

Explaining Unemployment in Eastern African Community using Robust Least Squares

Dimitrios Dapontas*

Technological Institute of Ionian Islands,
Greece

Abstract—

The present manuscript will explain the levels of unemployment in the EAC area. In contrast to the developed world the unemployment characteristics in developing countries should be different depending on their characteristics. We deploy a sample consisting of 26 years (1990-2015) using percentage of unemployment as dependent variable and a set of six independent regressors related. The initial traditional OLS methods seem weak for the nature of the sample. Instead we deployed more the more sophisticated and adjustable method the Robust Least Squares (RLS) having major advantages against large residuals and high leverages. The RLS results show that percentage of economic active population to total, HDI and inflation rate have positive effect percentage of urban population is negative in contrast to the known cases due to their economy structure and the low level of development.

Keywords— EAC, Unemployment, Robustness, Urban population, HDI, Literacy rate

I. INTRODUCTION

The impact of macroeconomic development measures in the labour market is a subject that hasn't been examined extensively and it has been paid minor attention for the countries participating EAC. The existing studies have focused on developed economies leaving apart possible candidates from the developing world and especially eastern Africa. The impact of unemployment and its consequences to the real economy attracted interest due its new characteristics. How social and economic freedom variables effect new occupation creating? Traditionally used variables have the same effect on underdeveloped countries? How internal emigration responds to unemployment? We deploy a sample consisting of all five EAC countries (Burundi, Kenya, Tanzania, Rwanda and Uganda respectively) using formal employment as depended variable and a set of seven independent variables (urban population to total percentage, Inflation rate, Real Effective Exchange Rate, HDI, Age of economic active population to total, literacy rate and labour freedom) for a twenty-six period (1990-2015) in annual frequency. The paper is structured as follows. First part makes an introduction to the manuscript contents, the second part gives the literature review following by the third where variables and results are presented on the third part. The final part gives present work conclusions and makes suggestions for further research.

II. LITERATURE REVIEW

There are no major works specialized on unemployment in EAC although the problem has been recognised and analysed since 1968 study (Franc R, 1968) where low urban development was blamed. The majority of studies based on Africa focus on development and social policy aspects. Even more these studies concentrate on francophone or developed South African regions. Agenda for poor and growing population countries is generally based on creating jobs for young people entering workforce. The earlier studies were based in Asian countries job creation such as India (Mahendra and Venkatanarayana, 2011) where active enforcements were applied based on education, micro finance and guided developments. Possible application to the case of Nigeria has been analysed in (Teal, 2014). This work rural development seem to create occupation rather than urban one. The returns of labour were higher for poor people returning or remaining to their region on countryside. Inequalities and structural problems exist even on developed African economies (Jauch, 2011) where a development plan for equal and prospective growth through private development should be followed. Sub-Saharan labor markets have been analysed in a complication of similar works (De Vreyen and Roubaud, 2013). The conclusions state that the urban unemployment is similar around Africa. Level of unemployment reaches the developed world levels. Of this set of manuscripts one can make that informal occupation reaches 70% in the urban areas. The work age and gender discrimination is high and there is a lack of sustainability in every economic aspect. More works (Golub and Hayat 2014) have claimed that Asian development model following globalization trends by labour-intensive industries' export channel and through expansion especially in the agricultural sector along with touristic development. As seen in (Vermeulen, 2015) under the monetary policy framework establishing the relationship between unemployment and inflation and the measures governments should deploy noticed that extremely strictly policies could make the achievement. While there is no causality of straight connection the assumption of comovements is accepted. Additionally he stated that high demand for labour won't lead to unemployment reduction because the lack of skills in Africa is high.

III. METHODOLOGY AND RESULTS

Preliminary analysis consists of the following steps:

Selecting variables effecting unemployment in the under examination countries. Developing a partial-correlation table among the variables for two reasons. First we eliminate possible multicollinearities among regressors' and second applying possible relation in favour of the model.

A preliminary OLS analysis:

Due to data nature and the set of the countries that consist the sample a possible sensitivity of conventional regression modes implication cannot reflect the underlying statistical relationship among the variables. The exact methods seem to get more than parametric or non-parametric methods. More accurate least squares methods such as robust least squares (RLS) tend to be less sensitive to outliers within datasets. We have selected RLS because it's more adjustable among exact methods and flexible applying a variety of regression modes.

- M-estimation guides regressors' outliers where its value differs significantly of the model pattern (large residuals) (Huber, 1973).
- S-estimation is a consequently computing procedure that focuses on outliers in the dependent variables values (high leverages) (Rousseeuw 1984).
- MM-estimation is joining both S-estimation and M-estimation. Algorithm starts on S-estimation evaluation and then uses the results from S-estimation as the starting grid of the M-estimation. Therefore MM-estimation combines the other two methods, it addresses outliers in both the outcomes and regressors (Yohai 1987).

In order to select an estimating method we have to apply further steps

OLS regression and control of all assumptions

Determination of outliers

Estimation of regression models on all three variants

Test independent variables effect on dependent.

We have pretested data based on algorithm above and we determined that outliers both on residual and leverage terms are high. Furthermore referring to the M and to S estimation the constant term is predetermined thus parametrizing could be less flexible. Least squares estimation on this model is given by the objective function:

$$\widehat{\beta}_{LS} = \operatorname{argmin}_{\beta} \sum_{i=1}^N r_i(\beta)^2$$

Where r are the residuals

$$r_i(\beta) = r_i = y_i - X_i' \beta$$

And the MM estimator's as an r function:

$$\widehat{\beta}_M = \operatorname{argmin}_{\beta} \sum_{i=1}^N \rho_c \left(\frac{r_i(\beta)}{\sigma w_i} \right)$$

Where σ is a measure of the scale of the residuals, ρ_c is a constant associated with function and w_i are individual weights set to down leveraged values:

$$w_i = \sqrt{1 - X_i(X'X)^{-1}X_i'}$$

In this case σ is calculated to the preliminary analysis. The $\widehat{\beta}_M$ is estimated for the k first non-linear equations.

$$\sum_{i=1}^N \psi_c \left(\frac{r_i(\beta)}{\sigma w_i} \right) \frac{x_{ij}}{w_i} = 0 \quad \text{for } j = 1 \dots k$$

(Yohai, 1987) suggests the use of bisquare function proposing a formula that eliminates 95% of errors giving a 4.684 value to the parameter.

The coefficient covariance matrix is given by three tantamount types of estimation. (Huber 1981). We have selected the easiest to compute one.

$$A^2 = \frac{\left[\frac{1}{(N-K)} \sum_{i=1}^N \psi_c(r_i^2) \right]}{\left[\left(\frac{1}{N} \sum_{i=1}^N \psi_c'(r_i) \right)^2 \right]} (X'X)^{-1}$$

With $\psi_c(\cdot) = \rho_c'(\cdot)$ and

$$A = 1 + \frac{N \sum_{i=1}^N [\psi_c'(r_i) - \overline{\psi_c'}]}{\kappa \psi_c'^2}$$

X_{ij} is the value of the j th regression for the observation i .

$$\overline{\psi_c'} = \frac{1}{N} \sum_{i=1}^N \psi_c'(r_i)$$

Under this methodology we used as an endogenous variable unemployment for all five countries (Burundi, Kenya, Tanzania, Rwanda and Uganda respectively) for a twenty six years period (1990-2015). The official unemployment rate is a measure of the pervasiveness of unemployment and it is computed as a rate by isolating the quantity of unemployed people by all people as of now in the work power as given by World Bank and National Statistics offices per country.

Urban population: This variable gives two measures of the level of urbanization of a populace given by World Bank population estimates. The main, urban populace, portrays the rate of the aggregate populace living in urban regions, as characterized by the nation. The second, rate of urbanization, portrays the anticipated normal rate of progress of the measure of the urban populace over the given timeframe. An urban agglomeration is characterized as including the city or town appropriate and additionally the rural periphery or thickly settled domain lying outside of, however nearby, the limits of the city. For the most part it alludes to towns and urban areas over than 2,000 populace. In extensive urban zones unemployment is higher because of the inward migration of youthful and well taught individuals from less created country ranges where unemployment is as of now high (open unemployment). Work market structures improve unemployment inside the urban zone through "camouflaged" labourers' unemployment alluding to individuals who won't scan for another occupation effectively in spite of the fact that they might want to discover one. The higher urbanization prompts higher unemployment, consequently we expect a negative sign for countries where open unemployment is high and positive for countries that urban population is relatively high.

Inflation rate: The change of CPI in the course of the most recent month as given by World Bank Statistics. It is an intermediary of macroeconomic fumble that is adverse affecting a nation's economy. It is connected decidedly with the raise of unemployment. The inflation rate assumed a focal part in the analysed economies as they were proved very weak against its remedy in the past. We can expect positive relation between the dependent variable and CPI.

Economic active people as percentage of total population: The people belonging between the ages 15 to 64 is the part of populace who could potentially be economically active under the methodology of ILO. The organization definition is the number of plausible economic active people is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin. Increase in the ratio will raise unemployment. Thus we expect a positive sign.

Real exchange rate (REER): The Real Effective Exchange Rate of the national currency given by World Bank or by calculation of the real exchange rates of important trading partners for every country. REER is a measure of competitiveness. A decrease of REER (overvaluation) has negative impact on it reducing exports and production and causing unemployment. Therefore we set up a negative connection.

Human Development Index (HDI): The UN Human Development Index indicant, which comprises of three similarly, weighted measures: The life expectancy indicator, the education indicant and the GNP one. We imply this indicator against plain GNP measure because we want to give a further development to new and more accurate measures of development (both economic and social) in this set of countries concerned than the GNP per capita is relatively low. The UN index is broader and it represents an initial effort to capture social phenomena as well. We expect that HDI will have a positive effect in countries at early development stages due to rising level of schooling and life expectancy.

Literacy rate: Percentage of the population schooling age (15) and above who can, fully understand, read and write a short, simple statement on their everyday life. The definition and the data are given by World Bank. Generally, 'literacy' also encompasses 'numeracy', the ability to make simple arithmetic calculations. This indicator is calculated by dividing the number of literates aged 15 years and over by the corresponding age group population and multiplying the result by 100. Literacy can cause delay on people economic activation due to participation for further studies and personal development. Therefore a positive sign is been expected.

Labour Freedom: The capacity of people or organizations to contract unreservedly for work and release excess laborers when they are no more required is an indispensable instrument for financial activity under the Heritage Foundation statistics for Economic Freedom. The level of freedom can determine the prosperity of the business sector. Government policies take an assortment of structures, including wage controls, enlisting and terminating limitations, and different confinements. In numerous nations, unions assume an essential part in managing work opportunity and, contingent upon the way of their action, might be either a power for more prominent opportunity or a hindrance to the proficient working of work markets. All in all, the more prominent the level of work opportunity, the lower the rate of unemployment in an economy.

The results for all five countries are presented on the Table 1 below:

Table 1: The RLS Results Under 5% Significance

	Burundi	Kenya	Tanzania	Rwanda	Uganda
C	7.0048 (0.4482)	8.5332 (0.5581)	4.4609 (2.056)	-36.1917 (5.0774)	-34.1487 (19.7104)
Urban	-0.1023 (0.063)	-0.0621 (0.0057)	-0.3481 (0.1339)	-0.3444 (0.0599)	0.0098 (0.5020)
Inf_rate	0.0065 (0.0012)	0.0044 (0.0011)	-0.0337 (0.0331)	0.1167 (0.0017)	0.0098 (0.1472)
REER	-0.0012 (0.0012)	-0.0008 (0.0002)	0.0228 (0.0425)	0.0022 (0.0060)	-0.0048 (0.0048)
HDI	2.3453 (2.7298)	4.8428 (0.9982)	16.6407 6.7817	9.6468 (2.8146)	4.4708 (2.3634)
Age	0.1128	0.3831	5.0749	0.6904	0.7645

	(0.0259)	0.0639	(2.4160)	(0.1053)	(0.3993)
Literacy	0.0049 (0.002)	0.0061 (0.0074)	0.0777 (0.0569)	0.2072 (0.0299)	-0.1065 (0.0585)
Labor_Free	-0.0013 (0.6532)	-0.002 (0.2330)	-0.0136 (0.0354)	-0.0885 (0.0331)	-0.0291 (0.0430)
R²	0.7193	0.8869	0.5952	0.7292	0.6461

As we can see level of urban population compared to the total population seems to be negative and important for four out of five countries. Countries of low development have large rural populations and open unemployment as described. Internal immigration procedure could raise level of employment even though the wave is still short. Small number of unemployed people who didn't search for alternative industry employment in the countryside joined cities in order to eliminate their structural unemployment problem. People that make permanent move to urban areas will find a job.

HDI is also statistically significant in four cases and positive. The countries of the EAC area have some the lowest scores in all three indices due to area underdevelopment and wars in the region. The raise of the HDI in these countries especially after the end of the Rwandan civil war is joined with low volatility changes at the level of unemployment thus the positive sign can be explained.

The 15-64 population raise as percentage of total population is strong in four occasions. As the indicator rises more and more people are available and economically active. The governments cannot intervene at the labour market as fast as this crew needs to join. In contrast to developed countries this rate will significantly raise in the future were new generations are about to enter workforce.

Inflation rate is positive and indicative for three countries. Beyond the idea of stable trade-off between them and the absence of possible natural rate of unemployment the inflation seem to have aversion effect on job creating. The growth of the economy and should be more balanced in order to avoid possible overheating.

Three more variables seem to be important and with the expected sign. Real effective rate raise can promote the competitiveness and employment compared to the other trading countries circumstances. Thus negative relationship was expected for Kenya. Labor freedom also has also negative effect on unemployment for the case of Rwanda. Liberation and reformation in every market can have positive results for all. Literacy rate is important and positive only for the case of Rwanda. Following the school or university studies over the age of 15 delays participation to the labour market enchased by the intention to get better and well payed jobs based on their study in the future.

IV. RESULTS

The present work show that the structure transformation in these countries is low, enchasing unemployment itself. Variables determining unemployment in the developing world could have different effects compared to the developed ones. Social development indicator HDI seem to have positive effect. The level of human elaboration raised significantly the latest years in EAC but the level of official employment remained stable giving a positive sign. Urban population didn't raise significantly within latest years for all countries but people who emigrated due to open unemployment from the countryside didn't seem employed formally and therefore the indicator is negative. The "economic active age" population as percentage of total population has positive relation to the level of unemployment. As the portion of possible workers raises less and less available jobs remain. Inflation rate and unemployment also covariate following the traditional theory pattern for four sample countries. As schooling rate raises the unemployment for the case of Rwanda raised. More people seek well payed jobs preferring to remain temporary unemployed. Finally, labor freedom seem to reduce unemployment accepting the principles of the market liberation which can bring economic development.

This work can be enchased to the future on the path of explaining the level of informal market which is relatively high for these countries and the possible effects following the world credit crunch and its effect for these countries. In any case tis manuscript could initiate a discussion over unemployment level reduction in an unusual environment where comparisons to the developed world cannot be easily made.

REFERENCES

- [1] De Vreyen P. and Roubaud F., "Urban Labor Markets in Sub-Saharan Africa", *International Bank for Reconstruction and Development / The World Bank*.2013
- [2] Frank, J.R., "Urban Unemployment and Economic Growth in Africa", *Oxford Economic Papers*, New Series, Vol. 20, No. 2, pp. 250-274.1968.
- [3] Golub S. and Hayat F. "Employment, unemployment, and underemployment in Africa", *World Institute for Development Economics Research*. Working Paper 2014/014. 2014
- [4] Huber, P.J., "Robust regression: Asymptotics, conjectures and Monte Carlo," *Ann. Stat.*, 1, 799-821. 1973
- [5] Huber, P.J., *Robust Statistics*. John Wiley & Sons, New York.1981
- [6] Jauch H., "Time to Turn the Tide Tackling Poverty, Inequality and Unemployment in Southern Africa" *Friedrich-Ebert-Stiftung*, Berlin.2011
- [7] Mahendra R.V. and Venkatanarayana M., "Youth Employment and Unemployment in India", *Indira Gandhi Institute of Development Research*, Mumbai
- [8] April 2011.

- [9] Rousseeuw, P.J., “Least Median of Squares Regression,” *Journal of the American Statistical Association*, 79, 871-880. 1984.
- [10] Susanti Y., Pratiw H. Sulistijowati S. and Liana T., “m estimation, s estimation, and mm estimation in robust regression”, *International Journal of Pure and Applied Mathematics* Volume 91 No. 3 2014, 349-360.2013
- [11] Teal F, “Employment Creation, Poverty and the Structure of the Job Market in Nigeria”, Paper prepared for the *53rd Annual Conference of the Nigerian Economic Society*, 2nd rev. 2014.
- [12] Vermeulen C., “Inflation, growth and employment in South Africa: Trends and trade-offs”, *Economic Research Southern Africa*, working paper no. 547. 2015
- [13] Yohai V.J., “High Breakdown Point and High Efficiency Robust Estimates for Regression,” *Annals of Statistics*, 15, 642-656.1987.