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Heterocedasticity and Cointegration Test Relationship (Case Study GDP and Gov. Expenditure in 194 Country)

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ABSTRACT

The purpose of this study to see if there is a relationship heterocedasticity test and cointegration test on the use of economic variables such as GDP and Gov. Expenditure. In this study used regression analysis and cointegration to get the proof of their relationship to the occurrence heterocedasticity co integration of data in the long term. Of the studies that have been performed concluded that, with the form data that is homocedasticitas used regression models 1, 2 and 3 and not heterocedasticity on regressions 4 and 5, the data on economic variables GDP and Gov. Expenditure in 194 countries in 2014 cointegrated.

Keywords : Heterocedasticity, Cointegration, GDP, Gov. Expenditure

I. INTRODUCTION

Heterocedasticity and Cointegration Theory

Tests of Heteroskedasticity

Consider the linear regression model

$Yi=\mathbf{X}'i\boldsymbol{\beta}+\varepsilon i$

Based on this regression model there are several regression-based tests of heteroskedasticity -- equivalent test statistics that are not regression-based do exist, but those obviate the comparisons that we are after.

1) Breusch-Pagan

The Breusch-Pagan test of heteroskedasticity has the following steps:

- Estimate the regression model above using OLS, and get the residuals $\varepsilon\hat{}i$, and the standard error of regression, $\sigma\hat{}2=\sum ni=1\varepsilon\hat{}2in$.
- Then, estimate the following auxiliary regression by OLS -- a regression of the standardized residuals on the cross-products of the included regressors.

$$\varepsilon\hat{}2i\sigma\hat{}2=vech(\mathbf{X}i\otimes\mathbf{X}'i)'\boldsymbol{\gamma}+\nu i$$

- The test statistic here is 12ESS, which is distributed $\chi 2K+K(K+1)2$, where there are K regressors in the model.

2) White

- The White test is based on a regression that looks very similar to the one employed by BP

$$\varepsilon\hat{}2i=vech(\mathbf{X}i\otimes\mathbf{X}'i)'\boldsymbol{\gamma}+\nu i$$

- The test statistic here is nR2 which is again distributed $\chi 2K+K(K+1)2$.

3) Aside: Equivalence of a modified version of BP and White

You would not be mistaken in thinking that there exists a version of the BP test that is exactly equivalent to the White test (which is robust to departures of the residuals from normality). This is discussed in Waldman (1983).

Tests of cointegration

Now consider the Engle-Granger two-step residual-based tests of cointegration.

- Here, the model is

$$Y1t=\beta 0+\boldsymbol{Y}'2t\boldsymbol{\beta}+\varepsilon 1t$$

Again, we fit the regresion model using OLS, and get the estimated residuals, $\varepsilon\hat{}1t$.

- We now conduct an ADF unit root test on these residuals, that is, we fit the regression

$$\Delta\varepsilon\hat{}1t=\beta0+\gamma\varepsilon\hat{}1t-1+\sum j=1p\gamma j\Delta\varepsilon\hat{}1t-j+vt$$

and conduct a t-test of the regression coefficient $\gamma=0$ using the Engle-Yoo critical values.

Bottomline

The heteroskedasticity tests regress squares of fitted residuals on regressors, and cointegration tests regress differences of fitted residuals on lags and lags of differences of those residuals (**compare the three boxed regressions**).

Every model has certain features, each of which can be exploited to form tests of that model. For unit root models, the ADF tests use the specific feature in a specific model -- ρ=1 in an autoregressive model -- to test for unit roots. There are other tests, for example, the variance ratio tests that exploit the increasing variance aspect of unit roots. They are all, as you can imagine, related.

II. DATA AND RESEARCH METHOD

Time and Data Research

The author in this study using GDP data and Gov. Expenditure of 194 countries in the world, to the data in 2014. The study was done by the authors at the time in December 2016. Here the authors show a general overview of research data from 194 countries:

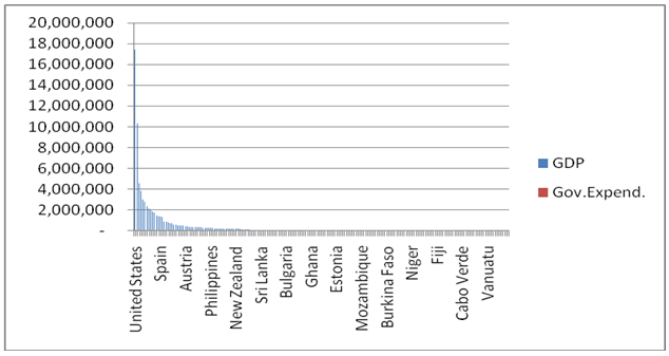

Figure 1 : GDP and Gov. Expenditure

Source : Procedd by author

Analisys Data Tehnique

In this study the authors used data analysis techniques Heterocedasticity and Cointegration in seeing the relationship of variant data in the long term. Heterocedasticity technique that is used in this study is test Goldfeld-Quandt (G-Q). As for Cointegration test, the authors use the model Johansen Cointegration.

III. RESULTS AND DISCUSSION

Here at the show for heteroscedasticity test results in the form of regression table 5:

Table 1 : Regression analisys for heterocedasticity

Dependent Variable: GDP

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-195882.6	367707.8	-0.532713	0.5948
GOV_EXPEND	37613.38	22190.23	1.695042	0.0917

R-squared	0.014744	Mean dependent var	398089.3
Adjusted R-squared	0.009612	S.D. dependent var	1559562.
S.E. of regression	1552049.	Akaike info criterion	31.35831
Sum squared resid	4.63E+14	Schwarz criterion	31.39199
Log likelihood	-3039.756	Hannan-Quinn criter.	31.37195
F-statistic	2.873167	Durbin-Watson stat	0.203242
Prob(F-statistic)	0.091689		

Source : Procedd by author

Table 2 : Regression analisys for heterocedasticity

Dependent Variable: D(GDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-89848.32	47515.03	-1.890945	0.0601
D(GOV_EXPEND_)	4861.053	7080.263	0.686564	0.4932

R-squared	0.002462	Mean dependent var	-90253.69
Adjusted R-squared	-0.002761	S.D. dependent var	659139.7
S.E. of regression	660049.0	Akaike info criterion	29.64832
Sum squared resid	8.32E+13	Schwarz criterion	29.68213
Log likelihood	-2859.063	Hannan-Quinn criter.	29.66202
F-statistic	0.471370	Durbin-Watson stat	0.342757
Prob(F-statistic)	0.493190		

Source : Procedd by author

Table 3 : Regression analisys for heterocedasticity

Dependent Variable: GDP(-1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-194633.1	373112.8	-0.521647	0.6025
GOV_EXPEND_(-1)	37545.44	22466.15	1.671200	0.0963

R-squared	0.014412	Mean dependent var	400151.7
Adjusted R-squared	0.009252	S.D. dependent var	1563353.
S.E. of regression	1556104.	Akaike info criterion	31.36358
Sum squared resid	4.62E+14	Schwarz criterion	31.39739
Log likelihood	-3024.585	Hannan-Quinn criter.	31.37727
F-statistic	2.792911	Durbin-Watson stat	0.203159
Prob(F-statistic)	0.096320		

Source : Procedd by author

Table 4 : Regression analisys for heterocedasticity

Dependent Variable: LOG(GDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.945767	1.300728	5.339908	0.0000
LOG(GOV_EXPEND_)	1.290009	0.477270	2.702894	0.0075

R-squared	0.036655	Mean dependent var	10.43195
Adjusted R-squared	0.031638	S.D. dependent var	2.381956
S.E. of regression	2.343973	Akaike info criterion	4.551828
Sum squared resid	1054.888	Schwarz criterion	4.585517
Log likelihood	-439.5273	Hannan-Quinn criter.	4.565469
F-statistic	7.305637	Durbin-Watson stat	0.066570
Prob(F-statistic)	0.007490		

Source : Procedd by author

Table 5 : Regrssion analisys for heterocedasticity

Dependent Variable: SQR(GDP)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-150.6888	224.2222	-0.672051	0.5024
SQR(GOV_EXPEND_)	130.8270	56.42439	2.318625	0.0215

R-squared	0.027237	Mean dependent var	362.1584
Adjusted R-squared	0.022171	S.D. dependent var	517.9900
S.E. of regression	512.2157	Akaike info criterion	15.32562
Sum squared resid	50374057	Schwarz criterion	15.35931
Log likelihood	-1484.586	Hannan-Quinn criter.	15.33927
F-statistic	5.376021	Durbin-Watson stat	0.090022
Prob(F-statistic)	0.021468		

Source : Procedd by author

From the analysis, five tables of regression that has been created, it can be given a conclusion that: to table 1, 2 and 3 the value of X ^ 2 count are described in squared, when compared with the value of X ^ 2 with 5% alpha, degrees freedom (df) = m-1 is the number of dependent and independent variables, the variable data in meticulous nature homokedastisitas, except for the regression table 4 and 5 heteroskedastisitas as X ^ 2 count is greater than the value of alpha is in use. Here in view of the results of cointegration test.

Table 6 : Regrssion analisys for cointegration

Series: GDP GOV_EXPEND_

Lags interval (in first differences): 1 to 1

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.321119	132.0480	15.49471	0.0001
At most 1 *	0.259508	57.68468	3.841466	0.0000

Lags interval (in first differences): 1 to 2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.545375	206.4208	15.49471	0.0001
At most 1 *	0.253571	55.85876	3.841466	0.0000

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.484592	168.0256	15.49471	0.0001
At most 1 *	0.198724	42.09444	3.841466	0.0000

Lags interval (in first differences): 1 to 4

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.487599	173.1408	15.49471	0.0001
At most 1 *	0.219203	46.76626	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

Source : Procedd by author

The results in Table 6 show that the probability is very significant, so the data cointegrated between one variable to another variable at the alpha level of 5%.

IV. CONCLUSION

From the study done in getting the results that the model in real GDP in the variable data and Gov. Expenditure is homokedastisitas in the form of regression 1, 2 and 3 with regression 4 and 5 and Gov. GDP variable data Expenditure is heteroscedasticity. With cointegration test data in meticulous nature or mutually cointegrated

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