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 between 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

\[ Y_i = X_i' \beta + \epsilon_i \]

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 \( \hat{\epsilon}_i \), and the standard error of regression, \( \sigma^2 \).
- Then, estimate the following auxiliary regression by OLS -- a regression of the standardized residuals on the cross-products of the included regressors.

\[ \hat{\epsilon}_i^2 \sigma^2 = \text{vech}(X_i \otimes X_i)' \gamma + \nu_i \]

- The test statistic here is 12ESS, which is distributed \( \chi^2 K+K(K+1)2 \), 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

\[ \hat{\epsilon}_i^2 = \text{vech}(X_i \otimes X_i)' \gamma + \nu_i \]

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

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

\[ Y_t = \beta_0 + Y_2 \beta + \epsilon_t \]

Again, we fit the regression model using OLS, and get the estimated residuals, \( \hat{\epsilon}_t \).

- We now conduct an ADF unit root test on these residuals, that is, we fit the regression
\[ \Delta \varepsilon_t = \beta_0 + \gamma \varepsilon_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta \varepsilon_{t-j} + \nu_t \]

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 -- \( \rho = 1 \) 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)

**Analysys Data Tehnicke**

In this study the authors used data analysis techniques Heteroscedasticity and Cointegration in seeing the relationship of variant data in the long term. Heteroscedasticity 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 analysis for heterocedasticity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-195882.6</td>
<td>367707.8</td>
<td>-0.532713</td>
<td>0.5948</td>
</tr>
<tr>
<td>GOV_EXPEND</td>
<td>37613.38</td>
<td>22190.23</td>
<td>1.695042</td>
<td>0.0917</td>
</tr>
</tbody>
</table>

**Source:** Procedd by author

**Table 2:** Regression analysis for heterocedasticity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-89843.32</td>
<td>47515.03</td>
<td>-1.890845</td>
<td>0.0691</td>
</tr>
<tr>
<td>D(GOV_EXPEND)</td>
<td>4861.053</td>
<td>7080.263</td>
<td>0.686664</td>
<td>0.4932</td>
</tr>
</tbody>
</table>

**Source:** Procedd by author

**Table 3:** Regression analysis for heterocedasticity

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>-194833.1</td>
<td>373112.8</td>
<td>-0.521647</td>
<td>0.6025</td>
</tr>
<tr>
<td>GOV_EXPEND(-1)</td>
<td>37545.44</td>
<td>22486.18</td>
<td>1.671200</td>
<td>0.0963</td>
</tr>
</tbody>
</table>

**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.

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

V. REFERENCES


[7]. http://stats.stackexchange.com/questions/24557/isnt-a-test-for-cointegration-the-same-as-testing-for-heteroskedasticity-in-the