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Effect of Selected Macroeconomic Variables on Budget Deficit in Kenya

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ABSTRACT: Macroeconomic stability has been a concern to many economies as it shows the economic health of a nation. Kenya has had unsustainable and persistent fiscal deficit which has been phenomenal in the recent past despite several economic reforms being established in an attempt to stabilizing the economy. The study was informed by the persistent increase in the budget deficit in Kenya amidst economic stagnation and macroeconomic instability. This therefore led to an attempt to establish the effect of selected macroeconomic variables on the budget deficit in Kenya. The specific objectives were to determine the effect of interest rates; exchange rate; inflation and money supply on budget deficit in Kenya. The study sought to evaluate the significant effect of the selected macroeconomic variables on budget deficit in order to formulate the policy consideration to the economic problem. The study was guided by the Keynesian which was the main theory of the study. The Mundell-Fleming and Ricardian Equivalence theories were also employed as addition theories to back up the study. The study methodology was based on an explanatory design for time series data covering 30 years from 1991 to 2020. Autoregressive distributed lag error correction model (ARDL) estimation was adopted to analyze and infer results of the study. The CUSUM model stability test indicated that the model was stable and the model coefficient was reliable. Diagnostic test results showed there was no autocorrelation (p=0.1510>2.062), no heteroscedasticity (p=0.0903>21.47), and there was no multicollinearity (vif=1.34). Shapiro wilk normality test indicated that the variables of the study were normally distributed. The ADF unit root test indicated that there was unit root and co-integration test confirmed that the variables had a long run relationship. The findings of the study were: interest rate had a positive significant effect on budget deficit in the long run (β_1 =0.0404, $p = 0.016$ <0.05); exchange rate had a positive significant effect on budget deficit (β_2 =0.4189, $p = 0.000$ <0.05); inflation had a negative insignificant effect on budget deficit (β_3 =-0.001, $p = 0.206$ >0.05). Money supply had a positive insignificant effect on Budget deficit (β_4 =0.00004, $p = 0.380$ >0.05). The ARDL long-run results showed that the explanatory variables had Adjusted R^2=0.4666 impact on the budget deficit and an F-statistics of 135.5802. The study therefore concluded that interest rate had a positive effect on the budget deficit in the long run. Increasing interest rates in the economy ends up driving budget deficit upwards in the long run. The same was true when the variable of concern is exchange rate. The study findings recommend that there is need for the government to ensure there is stability in macroeconomic variables. This is because there was a significant link between the budget deficit and the selected macroeconomic variables. A strive by the government to reduce budget deficit would mean an adjustment in macroeconomic variables to suit the purpose. These adjustments may include reducing the interest rate in the economy. A reduction in the interest rates in the economy would end up reducing the budget deficit.

KEYWORDS: budget deficit, inflation, money supply, exchange rate, macroeconomic stability

INTRODUCTION

Budget deficit or sometimes referred to as the fiscal gap is a common issue globally that policy makers are grappling with (Amin & Murshed 2017). Developed countries such as the United States and the United Kingdom usually operates a budget deficit with a hope of achieving macroeconomic stability on key macroeconomic variables such as inflation, interest rates, exchange rate, and gross domestic product. The attention towards budget deficit has become a prevalent focus across the globe due to the need for achieving sustainable macroeconomic stability. Although there are contrasting view in theory on the extent of deficit finance an economy should incur, with one group believing that budget deficit is destructive to an economy while the second group believing it is not destructive to the economy, practically however, there are few studies done to examine the impacts of selected macro-economic variables on budget deficit (Al-Khedair,1996).

Developing countries in Africa and Latin America have also been grappling with the issue of whether the stability of the economy is influenced by budget deficit. An economy characterized by deflation is likely to incur a budget deficit whereas, an economy with high inflation is unlikely to experience budget deficit (Myovella & Kisava 2018). This implies that the choice of the extent of the fiscal gap depends on the targeted level of these selected macroeconomic variables which are key determinants of budget deficit exposure in both developed and developing economies of the world (Moraa, 2014). Macroeconomic instability will likely raise inflationary pressures in the economy and adversely affect GDP growth which in effect will influence the extent of budget deficit (Moraa, 2014). Additionally, some of the techniques used to finance budget deficits, as creation of high-powered money, negates the attainment of macroeconomic stability in the long run (Imam, 2012).

The level of development of a country and the macroeconomic variables are significant in that budget deficit might be either helpful or detrimental. According to Makau, Njuru, & Ocharo, (2018), on a study of budget deficit on macroeconomic stability established to largely depend on the budget position of a country. Đukić, (2021) found out that there is a general agreement arising from both the classical and Keynesian schools of thought that fiscal policies have an effect on the aggregate demand but in different directions.

The most popular method of financing budget deficits in Kenya is borrowing which is done through the issuance of government securities and bonds in the open markets (Sirere, 2015). This, however, diminishes the real value of the currency and results in macroeconomic instability (Sirere, 2015). Since the government is the largest borrower in the capital markets, management of debt has an influence on the general credit conditions in the economy. If the government of Kenya decides to increase the return on its securities, this will impact all other financial assets, tending to increase their yields hence affecting interest rates so that they may remain competitive (Moraa, 2014).

LITURATURE REVIEW

A review of empirical literature shows that a large number of studies have been conducted on deficit financing. However, it is important to note that some of the relatively few studies have been conducted in developing countries compared to the more advanced economies. Many scholars have attempted to study the subject of macroeconomic stability as influenced by deficit financing. One key aspect of these empirical studies has been the focus on factors that affect macroeconomic stability. Others have largely focused on the various variables that are interlinked with deficit financing. These studies also indicate that the global economic and financial crisis reduce the levels of budget supports from developing nations thus eroding financing to developing countries budgets as well as the associated externalities.

Meltzer (1989) developed a monetarist approach to budget deficit by postulating that budget deficit financing have an impact on inflation. The researcher provided examples of countries that financed their budget deficits using inflation revenue in 1980s. Such countries include Brazil, Argentina, and Bolivia. The experience in many developed countries does not support the argument that budget deficits increase the growth of money hence producing inflation. One example is Italy, which experienced a budget deficit of about 10% of GNP throughout the 1980s. However, the rate of inflation in Italy was reduced from about 20% to about 5% annually during this period. Another good example of a country with persistent budget deficits and declining inflation is Japan. Many economists have argued that government deficit expenditure is a primary cause of inflation and not budget deficits. However, the inflationary effect of government deficits depends upon the manner in which the budget deficit is financed.

Sirere (2015) sought to examine the relationship between budget deficit financing and economic growth in Kenya. The study period was 2005 to 2014. The study established that there is a significant relationship between budget deficit financing and economic growth in Kenya. From the findings of this particular study, the higher the budget deficit the higher the inflation rate. This will have an implication on macroeconomic stability since attainment of macroeconomic stability will result to increased economic growth.

Many researchers have carried empirical studies concerning budget deficit and its effects. Elmendorf and Mankiw (1999) conducted a study to find out the effect of a budget deficit on accumulation of savings. An increased flow of borrowings can lead to distortionary tax measures. This is likely to ignite dissaving behavior among households and consumers. The consequence will be rise in interest rates. By implication, this reduces the funds available for investment and raises the cost of capital via increased interest rates. The final result would be a decline in private sector investments. Aschauer (1989) provided an empirical evidence pointing out to budget deficit as the major cause of crowding-out of private investments. Crowding-out of private investments will hinder a country from achieving macroeconomic stability.

Korsu, (2014) on the relationship between fiscal deficits and current account deficits in Sierra Leone found out that fiscal deficits affect the current account deficits through the monetary sector. The study opines that an increase in fiscal deficits increase the supply of money when the deficits is financed by using inflation revenue (seigniorage). Increase in money supply increases the

price level in the economy, which in turn results in the appreciation of the real exchange rate and deterioration of the current account.

Akinyi, Odunga, & Opuodho (2018) examined the effect of budget deficits on current account deficits in Kenya. The study covered the period between 1970 and 2017. The results of this study indicated that budget deficit has a significant long run effect on current account deficit and also current account deficit has a significant long run impact on budget deficit. The study also established that there exists a short run relationship between current account balance and budget deficit. The findings of this study have an implication on future studies concerning the relationship between current account balance and budget deficit.

RESEARCH METHODS

The data used in the study was secondary data. The range of data that was used was 1991 to 2020 on a annually basis. Government expenditure data was obtained from the annual government budgets. Data on Government budget deficit was acquired from the CBK publications and Annual Public Debt Reports over the years. Data on inflation, money supply and exchange rate were obtained from other government publications, and key institutions publications such as KNBS, KIPPRA as well as publications from international organizations such as the WB and IMF. The study adopted explanatory research design. This study was explanatory since it was concerned with analyzing the effect of selected macroeconomic variables on budget deficit in Kenya. The researcher analyzed data using the ARDL model and Stata software program.

DATA ANALYSIS AND INTERPRETATION

Descriptive Statistics

The summary of descriptive statistics for the variables used in this investigation is shown in Table 4.1. These descriptive statistics include minimum and maximum values as well as the mean, standard deviation, variance, skewness, and kurtosis. The mean is used to gauge the overall dataset's central value for the observation. The dataset's spread from the center values is depicted by the standard deviation. Additionally, skewness gauges how a distribution deviates from the norm; data can be either negatively or positively skewed, and kurtosis gauges how peaked a distribution is. The distribution's highest and lowest values are represented by minimum and maximum, respectively.

According to the data in table 4.1 below, Budget deficit, which was measured as percentage of GDP had a mean of 0.032 and ranged from 0.0002 to 0.81. It exhibited a positive skewness of 0.3126, which indicates a longer right tail. Additionally, the kurtosis of budget deficit was 1.5195, which is consistent with a leptokurtic distribution with a peak distribution. A standard deviation of roughly 0.0286 demonstrated how far budget deficit deviated from its mean.

Inflation had a mean of 11.39 and ranged from 1.5543 to 45.9789. It exhibited a positive skewness of 2.0369, which indicates a longer right tail. Additionally, the kurtosis of inflation was 7.1562, which is consistent with a leptokurtic distribution with a peak distribution. A standard deviation of roughly 9,5558 demonstrated how far inflation is from its mean.

Interest rate had a mean of 8.0174 and ranged from -10.096 to 21.0963. It exhibited a negative skewness of -0.5210, which indicates a longer left tail. Additionally, the kurtosis of interest rate was 3.0169, which is consistent with a mesokurtic distribution with a normal distribution. A standard deviation of roughly 7.6581 demonstrated how far interest rate is from its mean.

Exchange rate had a mean of 6.1186 and ranged from -8.2439 to 80.0343. It exhibited a positive skewness of 3.590408, which indicates a longer right tail. Additionally, the kurtosis of exchange rate was 17.5482, which is consistent with a leptokurtic distribution with a peak distribution. A standard deviation of roughly 15.7215 demonstrated how far exchange rate is from its mean.

Money supply had a mean of 15.8279 and ranged from 2.9313 to 39.0214. It exhibited an approximately symmetric distribution of 0.59433, which indicates a normal distribution. Additionally, the kurtosis of money supply was 3.0890, which is consistent with a mesokurtic distribution with a normal distribution. A standard deviation of roughly 8.5586 demonstrated how far money supply is from its mean.

Table 1. Descriptive Statistics Results

Variable	Budget deficit	Inflation	Interest Rate	Exchange Rate	Money Supply
Observation	30	30	30	30	30
Mean	.0319433	11.39156	8.017371	6.118613	15.82794
Standard deviation	.0285987	9.555797	7.658093	15.72145	8.558649

Variance	.0008179	91.31325	58.6464	247.1639	73.25048
Skewness	.3126238	2.036929	-.5299693	3.590408	.5943338
Kurtosis	1.519471	7.156204	3.016854	17.5482	3.088991
Minimum	.0002	1.554328	-10.096	-8.243879	2.931252
Maximum	.081	45.97888	21.09633	80.03425	39.02143

Source: Author, 2022

The results in table 1 above are supplemented by a graphical representation of the budget deficit, inflation, money supply, exchange rate and interest rate. This graphical representation is shown in figure 1 below.

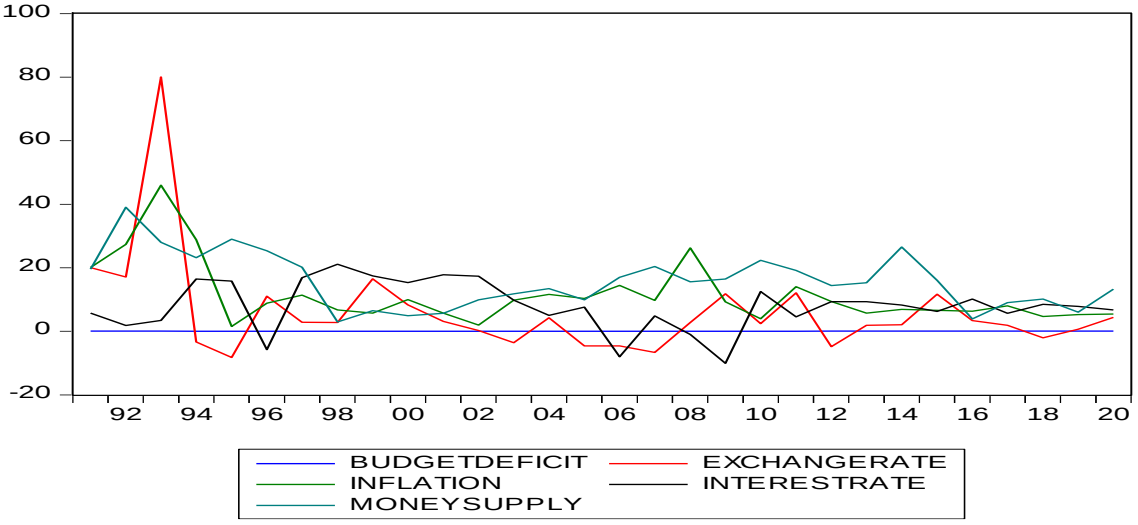

Figure 1. Budget deficit, inflation, money supply, exchange rate, interest rate Graphical representation

Diagnostic Tests

Normality Test

The summary of the normality tests performed on the variables used in this analysis is shown in Table 4.2. The shapiro-Wilk test of normalcy was used in the study, with a 5% level of significance. The alternative hypothesis for the Shapiro-Wilk test is that the data are not normally distributed, as opposed to the null hypothesis that they are normally distributed (Shapiro & Wilk,1965). When the p values are less than 0.05 level of significance, the judgment criteria are to reject the null hypothesis of normal distribution.

The p values for the budget deficit, inflation, and exchange rate are all below the threshold of 5% significance, indicating that they are not normally distributed variables. As evidenced by p values of 0.15434 and 0.38988, respectively, which are greater than the 5% level of significance, the interest rate and the money supply, on the other hand, are normally distributed.

Table 2 Normality test results

Variable	Observation	W	V	z	Prob>z
Budget Deficit	30	0.85715	4.541	3.129	0.00088
Inflation	30	0.75731	7.714	4.224	0.00001
Interest Rate	30	0.94852	1.636	1.018	0.15434
Exchange Rate	30	0.60308	12.616	5.242	0.00000
Money Supply	30	0.96398	1.145	0.280	0.38981

Source: Author, 2022

Lags Selection Order Criteria

The ARDL model's ideal lag length was determined in this study using the Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC), and Schwartz Information Criterion (SIC). Akaike Information Criterion (AIC) and Final Prediction Error (FPE), however, received particular attention. When dealing with small data sets or when there are less

than 60 observations, Liew (2004) asserts that the Akaike Information Criterion (AIC) and Final Prediction Error (FPE) are the most acceptable metrics to use.

This is due to the fact that AIC and FPE increase the likelihood of finding the best lag length in a model by minimizing the probability of underestimating the data. The various outcomes of the ideal lag length for the budget deficit, interest rate, exchange rate, inflation, and money supply are shown in Tables 3, 4, 5, 6, and 7.

Table 3 Lag Selection criteria for Budget Deficit

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	54.8558				0.00092	-4.14275	-4.14275	-4.09436
1	89.7554	69.799	1	0.000	0.000069	-6.75041	-6.72255	-6.65364
2	93.5201	7.5294	1	0.006	0.000055*	-6.96308 *	-6.92128*	-6.81792*
3	94.0606	1.0809	1	0.298	0.000058	-6.92774	-6.872	-6.73418
4	95.0087	1.8963	1	0.168	0.000058	-6.92375	-6.92375	-6.6818

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 3 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that budget deficit should have two lags.

Table 4 Lag Selection Criteria Results for Interest Rate

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-90.1561				64.9858	7.01201	7.02594	7.0604
1	-89.0442	2.2237	1	0.136	64.4461*	7.0034*	7.03127*	7.10018*
2	-88.7423	0.60394	1	0.437	68.0506	7.0571	7.0989	7.20226
3	-87.4054	2.6787	1	0.102	66.4049	7.03118	7.08692	7.22474
4	-87.1566	0.49753	1	0.481	70.5234	7.08897	7.15864	7.33091

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 4 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that interest rate should have one lag.

Table 5 Lag Selection Criteria Results for Exchange Rate

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-84.2372				41.2178*	6.55671*	6.57064*	6.6051*
1	-84.0752	.32414	1	0.560	43.9738	6.62117	6.64903	6.71794
2	-82.7567	2.6368	1	0.104	42.9411	6.59667	6.63848	6.74184
3	-82.2442	1.025	1	0.311	44.6457	6.63417	6.68991	6.82773
4	-82.0038	0.48093	1	0.488	47.445	6.6926	6.76227	6.93454

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 5 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that exchange rate should have zero lag.

Table 6 Lag Selection Criteria Results for Inflation

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC

0	-77.5367				24.6172*	6.04128*	6.05522*	6.08967*
1	-77.4401	.1931	1	0.660	26.3958	6.11078	6.13865	6.20756
2	-76.9479	.98446	1	0.321	27.4672	6.14984	6.19164	6.295
3	-76.0253	1.8452	1	0.174	27.6708	6.21153	6.21153	6.34934
4	-75.9021	.24642	1	0.620	29.6721	6.29291	6.29291	6.46518

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 6 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that inflation should have zero lag.

Table 7 Lag Selection Criteria Results for Money Supply

Lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-87.6097				53.4259	6.81613	6.83007	6.86452
1	-81.7664	11.687*	1	0.001	36.8185*	6.44357*	6.47144*	6.54035*
2	-81.6343	.26429	1	0.607	39.389	6.51033	6.55213	6.6555
3	-80.4509	2.3668	1	0.124	38.8928	6.49622	6.55196	6.68978
4	-79.3497	2.2023	1	0.138	38.6835	6.48844	6.55811	6.73038

(*) Indicates that the coefficient is statistically significant at 95 percent confident interval.

Source: Author, 2022

Table 7 above shows the lag selection order criteria for inflation under Akaike Information Criterion (AIC), Final Prediction Error (FPE), Hannan-Quinn Criterion (HQIC) and Schwartz Information Criterion (SIC). All the criteria suggest that money supply should have one lag.

Stationary Test

The Akaike Information Criterion (AIC) lag selection was used to test the unit root using the Augmented Dickey Fuller (ADF) test. ADF's alternative hypothesis is that there is no unit root, while the null hypothesis is that there is a unit root. A 5% level of significance was used in this investigation. The null hypothesis is accepted if the test statistic is less than the critical value at the level of significance of 5 percent; however, the null hypothesis is rejected if the test statistic exceeds the critical value at the level of significance of 5 percent (Mushtaq, 2011). The findings of the money supply, inflation, interest rate, exchange rate and budget deficit are summarized in Table 8.

The results of the table below show that, at the 5% level of significance, the unit root of interest rate, inflation, and money supply cannot be ruled out. This implies that the money supply, inflation, and interest rates all have unit roots, which indicates that they are not stationary. Additionally, the unit root of the budget deficit and exchange rate was rejected from the null hypothesis at the 5% level of significance. This shows that the budget deficit and exchange rate are stationary because they lack a unit root. The findings in Table 8 indicate that the ARDL limits test must be conducted to determine whether there is a level relationship.

Variable	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Budget deficit	-4.940	-4.362	-3.592	-3.235
Interest rate	-2.938	-4.352	-3.588	-3.233
Exchange rate	-5.144	-4.343	-3.584	-3.230
Inflation	-3.314	-4.342	-3.584	-3.230
Money Supply	-2.813	-4.352	-3.588	-3.233

Table 8 Stationarity test Results

Source: Author, 2022

Co-integration Test

ARDL bound tests developed by Pesaran/Shin/Smith (2001) were used to conduct the co-integration test. The test's null hypothesis claimed that there were no level relationships among the variables, and as a result, no long-term relationships. The alternative theory proposed that variables had level relationships with one another, indicating the existence of a long-term link. Five percent threshold of significance was used in this test.

Rejecting the null hypothesis of no level relationship at 5% level of significance if the F statistic was greater than the upper bound (I 1) and accepting the null hypothesis if the F statistic was less than the lower bound (I 0) or rejecting the null hypothesis of no level relationship at 5% level of significance if the t statistic was greater than the upper bound (I 1) and accepting the null hypothesis if the t statistic was less than the lower bound (I 0) were the decision Additionally, if the F statistic and/or t statistic values at the 5% level of significance are between the lower bound (I 0) and the higher bound (I 1), the results are deemed inconclusive.

Table 9 Co-integration Test Results

K-4	(I_0) (L_1)	(I_1) (L_1)	(I_0) (L_05)	(L_1) (L_05)	(I_0) (L_01)	(I_1) (L_01)
F-Statistic Case (4.080*)	2.45	3.52	2.86	4.01	3.74	5.06
t-statistics (-1.352*)	-2.57	-3.66	-2.86	-3.99	-3.43	-4.60

Source: Author, 2022

The rejection of the null hypothesis of no level association is shown in Table 4.9 above. This is due to the fact that the F statistics of 4.080 was higher than the critical value of 5% of the upper bound (I 1) of 4.01. According to the data, there was a level relationship between the variables, indicating that a long-term relationship existed. The t statistics also showed the same outcomes. These findings indicated that the model would be estimated using the ARDL Error Correction Model (ECM) in order to determine the long-term relationship among variables.

Autocorrelation Test

The Breusch-Godfrey Lm test was used to examine the autocorrelation of the residuals. The alternative hypothesis of serial correlation was compared against the null hypothesis of no serial correlation at the 5% level of significance. Breusch (1978) and Godfrey (1978) state that the null hypothesis of no serial correlation is rejected if the chi-square test statistic p value is less than the level of significance of 5%, and the null hypothesis of no autocorrelation is accepted if the chi-square test statistic p value is greater than the level of significance of 5%. The Durbin Watson test of serial correlation was also used to support the findings of this investigation.

Table 10 Autocorrelation Test Results

Source	chi2	df	Prob>chi2
Breusch Godfrey LM test for Autocorrelation(lags(1)	2.062	1	0.1510
Durbin Watsin Test d statistic			1.518945

Source: Author, 2022

The Breusch Godfrey Lm test and DW test findings for serial correlation are displayed in Table 4.10 above. The null hypothesis of no serial correlation is accepted since the p value for chi-square in the aforementioned table, which is 0.1510, is greater than the level of significance of 5% (0.05). The Durbin-Watson test statistic of 1.518945 further supports the null hypothesis that there is no serial correlation. The common rule of thumb is that there is no serial correlation when the test statistic values fall between 1.5 and 2.5.

Heteroscedasticity Test

The Breusch Pagan test was used to examine the heteroscedasticity of the residuals. The alternative hypothesis of heteroscedasticity was compared against the null hypothesis of homoscedasticity. Breusch and Pagan (1979) state that the null hypothesis of homoscedasticity is accepted if the chi-square test statistic's corresponding p value is more than the 5% threshold of significance and rejected if it is less than that level.

Table 11Homoscedasticity Test Results

Source	chi2	df	Prob>chi2
Heteroscedasticity	21.47	14	0.0903

Source: Author, 2022

The results of this test, which are displayed in Table 11 above, reveal that the model's residuals are homoscedastic. The chi-square test results with p values of 0.0903, which is greater than the 5% level of significance, support this (0.05). This implies that the model's residuals have a constant variance.

Multi-collinearity Test

The model's multi-collinearity was examined using the variance inflation factor (VIF). The VIF calculates how closely related the independent variables in a model are to one another. According to a standard guideline for multi-collinearity, values more than 10 signify the presence of multi-collinearity in the model, whereas values lower than 10 signify its absence.

Table 12 VIF Multicollinearity Test Results

Variable	VIF	1/VIF
Exchange rate	1.58	0.632221
Inflation	1.46	0.686021
Interest rate	1.25	0.797756
Money supply	1.06	0.947493
Mean VIF	1.34	

Source: Author, 2022

The outcomes of multicollinearity are displayed in Table 12 above. There is no multicollinearity among the independent variables, as indicated by the VIF in the table above, which is 1.34, which is less than the usually accepted rule of thumb of 10.

Correlation Analysis

Pairwise correlation was used to investigate any relationships between the dependent variable and the independent variables. Correlation was examined among the budget deficit, interest rate, exchange rate, inflation, and money supply variables. The Pearson coefficient value for each variable and its significance are shown in Table 13 below.

Table 13. Pairwise Correlation Test Results

Variable	Budget deficit	Interest rate	Exchange rate	inflation	Money supply
Budget deficit	1.0000				
Interest rate	-0.1685	1.0000			
	0.3735				
Exchange rate	0.2131	-0.1932	1.0000		
	0.2582	0.3063			
Inflation	0.0569	-0.2945	0.6892*	1.0000	
	0.7652	0.1142	0.000		
Money supply	0.0569	-0.3456	0.2944	0.4883*	1.0000
	0.7652	0.0614	0.1142	0.0062	

Source: Author, 2022

The results in table 13 above shows the results of correlation. There was a negative insignificant relationship between interest rate and budget deficit (-0.1685) at 5 percent level of significance. Exchange rate and budget deficit have a positive insignificant relationship (0.2131) at 5 percent level of significance. Exchange rate and interest rate (-0.1932) had a negative insignificant relationship, inflation and budget deficit (0.7652) had a positive insignificant relationship, inflation and interest rate (-0.2945) had a negative insignificant relationship, inflation and exchange rate (0.6892) had a positive significant relationship, money supply and budget deficit (0.0569) had a positive insignificant relationship, money supply and interest rate (-0.3456) had a negative insignificant relationship. Money supply and exchange rate (0.2944) had a positive insignificant relationship. Finally, money supply and inflation had a positive significant relationship at 5 percent level of significance.

Structural Break Results

The CUSUM test was utilized to evaluate the model's variable consistency. With a larger sample size of the data being used to generate the estimation, it was feasible to follow the development of the coefficients that were being estimated. Two bands of standard error are placed either side of the calculated coefficients. If there is a significant variation in the coefficient following

the addition of new data to the estimation equation, the system is clearly unstable. A definite sign that there is no stability is when the blue line is outside of the two red lines.

The CUSUM results are shown in Figures 2. The blue lines were within the red lines on the two graphs as shown below. This indicates that the model's input variables maintained their stability throughout time. The various graphs of the residuals for the variables utilized in the model are shown in Figure 2.

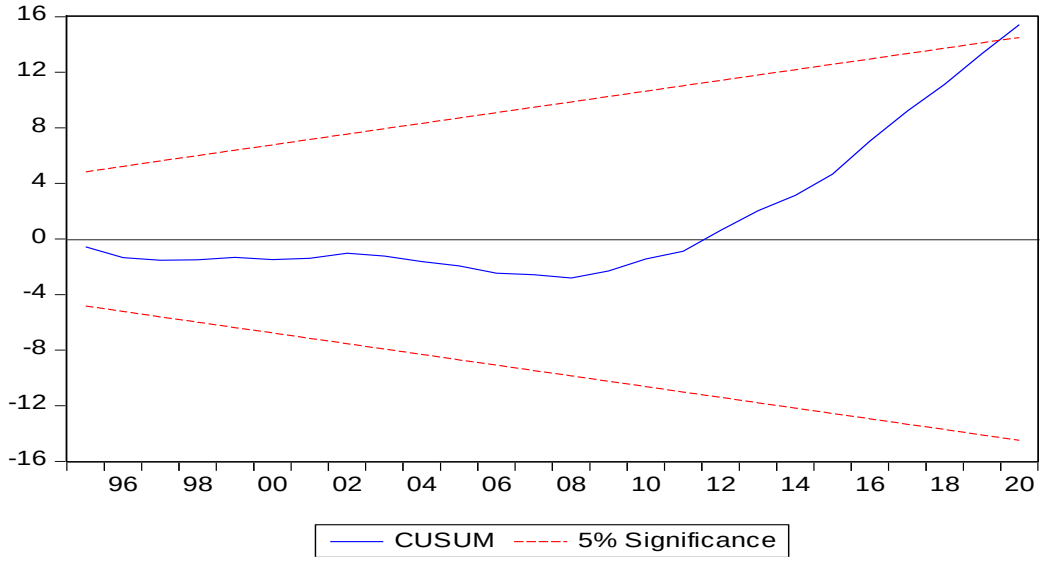

Figure 1. CUSUM Test Graph

ARDL ECM RESULTS

Table 14. ARDL ECM Results

Variables	Coefficient	Std. Error	t value	P > |t|	R-Squared	Adjusted R
LONG RUN						
Interest rate	0.04037	.0156864	2.57	0.016		
Exchange rate	0.41891	.0832293	5.03	0.000		
Inflation	-0.00966	.0073705	-1.31	0.206		
Money supply	.000042	.0061659	-0.90	0.380		
SHORT RUN						
Budget deficit LD	0.27205	.2023428	1.34	0.195		
Interest rate D1	0.00034	.0002436	1.41	0.175		
Money supply D1	-0.00004	.0002599	-1.78	0.868		
Constant	0.02166	0.0058	3.76	0.001		
R-Squared					0.6246	
Adjusted R						0.4666

Source: Author,2022

Table 14 above shows the results that were obtained from the ARDL Error Correction model. The results are broken down into short run and long run.it was found out that interest rate, exchange rate, inflation and money supply had a long run effect on budget deficit. On the other hand, the lag difference of budget deficit, the interest first difference, the money supply first difference had a short run effect on budget deficit. All other coefficients were found to be statistically insignificant except interest rate, exchange rate and the constant that were statistically significant at 5 percent level of significance. The coefficient of interest rate (0.04037) indicates that a one percentage increase in interest rate would have a positive significant effect on budget deficit in the long run at 5 percent level of significance. This was supported by a p value of 0.016. the coefficient of exchange rate (0.41891) had a positive significant effect on budget deficit in the long run at 5 percent level of significance as supported by a p value of 0.0000. the coefficient of inflation (-0.00966) had a negative insignificant effect on budget deficit in the long run. this was supported by the p values of 0.206 that was greater than the 5 percent level of significance. the coefficient of money supply (0.000042) had a positive insignificant effect on budget deficit in the long run as supported by the p values of 0.380 that was greater than the 5 percent level of significance.

The budget deficit lag difference coefficient (0.27205) that was positive and insignificant in the short run at 5 percent level of significance. This was supported by the p values of 0.195 that was greater than 0.05. the coefficient (0.00034) of the first difference of interest rate had a positive but insignificant effect on budget deficit in the short run. This was supported by a p value of 0.175 that was greater than the 5 percent level of significance. The coefficient (-0.00004) first difference of money supply had a negative but insignificant effect on budget deficit in the short run at 5 percent level of significance. The coefficient of constant (0.02166) was significant at 5 percent level of significance. This indicates that when all other factors are held constant, budget deficit would rise by 0.02166 percent. R squared was 62.46 percent which means that the budget deficit is explained by the independent variables by 62.46 percent. Additionally, the adjusted R was 46.66 percent which indicates that when the degree of freedom of the variables is incorporated then budget deficit is explained by the independent variable at 46.66 percent.

DISCUSSION OF FINDINGS

The findings of the descriptive statistics and stationary test showed that the variables employed in the study were not normally distributed. The ADF test indicated that there was a unit root among the variables at different orders. This meant that the variables were non-stationary. In order to examined the usefulness of employing the error correction model, ARDL cointegration test was carried out and the results indicated that the was cointegration among the variables. This meant that there was short and long run relationship among the variables employed in the study. Granger causality that is used to check whether one variable can be used to forecast another variable was examined. It was found out that inflation can be used to forecast money supply and money supply can be used to forecast inflation at 5 percent level of significance.it was also found out that money supply can be used to forecast exchange rate and exchange rate can be used to forecast interest rate at 5 percent level of significance. All the other variables could not be used to forecast one another at 5 percent level of significance.

The results from the various diagnostics test performed indicated that the model was stable over time. This was supported by the CUSUM curve where the blue lines were within the red lines. The results of the Breusch-Godfrey Lm test and DW tested indicated that the model did suffer from serial correction. The residuals of the model were not serially corrected over time. Heteroscedasticity test that was examined using the Breusch Pagan test also showed the model did not suffer from heteroscedasticity. This means that the residuals of the model had a constant variance over time. Multicollinearity test was determined using the VIF test. The results of the VIF test indicated that the model did not suffer from multicollinearity. This means that the independent variables employed in the study were not perfectly correlated and therefore did not affect the model results. The results of the lag selection criteria were examined using the SIC and AIC lag selection criteria. The two criteria were selected because of their appropriateness when a small data set is being employed in a study. The budget deficit was determined to have two lags, exchange rate was determined to have zero lag, inflation was determined to have zero lag, interest rate was determined to have one lag, and money supply was determined to have one lag.

ARDL ECM model results indicated that only interest rate and exchange rate had significant effect on budget deficit in the long run. The coefficient of interest rate indicated that one percent increase in the interest rates would end up raising the budget deficit by 0.04037 percent at 5 percent level of significance in the long run. The coefficient of exchange rate also showed that a one percentage increase in exchange rate would end have raising the budget deficit by 0.41891 percent in the long run at 5 percent level of significance. These findings were in conformity with findings that were obtained by Knot & de Haan (1999) and (Banerjee, Siddique & Amin, 2019). Money supply and inflation were found to have insignificant effect on budget deficit in the long run. The coefficient of inflation indicated that a percent increase in inflation would reduce budget deficit by 0.01 percent in the long run. This results were however insignificant as supported by the p value of 0.206 that was greater than the 5 percent level of significance. Money supply coefficient also showed that a percentage increase in exchange rate would drive budget deficit upward by 0.000042 percent in the long run. This result was however insignificant at 5 percent level of significance. These results did not agree with those obtained by Sunday, Bereh & Gopar (2016) and Akcay, Alper, & Ozmucur (1996) that established a significant relationship. The short run results of the ARDL model were found to be insignificant at 5 percent level of significance. The R squared and the Adjusted R of the ARDL ECM model indicated that the independent variables of the model, that is, inflation, exchange rate, interest rate and money supply did explain the budget deficit at 62.46 percent and 46.66 percent respectively. The constant of the model was significant at 5 percent level of significance. Its coefficient indicated that the budget deficit would still rise by 0.021 percent when the independent variables are held constant.

CONCLUSIONS

The study concluded that interest rate had a positive effect on the budget deficit in the long run. Increasing interest rates in the economy ends up driving budget deficit upwards in the long run. The same is true when the variable of concern is exchange rate.

Currency devaluation against the dollar will end up widening the budget deficit which means more borrowing to finance the high government expenditure. Inflation had an insignificant negative relationship with budget deficit. a percentage increase in inflation will end reducing budget deficit in the economy although the results was not supported by the sample size at the 5 percent level of significance. This means a persistent increase in prices of goods and services in the Kenyan economy may necessitate the government to increase the budget deficit. money supply in the economy also had a positive insignificant effect on budget deficit. This means that increasing money stock levels in the economy would up widening the budget deficit. The widening budget deficit would necessitate more borrowing either internally or externally that would be spend in the economy and therefore increasing the money stock levels in the economy.

The study findings agree with those of Knot & de Haan (1999), (Banerjee, Siddique & Amin, 2019), Bereh & Gopar (2016) and Akcay, Alper, & Ozmucur (1996) that macroeconomic variables may have an effect on the budget deficit. The study therefore concludes that in order to ensure that the budget deficit in an economy is maintained with the required optimal levels, there is need to ensure the stability of the major macroeconomic variables. The macroeconomic variables have a direct link to the extent to which the budget deficit in an economy would be maintained. Any attempt to reduce budget deficit would therefore require a reduction in interest rate, exchange rate and money supply. This because there is a positive relationship between the budget deficit and these variables. Sound and proper macroeconomic management is necessary in the government attempts to maintain the budget deficit at the required optimal level. This is because when there is instability in these macroeconomic variables, the Kenyan budget deficit will continue increasing and plunge the economy into a debt crisis cycle.

RECOMMENDATIONS

The study findings recommend that there is need for the government to ensure there is stability in macroeconomic variables. This is because there is a significant link between the budget deficit and the selected macroeconomic variables. A strive by the government to reduce budget deficit would mean an adjustment in macroeconomic variables to suit the purpose. These adjustments may include reducing the interest rate in the economy. A reduction in the interest rates in the economy would end reducing the budget deficit. reducing interest rate means more investment opportunities that drive the national income upwards which translates into a wider tax base in the economy. More tax revenues would reduce the budget deficit in the economy and prevent the economy into plunging to a debt crisis problem. The same is true for exchange rate. There was a significant link between exchange rate and budget deficit in the Kenyan economy. This finding mean that a reduction in exchange rate would end reducing the budget deficit in the economy. A reduction in exchange rate means an appreciation in the Kenyan currency against the US dollar would make the imports to Kenya expensive and this would end up reducing the huge expenditures incurred by the government, members of the households and business community. Policy makers can therefore utilize exchange rate as one of the sound avenues of controlling budget deficit in Kenya. Although the findings showed that inflation and budget deficit had an insignificant relationship, it is crucial to note that inflation can impact the budget deficit negatively. This means that the government should put in place proper measures of ensuring that inflation is marinated at the proper level that is neither too high nor too low so that it doesn't dislodge budget deficit. Additionally, there is need for the central bank which is in charge of controlling money stock levels in the economy to ensure that money supply does not exceed the required limit in order to maintain a balanced budget. This can be made possible through frequent meetings by the monetary policy committee of the Central bank. Finally, it is crucial for policy makers to ensure that there is fiscal discipline and sound macroeconomic management that would be crucial in attaining the stability of macroeconomic variables in the economy. Unstable macroeconomic variables may result into a widening budget deficit in the Kenyan economy.

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