

Section 1: Short Answer

1. Discuss the problem of Heteroskedasticity.

Homoscedasticity is one of the Classical Assumptions that makes OLS BLUE or the Ordinary Least Squares the best linear unbiased estimator. Homoscedasticity is when the variance of the error term given all other independent variables (x 's) is equal to the variance of the marginal error term. More generally, the independent variables (x 's) do not play a role in the variance of the error term.

Heteroscedasticity is the opposite of homoscedasticity. This means that under heteroscedasticity OLS is not BLUE, and indicates a relationship between the variance of the error term and the independent variable (x). In its pure form, heteroscedasticity is caused by the relationship of data.

The major problem of heteroscedasticity is that it causes the estimate of standard errors to be biased. Due to the standard errors being wrong, it causes t tests to be inaccurate. $T \text{ stat} = (\text{beta hat}) / \text{SE}$. Generally, heteroscedasticity tends to cause the SE to be smaller, and this causes the t stat to be inflated. This causes one to be more likely to reject a false positive. It can be a slight deviation, so you don't know which level to reject.

Since most data has some heteroscedasticity it is always important to test for it and correct it through the Breusch-Pagan test, the White test, and the generalized least squares to solve heteroscedasticity. If either of the BP and White tests says there isn't hetero and the other says there is, always assume heteroscedasticity and correct for it.

Overall heteroscedasticity could lead to incorrect decision making. Either the decision could be wrong or often not as beneficial as it could have been which is why it is important to test for it and correct it so that OLS is BLUE and achieves the most accurate results.

2. Discuss the problem of Serial Correlation.

No serial correlation is one of the classical assumptions that OLS BLUE or the Ordinary Least Squares is the best linear unbiased estimator. No serial correlation is when the current value of the error term is not a function of the past error term.

Serial correlation is the opposite, where the error terms are correlated across different observations. Or more simply, the error term of one observation is related to another observation's error term. Error terms should be random because they represent factors affecting the dependent variable. If they are correlated, it means there is a pattern or relationship that the model has failed to incorporate in the regression. There may be a missing independent variable driving the error term, suggesting your model is not a good fit for the data. This could also indicate that observations are not truly independent and that past events can influence future events.

The overall problem with serial correlation is that it leads to biased standard errors and unreliable hypothesis testing. Similar to heteroscedasticity, due to the standard errors being wrong, it causes t -tests and f -tests to be inaccurate. This causes many Type I or II errors, leading to inaccurate conclusions on hypothesis testing.

Serial Correlation often occurs in time series and forecasting, as the past and present are correlated to the future. To address the issue of serial correlation we can use models incorporating lags. Lags are previous values of either x or y to use as predictors for y . We can use forecasting models to reduce the likelihood of having serial correlation in the residuals through these models that deal with time relationships.

It is important to test for serial correlation, and we can test through the Breusch-Godfrey test. To solve for serial correlation, we can use methods like adding lagged variables to the model, Generalized Least Squares (GLS), or Newey-West, to correct for the correlation in the error terms.

Overall, serial correlation could lead to incorrect decision making. The decision from the regression could be misleading or less reliable and not as beneficial as it could have been which is why it is important to test for it and correct it so that OLS is BLUE and achieves the most accurate results.