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07:12

As per the Guass Markov Theorem whenever a model is developed and if you find homoscedasticity problem exists then what ever the Beta values are generated are not going to be the BEST Beta values that means they not appropriate.

Until unless my Beta values are not appropriate we cannot use the predicted model.

Q. Now the question is , if my model is not satisfying the homoscedasticity problem how I am going to handle the situation.
R. Using Transformations we can handle such scenario.

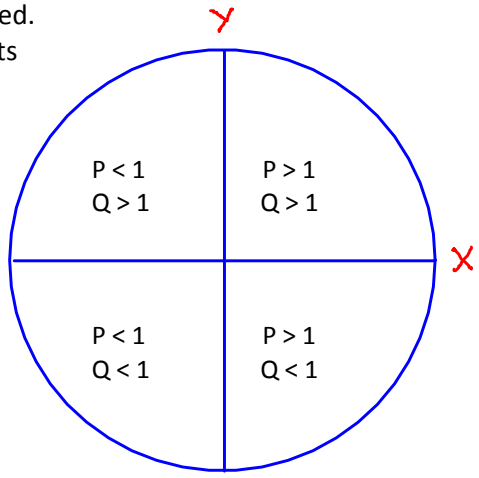
TRANSFORMATIONS

Transformations can be performed on X variables or Y variables or X & Y variables.

STEP 1: Try with X variable. Even though if homoscedasticity problem not solved.
STEP 2: Go with Y variable. Even though if homoscedasticity problem not solved.
STEP 3: Go with X and Y variable.

BULGING RULE: It helps us to find out how the X and Y transformations will be.

I need to transform X^p or Y^q .
Based on the scatter plot of two variables when model is developed.
We can decide which graph it represents. Based on this, it suggests
Us which transformation is required.



Compare the original graph with the circle.
Graph and Compare the shape of the circle. Try with first one i.e P < 1, Q > 1, So P values can be 0.5,-1,-1.5,-2,…..

After doing transformations, you need to check the Residuals, Adj-R^2 then only we can confirm the predicted model.

Some times, if the scatter plot shape is not similar to any of the curvature in bulging rules. Then How?
Go for Analytical Methods.

Box - Tidwell (X>0). Used for only X Transformation.

Box - Cox (Y, Y >0) : Used for only Y Transformation.

In 'R', Box Tidwell suggests us what kind of X transformation is required for us? Based on the nearest integer for lambda values it can be decided. How?

H0 : No Transformation
H1 : Transformation is possible

Ex: boxtidwell=boxTidwell(CurrentOutput~WindVelocity)
Based on the 'P' value we can check weather transformation is applicable or not.

-0.8330594 is nearest to integer -1.
Note: 1) When lambda = 1, that means there is no transformation is required for the analysis.
2) Lambda should not be zero.
3) When you see Lambda value as zero, you can assume that you can apply log transformation.
4) These above Lambda conditions are applicable for both Boxtid well and Box cox as well.

Suppose if we have a X values are negative then how?

Ex: Convert your original X values in to adding minimum negative value

X	------->	X	X* = X+40
-10		-10	30
20		20	60
-40		-40	0

Now, Fit the model between X* and Y.

If above all the procedures or transformations are not working properly, then go for WLS method.

WEIGHTED LEAST SQUARE METHOD:

$1/x$, $1/x^2$, $\sqrt{x}$

NOTE:
1) Bulging Rule may not work always. Since it works well for single variable.
2) Box Tidwell is more appropriate. Since it can be worked on multiple X variables
3) Weighted Least Square is ultimate method.
4) Assumptions: Data should be followed Normal, Independent variables are independent of each other, $v(\epsilon) = \sigma^2$.
5) If we able to fix one problem most of the other problems also going to fixed.