	0.082	-0.243*	1.000		
(6) Trade openness	0.512*	0.046	0.173	-0.099	-0.002	1.000	
(7) Log of population	0.927*	0.133	0.836*	-0.084	0.135	0.447*	1.000

Note: * shows significance at the .05 level

Table A8: Regression analysis
(dependent variable: log of unemployed population)

Variables	(1) Re	(2) Fe	(4) Re	(5) Fe
GDP growth rate	-0.076***	-0.039***	-0.070***	-0.038***
	(0.016)	(0.014)	(0.014)	(0.014)
Inflation	0.015**	0.005	0.017**	0.008
	(0.007)	(0.006)	(0.007)	(0.006)
Log of private sector credit	-0.120	-0.399**	-0.157*	-0.347**
	(0.118)	(0.158)	(0.086)	(0.163)
Trade openness	0.014**	0.019***	0.024***	0.016***
	(0.006)	(0.006)	(0.007)	(0.006)
Log of gross national expenditure	1.076***	1.792***	1.084***	1.169***
	(0.289)	(0.458)	(0.129)	(0.300)
Log of total population	0.288	-1.138*		
	(0.288)	(0.627)		
Log of external debt			0.230***	0.028
			(0.074)	(0.080)
Constant	-15.044***	-2.085	-15.133***	-8.442*
	(0.951)	(4.771)	(0.894)	(4.534)
Observations	110	110	110	110
R-squared	0.915	0.840	0.922	0.898
Number of countries	5	5	5	5
F-test (P-value)	0.000	0.000	0.000	0.000
Hausman test	0.000		0.000	
Exogeneity test (p-value)			0.013	
Sargan Hansen statistic			0.000	