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Application of Stability Test on consistency coefficient parameters at Drop-point: Evidence of Nigeria Growth Domestic Product (GDP).

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Abstract

The paper studies the stability test on consistency coefficient parameters at drop-point: evidence of Nigeria Growth domestic Product (GDP). Raw daily data is from 2010 to 2016 from Central Bank of Nigeria (CBN). Descriptive statistic was obtained and the graph of both raw and differenced dataset was plotted as shows in Figure 1 and 2. From the raw dataset, we locate the drop-point of GDP in order to test the stability between before and after the drop point. Regression analysis was estimated from the whole dataset where also the whole dataset was split into two sub samples. The result of the entire regressions estimate shows positive values of increases on the dependent variable (i.e. GDP). Testing the hypothesis of the chow test (F-Statistic) of the stability of the coefficient of the two sub-samples to the whole dataset shows that the dependent coefficient is stable. Forecasting the chow test for the first sub sample shows that the dependent variable (GDP) was not stable since the blue line is out of the significant confident interval and for the second sub sample shows that the dependent variable (GDP) later approaches a stable state as shows in the CUSUM plot in Figure 3 and 4. The idea of using residuals calculated recursively is to test model misspecification dates from the landmark CUSUM chow test as stated.

Keywords: Chow Test, Regression, Stationarity, F-Statistic, Forecast, CUMUM.

1.0 Introduction

Stability consistent of a particular model is of important and in order to determine the consistency of the parameter coefficient one has to subject such model to a stability test. However, such regression model or coefficients are split into two separate regression lines to best fit a spited set of data. Chow test was proposed in [1] where coefficients in two linear regressions on different data sets are equal especially in time series analysis in which for the presence of a structural break at any period which is assumed to be known as a *priori*. In evaluation, the Chow test is often used to determine whether the independent variables have different impacts on different subgroups or sub samples of the population. Also the model in effect uses an F-test to determine whether a single regression is more efficient than two separate regressions involving splitting the data into two sub-samples

Moreover, most researchers always estimate different models parameters without evaluating the coefficient of the models by subjecting it to a stability test. Therefore, in this paper we are going to be looking in the key issue of our nation, national macroeconomic variable known as the Growth Domestic Product (GDP) by estimating the regression lines and forecasting into the stability of the nation GDP to observe the trend of the macroeconomic variable will take and make recommendation.

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The drop-point is the year of great significant low change in the Nigeria economic, so by evaluating the drop-point and subjecting it i.e. as the structural break test will help us determine how the structure will look like.
According to [1], to test the equality between sets of coefficients in two linear regressions, one starts with the assumption that both are equal. A regression equation is fitted to the combined set of observations, i.e., excluded and selected, and the residual sum-of-squares is computed. Next, a regression equation is fitted to the data without assuming the sets are equal. Likewise, the residual sum-of-squares is obtained. Chow shows that the ratio of the difference between these two sums to the latter sum, adjusted for the corresponding degrees of freedom, will be distributed as an F-ratio under the null hypothesis. Chow presents two variations of his method.
Regression discontinuity is used in [2] to study children who were placed or not placed in gifted educational programs and the effect it had on achievement.
This method of chow test in analyzing data from regression discontinuity studies was briefly mentioned by [3]. Regression cutoff design was described in [4] on how it can be used to make causal inferences when random assignment may not be practical. Cut-off All of these studies used some form of multiple regression where the separation or was a dummy-coded variable in the equation.
The possible usefulness of this method was demonstrated in [5] in field research that does not have the constraints of laboratory research. Braden and Bryant [2] used Both real and invented data was used in [6] from the regression discontinuity design that could be analyzed with multiple regression and the use of dummy variables and also [2] provides another example of a two-dimensional application where the independent variable is group membership (i.e., skillful, not skillful), the dependent variable was achievement scores and the covariarte was IQ scores.

2.0 Methodology

Tests For Parameter Constancy

Chow Test

Testing the maintained assumption of parameter stability is by using Chow's parameter constancy test, sometime called Chow's First test. The procedure of this test is implemented by dividing the sample into two sub-samples, estimating each sample separately by Ordinary Least Square (OLS), and then testing whether the two sets of parameter estimates are significantly different from one another. This can be tested using a conventional F test procedure. For example, like testing the equality of the sample variances.
we have two separate models, expressed as:

$$y_t = \beta_1 + \beta_2 x_t + \varepsilon_{1t}$$
$$y_t = \delta_1 + \delta_2 x_t + \varepsilon_{2t} \qquad (1)$$

Note carefully that the disturbance term for each of the two models is a vector. We may interpret X_t as a matrix (of dimension $T_i \times p$) consisting of all the observations in the two sample on a set of p variables. Then $\square_i$ is a $(p\times 1)$ vector of parameters for the sample period i. We shall use the following notation for residual sums of squares (RSS) from estimation over different periods:
RSS_1: The RSS from estimation over1t=1
RSS_2: The RSS from estimation over 2ti=2
RSS_0: The RSS from estimation over the whole sample, with the restrictions of parameter constancy imposed.
The null and alternative hypotheses are given as:

$$H_0: \beta_1 = \beta_2, \ldots, \sigma_1^2 = \sigma_2^2 \qquad (2)$$
$$H_1: \beta_1 \neq \beta_2, \ldots, \sigma_1^2 = \sigma_2^2$$

where the null hypothesis state that there is no structural break.
The Chow test is a commonly used parameter stability test. It can also be used to test for parameter equality between subsets of cross-section data, and can be generalized to test for parameter stability against an alternative of more than one "regime change".
The principle of the test can also be applied to a subset of the regression coefficients.
Recall the general form of the F test statistic is

$$F^* = \frac{(RSS_R - RSS_U)/q}{RSS_U/(T-p)} \sim F(q, T-p) \text{ if } H_0 \text{ is true} \quad (3)$$

Now given that in this case, the restricted residual sum of squares (RSS_R) is RSS_0, the unrestricted residual sum of squares (RSS_U) is $RSS_1 + RSS_2$, the number of restrictions under the null hypothesis (q) is p, and the degrees of freedom in the unrestricted model is T-2p (the full sample, less the two sets of k parameters being estimated), the F test statistic can be written as

$$CHOW(Test) = \frac{(RSS_0 - (RSS_1 + RSS_2))/k}{(RSS_1 + RSS_2)/(T-2k)} \sim F(p, T-2p) \text{ if } H_0 \text{ is true} \quad (4)$$

Reject the null hypothesis if calculated F-value falls into the rejection region (i.e. if the calculated F-value is greater than the F-critical value).

3.0 Result Analysis

3.1 Empirical Result

An empirical analysis showed the results of the Nigeria Growth Domestic Product (GDP).

Table 1: Empirical Result of Nigeria GDP

Variable	***#obs***	***min***	***mean***	***max***	***std.dev***
DGDP	175	9.2743	15.212	16.261	1.0345

3.2 Analysis of the main result

Stationarity test in Table 2 shows that the variable is stationary at first differences which make the series under study to be free from unit root.

Table 2: Augmented Dickey-Fuller Test

	ADF Statistics	P-Value
DGDP	-0.0589	0.0001

1% 5% 10%
-2.56572, -1.94093, -1.61663

From the above result, shows that the series is stationary.

3.3 Parameter Estimation of the regression models

Table 3: Parameter Estimation of the overall observation

Sample: 1 175
Included observations: 175

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.065436	0.000337	193.9671	0.0000

Mean dependent var	1.000000	S.D. dependent var	0.000000
S.E. of regression	0.068044	Akaike info criterion	-2.531630
Sum squared resid	**0.805614**	Schwarz criterion	-2.513546
Log likelihood	222.5177	Hannan-Quinn criter.	-2.524295
Durbin-Watson stat	0.416885		

Table 4: First Parameter Estimation

Sample: 1 87
Included observations: 87

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.064968	0.000285	227.6159	0.0000

Mean dependent var	1.000000	S.D. dependent var	0.000000
S.E. of regression	0.040945	Akaike info criterion	-3.541765
Sum squared resid	**0.144176**	Schwarz criterion	-3.513421
Log likelihood	155.0668	Hannan-Quinn criter.	-3.530352
Durbin-Watson stat	0.101103		

Table 5: Second Parameter Estimation

Sample: 88 175
Included observations: 88

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.065916	0.000611	107.9338	0.0000

Mean dependent var	1.000000	S.D. dependent var	0.000000
S.E. of regression	0.086590	Akaike info criterion	-2.043964
Sum squared resid	**0.652313**	Schwarz criterion	-2.015812
Log likelihood	90.93442	Hannan-Quinn criter.	-2.032622

3.4 Chow test main result

$$CHOW(Test)=\frac{(RSS_0-(RSS_1+RSS_2))/k}{(RSS_1+RSS_2)/(T-2k)} \sim F(p,T-2p) \text{ if } H_0 \text{ is true}$$

Definition of variables: *from table 4.5 to table 4.6 shows the values of Sum of square residual for each parameters estimation of overall, first and second parameter estimation*

RSS_0=0.85614,RSS_1=0.144176, RSS_2=0.652313, K=2, N_1+N_2=175

Substituting the above definition into the above chow test statistic

$$F=\frac{(0.805614-(0.144176+0.652313))/2}{(0.144176+0.652313)/175-2(2)}=\frac{0.004566}{0.004657}=0.9805$$

$F_{Tabulation}$=0.9805 and $F_{Critical}$=3.05

Since F= 0.9805 < 3.05, the hypothesis of stability is not rejected. There is insufficient evidence that the two sub samples are different, therefore we can conclude that the coefficients of the two samples are equal.

Graphical Plot of raw data on Nigeria Growth Domestic Product

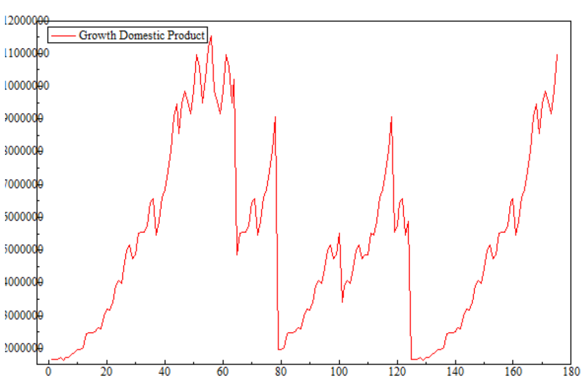

Figure 1: Graphical Plot Difference data on Nigeria Growth Domestic Product

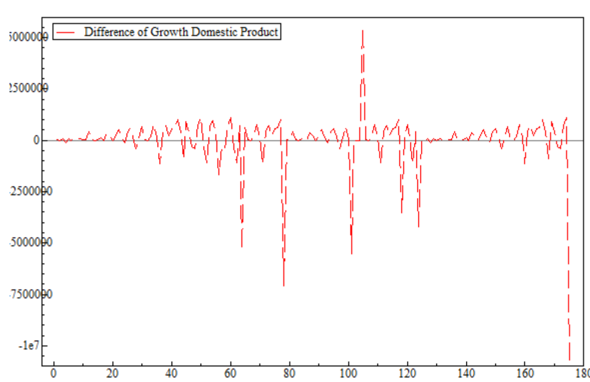

Figure 2: shows the graph of raw data and difference data

CUSUM Chow Forecast graph
FIRST REGRESSION ESTIMATE

The dependent variable (GDP) is not stable of the first regression since the blue line is out of the significant confident interval

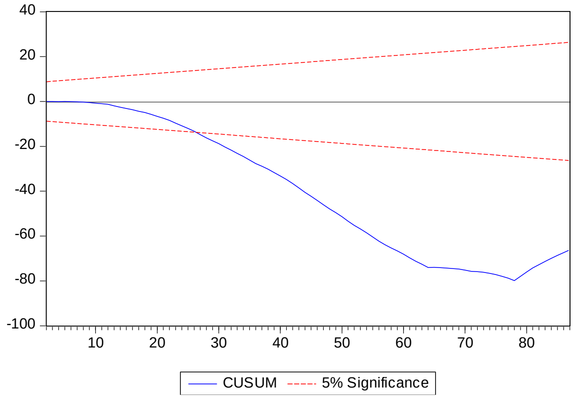

Figure 3: *FIRST REGRESSION ESTIMATE*

CUSUM Chow Forecast graph
SECOND REGRESSION ESTIMATE

The dependent variable (GDP) is slightly stable of the second regression since the blue line is out between 100 to 110 observations of the significant confident interval

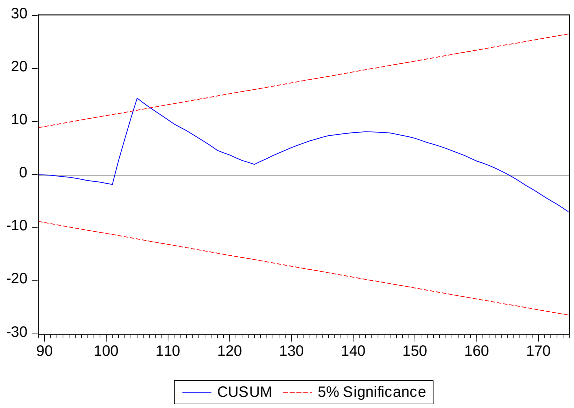

Figure 4: forecast plot of both first and second regression of GDP

CUSUM Chow Forecast graph
OVERALL REGRESSION ESTIMATE

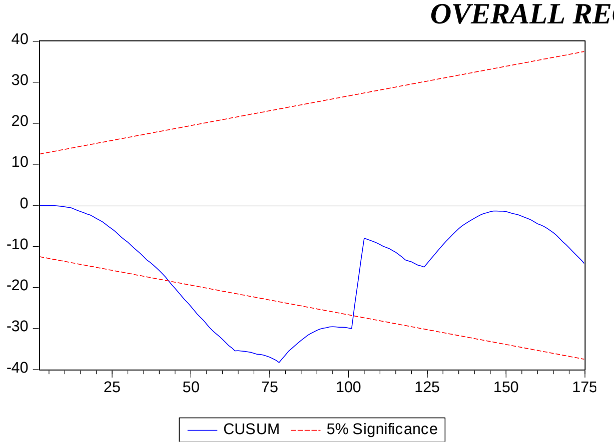

Figure 5: Overall Regression Estimate

4.0 Conclusion

This paper introduced the Chow test and its possibility in analyzing data from a regression study. From the overall estimate to separate estimation, the result of the entire regressions estimate shows positive values of percentage increases on the dependent variable (i.e. GDP) since independent coefficient are positive. Testing the hypothesis of the chow test (F-Statistic) of the stability of the coefficient of the two sub-samples to the whole dataset shows that the coefficients are stable, since F-calculated is less than the F -tabulation. Forecasting the chow test for the first sub sample shows that the dependent variable (GDP) was not stable since the blue line is out of the significant confident interval and for the second sub sample shows that the dependent variable (GDP) later approaches a stable state as shows in the CUSUM plot as shown in Figure 1 and 2.
However from the overall CUSUM Chow test shows that both the overall and the separate estimation graph exhibit the same trend as illustrated in Figure 3.

5.0 References

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