Stat 401 B – Lecture 18

Interaction Model

- The model that contains Age, Bidders and Age*Bidders is a very good model.
- R^2=0.954, 95.4% variation in the price of antique clocks is explained by the interaction model.

1

Interaction Model

- The interaction model also has some problems.
- Cannot interpret the estimates of slope coefficients.
- Age does not appear to add significantly to the model.

2

Interaction Model

- By including the interaction term Age*Bidders we have added an explanatory variable that is clearly related to the other explanatory variables, Age and Bidders.

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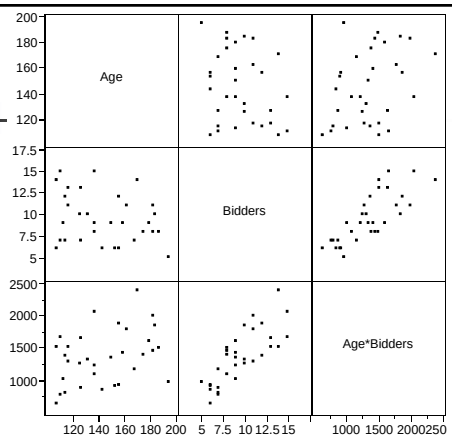
Multicollinearity

- When explanatory variables are correlated, this is called multicollinearity.
- Multicollinearity causes problems with interpretation and by inflating standard errors of estimates.



Correlations

Variable	by Variable	Correlation	Signif Prob
Bidders	Age	-0.2537	0.1611
Age*Bidders	**Age**	**0.3635**	**0.0408**
Age*Bidders	**Bidders**	**0.7916**	**0.0000**

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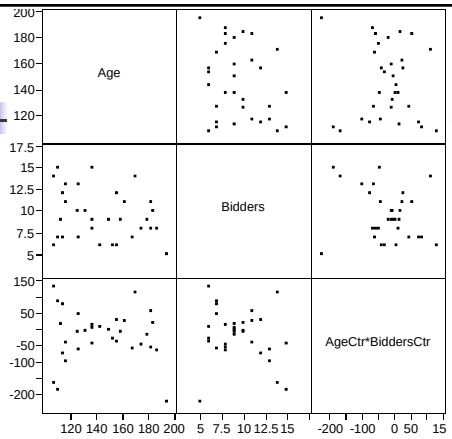
Centering Variables

- By centering variables, subtracting off the mean value, the correlation between explanatory variables and the interaction term is greatly reduced.



Correlations

Variable	by Variable	Correlation	Signif Prob
Bidders	Age	-0.2537	0.1611
AgeCtr*BiddersCtr	Age	-0.0744	0.6859
AgeCtr*BiddersCtr	Bidders	-0.2152	0.2369

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Interaction Model (centered)

- JMP will automatically center the variables before creating the interaction term.
  - (Age – 144.938)*(Bidders – 9.53125)

Interaction Model (centered)

- Predicted Price = – 1470.208 + 13.244*Age + 94.704*Bidders + 1.298*(Age – 144.938)*(Bidders – 9.53125)
- Although the prediction equation looks different, it is equivalent to the un-centered prediction equation.

Model Utility

- F=195.19, P-value<0.0001
- The small P-value indicates that the model using Age, Bidders and (Age – 144.938)*(Bidders – 9.53125) is useful in explaining variability in the prices of antique clocks.

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Statistical Significance

- (Age – 144.938)*(Bidders – 9.53125) (added to Age, Bidders)
  - t=6.15, P-value<0.0001
  - F=37.83, P-value<0.0001
- The P-value is small, therefore the interaction term (Age – 144.938)*(Bidders – 9.53125) adds significantly to the no interaction model.

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Interaction Model (centered)

- R^2=0.954 or 95.4% of the variation in price can be explained by the interaction model.
- RMSE=88.37

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Interaction Model (centered)

- Number of Bidders = 5
  - Predicted Price = –144.296 + 7.363*Age
- Number of Bidders = 10
  - Predicted Price = –611.346 + 13.853*Age

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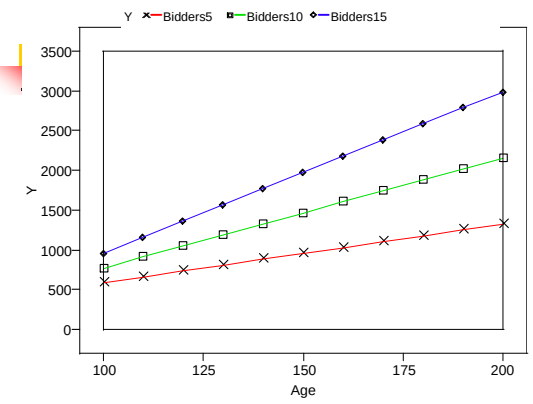
Interaction Model (centered)

- Number of Bidders = 15
  - Predicted Price = –1078.396 + 20.343*Age
- The slope estimate for Age changes as the number of bidders changes.



Interaction Model (centered)

- The interaction model is doing an even better job than the no interaction model.
- The test for Age in the centered interaction model is now statistically significant.