EFFECT OF EXTERNAL DEBT ON INFLATION: THE CASE OF KENYA, TANZANIA AND UGANDA

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I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Project contains no material previously published or written by another person except where due reference is made in the Research Project itself.

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Abstract

High inflation is considered to be a threat to growth of emerging countries. However, most of these countries need to borrow in order to cater for budget deficits and sustain economic growth. The aim of this study is to empirically investigate the effect of external debt on inflation in Kenya, Uganda and Tanzania for the period 1988-2018. Other independent variable is included, broad money growth rate, and analysed if it helps in explaining the relationship between external debt and inflation. The study uses a balanced annual panel data obtained from World Bank International Financial Statistics and Data Files. The variables are tested for stationarity to establish their order of integration and select a suitable model. Two tests are done for robustness, Engle and Granger, and Johansen's Cointegration to test for availability of co-integration relationship among the variables. A Vector Error Correction Model (VECM) is employed to estimate long run dynamics and Granger Causality to test if the co-integrated variables can help in predicting each other. The results show that external debt has a positive long-term effect on inflation and that money growth helped in explaining this relationship. Moreover, it was found that there is a unidirectional causality between external debt and inflation. This causality was found to be homogeneous. It is therefore necessary for governments to effectively manage external debt so as to avoid negative economic circumstances which may affects other countries in the region.

Key words: external debt, inflation.

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LIST OF SYMBOLS

CPI – Consumer Price Index

PPI – Producer Price Index

GMM – Generalized Methods of Moment

CLRM - Classical Linear Regression Model

ADF - Augmented Dickey Fuller

VAR – Vector Auto Regression

VECM – Vector Error Correction Model

CHAPTER ONE: INTRODUCTION

1.1. Background of the problem

Sustainable economic growth and economic development is a major concern to all economies. There is increase in public expenditure in many countries which are unable to meet their target revenues (Aliko & Arowolo, 2010). This has led to widening of the budgetary deficits in which the total expenditure (both on revenue and total accounts) exceeds the total receipts of the government. To fill the gap, majority are forced to pursue debt either internally or/ and externally.

Debt plays a vital role in supplementing government budget for development . Governments in developing countries are increasingly investing in education, health and infrastructure. According to Nelasco (2012), to increase capital formation and industrialization, heavy investments like road construction is required. Furthermore, rapid growth in industrialization necessitates heavy import of capital goods such as machinery (Nelasco, 2012). This prompts not only domestic borrowing but also, external borrowing to alleviate the deficit in the balance of payments.

Total public debt has two main divisions, domestic debt and foreign debt. Domestic debt are funds that are raised internally through taxation or internal debt by issuing of treasury bills and government bonds. However, a high domestic debt may lead to crowding-out of private sector thus the need for external debt. According to World Bank (2019), external debt is foreign monetary obligations, that requires payment(s) of interest and/or principal by debtor in the future and that are owed to non-residents in other currencies. It is inclusion of public debt, public guaranteed debt and private nonguaranteed debt. External borrowing is indispensable during situations such as epidemics, pandemics and natural calamities such as the 2008 financial crisis, which resulted in mounted borrowing by economies.(Nelasco, 2012). Therefore, while external debt may foster development in both public and private sectors of a country, there is need for caution as it may be counterproductive.

A situation in which external debt cannot be sustained poses a risk to the economy of a country as it may cause some countries to default especially during pandemics or its

servicing may lead to debt overhang. This may stunt or decline economic growth as less investment is made in education, health and infrastructure sectors of developing countries. This becomes a source of weakness when debt is not being utilized productively. The aggregate demand by consumers increases which causes inflation.

Inflation being a key macroeconomic indicator provides insights on the state of the economy. The continuous and persistent increase in general prices in an economy decreases the purchasing power of money. This can reduce the standards of living of people over time. Therefore, it poses undesirable effects hence a global concern and threat to all economies (Asmamaw, 2011).

The focus of this study is the impact of external debt on inflation on three East Africa countries, Kenya, Tanzania and Uganda, that are considered to be among the top fifty countries in the world which are highly indebted to China, according to Brookings Research Firm based in US. According to East Africa Economic Outlook (2019), current account deficits and external debt posed a downside risk to economic growth. Moreover, the report indicated that the debt owed to China has expensive terms which may cause some countries to default payment when it fell due. There are two opposing views in this study. One view suggested that external borrowing has inflationary effect while the other suggested that it is deflationary in short run dynamics and long run dynamics. This study seeks to establish where the three countries lie in these views.

1.2. The statement of the problem

External debt is expected to bring a positive impact to the economy of developing countries. However, this may not be the case as Reinhart & Rogoff (2010) in their evaluation of debt , economic growth and inflation, showed that economic growth detoriates faster with increase in external debt levels than with increase in total debt.

However, borrowing is inevitable in both developed and developing countries. The domestic debt markets in some states are less developed hence, the need to rely on foreign debt to bridge the domestic gap(Halima, 2013). This is because their domestic debt market is underdeveloped and does not match the government financial needs. Consequently, a large proportion of their total debt is composed of external debt(Halima, 2013).

In the context of East Africa, countries in this region are low-income, developing countries hence a large portion of their debt is foreign. Through the East African Community (EAC), some of the countries in this region can trade with less restrictions. However, this may be risky as changes in economic circumstances in one of these countries may affect other countries may affect countries in EAC and extend to countries in the East African region. The Mexican Peso crisis which occurred in 1994 is an example of how one country's economic circumstances affects or spreads to other countries in the region.

Several studies have analysed the effect of external debt on inflation with regards to their relationship. This study, therefore, sought to investigate the long-term effects of external debt on inflation in Kenya, Uganda and Tanzania.

1.3. Research objective

- The objective of this study is to investigate the effect of external debt on inflation in Kenya, Tanzania and Uganda.

1.4. Research questions

1. What is the long-term effect of external debt on inflation in Kenya, Tanzania and Uganda ?

1.5. Significance of the study

Kenya, Uganda and Tanzania have increasingly accumulated debt over the years with the amount of outstanding foreign debt being a cause for concern about the future sustainability of these developing countries. Moreover, the weak arrangements by institutions and the regulatory framework governing debt management, makes it important to establish if there is a causal relationship between external debt and inflation in the short run and long run(Halima, 2013). This will help provide a prudent approach to managing debt.

Furthermore, few studies have concentrated on external borrowing, if its inflationary or deflationary in East African countries. This study is of great importance to policy makers and macroeconomists to understand how governments should implement monetary and fiscal

policies and efficiently manage external borrowing especially to foreign countries or institutions with expensive terms.

1.6. Scope and organisation of the study

The study is divided into five sections. Chapter two reviews both theoretical and empirical literature done on previous studies . Chapter three will entail the type of data and its source, and the methodology the study aims to use. Chapter four will discuss the empirical findings while chapter five will encompass the conclusions of the study's results.

CHAPTER TWO: LITERATURE REVIEW

Introduction

In this chapter, the study delves into the theoretical issues surrounding external debt and inflation and concludes by highlighting empirical literature on the relationship between external debt and inflation in developing countries.

2.1. Theoretical literature

2.1.1. Demand-pull inflation theory

The Demand-pull inflation theory states that price levels rise due to aggregate demand in an economy being greater than aggregate supply. Several factors cause the demand driven inflation. A growing economy encourages consumers to spend more money and be confident that their wages will increase. Consumers become inclined to borrow money and save less today. This increases general demand, and many companies may have difficulty keeping pace with the growing demand. Moreover, overexpansion of the money supply brings out the idea of " too much money chasing too few goods". Printing of too much money by the government to meet its financial requirements may cause demand pull inflation.

2.1.2. Cost-push inflation theory

The Cost push inflation theory states that price levels rise due to increase in cost of production caused by shortage or scarcity of capital or monopolistic segments of the economy driving wages above average levels. Keynesian suggests the same idea of costs of production causing inflation but notes that future price levels would be constant if it were determined by past and expected price levels.

2.1.3. Monetary theory of inflation

The monetary view is based on the quantity theory of money borrowed from Friedman(1968), that "inflation is always and everywhere a monetary phenomenon". However, this does not exclude the role of non-monetary variables in determining inflation.

The theory assumes that inflation is affected by changes in money density due to changes in aggregate demand and aggregate supply. Furthermore, it is believed that the additional demand for money generated by expectations by consumers on increased inflation or increase in utility prices by government adds to inflation(Ali, 1996). This generated demand is met by either increase in velocity of money stock or accommodating increase in money supply(Ali, 1996).

From the above theory reviews, ingredients that cause price escalation are demand and supply disturbances, monetary shocks and inflation expectations. Moreover, theories of demand-pull and cost-push inflation have similar results, increasing price levels, but have different inherent sources. It may therefore be difficult to distinguish both cases in reality.

2.2. Empirical literature

The following section provides a review of some of the empirical literature that has been done in the areas of external debt and inflation for cross country reviews and country specific analysis reviews.

2.2.1. Cross country analysis

Reinhart & Rogoff (2010) explored the relationship of total debt, economic growth and inflation in 20 developed economies and 24 developing economies. The study grouped data into four categories according to ratio of public debt to GDP during a particular year for each economy: low debt, medium debt, high debt and very high debt. The ratios showed that the link between debt and growth is relatively weak for countries with "normal" debt levels while those with very high debt levels have growth rates about one percent less than those with "normal" debt levels in both advanced and emerging economies. However, the similarity in both economies ends there as the study indicated that there is no significant correlation between high debt levels and inflation in advanced economies contrast to emerging countries where there is a casual relationship between high debt levels and inflation. The authors further evaluated external debt in emerging economies since most countries have a high dependence on external borrowing. The growth level detoriated faster

with increase in external debt levels than with increase in total debt at external debt levels above 60%. When external debt exceeds 90% emerging countries showed a declining growth rate and a significantly high inflation rate.

(Nguyen, 2015) This study used PMG (Pooled Mean Group) estimation and panel differenced GMM Arellano-Bond regression to examine the impact of public debt on inflation with control variables in 15 Asian developing countries for the period 1990-2012. The control variables are money supply, private investment, GDP per capita, budget revenue, government investment, government current expenditure and trade openness. The results from the GMM regression indicate public debt, economic growth and trade openness have a positive significant impact on inflation, therefore, increase in the above independent variables increases the general price levels while increase in first lag of inflation and private investments causes general prices to reduce(deflation) . However, the GMM regression did not consider stationarity of variables hence PMG-error correction model is employed to check robustness of the GMM estimation. Results from wasterlund panel co-integration test indicates that all the independent variables are co-integrated with inflation. PMG estimation indicated that in the short run, public debt is deflationary. It also confirmed that the GMM regression is consistent and robust as in the long run, the impact of public debt, economic growth and private investments are similar. However, the study did not consider if there is a unidirectional or bidirectional causality between external debt and inflation.

(Karakaplan, 2009) The author conducted a research based on two hypotheses: external debt has less effect on inflation when financial markets are well developed and the effects of the determinants of inflation are heterogeneous across countries. The study employed a GMM technique to prevent estimation problems of the unbalanced data of 121 countries for the period 1960-2004. The results support the first hypothesis of external debt having less impact on inflation in countries with well-developed financial markets if, the effects of the determinants are assumed to be homogeneous across countries. However, the results from the first hypothesis cannot be generalized as the second hypothesis that suggests the relationship are heterogeneous is supported by the presence of different coefficients of variables across the countries. Despite this study not looking at long run inflationary effects, it indicates that impact of determinants of inflation differ across countries which is in line

with the case of this study: what is the long run relationship between external debt and inflation in Kenya, Tanzania and Uganda.

2.2.2. Country specific analysis

Ahmad, Sheikh & Tariq(2012) explored how domestic debt and servicing of this type of debt affected inflation in Pakistan for the period 1972 to 2009. This study used two econometric models to study the ingredients of price escalation. These ingredients are demand and supply disturbances, monetary shocks and inflation expectations which are based on theoretical stances on inflation. The first model has five independent variables, total domestic debt, money supply to show consistency with Expectation of quantity theory of money and demand-pull inflation effects are shown by variables of private investments, exports and government expenditures. The variables were found to have a significant impact on inflation. Domestic debt and money supply had a positive effect on inflation with the latter being consistent with the quantity theory of money. The variables export and government purchases are consistent with the demand-pull inflation theory. However, private investments are negative hence, does not contribute to aggregate demand thus contradicting the demand-pull inflation theory. The second model has four variables, domestic debt servicing, indirect tax in light of cost push inflation, exchange rate under theory of devaluation and budget deficit according to neoclassical and Keynesian framework. All variables are positive and statistically significant except for exchange rates which is statistically insignificant. Also, the effect of debt servicing on inflation is very small but it has a high statistical significance. This study covers a vast arena on the ingredients of inflation but fails to tell us how these ingredients respond in the short run and long run.

(Mweni, Njuguna & Oketch, 2016) The study employed an ordinary least square regression to establish the relationship between external debt on inflation in Kenya for the period 1972-2012. The authors carried out various tests on the data to ensure it is consistent with classical linear regression model (CLRM) assumptions. Using the Augmented Dicky Fuller(ADF), external debt is stationary at first difference while inflation is stationary at level. The study regresses balance of trade, exchange rate, foreign reserves, total investment, GDP growth rate and inflation on external debt at their stationary levels. The Breusch-Pagan/Cook-Weisberg test indicated that the variance of the residual term of the model is

constant hence homoscedastic. Moreover, the Lagrangian multiplier test indicated that the autoregressive conditional heteroscedasticity(ARCH) effect on data is not significant at lag one. Furthermore, the data does not suffer from serial correlation as the first and second order autocorrelations are insignificant. Having met the CLRM assumptions, the authors establish that increase on inflation rate increases the level of external debt in Kenya. However, the authors fail to establish if inflation helps in prediction of level of external debt or vice versa.

Ekinci (2016) used a simple linear regression to analyse how both consumers and producers are affected by external borrowing in terms of inflation in Turkey from 2003 to 2015. The study has two regression models each with different dependent variables, CPI and PPI, and the same explanatory variable, external debt. The author carried out various tests to ascertain that the data is consistent with the Classical Linear Regression Model(CLRM) assumptions. The Augmented Dickey Fuller (ADF) test showed that CPI, PPI and external debt are stationary at first difference. The Lagrangian multiplier test for autocorrelation indicated that the variables do not suffer from serial correlation when a lag length of 2 is used. Granger causality test done through VAR analysis shows that only CPI can help predict PPI and no relation between other variables. The white heteroskedasticity test indicated that the error variance term is constant for all observations. Having met the CLRM assumptions, the authors establish that the strong positive correlation between CPI and external debt is similar to the case of PPI as the R-squared of both models are quite high, 96.6%(CPI) and 97%(PPI). Despite the study conducting a VAR analysis to determine causality, it does not examine in the short-run and long-run relationships.

2.3. Summary of literature

The theoretical literature looked at some theories, the demand-pull inflation and cost push inflation and how some factors relate to these theories. This study includes two other independent variables, growth of gross domestic product and growth of broad money and analysed if they helped in explaining the relationship between external debt and inflation. These two variables are factors identified to cause a demand driven inflation. Furthermore, the monetarist view suggested that changes in demand and supply changes money supply

that affects inflation. Therefore, it suggests a positive relationship between money supply and inflation.

The empirical analysis covered six published works of which all involved analysis of developing countries except for Growth in a time of Debt (Reingart & Rogoff, 2010) and the conditional effects of external debt on inflation (Karakaplan, 2009) which analysed both developed countries and developing countries. It is clear that empirical analysis for both cross-country analysis and country specific analysis have consistent results for relationship between total public debt and inflation, domestic debt and inflation, and external debt and inflation. The results showed positive correlations of the three types of debt with inflation. This study adopted a model, vector error correction model, contrast with those presented in the empirical review so as to answer the research question on the long-term relationship and the direction of causality between external debt and inflation in Kenya, Uganda and Tanzania.

CHAPTER THREE: METHODOLOGY

Introduction

This section included the approaches that were undertaken to prepare and study the data, including comprehensive description of the variables, the tests and the models used in the analysis of the data.

3.1. Research design

The study took a causal research design, to investigate the effect of external debt on inflation. This study included other independent variables, broad money growth rate and analysed if they help in explaining the relationship between external debt and inflation, which involved quantitative analysis.

3.2. Population and sampling

This study used secondary data. All the data was obtained from the World Bank International Financial Statistics and Data Files. This study analysed annual panel data spanning 1988 to 2018 on the following macroeconomic variables: inflation rate, external debt stocks, and broad money growth rate. This study picked a sample of data from 1988 to 2015 for Kenya, Uganda and Tanzania. The table below summarizes the variables:

Variable	Description
external debt stocks	Total external debt stocks as a percentage of Gross National Income(GNI)
inflation rate	Changes in the consumer price index
broad money growth rate	It is the sum of currency outside banks and proxy for money supply

Table 1: summary of data variables

3.3. Data analysis

3.3.1. Stationarity Test

This is the first step in analysis of the panel data. A variety of tests are used in this to check for unit root such as the Levin-Lin-Chu, Harris-Tzavalis , Fisher-type and Im-Pesaran-Shin. These tests are applied to the variables at level to test for stationarity, in order to avoid a spurious regression. The importance of this test is to examine whether the variables are stationary and determine the order of integration as this is important when deciding what model to use. The null hypothesis is defined as; all panels contain a unit root against the alternative hypothesis; all panels are stationary. Failure to reject the null implies that the data needs to be differenced and tested for stationarity at each differenced level.

3.3.2. Engle and Granger (1987) Cointegration Test

After conducting stationarity tests for each of the variables, finding the order of integration and specifying optimal lag length, the next step was to determine whether the variables are co-integrated or not, using Engle and Granger and Johansen's Cointegration test. Cointegration shows existence of long-run relationship between the dependent variable, which is inflation in this study, and the independent variables. This test required that the variables be not stationary at level but become stationary when they are differenced . This test involves testing the null hypothesis that there is no cointegration, against the alternative hypothesis that cointegration exists.

3.3.3. Johansen's Cointegration Test

For robustness, this study also conducted the Johansen's test for cointegration so as to provide for all the weaknesses of the Engle and Granger test which are the Engle and Granger test is weak for finite sample data and permits more than one co-integration relationship.

3.3.4. Error Correction Model

After conducting the cointegration tests and finding the existence of cointegrating relationships between the dependent and independent variables, a vector error correction model is estimated. The error correction model is advantageous as it captures not only the long-run equilibrium to but also the short run dynamics and the rate of adjustment to equilibrium after a disequilibrium; and it is of the form:

$$\Delta \text{inflation}_t = a_0 + \sum_{i=0}^{2} \beta_i \Delta X_{t-i} + \sum_{j=0}^{2} Y_j \Delta \text{inflation}_{t-j} + P\,\mathcal{E}_{t-1} + \mu_t$$

Where Δ shows the first difference aspect of the model, ε_t is the estimated residual from the selected Engle and Granger cointegration equation while X_{it} is the vector of exogenous variables, including external debt stocks, and broad money growth rate. For stability of the system in the model, the *P* coefficient, which measures the speed of adjustment of inflation rate to the value implied by the long run equilibrium relationship should be statistically significant.

3.3.5. Granger Causality Test

Granger (1969) suggested an approach to measure causality between co-integrated variables. This study tested whether there is unidirectional or bidirectional causality between external debt and inflation. The test is carried out on in order to determine if historic values of one random variable can help predict the future values of the other random variable, whether there is unidirectional or bidirectional causality between external debt and inflation. When carrying out the test, the implied null hypothesis is that external debt does not Granger cause inflation and inflation does not Granger cause external debt.

CHAPTER FOUR: DATA ANALYSIS AND FINDINGS

4.1. Descriptive statistics

Variables	INFLATION_RATE	EXTERNAL_DEBT	MONEY_GROWTH
Mean	14.33156	56.85042	21.75008
Median	8.169021	46.79714	17.71556
Maximum	196.1000	165.8710	117.6640
Minimum	-0.287509	13.47453	2.931252
Std. Dev.	22.16245	37.61375	16.72408
Skewness	6.224646	1.299648	2.742660
Kurtosis	50.14035	4.017277	14.01860
Jarque-Bera	9211.640	30.19088	587.0562
Probability	0.000000	0.000000	0.000000
Observations	93	93	93

Table 2: Descriptive statistics

As shown in table 2 above, inflation was quite high at an average of 14.33 percent over the sample period. The standard deviation was also high at 22.16 percent

which means that there were price levels fluctuated during the sample period. Over the sample period the maximum value of inflation has been surprisingly high at 196 percent in Uganda.

External debt was quite high with an average of 56.85 percent with a standard deviation of 37.61 percent which is high.

Skewness is a measure of the symmetry of the data. If the skewness value is between -0.5 and 0.5 the data is fairly symmetrical, and the results showed that the data on the three variables were highly skewed

4.2. Correlation test

Variables	INFLATION_RATE	EXTERNAL_DEBT	MONEY_GROWTH
INFLATION_RATE	1.0000		
EXTERNAL_DEBT	0.2224	1.0000	
MONEY_GROWTH	0.7779	0.3137	1.0000

Table 3: Correlation matrix

Table 3 above shows results on the relationship among the variables. Correlation between external debt and inflation, and external debt and money growth is low while inflation and money growth have a high correlation.

4.3. Stationarity Test

The data is first tested for stationarity using the Levin-Lin-Chu and Im, Pesaran and Shin unit root tests. The null hypothesis is that panels contain unit root, while the alternative is that panels are stationary. The results of the tests are shown in the table below:

Series	Levin, Lin & Chu				Im, Pesaran and Shin			
	Level		**First difference**		**Level**		**First difference**	
	constant	**Constant and trend**	**constant**	**Constant and trend**	**Constant**	**Constant and trend**	**Constant**	**Constant and trend**
INFLATION_RATE	0.2729	0.6915	0.0000***	0.0000***	0.0005***	0.0034***	0.0000***	0.0000***
EXTERNAL_DEBT	0.4053	0.8652	0.0000***	0.0000***	0.6154	0.5372	0.0000***	0.0000***
MONEY_GROWTH	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***

Table 4: unit root test p values

*Note: ***, ** and * show significance at 1%, 5% and 10% levels, respectively.*

Lags were included in the test so as to eliminate autocorrelation. The Schwarz Bayesian Criterion was used as an automatic lag length selection given two as the maximum number of lags to avoid losing the degrees of freedom.

Individual effects and Individual effects, individual linear trends were included in the test equations when conducting the unit root test for all the series at level. Both constant and constant trend values under Levin, Lin & Chu test fail to reject the null hypothesis of panels containing unit root at level except for MONEY_GROWTH. Under the Im, Pesaran and Shin test, we reject the null hypothesis of panels containing unit root at level in favour of the alternative of at least one panel is stationary. For both unit root tests, the null hypothesis of panels containing unit root is rejected at first difference.

4.4. Cointegration Tests

All the variables are integrated at order 1, I(1). These variables were tested for cointegration properties to show if they have compatible long run properties. Three panel cointegration test were used, Pedroni Residual Cointegration test and Kao Residual Cointegration Test which are Engle-Granger based tests and the Johansen Fisher Panel Cointegration Test, a system-based test and a superior test of the three as it permits more than one cointegration relationship.

4.4.1. Engle-Granger based Test

Trend assumption	No deterministic trend	Deterministic intercept and trend	No deterministic intercept and trend
cointegration statistics probabilities	9/11	8/11	10/11

Table 5: Pedroni Residual Cointegration test

An automatic lag length selection, Schwarz Bayesian Criterion (SIC), was used with a maximum lag length of two. From table above, null hypothesis of no cointegration was rejected under all trend assumptions. 9 out of the 11 cointegration statistics are below the 5 percent significance level when individual fixed effects are included. 8 out of the 11 cointegration statistics are below the 5 percent significance level when both individual fixed effects and trends are included while 10 out of the 11 cointegration statistics are below the 5 percent significance level when no regressors are included. The variables, INFLATION_RATE, EXTERNAL_DEBT and MONEY_GROWTH, were cointegrated.

	t-Statistic	Prob.
ADF	-9.823736	0.0000

Table 6: Kao Residual Cointegration test

An automatic lag length selection, Schwarz Bayesian Criterion (SIC), was used with a maximum lag length of two. From table above, null hypothesis of no cointegration was rejected given that the statistic is below the 5 percent significance. The variables, INFLATION_RATE, EXTERNAL_DEBT and MONEY_GROWTH, were cointegrated.

4.4.2. Johansen Fisher Panel Cointegration Test

Further evaluation of the existence of long-run equilibrium relations is estimated using the Fisher (combined Johansen) test which incorporate both the trace test and maximum eigen test.

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	31.81	0.0000	30.51	0.0000
At most 1	8.388	0.2111	4.932	0.5526
At most 2	14.83	0.0216	14.83	0.0216
Individual cross section results				

Cross Section	Trace Test Statistics	Prob.**	Max-Eigen Test Statistics	Prob.**
Hypothesis of no cointegration				
Kenya	39.3332	0.0030	30.0984	0.0021
Tanzania	24.9617	0.1628	15.3068	0.2680
Uganda	46.6544	0.0003	34.3349	0.0004

Table 7: Johansen Fisher Panel Cointegration Test

The result displayed in table above were obtained when the linear deterministic trend (unrestricted) was included in the cointegration test. Both Johansen Fisher trace and maximum eigen test reject the null hypothesis of no cointegration indicating that there is long run panel relationship between the variables. These results are consistent when the trend assumptions; no intercept or trend, intercept no trend, intercept and trend are used as shown in APPENDIX 2. The result showed that there is one cointegrating relationship with a 5 percent critical value among the series. The individual cross sections reveal the same result for the rank tests except for Tanzania.

4.5. Vector Error Correction Model

The vector error correction model requires that the variables be integrated at order 1 and cointegrated.

D(INFLATION_RATE) = C(1)*(INFLATION_RATE(-1) + 0.1511*EXTERNAL_DEBT(-1) + 0.1288*MONEY_GROWTH(-1) - 19.3799) + C(2)*D(INFLATION_RATE(-1)) + C(3)*D(INFLATION_RATE(-2)) + C(4)*D(INFLATION_RATE(-3)) + C(5)*D(INFLATION_RATE(-4))

+ C(6)*D(INFLATION_RATE(-5)) + C(7)*D(EXTERNAL_DEBT(-1)) + C(8)*D(EXTERNAL_DEBT(-2)) + C(9)*D(EXTERNAL_DEBT(-3)) + C(10)*D(EXTERNAL_DEBT(-4)) + C(11)*D(EXTERNAL_DEBT(-5)) + C(12)*D(MONEY_GROWTH(-1)) + C(13)*D(MONEY_GROWTH(-2)) + C(14)*D(MONEY_GROWTH(-3)) + C(15)*D(MONEY_GROWTH(-4)) + C(16)*D(MONEY_GROWTH(-5)) + C(17)

This equation above shows the error correction model with the coefficient of the first difference sum showing the short run dynamics. Thus, in the short run, C (1) is the speed of adjustment of the model to equilibrium in the short run which is at a rate of -0.193342 as shown in the table below. C(1) is significant as its coefficient is negative and statistically significant. Furthermore, all coefficients in the table are insignificant except for first lag of INFLATION_RATE, second lag of INFLATION_RATE, third lag of INFLATION_RATE, first lag of MONEY_GROWTH and second lag of MONEY_GROWTH.

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.1933*	0.05664	-3.4129	0.0008
C(2)	-0.3117*	0.1156	-2.6965	0.0077
C(3)	-0.2861*	0.09694	-2.9515	0.0036
C(4)	-0.1764***	0.09427	-1.8713	0.0630
C(5)	-0.08628	0.07910	-1.09078	0.2769
C(6)	-0.01195	0.04630	-0.2581	0.7966
C(7)	0.09193	0.06310	1.4568	0.1470
C(8)	-0.06172	0.05856	-1.0539	0.2934
C(9)	-0.01165	0.05543	-0.2102	0.8337
C(10)	0.08069	0.05277	1.5290	0.1281
C(11)	-0.01045	0.05192	-0.2013	0.8407
C(12)	0.2443*	0.08036	3.0411	0.0027
C(13)	0.1521***	0.07940	1.9163	0.0570
C(14)	0.04706	0.07756	0.6067	0.5448
C(15)	0.1020	0.07796	1.3089	0.1923
C(16)	0.02698	0.07196	0.3749	0.7082
C(17)	-0.72500	0.6819	-1.0630	0.2892

Table 8: Short-run adjustment

*Note: *, **, *** represent 1%, 5% and 10% significance level respectively*

Long Run Dynamics

The long run relationship between EXTERNAL_DEBT, INFLATION_RATE and MONEY_GROWTH for one cointegrating vector for Kenya, Uganda and Tanzania in the period 1988-2018 is displayed below. This is the first part of the VECM resultant equation.

INFLATION_RATE(-1) = 0.1511*EXTERNAL_DEBT(-1) + 0.1288*MONEY_GROWTH(-1) - 19.3799

The equation above shows long run elasticities when there is one cointegration equation. Increase in level of external debt and money supply is related to increase in inflation, thus, the estimated model was able to produce expected results that is consistent. The results displayed in equation above show that a one percent increase in EXTERNAL_DEBT, ceteris paribus, is likely to increases INFLATION_RATE by 0.1511 percent while a one percent increase in MONEY_GROWTH, ceteris paribus, is likely to increases INFLATION_RATE by 0.1288 percent. The result above is consistent with the monetary theory of inflation; increase in money supply leads to higher prices and inflation.

4.6. Granger causality test

4.6.1. Block Exogeneity Wald Tests

Dependent variable: D(INFLATION_RATE)

Excluded	Chi-sq	df	Prob.
D(EXTERNAL_DEBT)	2.697755	2	0.2595
D(MONEY_GROWTH)	2.484214	2	0.2888
All	5.044300	4	0.2828

Table 9: Block Exogeneity Wald Tests

Also, known as the VEC granger causality test; test on lagged explanatory variables where the null hypothesis is that the lagged coefficient(s) are equal to zero. The table below shows that the null hypothesis fails to be rejected given the prob-value of the chi-sq statistic is greater than the 5 percent significance level. There is no short run causality among the variables.

4.6.2. Dumitrescu-Hurlin Panel Granger Causality Test

Null Hypothesis: V1 does not homogeneously cause V2

V1	V2	Prob.
EXTERNAL_DEBT	INFLATION_RATE	0.0084
INFLATION_RATE	EXTERNAL_DEBT	0.3445

Table 10: Dumitrescu-Hurlin Panel Granger Causality Test

The Granger Causality test shows that there is unidirectional causality between external debt and inflation for the sample data of the three countries. The test null hypothesis that external debt does not Granger cause inflation is rejected, and the test fails to reject that inflation does not Granger cause inflation. The study therefore concluded that external debt helped in the prediction of inflation.

CHAPTER FIVE: CONCLUSION

4.1. Summary of findings

The study conducted an empirical analysis into the relationship between external debt and inflation. liquidity measures and top twenty performing stocks of Nairobi Stock Exchange: stocks in NSE 20. The study adopted annual panel time-series data under the time spanning 1988 to 2018. The study utilized cointegration tests as well as granger causality test. The results from Engle-Granger and Johansen cointegration approach revealed the existence of long-run relationship among the variables. This results were further established under the long-run scenario of the VECM estimation output. The VECM result revealed positive relationships among inflation rate, external debt and the control variable, money growth. However, the short run effects were not statistically significant enough to cause a desired change in the short run. Granger causality tests reveal that external debt causes inflation homogeneously this means that a crisis in one of these countries may spread the crisis to the other countries similar to the Mexican peso crisis that occurred in 1994.

4.2. Recommendations

Based on the results, the governments of Kenya, Tanzania and Uganda should effectively manage debt to foreign countries and institutions with expensive terms. This is because in the sample period of the study, external debt was found to have long term effects rather than short terms effects on inflation. This may be detrimental to the country(s) as it may limit other countries from establishing relationships with them. Also, external debt is likely to cause inflation as shown in chapter four therefore, policy makers should set effective debt limits to lower this probability.

The study leaves room for further exploration on this topic using additional variables such as imports and exports. This is because regional integration involves a lot of trading amongst the member countries, thus imports and exports are expected to play a major role.

4.3. Limitation of study

The study was limited to the period 1988 to 2015 for lack of data, and also limited to Kenya, Uganda and Tanzania for the same reason.

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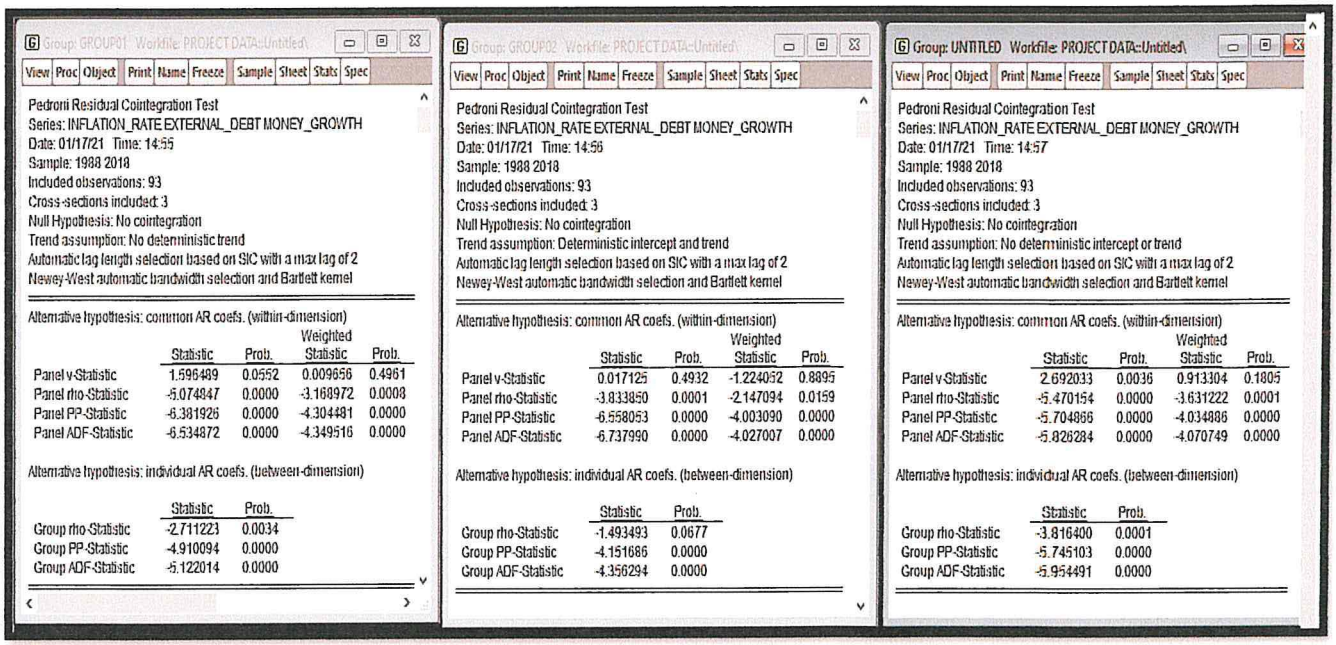
APPENDIX



Group: GROUP01 Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Pedroni Residual Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/17/21 Time: 14:55
Sample: 1988 2018
Included observations: 93
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	1.596489	0.0552	0.009656	0.4961
Panel rho-Statistic	-5.074947	0.0000	-3.168972	0.0008
Panel PP-Statistic	-6.381926	0.0000	-4.304481	0.0000
Panel ADF-Statistic	-6.534872	0.0000	-4.349516	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-2.711223	0.0034
Group PP-Statistic	-4.910094	0.0000
Group ADF-Statistic	-5.122014	0.0000

Group: GROUP02 Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Pedroni Residual Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/17/21 Time: 14:56
Sample: 1988 2018
Included observations: 93
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.017125	0.4932	-1.224052	0.8895
Panel rho-Statistic	-3.833850	0.0001	-2.147094	0.0159
Panel PP-Statistic	-6.558053	0.0000	-4.003090	0.0000
Panel ADF-Statistic	-6.737990	0.0000	-4.027007	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-1.493493	0.0677
Group PP-Statistic	-4.151686	0.0000
Group ADF-Statistic	-4.356294	0.0000

Group: UNTITLED Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

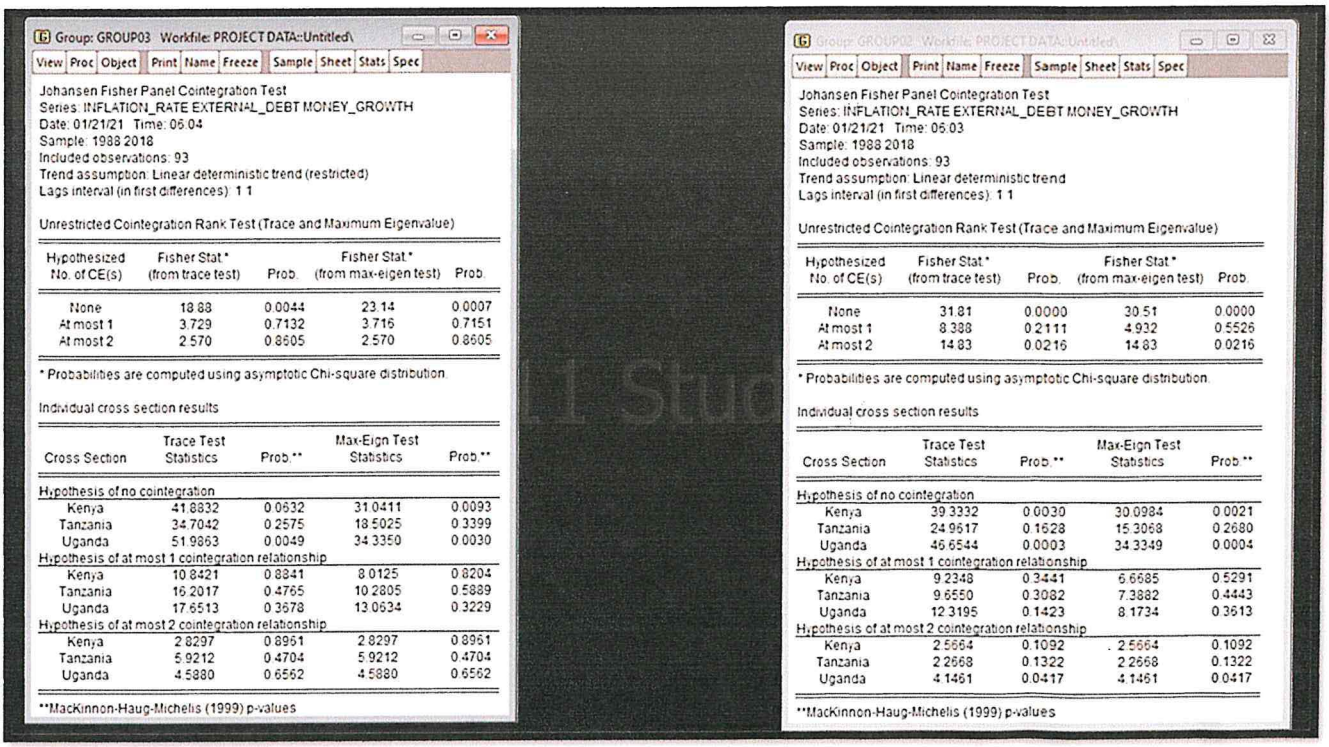
Pedroni Residual Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/17/21 Time: 14:57
Sample: 1988 2018
Included observations: 93
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: No deterministic intercept or trend
Automatic lag length selection based on SIC with a max lag of 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	2.692033	0.0036	0.913304	0.1805
Panel rho-Statistic	-5.470154	0.0000	-3.631222	0.0001
Panel PP-Statistic	-5.704866	0.0000	-4.034886	0.0000
Panel ADF-Statistic	-5.826284	0.0000	-4.070749	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-3.816400	0.0001
Group PP-Statistic	-5.745103	0.0000
Group ADF-Statistic	-5.954491	0.0000



Group: GROUP03 Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Johansen Fisher Panel Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/21/21 Time: 06:04
Sample: 1988 2018
Included observations: 93
Trend assumption: Linear deterministic trend (restricted)
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	18.88	0.0044	23.14	0.0007
At most 1	3.729	0.7132	3.716	0.7151
At most 2	2.570	0.8605	2.570	0.8605

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Kenya	41.8832	0.0632	31.0411	0.0093
Tanzania	34.7042	0.2575	18.5025	0.3399
Uganda	51.9863	0.0049	34.3350	0.0030
Hypothesis of at most 1 cointegration relationship				
Kenya	10.8421	0.8841	8.0125	0.8204
Tanzania	16.2017	0.4765	10.2805	0.5889
Uganda	17.6513	0.3678	13.0634	0.3229
Hypothesis of at most 2 cointegration relationship				
Kenya	2.8297	0.8961	2.8297	0.8961
Tanzania	5.9212	0.4704	5.9212	0.4704
Uganda	4.5880	0.6562	4.5880	0.6562

**MacKinnon-Haug-Michelis (1999) p-values

Group: GROUP02 Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Johansen Fisher Panel Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/21/21 Time: 06:03
Sample: 1988 2018
Included observations: 93
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

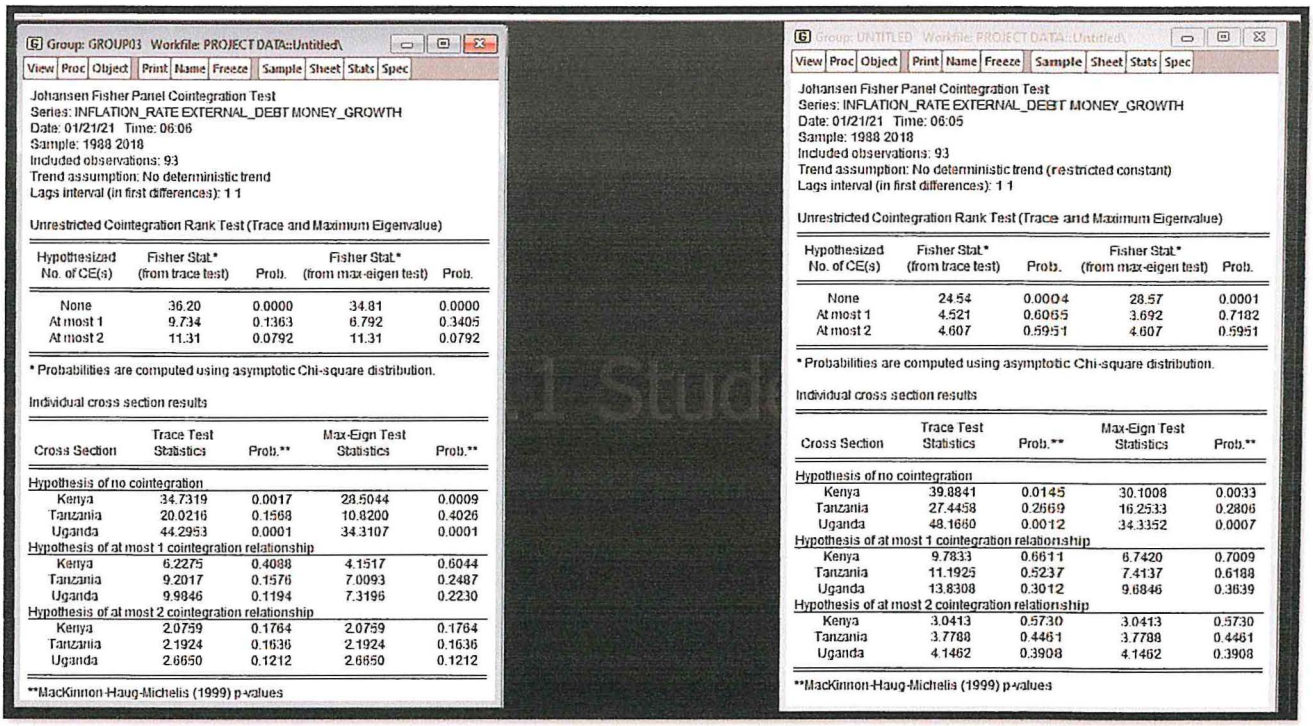
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	31.81	0.0000	30.51	0.0000
At most 1	8.388	0.2111	4.932	0.5526
At most 2	14.83	0.0216	14.83	0.0216

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Kenya	39.3332	0.0030	30.0984	0.0021
Tanzania	24.9617	0.1628	15.3068	0.2680
Uganda	46.6544	0.0003	34.3349	0.0004
Hypothesis of at most 1 cointegration relationship				
Kenya	9.2348	0.3441	6.6685	0.5291
Tanzania	9.6550	0.3082	7.3882	0.4443
Uganda	12.3195	0.1423	8.1734	0.3613
Hypothesis of at most 2 cointegration relationship				
Kenya	2.5664	0.1092	2.5664	0.1092
Tanzania	2.2668	0.1322	2.2668	0.1322
Uganda	4.1461	0.0417	4.1461	0.0417

**MacKinnon-Haug-Michelis (1999) p-values



Group: GROUP03 Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Johansen Fisher Panel Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/21/21 Time: 06:06
Sample: 1988 2018
Included observations: 93
Trend assumption: No deterministic trend
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	36.20	0.0000	34.81	0.0000
At most 1	9.734	0.1363	6.792	0.3405
At most 2	11.31	0.0792	11.31	0.0792

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Kenya	34.7319	0.0017	28.5044	0.0009
Tanzania	20.0216	0.1568	10.8200	0.4026
Uganda	44.2953	0.0001	34.3107	0.0001
Hypothesis of at most 1 cointegration relationship				
Kenya	6.2275	0.4088	4.1517	0.6044
Tanzania	9.2017	0.1576	7.0093	0.2487
Uganda	9.9846	0.1194	7.3196	0.2230
Hypothesis of at most 2 cointegration relationship				
Kenya	2.0759	0.1764	2.0759	0.1764
Tanzania	2.1924	0.1636	2.1924	0.1636
Uganda	2.6650	0.1212	2.6650	0.1212

**MacKinnon-Haug-Michelis (1999) p-values

Group: UNTITLED Workfile: PROJECT DATA::Untitled\

View | Proc | Object | Print | Name | Freeze | Sample | Sheet | Stats | Spec

Johansen Fisher Panel Cointegration Test
Series: INFLATION_RATE EXTERNAL_DEBT MONEY_GROWTH
Date: 01/21/21 Time: 06:05
Sample: 1988 2018
Included observations: 93
Trend assumption: No deterministic trend (restricted constant)
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	24.54	0.0004	28.57	0.0001
At most 1	4.521	0.6065	3.692	0.7182
At most 2	4.607	0.5951	4.607	0.5951

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
Kenya	39.8841	0.0145	30.1008	0.0033
Tanzania	27.4458	0.2669	16.2533	0.2806
Uganda	48.1660	0.0012	34.3352	0.0007
Hypothesis of at most 1 cointegration relationship				
Kenya	9.7833	0.6611	6.7420	0.7009
Tanzania	11.1925	0.5237	7.4137	0.6188
Uganda	13.8308	0.3012	9.6846	0.3639
Hypothesis of at most 2 cointegration relationship				
Kenya	3.0413	0.5730	3.0413	0.5730
Tanzania	3.7788	0.4461	3.7788	0.4461
Uganda	4.1462	0.3908	4.1462	0.3908

**MacKinnon-Haug-Michelis (1999) p-values

Vector Error Correction Estimates
Date: 02/09/21 Time: 09:25
Sample (adjusted): 1994 2018
Included observations: 75 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
INFLATION_RATE(-1)	1.000000
EXTERNAL_DEBT(-1)	0.151050 (0.05004) [3.01852]
MONEY_GROWTH(-1)	0.128757 (0.23129) [0.55668]
C	-19.37991

Error Correction:	D(INFLATIO...	D(EXTERNA..	D(MONEY_...
CointEq1	-0.193342 (0.05665) [-3.41300]	-0.551438 (0.08192) [-6.73172]	-0.201021 (0.08269) [-2.43102]
D(INFLATION_RATE(-1))	-0.311752 (0.11561) [-2.69653]	-0.063732 (0.16718) [-0.38121]	-0.019660 (0.16876) [-0.11649]
D(INFLATION_RATE(-2))	-0.286127 (0.09694) [-2.95152]	0.009547 (0.14018) [0.06810]	0.362736 (0.14151) [2.56340]
D(INFLATION_RATE(-3))	-0.176408 (0.09427) [-1.87130]	-0.233811 (0.13632) [-1.71518]	0.378804 (0.13761) [2.75282]
D(INFLATION_RATE(-4))	-0.086281 (0.07910) [-1.09078]	-0.078290 (0.11438) [-0.68446]	0.315082 (0.11546) [2.72889]
D(INFLATION_RATE(-5))	-0.011953 (0.04631) [-0.25812]	0.046378 (0.06696) [0.69260]	0.101645 (0.06759) [1.50376]
D(EXTERNAL_DEBT(-1))	0.091935 (0.06310) [1.45688]	0.255104 (0.09125) [2.79561]	0.033887 (0.09211) [0.36789]
D(EXTERNAL_DEBT(-2))	-0.061726 (0.05857) [-1.05396]	0.171569 (0.08469) [2.02587]	0.001347 (0.08549) [0.01575]
D(EXTERNAL_DEBT(-3))	-0.011654 (0.05544) [-0.21022]	-0.173726 (0.08017) [-2.16709]	-0.157008 (0.08092) [-1.94022]
D(EXTERNAL_DEBT(-4))	0.080692 (0.05277) [1.52908]	-0.023502 (0.07631) [-0.30798]	-0.160603 (0.07703) [-2.08493]
D(EXTERNAL_DEBT(-5))	-0.010453 (0.05192) [-0.20131]	0.022272 (0.07509) [0.29662]	0.035633 (0.07579) [0.47012]
D(MONEY_GROWTH(-1))	0.244395 (0.08036) [3.04115]	-0.124834 (0.11621) [-1.07423]	-0.562399 (0.11731) [-4.79432]
D(MONEY_GROWTH(-2))	0.152164 (0.07940) [1.91634]	0.098158 (0.11482) [0.85488]	-0.139873 (0.11591) [-1.20679]
D(MONEY_GROWTH(-3))	0.047066 (0.07757) [0.60677]	0.071130 (0.11217) [0.63415]	-0.241971 (0.11323) [-2.13707]
D(MONEY_GROWTH(-4))	0.102050 (0.07797) [1.30892]	-0.095375 (0.11274) [-0.84596]	-0.029627 (0.11381) [-0.26033]
D(MONEY_GROWTH(-5))	0.026983 (0.07197) [0.37494]	0.098874 (0.10407) [0.95009]	0.084854 (0.10505) [0.80774]
C	-0.725008 (0.68199) [-1.06308]	-3.091740 (0.98619) [-3.13504]	-1.845158 (0.99550) [-1.85350]
R-squared	0.510826	0.595766	0.469725
Adj. R-squared	0.375882	0.484253	0.323443
Sum sq. resids	1483.119	3101.267	3160.107
S.E. equation	5.056780	7.312327	7.381368
F-statistic	3.785453	5.342582	3.211079
Log likelihood	-218.3359	-245.9983	-246.7031
Akaike AIC	6.275625	7.013288	7.032083
Schwarz SC	6.800922	7.538586	7.557381
Mean dependent	-0.821972	-3.705832	-1.345304
S.D. dependent	6.400893	10.18210	8.973968