AGEC5213: *ECONOMETRIC METHODS*
Spring 2019

PROBLEM SET NO. 4 - due on April 17, 2019

Question: Test three hypothesis listed in (A) (B) and (C) under three different conditions of variances (a) Homo. Var. (b) Hetero Var. and (c) Hetero Var.

Heteroskedasticity test and GLS

Oklahoma State is considering several policy changes in public transportation. Before approving any changes in transportation policy Governor Stitt wants to assess whether weekly expenditure figures provided by the Department of Transportation are realistic. For expenditure on transport, the Department believes that: $\frac{dy}{dx} = 10$; $H_0: \alpha_4 = 10$. $H_A: \alpha_4 \neq 10$

(A) Adding an adult to a household increases household expenditure on transport by \$10 per week.

(B) Adding a child to a household increases household expenditure on transport by \$2 per week. $\frac{dy}{dx} = 2$ $H_0: \alpha_3 = 2$ $H_A: \alpha_3 \neq 2$

(C) For a household with a weekly income of \$800, an incremental increase in income increases household expenditure on transport by 3 cents per one dollar increase. $H_0: \alpha_2 = 24$ $H_A: \alpha_2 \neq 24$

$\frac{dy}{dx} = \frac{dy}{d\ln x} \cdot \frac{d\ln x}{dx} = \alpha_2 \cdot \frac{1}{x} = 0.03$ $X = 800$. $\alpha_2 = 24$

Your task is to provide the Governor helpful advice related to these issues. You have been retained to see if each of these rules of thumb are consistent with observed data. You decide to use data from the household expenditure survey that was conducted by the Department of Transportation of Oklahoma State. These data are stored in the file HW4-DATA.xls. You decide to set up the model.

$$y_t = \alpha_1 + \alpha_2 \ln(x_t) + \alpha_3 k_t + \alpha_4 a_t + e_t$$

where y_t represents weekly expenditure on transport, x_t represents weekly income and k_t and a_t represent the number of children and the number of adults in the household, respectively. Conscious of the fact that error terms in expenditure functions often have variances that depend on income, you decide to estimate the transport-expenditure function using three alternative variance assumptions, namely,

Homo Hetro Hetero
$$(i)\ \mathrm{var}(e_t) = \sigma^2 \quad (ii)\ \mathrm{var}(e_t) = \sigma^2[\ln(x_t)]^2 \quad (iii)\ \mathrm{var}(e_t) = \sigma^2[\ln(x_t)]^4$$

(a) Express each of the rules of thumb in terms of a null hypothesis that involves the parameters of the expenditure function. Specify the corresponding alternative hypotheses.

(b) Report the parameter estimates obtained under each error variance assumption and discuss the sensitivity of the estimates to this assumption (**Hint**: see GLS procedures in the lecture note). Run GLS

Sensitivity of the estimates: How sign, magnitude and significance of estimates differs in these three cases?

(c) For each of the equation estimates in part (b), use the Goldfeld-Quandt test to test for the existence of heteroskedasticity, where the heteroskedasticitiy is assumed to depend on x_t. Use a 1% level of significance with a one-tailed test for assumption that the variance of residuals increases with weekly income. In what equation(s) does heteroscedasticity still appear to be a problem based on the Goldfeld-Quandt test? Specify how you transform data

$H_0: \sigma_t^2 = \sigma^2$; $H_A: \sigma_t^2 = \sigma^2 x_t$ # Split data & test for each of three cases.

(d) Using each of the estimated equations under ii) and iii) and a 5% significance level, test the hypotheses specified in part (a). Comment on the results under the assumption that GLS has successfully removed heteroskedasticity. Question: Test above hypothesis using the regression equation assuming there is no heteroskedasticity in the model though model (ii) still has heteroskedasticity.

(e) Redo the White heteroskedasticity test at the 5% significance level for the equation estimates in

Include all variables & their permultations

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part (b) with

$$(i)\ \mathrm{var}(e_t) = \sigma^2$$

(**Hint:** include independent variables and square of these variables in the variance equation). (No interaction)

(f) Using PROC AUTOREG procedure, test heteroskedasticity with LM test at the 5% level and find GLS and ML estimates. Your variance equation is assumed as: $\sigma_t^2 = \sigma^2(1+\gamma \ln x_t)$, where γ is the parameter of the variable $\ln x_t$.

In SAS

hetero LNx

Question: The given condition of variance has is for linear variance as symbolized by the equation. Use method (1) under heading "How to do GLS/MLE in SAS" in sas code page. Other two conditions not mentioned here has non-linear variance.