Economics Department 2002 Honors General Exam

You have three hours to complete this exam.

You must answer TWO of the three possible micro questions.

You must answer ALL TWO of the two possible macro questions.

You must only answer ONE of the two possible econometrics questions. If you try to answer all three micro questions, or both econometrics questions, you will not get any credit for any work done on the last question you try to answer.

You must use a SEPARATE blue book for each question, so you will hand in five (5) bluebooks. Calculators are NOT permitted.

Make sure your name and the question number (Micro 3, Macro 2) is on the outside of each of the five bluebooks! The number should refer to the actual question number on the exam).

Micro Question 1. A competitive farmer can grow q bushels of corn a cost of

$$c(q) = 0.5q^2.$$

(a) If the price of corn is p, what is the profit–maximizing amount of corn to supply?

(b) What is the farmer's profit function?

(c) The price of grain is very volatile. It is \$10 per bushel with probability $\frac{1}{2}$ and \$0 per bushel with probability $\frac{1}{2}$. Fortunately, the farmer learns the price before he has to make his production decision. What is the expected profit of the farmer?

(d) The farmer is approached by a grain merchant who offers the following long-term contract: The merchant will buy all the grain produced by the farmer at a fixed price of \$5 per bushel. What is the profit associated with this contract?

(e) Assume that the farmer chooses the contract on the basis of the expected utility of the profit that each contract yields. His expected utility is given by $\sqrt{\pi}$, where π denotes profits. Which of the two contracts will the farmer choose?

Remember: Answer only TWO of the three Micro questions.

Micro Question 2. **(New blue book!)** Provide a brief explanation for each part. None of the explanations need to be longer than a few sentences.

There are only two manufactures of birdcages in the market: BirdHome and. GoldenCage Corp. The duopolists compete Cournot style (that is they simultaneously select quantities). You are the CEO of GoldenCage Corp. You have hired a consultant, Mr. Knowall who knows the market demand and cost functions of both firms. Based on this information Mr. Knowall computed the Cournot equilibrium of the duopoly competition. According to Mr. Knowall GoldenCage Corp should produce 10,000 cages in equilibrium. Originally you intend to follow Mr. Knowall suggestion, however, you learn that the CEO of BirdHome is not planning to manufacture an equilibrium quantity of cages. You learn instead, from a reliable source, that he is planning to manufacture more then the equilibrium quantity. [Note: To answer this problem you do not have to do any computation. However, if you prefer, you can write down a model of Cournot competition and use it to illustrate the solution of this problem.]

(a.) Given this information from the reliable source, would you change your production plan? If so, would you produce more or less than 10,000 cages?

(b.) Given your answer to part (a), can you say with certainty that the profit of the other firm (BirdHome Corp.) will decline relative to its equilibrium level of profit? What about your profit?

Micro Question 3. **(New blue book!)** Provide a brief explanation for each part. None of the explanations need to be longer than a few sentences.

Many employees are subject to mandatory drug testing at the time of hiring (and only at that time). Assume that a drug test costs $100 and one that out of 700 hires fails it (thus the cost is $70,000 per detection). Many government employees are subject to mandatory drug testing at the time of hiring (and only at that time). Assume a drug test costs $100 and that one out of 700 hires fails it (thus the cost is $70, 000 per detection). Assume that the productivity of drug users is 2 per cent lower than their productivity would be if they were not using drugs.

(a.) Does the information given above prove that drug–testing program is unreasonable?

(b.) Mr. Conformist is a VP for human resources at UnitedWidget, a major New England widget manufacturer. UnitedWidget requires new hires to take a drug test. Mr. Conformist claims that he requires new hires to be drug tested because other companies in the area do the same. Mr. Conformist feels that everybody would be better off if drug testing of new hires is outlawed. Does this argument make any sense?

(c.) Assume that the government decides to legalize marijuana. The plan is to all the drug to be sold legally, but also to impose a tax on the drug that would fully capture the externalities imposed by the drug. Should the tax take into account the productivity loss of workers due to marijuana consumption? Now suppose that marijuana consumption makes workers more productive. Does this fact mean that economic efficiency requires us to subsidize the drug?

Macro Question 1. **(New blue book!)** Consider an economy that is well–described by the Solow model. The aggregate production function is $Y = F(K, L) = K^{\alpha}(EL)^{1-\alpha}$, with $\alpha = .30$. The rate of growth of population (L) is n, while the rate of growth of labor–augmenting technological progress (E) is g. In this economy, n equals 2 (two) percent, g equals 0 (zero) percent, δ (the rate of physical depreciation) equals 3 (three) percent, $E = 1$, and the capital/output ratio ($\frac{K}{Y}$) is 4. The economy has been in steady state for some time, and the current date is August 1, 2000.

a. What is the value of the savings rate, s? (Write down a numerical value)

b. What is the numerical value of the marginal product of capital (MPK)?

c. Is the capital stock of this economy above, below, or at the Golden Rule? If not at the Golden Rule, what numerical *savings* rate (s), given the numerical values of g, n, δ, and α above, would place this economy at the Golden Rule? Explain your reasoning.

d. Now assume that for some exogenous reason, the rate of saving s drops two percentage points. For convenience, assume that this drop happens instantly in a single day. *On the day of the change* in s, what happens to the *levels* of aggregate output and output per worker?

e. In the years following the change in s, as the economy moves to its new steady state, what happens to consumption per worker, aggregate output and output per worker? Answer this question with three graphs, all of which have time on the horizontal axis. For each of the graphs, put either consumption per worker or one of the two output measures on the vertical axis. Show how the three variables move over time. [Note: For convenience, you can represent constant percentage changes in a variable as a tilted straight line. Equivalently, you can graph the time–series behavior of the *log* of the consumption per worker, output per worker and aggregate output.]

f. Now assume a completely different economy, with no labor input. Its production function is $Y = AK$, where A is a *constant* parameter that describes the technology of this economy. As in the previous economy, a fraction of aggregate output (s) is saved every period for capital accumulation. This fraction drops by two percentage points in a single day, as before. There is also a constant rate of physical depreciation, ($\delta > 0$). Describe

i.) the instantaneous change in consumption, aggregate output and output per worker on the day that the savings rate dropped.

ii.) the behavior of consumption per worker, aggregate output and output per worker in the years following the change in savings rate.

Macro Question 2. (**New blue book!**) Argentina has been in the news a lot in the past several months. Over this period, the "currency board" that Argentina instituted several years ago collapsed. This currency board operated as an extreme form of a fixed exchange rate, as Argentina promised not to print a peso (the domestic currency) unless it could be backed by a dollar's worth of "hard currency" from the United States that was held by the Argentine government. In other words, the peso was pegged to the U.S. dollar at an exchange rate of 1:1 in a particularly strong way.

In all of the questions below, assume that Argentina is a small open economy with perfect capital mobility. Also assume that all of the short–run movements in the relative price of Argentine goods in the world market come from changes in nominal variables (i.e. that productivity growth in all industries is the same around the world, and that there are no real changes in demand either toward or away from the good produced by any country.)

a.) Using the standard Mundell–Fleming diagram, show how this fixed exchange rate affected Argentina's ability to conduct fiscal and monetary policy.

b.) One situation that put a lot of strain on the currency board was the simultaneous *increase* in the strength of the dollar relative to other world currencies and a weakening of the "real," the currency of Brazil. (Brazil is a major trading partner and competitor of Argentina.) Use the Mundell–Fleming diagram to show how the movements in the dollar and the real would have been reflected in the Argentine economy. Explain your graph with a few sentences.

c.) Given your answer in b.) what would be the advantages to either a *devaluation* or *revaluation* of the peso relative to the dollar? (In a devaluation, the peso would have weakened relative to the dollar, and vice versa for a revaluation.) What would be the disadvantages? In writing your answer, keep in mind the reasons that Argentina might have adopted a currency board in the first place.

d.) Now assume that (in contrast to the basic assumptions of Mundell–Fleming) prices and wages are perfectly flexible in the domestic country, even if the price of U.S. goods are sticky in the the U.S. and the price of Brazilian goods are sticky in Brazil. (Remember, perfect price flexibility means that prices can "jump" instantaneously to any required level, not just move quickly over short time periods.) How would the presence of perfect price flexibility in Argentina have affected the behavior of output in Argentina in the face of the movements in the dollar and real?

Econometrics Question 1. (**New blue book — answer EITHER this question or Econometrics Question 2.**)

We want to determine whether increasing the prison population leads to decreases in violent crime. We have a sample of 50 US states observed from 1971 to 1993. The model is

$$log(crime_{it}) = \theta_t + \alpha \cdot log(prison_{it}) + \beta_1 z_{it1} + \cdots + \beta_k z_{itk} + a_i + u_{it}.$$

θ_t is a year-specific intercept. $crime_{it}$ is the number of crimes per 100,000 people in state i in year t, and $prison_{it}$ is the prison population per 100,000 people. The z variables are controls like police per capita, income per capita, the unemployment rate, the racial mix, the proportion of the state that lives in cities, and the age distribution. a is an unobserved state-specific effect and u is an unobserved error.

(a) Suppose we compute the ordinary least squares (OLS) regression of $log(crime_{it})$ on year-specific dummy variables, $log(prison_{it})$ and the z variables. Do you expect the estimate of α to be unbiased? Explain.

(b) It seems reasonable to believe that increased crime rates lead to larger prison populations. If more crimes are committed, more people go to jail. Suppose we estimate α by regressing $\Delta log(crime_{it})$ on year dummies, $\Delta log(prison_{it})$ and the Δz variables. Here Δ is the "changes" operator, so for any variable x_{it}, $\Delta x_{it} = x_{it} - x_{i,t-1}$. Does the "changes" regression lead to an unbiased estimator for α_1? Explain. If there is bias, do you expect it to be positive or negative? Explain.

(c) Many states have been sued for prison overcrowding. Many of the suits are successful and have lead to the courts imposing limits on prison populations. It seems plausible that criminals do not alter their behavior in response to these suits. Let S_{it} denote a dummy variable equal to 1 if the state was successfully sued for overcrowding in year $t-2$. Describe a method for using this variable to estimate the effect of incarceration rates on crime rates. What do we need to assume about S_{it}?

(d) Consider a general two equation system

$$y_i = \beta_0 + \beta_1 x_i + u_i$$
$$x_i = \gamma_0 + \gamma_1 z_i + v_i.$$

Here y, x, and z are observed, and u and v are unobserved mean-zero errors. z_i is independent of u and v, but x_i is correlated with u_i. Describe in some detail how you would estimate β_1. Also describe how you would construct a confidence interval for your estimator. What assumptions are needed?

Econometrics Question 2. (**New blue book — answer EITHER this question or Econometrics Question 1.**)

We want to estimate the effect of being married on a man's income.

(a) Suppose we collect data on a cross section of men observed in one year. For each individual we know $log(wage)$ and marital status M (equal to 0 if unmarried and 1 if married). We also know the individual's years of education and years of work experience, whether the person is black, hispanic or white, and whether the person belongs to a union. An ordinary least squares (OLS) regression of $log(wage)$ on M and the other variables leads to a large, positive, statistically significant estimate for the coefficient on M. Is this estimate likely to be unbiased for the causal effect of being married on log-wages? Explain. If you think there is bias, is the bias positive or negative? Explain.

(b) Suppose we collect data on these men each year for 10 years. During those 10 years many of the men go from being to unmarried to married, and vice-versa. How could this data be used in trying to estimate a causal effect of marital status on earnings? What assumptions are needed? Explain in detail how to construct your estimator. Should we exclude from the sample those men whose marital status did not change during the 10 years? Explain.

(c) Consider the equation

$$log(wage_{it}) = \theta_t + \alpha M_{it} + \text{other factors} + a_i + u_{it}.$$

Here θ_t is the year-specific dummy, and $wage_{it}$ and M_{it} are the wage and marital status of individual i in year t. a and u are not observed. The equation is estimated by pooled OLS, random effects and fixed effects. All three estimates of α are positive and statistically different from zero. The pooled OLS estimate is largest, the random effects estimate is smaller, and fixed effects is the smallest. Which point estimate would you use as the causal effect of marital status on earnings? How would you test to decide which estimator was appropriate? Explain.

(d) Consider a general two equation system

$$y_i = \beta_0 + \beta_1 x_i + u_i$$
$$x_i = \gamma_0 + \gamma_1 z_i + v_i.$$

Here y, x, and z are observed, and u and v are unobserved mean-zero errors. z_i is independent of u and v, but x_i is correlated with u_i. Describe in some detail how you would estimate β_1. Also describe how you would construct a confidence interval for your estimator. What assumptions are needed?