Economics 310 | Menzie D. Chinn
Spring 2004 | Social Sciences 7418
University of Wisconsin-Madison

Final Exam

Answer all questions in the 3 (three) bluebooks provided. Make certain you write your name, your student ID number, and your TA's name on all your bluebooks, as well as noting the bluebook (A, B, or C).

Point allocations are proportional to time allocations. Partial credit will be awarded if the written material indicates understanding of how to answer the question (i.e., gibberish will not be given credit).

Bluebook A: 24 minutes, hypothesis testing

A.1 (10 minutes total) Suppose your firm has been experimenting with two different physical arrangements of its assembly line. It has been observed that both arrangements yield approximately the same average number of finished units per day. To obtain greater process control, you suggest that the arrangement with the smaller variance in the number of finished units per day be permanently adopted. Two independent random samples yield the results shown in the table.

Assembly Line 1	Assembly Line 2
$\bar{x}_1=85$	$\bar{x}_2=87$
$n_1=21$	$n_2=21$
$s^2_1=1200$	$s^2_2=3600$

a) (6 minutes) Conduct a test to determine if the variation in the number of finished units per day for assembly line 1 is less than the number of finished units per day for assembly line 2. Use $\alpha=.025$.

b) (4 minutes) Given the information provided above, is it possible to formally test if the average number of finished units per day for assembly line 1 is the same as the average number of finished units per day for assembly line 2? If yes, how? If no, why? (Hint: what assumptions do you need to test this hypothesis?)

A.2 (6 minutes) Smoke detectors are highly recommended safety devices for early fire detection in homes and businesses. It is vital that the devices be nondefective. Suppose 100 Brand A detectors are tested and 12 fail to emit a warning signal. Subjected to the same test, 15 out of 90 Brand B detectors fail to operate. Create a 95% confidence interval to estimate the difference in the fractions of defective smoke detectors produced by the two companies.

A.3 (8 minutes) Two surgical procedures are widely used to treat a certain type of cancer. To compare the success rates of the two procedures, random samples of the two types of surgical patients were obtained and the numbers of patients who showed no recurrence of the disease after a 1-year period were recorded. The data are shown in the table.

	Sample size	Number of Successes
Procedure A	100	78
Procedure B	100	87

Show how to calculate the test statistic for H_0: $P_A - P_B = 0$. Suppose the p-value for the test was reported as p = .0475. State the proper conclusion when testing H_a: $P_A - P_B < 0$ at $\alpha = .05$.

<u>Bluebook B: 36 minutes, regression</u>

Consider the following regression results for a regression of the annualized quarterly growth rate of the value of the dollar against the euro (GROWTH_DOLLAREURO) on the difference in the annualized growth rates of US and European labor productivity (GROWTH_USEUPRODDIF).

Dependent Variable: GROWTH_DOLLAREURO
Method: Least Squares
Date: 04/29/04 Time: 21:08
Sample(adjusted): 1989:4 2001:4
Included observations: 49 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.024188	0.025156	0.961538	0.3412
GROWTH_USEUPRODDIF	1.918305	0.894341	2.144936	0.0372

R-squared	0.089161	Mean dependent var	0.037881
Adjusted R-squared	0.069781	S.D. dependent var	0.176599
S.E. of regression	0.170326	Akaike info criterion	-0.662240
Sum squared resid	1.363521	Schwarz criterion	-0.585023
Log likelihood	18.22488	F-statistic	4.600749
Durbin-Watson stat	1.592695	Prob(F-statistic)	0.037157

Note: A 10% growth rate is expressed as 0.10 in the data.

a) (4 minutes) Show how to calculate the S.E. of regression using the output above.

b) (5 minutes) If the GROWTH_USEUPRODDIF was -1% (that is European productivity is faster than US productivity by 1 percentage points), what would your *predicted individual value* of the growth rate of the value of the dollar be? What would your *estimated mean* of the growth rate of the value of the dollar be?

c) (3 minutes) If you were to estimate two separate 95% confidence intervals for the *predicted value* and the *estimated mean*, which one would be wider? Why? Please provide the reasoning to get credit, no actual calculation is required.

d) (6 minutes) Suppose you thought that the behavior of the value of the dollar against the euro was systematically different when European Monetary Union was implemented in 1999. Define a variable EMU that takes on a value of 1 when the EMU is in effect, and 0 otherwise, and then run the regression to obtain:

Dependent Variable: GROWTH_DOLLAREURO
Method: Least Squares
Date: 04/29/04 Time: 21:11
Sample(adjusted): 1989:4 2001:4
Included observations: 49 after adjusting endpoints

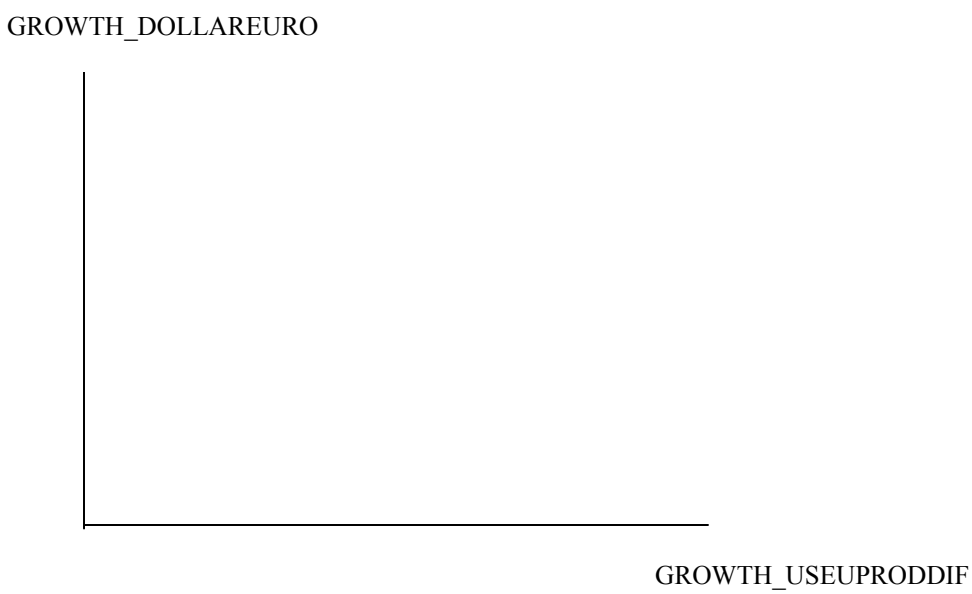
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.005124	0.027864	0.183885	0.8549
GROWTH_USEUPRODDIF	2.301852	1.000194	2.301405	0.0261
EMU	0.116545	0.064722	1.800693	0.0785
EMU*GROWTH_USEUPRODDIF	-3.073703	2.252658	-1.364478	0.1792

R-squared	0.155993	Mean dependent var	0.037881
Adjusted R-squared	0.099726	S.D. dependent var	0.176599
S.E. of regression	0.167563	Akaike info criterion	-0.656813
Sum squared resid	1.263474	Schwarz criterion	-0.502379
Log likelihood	20.09192	F-statistic	2.772360
Durbin-Watson stat	1.572148	Prob(F-statistic)	0.052294

Interpret in words the coefficient on EMU. Is this coefficient estimate statistically significant?

e) (6 minutes) What is the effect of a one percentage point increase in the difference in productivity growth rates on the growth rate of the value of the dollar when the EMU is in effect (use a 20% significance level for making your inferences).

f) (6 minutes) Draw a diagram showing the regression lines for periods when the EMU is in effect, and when it is not. Indicate the values of the intercepts and slopes for each regression line. [Draw your graph in your bluebook!]



g) (6 minutes) How would you assess the overall utility of our model by using an F-test?

Bluebook C: 30 minutes, comprehensive

C.1 True/False/Explain (10 minutes total)

Events G and F are defined on the sample space of the same experiment, with P(G)=0.5, and P(F)=0.4. Consider each of the statements given below separately. Indicate whether it is true or false, and justify your answer. In "Suppose …" followed by "Then …" type statements you must show that the second part follows from the first.

a) Suppose P(G|F)=0.6. Then P(F|G)=0.48
b) Suppose P(G U F)=0.9. Then G and F are independent.

C.2 Conditional and unconditional probabilities (8 minutes total)
Consider this table of the probabilities of quarterly percent changes in the real value of the dollar.

Tabulation of DLUS_MAJOR and DLUS_MAJORLAG
Date: 04/29/04 Time: 22:21
Sample: 1973:3 2003:4
Included observations: 122

% Total % Table		DLUS_MAJORLAG [-0.1, 0)	 [0, 0.1)	 Total
	[-0.1, 0)	28.69	18.85	47.54
DLUS_MAJOR	[0, 0.1)	18.85	33.61	52.46
	Total	47.54	52.46	100.00

What is the probability that growth rate this quarter *or* next quarter is positive?

C.3 (4 minutes) Calculating an expected value
In a machine shop, the probability distribution of the number of daily breakdowns is as follows:

Number of breakdowns	0	1	2
Probability	0.3	0.6	0.1

The daily repair cost C, in $, is given by $C=30+20X^2$ where X is the number of breakdowns. Calculate the expected daily repair cost.

C.4 (8 minutes) Calculating an expected value using a random variable

We have 100 machines manufacturing a certain type of bolt. It is known that each of these machines has a chance of 0.1 to break down (and it is independent of other machines' breakdowns). To repair those broken machines, it costs $C=30+2X^2$, where X is the number of machines that break down (so 30 is the fixed cost and $2X^2$ the variable cost to repair machines). Calculate the expected repair cost E(C).

5.5.2004 1:30PM