d. Provide a thoughtful interpretation of the coefficient on the Bt dummy variable, which indicates whether the farmer planted Bt cotton or not.

e. This specification includes no interaction terms between Bt and other inputs. Do you agree with this specification choice? Explain your agreement or disagreement with this choice.

f. Sowing date generally has a big effect on production in India. What do you think explains the statistically insignificant coefficient on this variable in their model?

g. During this growing season, there were many counterfeit Bt cotton seeds on the market in Andhra Pradesh (but not in the other states). These seeds were sold as if they were Bt cotton seeds, but they were not. Assuming the farmers in Andhra Pradesh did not know whether they were growing counterfeit Bt cotton seeds or not, propose a modification to their specification above that would control for these counterfeit Bt cotton seeds while still allowing you to estimate the productive effect of genuine Bt cotton seeds.

h. What is selection bias in the context of this research question and how might it affect the estimated coefficient on Bt cotton? Be as specific as possible.

i. Qaim et al. chose to estimate a production function to test the impact of Bt cotton on cotton productivity. Describe intuitively and thoroughly the duality relationships that exist between such an approach and a cost function approach.

j. Suppose you were hired by a research institute to estimate the benefits of Bt cotton to Indian farmers with more recent data from the 2009-2010 growing season. Based on your familiarity with the duality relationships in part (j), you think a cost function approach might be better than a production function approach. Your supervisor is unconvinced. Write a concise paragraph that clearly explains why a cost function might be a better approach to econometrically estimate the Bt cotton impact.

Answer three of the following four questions

2. Women, Infants, and Children (WIC) is a supplemental food program operated in the United States. WIC provides selected nutritional foods free of charge to low-income pregnant and postpartum women, mothers of small children, infants, and young children. A fundamental precept of the WIC supplemental foods program is that the foods offered under the program are provided at no charge to program participants. Unlike a traditional food-stamp program wherein participants receive vouchers to purchase a fixed dollar value of food and decide on their own which food items to purchase, WIC gives participants "food instruments" that authorize the purchase of specified quantities of particular foods. Examples include infant formula, certain baby foods, fluid milk, cheese, and whole grain breakfast cereals. If participants wish to purchase more of the product than is authorized under the food instrument, they must buy it with their own income. Most retail food outlets participate in WIC, so WIC program participants can redeem their food instruments at any retailer they wish. Food retailers submit the food instruments to the government and are reimbursed for their regular shelf price for the item. In California, WIC purchases may comprise nearly half of total sales of some items such as infant formula.

a. Suppose every shopper has a fixed budget for food, and we can divide all foods into those that can be obtained under WIC if you are in the WIC program and all others. Janelle is a young mother who is eligible to participate in WIC, and she has "well-behaved" preferences as defined in 204A. Use indifference curves to show how joining the WIC program will affect Janelle's consumption of WIC foods and "other" foods.

b. Given the program description, discuss the incentives of WIC participants to be price conscious in their purchase decisions for WIC foods. Contrast the WIC program to a food voucher program like the U.S. food stamp program as it pertains to incentives of consumers to be price conscious.

c. Using graphical analysis, consider how the WIC program might affect the retail price for a food item, such as fluid milk, that is purchased in substantial amount by WIC participants, as well as by regular shoppers who pay out of their own pocket. Specifically address this issue under the following alternative assumptions:

   (i) Food retailing is a competitive industry.

   (ii) Food retailers are monopolists in their local market areas.

d. What type of competition do you think characterizes grocery retailing in the U.S. in reality? Explain your thinking in economic terms. Will different geographic areas have different levels of competition? Explain why or why not. If you were conducting an analysis of grocery retailing in the U.S., what economic models would you consider using? Be as specific as you can in your answer and give your reasoning.

e. Suppose the existence of the WIC program causes the retail prices for the specific foods, eligible to be purchased under WIC, to increase. Consider two consumers who have identical budgets and preferences, John and Janelle. Janelle participates in WIC, but, of course, John is not eligible to participate. Using indifference curves, contrast the effect of the WIC program on these two consumers, assuming the program causes an increase in the price of WIC-eligible foods. Use a relatively "large" price increase so things are clear on your graphs.

3. One of the more controversial U.S. agricultural policies is the subsidy of $0.45 per gallon for production of ethanol. The subsidy is paid to refiners who blend ethanol with conventional oil based gasoline. Ethanol can be produced from several crops, but in the U.S. is produced mainly from corn, so we will consider for purposes of this question that the subsidy is for corn-based ethanol.

a. Construct a market model for corn to analyze the impacts of the ethanol subsidy on the corn market. What impacts on the corn market does your model predict as a consequence of the ethanol subsidy?

b. One of the arguments made by critics of the ethanol subsidy is that the subsidy has raised food costs generally, not just for corn. Your job is to evaluate this claim for two key foods, cattle/beef and soybeans. Key information for your analysis is that:

   - Most U.S. corn production occurs in the Midwest, where corn competes for acreage with soybeans.
   - Corn and cattle/beef aren't generally produced on the same farms, but corn is a key feed grain used to fatten cattle.

   You want to evaluate the impacts of the ethanol subsidy on the soybean and cattle/beef markets using two separate analyses. The ideal answer will begin at the producer level and then aggregate the producer results to the market level. Use graphs and/or math if possible.

c. How would your answer in part (b) change if all cattle/beef production occurred on farms that also grow corn?

d. Although in its early days, ethanol was promoted as having a positive environmental impact, more recent analyses suggest the environmental impact may be negative. One specific claim is that the subsidy increases the total amount of land under cultivation, which has negative environmental impacts, especially as it pertains to carbon emissions. Sketch an analytical model that would enable you to evaluate this claim. A good approach might be to consider a "representative" farmer in the Midwest. What are key elements that would need to be in this model that might not be included in a "typical" producer optimization problem?

4 You are interested in estimating β, the expected value of a normal random variable, and you will have n observations from $Y_i \sim N(\beta,\sigma^2)$.

a. Demonstrate that the least-squares estimator is unbiased and consistent. (State any assumption you require.)

b. Give an example of an estimator of β that is biased but consistent.

c. Give an example of an unbiased estimator of β that is not consistent.

d. Now you realize that it is unlikely that the expected value of this random variable is constant across all observations, and you are concerned that the variance is also not constant. Specifically, you hypothesize that the expected value of your random variable is proportional to some characteristic (X_i) of the observation, and you hypothesize that the variance is proportional to some other characteristic (Z_i).

   Indicate how you will estimate β so that you can claim that your estimator is BLUE.

e. Indicate the consequences for your estimator in (d) from having erred in assuming that the expected value is proportional to X_i .In fact, the expected value of Y_i is $\beta_1 + \beta_2 X_i$.

f. Now assume that you were correct in assuming that the expected value was proportional to X_i, but you were incorrect in assuming that the variance is not constant. In fact, $V(Y_i)=\sigma^2$.

   Indicate the consequences for the properties of your estimator in (d).

5. Your understanding of the market for fresh strawberries produced in California is that the weekly quantity produced (Q) depends on the previous week's weather (W) and the previous week's production:

$$Q_t = \beta_1 + \beta_2 Q_{t-1} + \beta_3 W_{t-1} + e_t$$

Market prices are determined by

$$P_t = \alpha_1 + \alpha_2 Q_t + \alpha_3 D_t + \alpha_4 P_{t-1} + u_t$$

where P denotes price and D is a dummy variable indicating whether or not retailers are featuring strawberries prominently in their weekly advertisements.

a. Indicate whether or not you would be willing to estimate the first equation using OLS. (Justify your answer.)

b. Indicate whether or not you would be willing to estimate the second equation using OLS. (Justify your answer.)

c. How does your answer to (a) change if it is lagged price and not lagged quantity that appears in the first equation?

d. How does your answer to (b) change if it is lagged price and not lagged quantity that appears in the first equation?

e. Repeat (c) and (d) for the case where *current* price replaces the lagged quantity variable in the first equation.

f. Currently, most retailer advertising is done using newspaper ads that must be printed weeks in advance. Imagine that in the future, all newspapers will be online, and ads can be determined at the beginning of each week. Suppose that retailers can observe the previous week's weather in determining their advertising plans. Does this change how you would estimate the second equation above?

University of California, Davis

Department of Agricultural and Resource Economics

M.S. Comprehensive Exam, June 25, 2012

You have four hours for this exam after a 20 minute reading period (8:30-12:50). You do not need to use the whole time period. This exam consists of four questions.

- You must answer questions 1. It is worth 30% of the total exam score.
- You must also answer question 2. It is worth 40% of the total exam score.
- You must answer either question 3 or question 4. Do not answer both. Your chosen question is worth 30% of the total exam score.

Watch the time carefully. The logic used to answer the question is important, so be sure to clearly specify your reasoning, with full sentences. Supporting your answer as rigorously as possible – usually by diagrams or equations – is also important. This is not the time to economize on paper. Make any graphs you draw large and easily read. Make sure your writing is legible; if we can't read it, it will be assumed wrong.

QUESTION 1: Everyone must answer this question.

Catfish in the U.S. are produced in ponds and fed a grain-based diet. The U.S. catfish industry faces competition from other fish products, most notably tilapia, and also from catfish imported mainly from Vietnam.

a. Suppose at time t = 1 the market for catfish in the U.S. is in a long-run competitive equilibrium. Describe in words what this market condition means and depict a long-run competitive equilibrium graphically, using two graphs, one depicting the industry and the second depicting a representative catfish farmer.

b. Let time t = 2 correspond to the time period beginning in 2007 when grain prices increased sharply in the U.S., due to several factors including the increasing use of corn to make ethanol. Show how this shock to the market would have impacted the U.S. catfish industry for both a representative farm and the industry. (A good approach may be to begin with your time t = 1 equilibrium and show how the events in this question would have affected that equilibrium.)

c. Vietnamese catfish are raised using inferior production methods to U.S. catfish. For example some are grown in cages on the Mekong River, where they encounter effluents discharged into the river. Toxins and antibiotics may therefore be present in Vietnamese catfish. Yet it is difficult for consumers to distinguish between U.S. and Vietnamese catfish based on appearance alone. Describe using the correct economic terminology for the market failure in the catfish industry created by this situation. What will be the impacts of this market failure on U.S. consumer demand? What will be the impacts on U.S. catfish producers?

d. Suppose in response to the situation in part (c) that the U.S. catfish producers had country of origin labeling (COOL) implemented for catfish and then launched a successful promotion campaign to inform consumers of the objective differences between U.S. and Vietnamese catfish. How would this change the market equilibrium relative to what you discussed in part (c)?

e. You modeled the U.S. catfish industry in part (a) using a competitive markets model. Would you use a competitive model to study the U.S. catfish industry if the events described in part (d) were true? Why or why not? If your answer is no, describe briefly the essential features a model of the industry would need to have.

QUESTION 2: Everyone must answer this question

Marketing analysts play an important role in the private sector by helping firms understand what consumers want.

a. Describe briefly why public policy analysts must also understand consumer demand. Provide an example of a specific consumer demand analysis that could improve a specific policy intervention. In your example, what specifically would be useful for the analyst to know about consumer demand?

b. In a recent analysis of consumer demand for table wine in Italy, Torrisi et al. use scanner data from Italian supermarkets to understand "the competitive environment of the table wine market and shed light on the nature and differences in price competition among the selected brands and how consumers substitute across products." Torrisi et al. estimate a modified linearized Almost Ideal Demand System (AIDS) model of the following form:

$$w_{ilt} = \alpha_{ilt} + \sum_{j=1}^{N} \gamma_{ij} \log(p_{jlt}) + \beta_i \log\left(\frac{y_{lt}}{P_{lt}}\right) + \varepsilon_{ilt}, \; i=1,\ldots,5.$$

Subscript l indexes the l^{th} city. Based on what you know about AIDS models, describe this specification as carefully and completely as you can, including the variables, coefficients and other subscripts.

c. Torrisi et al. modify this conventional AIDS specification by specifying:

$$\alpha_{ilt} = \alpha_{0i} + \sum_{k=1}^{K} \lambda_{ik} Z_{klt} \quad i = 1, \ldots, 5$$

Based on how these additional K variables enter the AIDS model and on the context (i.e., retail demand for table wine), provide and discuss two examples of Z variables that might make sense. Explain why you think your two candidate Z variables could make sense.

d. Describe how an AIDS model is typically estimated econometrically and why this particular econometric approach is used. Be as specific as possible in your justification.

e. The authors describe their conventional independent variables as follows, where P_ indicates log prices of different brands of Italian table wines:

Variable	Description
P_OTHER	Natural log of Other wines
P_CAST	Natural log of Castellino
P_PL	Natural log of Private Labels
P_RONCO	Natural log of Ronco
P_TAV	Natural log of Tavernello
EXP	Natural log of the Italian red wine expenditures divided by the Stone's index

Their estimated coefficients on these variables are shown below, where each column contains the results for a separate equation and standard errors in displayed in parentheses:

Variable	CAST	PL	RONCO	TAV
P_OTHER	−0.03421	0.02495	−0.00284	0.04384
	(−0.01072)	(0.00903)	(0.01052)	(0.01400)
P_CAST	−0.10991	0.01087	0.02968	0.10356
	(−0.01528)	(0.00918)	(0.01034)	(0.01482)
P_PL	0.01087	−0.08543	−0.00665	0.05626
	(0.00918)	(0.01086)	(0.00840)	(0.01204)
P_RONCO	0.02968	−0.00665	−0.12364	0.10345
	(0.01034)	(0.00840)	(0.01381)	(0.01335)
P_TAV	0.10356	0.05626	0.10345	−0.30711
	(0.01482)	(0.01204)	(0.01335)	(0.02432)
EXP	−0.00772	0.00151	0.03176	0.00560
	(0.00498)	(0.00393)	(0.00537)	(0.00622)

Interpret the estimated coefficients for the RONCO equation, including their statistical significance.

f. These results have been restricted to conform to a specific pattern. What restriction have the authors imposed on their specification? What axiom from utility theory is responsible for this preference restriction?

g. The estimates above imply the own- and cross-price elasticities below:

Variable	OTHER	CAST	PL	RONCO	TAV
OTHER	−1.10	−0.13	0.12	0.00	0.24
	(0.13)	(0.05)	(0.06)	(0.06)	(0.08)
CAST	−0.29	−1.99	0.11	0.28	0.97
	(0.10)	(0.20)	(0.10)	(0.10)	(0.15)
PL	0.24	0.10	−1.82	−0.07	0.53
	(0.13)	(0.11)	(0.15)	(0.10)	(0.13)
RONCO	−0.10	0.25	−0.10	−2.21	0.86
	(0.13)	(0.10)	(0.09)	(0.18)	(0.15)
TAV	0.10	0.23	0.12	0.23	−1.69
	(0.04)	(0.04)	(0.03)	(0.04)	(0.06)

Note. Bootstrap standard errors in parenthesis.

Is the restriction you discussed in part (f) evident in these elasticities? Why or why not?

h. Suppose this was an analysis that you had conducted as a consultant for the Ronco Winery. The management team at this wine retailer is primarily interested in understanding how their Ronco brand table wines compare to and compete with other table wines. Write a concise paragraph that addresses this primary objective using the elasticites above.

Answer ONE of the following TWO questions. Do not answer both.

QUESTION 3:

Suppose you want to model electricity demand. Understanding electricity demand is extremely important, because this is one commodity that doesn't store well. At any moment, there has to be sufficient supply on the grid to meet the demand.

You want to estimate an electricity demand model of this form:

$$E_i = \beta_0 + \beta_1 Y_i + \varepsilon_i$$

where E_i is electricity demand by household i; Y_i is household i's income; and ε_i is a stochastic error.

Unfortunately, you cannot get data on individuals. Instead, you have state averages that allow you to estimate:

$$\overline{E}_i = \beta_0 + \beta_1 \overline{Y}_i + \overline{\varepsilon}_i$$

$\overline{Y}_i$ is the average electricity demand of households in state *i*, and $\overline{X}_i$ is the average state income. The error, $\overline{\varepsilon}_i$, is the error averaged across the state-*i* households. You also know the population of each state, n_i.

a. If you perform an ordinary least squares (OLS) estimate of this model using state averages, why are your estimates not likely to be best linear unbiased estimates (BLUE)?

b. What would you do to correct this problem?

c. After searching long and hard, you finally manage to get household survey data on electricity demand and income. The survey also provides information on the household head's education level and years of work experience. You use these data to estimate the following regression:

$$E_i = \beta_0 + \beta_1 Y_i + \varepsilon_i$$

i. Please state two reasons why an OLS estimation of this regression equation using household-level data is not likely to be BLUE.

ii. Given the survey data that you have, can you propose a solution to each of these two problems that will give desirable estimates?

QUESTION 4:

You are interested in predicting wages for a particular Canadian labor market. You have collected data for a cross-section of workers that includes the following variables:

Y = Monthly salary, in Canadian dollars;
E = 1 if the individual speaks English; 0 otherwise;
F=1 if the individual speaks French; 0 otherwise;
X = years of experience in the labor market;
S = years of schooling;
W = 1 if the individual is a woman; 0 otherwise;

In this labor market, some individuals speak English only, some speak French only, and some are bilingual. Everyone speaks at least one of the two languages.

1. Can you estimate a linear regression model with an intercept, E, and F all included? Why or why not?

2. Does your answer change if there are individuals who do not speak either English or French?

3. For both 1 and 2, indicate how you could estimate the effects of X, S, and W on Y, allowing for different models for each possible language category.

For the rest of this question, assume that your data set includes individuals who speak neither English nor French, as in question 2.

4. Indicate a model that would let you test for differences between men and women in the effects of schooling on wages.

5. How would you test the hypothesis that a French-speaking man is expected to earn the same salary, for a given number of years of experience and schooling, as a bilingual woman?

6. For some purposes, it would make more sense to estimate separate regressions for men and women. Why might you prefer to estimate a single model, as in this question?

7. Give at least one advantage of estimating separate regressions for men and women.

8. Suppose it is discovered that your assistant accidentally omitted all observations for which X>20. Is OLS unbiased? Is it consistent? (State any assumptions you require for this outcome.)

9. Suppose it is discovered that your assistant did not omit the observations with large X values, but did omit those for whom Y was below a certain value. Is OLS unbiased? Is it consistent?

University of California, Davis

Department of Agricultural and Resource Economics

M.S. Comprehensive Exam, August 20, 2012

You have four hours for this exam after a 20 minute reading period (8:30-12:50). You do not need to use the whole time period. This exam consists of five questions.

- You must answer questions 1. It is worth 30% of the total exam score.
- You must answer question 2. It is worth 40% of the total exam score.
- You must answer question 3. It is worth 30% of the total exam score.

Watch the time carefully. The logic used to answer the question is important, so be sure to clearly specify your reasoning, with full sentences. Supporting your answer as rigorously as possible – usually by diagrams or equations – is also important. This is not the time to economize on paper. Make any graphs you draw large and easily read. Make sure your writing is legible; if we can't read it, it will be assumed wrong.

QUESTION 1: Everyone must answer this question.

Corn for grain is by far the most important field crop produced in the U.S. based upon the farm revenue it generates. Currently about 40% of the U.S. corn crop is used to produce ethanol. Use of corn for production of ethanol has been promoted by two policies of the U.S. government:

- A $0.45 per gallon tax credit paid to ethanol producers. This credit expired January 1, 2012.
- The Renewal Fuel Standard (RFS), which mandates that a minimum quantity of ethanol be blended into gasoline each year. Corn ethanol currently comprises 10% of finished motor gasoline in the U.S. due to the RFS.

This question focuses on the U.S. market for corn for grain (henceforth simply "corn") at the farm level.

a. Discuss the factors that contribute to determining the U.S. supply and demand for corn at the farm level. You can base your discussion on a formal economic model if you wish, but it is not necessary. What is important is a concise verbal description of the economic factors that determine demand and supply at the farm level.

b. Show graphically how the aforementioned ethanol credit affected the corn market. Explain in words what your graph(s) show.

c. Show graphically and discuss how the aforementioned RFS, independent of the ethanol credit, affects the corn market.

d. Show graphically how the U.S. subsidization of corn ethanol affects the price paid for beef by U.S. consumers, recognizing that most beef cattle eat a diet rich in corn.

e. The Midwestern U.S. is a major production region for corn, and it has experienced a severe drought in 2012. In response to the drought conditions, a prominent member of the ARE faculty, in a recent editorial in the New York Times, proposed that the U.S. relax (reduce) the RFS as a policy response to the drought. Provide a graphical and written analysis of the impact of the drought on the corn market and the policy response proposed by the ARE faculty member.

f. An additional policy related to ethanol that we have not yet considered is the tariff of 54 cents a gallon on ethanol imports. This tariff expired on January 1, 2012, the same time the $0.45 per gallon subsidy (discussed above) given to U.S. ethanol producers expired. Many experts expect the expiration of the tariff to have little immediate impact on the U.S. market, but predict that the long-run impact could be substantially larger. Discuss the short- and long-run impacts of this policy change, using graphical analysis if possible. Evaluate the experts' opinion regarding short- and long-run impacts. What factors might cause long-run impacts to be greater?

QUESTION 2: Everyone must answer this question

Most goods (e.g., wine, cars, etc.) have multiple attributes (e.g., sugar content, engine size, etc.) – each of which may be valued differently by consumers. Applied economists often use hedonic price regressions to estimate the value consumers attach to these various attributes of a good. A hedonic price regression includes the price of the good as the dependent variable and attributes of the good as independent variables.

Below are hedonic price regression results from a sample of 782 different types of olive oil available in European markets. The dependent variable is price in Euros per 0.5 liter. Note that Europe uses International Olive Council standards for determining whether a particular olive oil qualifies as "extra virgin": the oil must be processed in a certain way and must have no taste defects.

Variable	Coefficient	Standard Error
Constant	3.4	0.7
Degree of Acidity (mean=0.58)	-1.5	0.8
Extra virgin dummy (1 if certified as extra virgin, 0 otherwise)	1.7	0.4
Italian origin dummy	0.7	0.1
Greek origin dummy	0.2	0.2
Spanish origin dummy	0.3	0.05
Glass bottle dummy (1 if sold in glass bottle, 0 otherwise)	1.2	1.4
N=782 R^2=0.67		

a. Interpret these econometric results in words. As you discuss these results, carefully assess the statistical and economic significance of these estimates.

b. Formulate null and alternative hypotheses to test whether consumers are willing to pay extra for extra virgin certification. Derive a test statistic from these results to test this hypothesis and interpret the result of this test.

c. Formulate null and alternative hypotheses to test whether consumers distinguish and discriminate between olive oil from different origins. Discuss carefully how you would test this null hypothesis, including the test statistic you would use.

d. Suppose Greek olives tend to have relatively high acidity, while Spanish and Italian olives tend to have lower acidity. Describe why this matters for the validity and interpretation of this hedonic price regression.

e. The U.S. does not currently regulate or certify what qualifies as extra virgin olive oil. As a result, there is substantial consumer confusion about what the term extra virgin means on an olive oil label. You have been given access to the data used in the regression above and have collected data from an additional 700 types of olive oil in the U.S. market. Specify a single, flexible regression model you could estimate from the pooled European and U.S. data to test whether and how Americans and Europeans are different in their hedonic valuation of olive oil.

f. The California legislature is currently debating a bill that would impose International Olive Council standards for any extra virgin olive oil sold in California. Suppose the bill passes and these standards are effective January 1, 2009. Suppose further that you could track the prices of 300 types of olive oil sold in California each year from 2008 to 2013. Specify and discuss a model you could estimate in 2014 using this data to determine how California's adoption of extra virgin standards has changed consumer valuation of extra virgin olive oil over the period 2008 to 2013.

g. In general, what market assumptions must hold in order for hedonic price regressions to offer meaningful insights into consumers' marginal valuation of attributes?

QUESTION 3: Everyone must answer this question.

a. You wish to test whether or not the following regression equation:

$$Y_i = \alpha + \beta_1 X1_i + \beta_2 X2_i + u_i$$

significantly explains the variation in Y_i around its mean, $\bar{Y}$. Unfortunately, when you get to class you discover that your dog ate part of your output, and this is all you can salvage:

OLS ESTIMATION
1003 OBSERVATIONS DEPENDENT VARIABLE = Y
TOTAL SUM OF SQUARES = 32000
VARIANCE OF THE ESTIMATE-SIGMA**2 = 30
MEAN OF DEPENDENT VARIABLE = 80.2

i. Can you still perform your test?
ii. If so, what is the value of your test statistic?
iii. Is your regression equation significant at the .01 level of significance? Explain.

b. In the above model, let Y_i be person i's income, $X1_i$ years of schooling, and $X2_i$ years of work experience. You want to test the null hypothesis that going back to school for an additional year will raise earnings by twice as much as working for another year, versus the alternative hypothesis that it will *not* increase earnings by twice as much. Please propose a way to do this. Specifically:
   i. What is your test statistic, and how do you construct it?
   ii. What is your null hypothesis?
   iii. What will be your criteria for rejecting the null hypothesis?

c. A colleague claims that your model ignores the "glass ceiling" syndrome: a 1-year increase in education, work experience, or both increases earnings less for women than men. Please propose a way to test this claim. Specifically:
   i. What is your test statistic, and how do you construct it?
   ii. What is your null hypothesis?
   iii. What will be your criteria for rejecting the null hypothesis?

d. Which potential violation of the classical regression model would you worry about most in this study: serial correlation or heteroskedasticity?
   i. Why?
   ii. Please propose a way to test for this violation of the classical regression model
   iii. If your test concludes that there is a violation, will your ordinary least squares estimator be the best linear unbiased estimator (BLUE)? Why or why not?
   iv. Please propose a way to address this problem while estimating your model.

Critical Values for Commonly Used Tests

In Econometrics

Student's t and z Distributions

Degrees of Freedom	p=value		
	0.10	0.05	0.01
1	6.31	12.71	63.66
2	2.92	4.30	9.93
3	2.35	3.18	5.84
4	2.13	2.78	4.60
5	2.02	2.57	4.03
6	1.94	2.45	3.71
7	1.90	2.37	3.50
8	1.86	2.31	3.36
9	1.83	2.26	3.25
10	1.81	2.23	3.17
11	1.80	2.20	3.11
12	1.78	2.18	3.06
13	1.77	2.16	3.01
14	1.76	2.15	2.98
15	1.75	2.13	2.95
16	1.75	2.12	2.92
17	1.74	2.11	2.90
18	1.73	2.10	2.88
19	1.73	2.09	2.86
20	1.73	2.09	2.85
21	1.72	2.08	2.83
22	1.72	2.07	2.82
23	1.71	2.07	2.81
24	1.71	2.06	2.80
25	1.71	2.06	2.79
26	1.71	2.06	2.78
27	1.70	2.05	2.77
28	1.70	2.05	2.76
29	1.70	2.05	2.76
30	1.70	2.04	2.75
40	1.68	2.02	2.70
50	1.68	2.01	2.68
60	1.67	2.00	2.66
80	1.66	1.99	2.64
100	1.66	1.98	2.63
150	1.66	1.98	2.61
Z	1.65	1.96	2.58

The Chi-squared Distribution

Degrees of Freedom	p=value		
	0.10	0.05	0.01
1	2.71	3.84	6.64
2	4.61	5.99	9.21
3	6.25	7.82	11.35
4	7.78	9.49	13.28
5	9.24	11.07	15.09
6	10.65	12.59	16.81
7	12.02	14.07	18.48
8	13.36	15.51	20.09
9	14.68	16.92	21.67
10	15.99	18.31	23.21
11	17.28	19.68	24.73
12	18.55	21.03	26.22
13	19.81	22.36	27.69
14	21.06	23.69	29.14
15	22.31	25.00	30.58
16	23.54	26.30	32.00
17	24.77	27.59	33.41
18	25.99	28.87	34.81
19	27.20	30.14	36.19
20	28.41	31.41	37.57

The F Distribution

Denom-inator df	p=0.01 Numerator df														
	1	2	3	4	5	6	7	8	9	10	20	40	60	120	∞
1	4052.00	4999.50	5403.00	5625.00	5764.00	5859.00	5928.00	5982.00	6022.00	6056.00	6209.00	6287.00	6313.00	6339.00	6366.00
2	98.50	99.00	99.17	99.25	99.30	99.33	99.36	99.37	99.39	99.40	99.45	99.47	99.48	99.49	99.50
3	34.12	30.82	29.46	28.71	28.24	27.91	27.67	27.49	27.35	27.23	26.69	26.41	26.32	26.22	26.13
4	21.20	18.00	16.69	15.98	15.52	15.21	14.98	14.80	14.66	14.55	14.02	13.75	13.65	13.56	13.46
5	16.26	13.27	12.06	11.39	10.97	10.67	10.46	10.29	10.16	10.05	9.55	9.29	9.20	9.11	9.02
6	13.75	10.92	9.78	9.15	8.75	8.47	8.26	8.10	7.98	7.87	7.40	7.14	7.06	6.97	6.88
7	12.25	9.55	8.45	7.85	7.46	7.19	6.99	6.84	6.72	6.62	6.16	5.91	5.82	5.74	5.65
8	11.26	8.65	7.59	7.01	6.63	6.37	6.18	6.03	5.91	5.81	5.36	5.12	5.03	4.95	4.86
9	10.56	8.02	6.99	6.42	6.06	5.80	5.61	5.47	5.35	5.26	4.81	4.57	4.48	4.40	4.31
10	10.04	7.56	6.55	5.99	5.64	5.39	5.20	5.06	4.94	4.85	4.41	4.17	4.08	4.00	3.91
15	8.68	6.36	5.42	4.89	4.56	4.32	4.14	4.00	3.89	3.80	3.37	3.13	3.05	2.96	2.87
20	8.10	5.85	4.94	4.43	4.10	3.87	3.70	3.56	3.46	3.37	2.94	2.69	2.61	2.52	2.42
40	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.89	2.80	2.37	2.11	2.02	1.92	1.80
60	7.08	4.98	4.13	3.65	3.34	3.12	2.95	2.82	2.72	2.63	2.20	1.94	1.84	1.73	1.60
120	6.85	4.79	3.95	3.48	3.17	2.96	2.79	2.66	2.56	2.47	2.03	1.76	1.66	1.53	1.38
∞	6.63	4.61	3.78	3.32	3.02	2.80	2.64	2.51	2.41	2.32	1.88	1.59	1.47	1.32	1.00