HYPOTHESIS TESTING

Steps for conducting a hypothesis test:
1) Set up a null hypothesis (i.e., posit that the true value is equal to a specific number).
2) Create a test statistic.
3) Make a decision rule (i.e., reject the null hypothesis if the test statistic exceeds some cutoff value).

P-Value, Critical Value, Size of Test
• The size of test is the probability that you are rejecting the null hypothesis when in fact it is true.
• The critical value of a t-statistic or f-statistic is constructed assuming a certain size of test (usually 0.05).
• The p-value gives the size of test at which the estimated t-statistic or f-statistic becomes the critical value.

F-tests for group of parameters
1) $H_0$: $b_1 = b_2 = 0$
2) $F$-stat = $(\text{error sum of squares in restricted regression-error sum of squares in unrestricted regression/number of restrictions})/\text{(error sum of squares in unrestricted regression/degrees of freedom in unrestricted regression)}$
3) Reject $H_0$ if $F$-stat>F-critical(numerator degrees of freedom=number of parameters set equal to zero; denominator degrees of freedom set equal to degrees of freedom in the unrestricted regression)

F-test to Drop Irrelevant Independent variables
Create a model to explain variation in home values. You should follow these steps:
1) Run a regression in which you include all the independent variables that you think—a priori—are relevant. Call this the unrestricted regression.
2) Store the sum of squared residuals and the degrees of freedom from this regression.
3) Make a note of the variables which have a p-value above 0.10.
4) Set up a new regression, which omits all those independent variables with a high p-value.
5) Store the sum of squared residuals and the degrees of freedom from this regression. Call this the restricted regression.
6) Use your stored values to carry out a hypothesis test
a) Null Hypothesis: the omitted variables do not belong in the model
b) Test Statistic: F-test
c) Decision rule: if the F-statistic is high enough, then reject the null hypothesis
i) How do we determine if the F-statistic is high enough? If it exceeds the critical value.
ii) How do we calculate the critical value? Set it equal to an F-statistic with numerator degrees of freedom equal to the number of omitted variables and denominator degrees of freedom equal to the degrees of freedom in the unrestricted regression. Set the size of test equal to .05.

General modeling procedure:
• In building a model, one begins with theory, selecting independent variables that theory suggests explain the variation in the dependent variable.
• The first (unrestricted) regression will usually show that some coefficients are not different from zero. One identifies these insignificant coefficients by examining the t-test, given in the summary(lm(…)) output; the null hypothesis of the t-test is that the coefficient equals zero. If the p-value is less than 0.1 then you can reject the null hypothesis.
• Remove the insignificant variables from the model and perform an F-test to see if these independent variables jointly fail to explain the variation in the dependent variable. The null hypothesis is that these variables do not belong in the model. If the p-value is less than 0.1 then you can reject the null hypothesis.

Homework assignment: We have a new dataset with data on the single family home market in Williamson County. Once again, you will estimate a hedonic house price model. Provide two tables. The first contains descriptive statistics (mean, min, max, standard deviation) for all variables used in your unrestricted model. The second reports the results of your final restricted model. Write a half page essay interpreting this final model. The homework is due by noon next Thursday (this gives me time to look at it before class).
Schema of General Model-Building Strategy

Data \rightarrow Unrestricted Model \rightarrow Theory

Examine t-statistics

Restricted Model (excludes independent variables with t-stat p-values above cutoff)

raise the p-value cutoff

F-statistic

\text{p-value(F) \leq 0.05} \Rightarrow \text{reject H0}

\text{p-value(F) > 0.05} \Rightarrow \text{don’t reject H0}

Finished Model

ex ante discussion

ex post discussion