Economics Department 2010 Honors General Exam

This is a 3-hour exam. (For joint concentrators with economics as the secondary field, this is a 1-hour exam. Choose one section of the exam to complete, and turn in your bluebook one hour after the exam begins.)

The exam has three sections: microeconomics (Questions 1-3), macroeconomics (Questions 4-7), and econometrics (Questions 8-9). Each section of the exam is of equal point value. Thus you should spend roughly 1 hour on each section of the exam.

You must answer either the first TWO (Questions 1 and 2) or the last ONE (Question 3) of the three Micro questions. Questions 1 and 2 are of 30 points each, and Question 3 is of 60 points. If you try to answer all three questions, you will not get any credit for any work done on the third question (Question 3). If you try to answer the third question (Question 3) plus one of the first two questions (Questions 1 or 2), you will only get credit for Question 3.

You must answer TWO of the four Macro questions. Each question is of equal point value (30 points). If you try to answer more than two macro questions, you will not get any credit for any work done on questions beyond the first two you try to answer.

You must answer ONE of the two Econometrics questions. Each question is of equal point value (60 points). If you try to answer 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 four (4) or five (5) bluebooks. Make sure your name and the question number are on the outside of each of the bluebooks! The number should refer to the actual question number on the exam.

You can bring one calculator, but no notes are permitted.

Good luck!

Microeconomics

Question 1 (Microeconomics, 30 minutes).   Consider a small exchange economy with two consumers, A and B, and two commodities, x and y.

Consumers A and B have preferences

$$u_A(x_A, y_A) = x_A y_A, \qquad\qquad u_B(x_B, y_B) = x_B y_B$$

The initial endowments of the goods are that A has 12 units of x and 2 units of y while B has 8 units of x and 18 units of y.

a. (**5 points**) Draw an Edgeworth box for this economy. Be sure to label everything clearly (including the endowment point).

b. (**5 points**) Draw in the efficient lens that corresponds to the initial endowment. Explain this lens.

c. (**6 points**) For an allocation in this economy to be Pareto efficient, it must maximize the utility of consumer A given the utility of consumer B. Is the initial endowment Pareto efficient? Why or why not?

d. (**6 points**) Now assume A gets to choose a new allocation to maximize utility, subject to the constraint that B's utility be no lower than at the endowment point. Illustrate this situation on a separate graph.

e. (**8 points**) Solve formally for the Pareto efficient allocations of x and y under the assumptions in part (d).

Question 2 (Microeconomics, 30 minutes). Consider the following game, known as Chicken. It represents a situation where two players drive their cars directly at each other as fast as possible. If one swerves away at the last minute, that person is a "chicken," which is not good, but the person avoids serious injury. The other person is the "hero" and also avoids injury. If both swerve they are both chickens but avoid injury. If no one swerves, they both experience serious injury.

The payoff matrix for this game is as follows:

		Driver B	
		Swerve	*Don't Swerve*
Driver A	*Swerve*	1,1	1,4
	Don't Swerve	4,1	0,0

a. **(9 points)** Does the game have a dominant strategy for Driver A or Driver B? If so, state the dominant strategies.

b. **(9 points)** Does the game have any pure strategy Nash Equilibria? If so, what are they?

c. **(12 points)** Does the game have any mixed strategy Nash Equilibria? If so, what are they?

Question 3 (Microeconomics, 60 minutes). In the land of Oz, a criminal class terrorizes the population by hurling pails of water on poor defenseless witches. The wizard– the land's benevolent leader– can fight crime either by enhancing the number of green guardsmen (who increase the probability of catching criminals) or increasing penalties.

a. **(6 points)** Write down the criminals choice problem and solve for the supply of crime.

b. **(6 points)** Generate comparative statics for the probability of arrest and the size of the penalty. Also generate comparative statics for the rate of time preference and the opportunity cost of time.

c. **(6 points)** Write down the wizard's objective function and maximize over his two inputs.

d. **(18 points)** Explicitly write down the wizard's second order conditions. Interpret them and explain what happens if they hold.

e. **(24 points)** Assume second order conditions now work. Solve explicitly for the comparative statics of both punishment inputs with respect to the opportunity cost of criminal's time and the rate of time preference. Interpret.

Macroeconomics

Question 4 (Macroeconomics, 30 minutes). This question asks you to interpret various theories about the current recession using the IS-LM model, the Phillips Curve, and the data below. The first two parts of the question, (a) and (b), ask you to evaluate two potential theories for why the crisis began. These two theories are not necessarily mutually exclusive — both may be true.
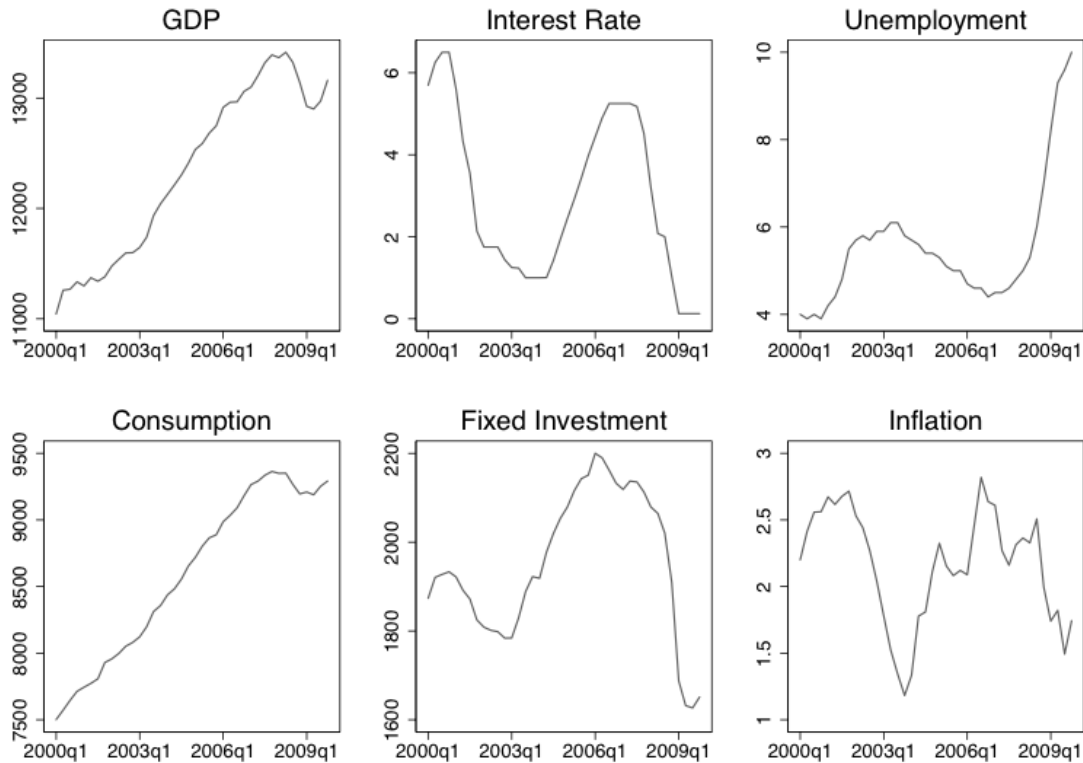

Figure 1: **Selected U.S. Macroeconomic Data: 2000:Q1 to 2009:Q4.** In the graphs above, GDP, fixed investment, and consumption are all measured in constant (2005) dollars. Unemployment, the interest rate, and the inflation rate are all measured as percentages. The interest rate is the Fed's target for the federal funds rate. The inflation rate is the 12-month percent change in the core Consumer Price Index.

a. **(5 points)** Economist A argues that the recession was caused by a steep drop in "animal spirits." In other words, this economist believes that firms became less

optimistic about the future, so they stopped adding to their capital stocks. What features of the data could the economist point to in order to prove her theory? What other data would be useful in shedding light on it?

b. **(5 points)** Economist B argues that the recession was caused by a steep drop in "autonomous consumption." In other words, this economist believes that consumers reduced their spending because of an increased desire to save for the future. What features of the data could the economist point to in order to prove her theory? What other data would be useful in shedding light on it?

c. **(5 points)** As the recession took hold, many economists argued that fiscal policy, rather than monetary policy, would be most effective in fighting the recession. Draw two IS-LM diagrams. The first one assumes that both Economist A and B's theories are correct and illustrates these theories in IS-LM. The second graph will depict the situation in which monetary policy is less effective in boosting output than fiscal policy. Draw your IS-LM diagrams with the nominal interest rate on the vertical axis and real GDP on the horizontal axis.

d. **(5 points)** Are the data for unemployment and inflation during the 2000s in general agreement with the Phillips Curve? Does the behavior of inflation and unemployment during this period suggest a value (or range of values) for the natural rate of unemployment, UR^*? Explain your reasoning.

e. **(5 points)** The data above indicate that inflation has fallen during the past few years. Assume that consumers and firms expect inflation to continue falling in 2010 and become negative in 2011. How would this *expected future deflation* affect the IS-LM diagram that you drew in part (c) above, which is relevant for the current time period?

f. **(5 points)** Your answer in part (d) might suggest a way in which the Federal Reserve could fight the recession. What is it? What are some advantages and disadvantages to this approach?

Question 5 (Macroeconomics, 30 minutes). Consider a version of the Solow Model where households require a subsistence level of consumption. The production function is standard:

$$Y = K^\alpha E L^{1-\alpha}, \tag{1}$$

as is the equation of motion for the aggregate capital stock,

$$\Delta K = sY - \delta K. \tag{2}$$

Labor (L) grows at a constant rate n. Labor-augmenting technical progress (E) is constant at 1. Unlike the standard Solow Model, savings is not a constant, but depends on per-capita income $y = \frac{Y}{L}$. If y is lower than a threshold level $\bar{y}$, then the representative household does not save. Of the income above $\bar{y}$, the household saves a constant fraction $\bar{s}$. Per-capita saving is therefore given by $sy = 0$ if $y < \bar{y}$ and

$$sy = \bar{s}(y - \bar{y}) \tag{3}$$

if $y > \bar{y}$.

a. **(8 points)** Graph the saving rate $s(= \frac{sy}{y})$ as a function of y.

b. **(6 points)** Draw the Solow diagram for this model. In other words, draw a diagram depicting sy and $(n + \delta)k$. Be sure to label your lines.

c. **(4 points)** How many steady-states does the model have? (Assume that $\bar{y}$ is not too large. Otherwise the economy has no steady states with $k > 0$.)

d. **(6 points)** For various values of initial capital, characterize which steady states the economy may converge to.

e. **(6 points)** This formulation of the Solow Model is sometimes called a "poverty trap" model. Why?

Question 6 (Macroeconomics, 30 minutes). Please answer each question below. You will be graded on the quality of your explanation.

a. **(15 points)** Compare between the neoclassical and the Schumpeterian theories of convergence.

b. **(15 points)** What do the various growth theories have to say about the determinants of long-run income differences, and how can we empirically show that institutions matter?

Question 7 (Macroeconomics, 30 minutes). Suppose that a household had only one asset: a savings account holding $100,000. Suppose that the household will live for exactly two periods: the current period, 0, and the next period, 1. Suppose that the household has no bequest motive (in other words, the household does not want to leave money to anyone after period 1).

Assume that the household has access to an investment that is risk-free and earns a rate of return, r. In other words, every dollar of saving during period 0 yields $1+r$ dollars in period 1. Assume as well that the inflation rate is 0.

a. **(5 points)** Draw the household's budget constraint between periods 0 and 1. Put consumption in period 0 on the horizontal axis and consumption in period 1 on the vertical axis.

b. **(5 points)** Draw a family of indifference curves on your figure. Explain why the indifference curves take the shape that they do. How do they slope? How do they bend?

c. **(5 points)** Draw a family of indifference curves on your figure. Explain why the indifference curves take the shape that they do. How do they slope? How do they bend?

d. **(5 points)** Assume that the interest rate rises from r to $r' > r$. Draw a new budget constraint and a new tangency point.

e. **(5 points)** How does the optimal consumption choice in period 0 change? How does the optimal consumption choice in period 1 change? Interpret your answer using substitution and income effects.

f. **(5 points)** In general, the rise in the interest rate has an ambiguous effect on consumption in period 0. Please explain why this is the case.

Econometrics

Question 8 (Econometrics, 60 minutes).

This question consists of two subquestions, each worth 30 points.

1. **(30 points)** In this question we will look at the relation between the labor earnings and lottery winnings. Using data from a study by Imbens, Rubin and Sacerdote (2001) on the lottery prize, earnings after winning the lottery (earn), earning prior to winning the lottery (priorearn), age and the number of lottery tickets bought (tixbot), we find the following results for a regression of earnings on the lottery prize, age and prior earnings:

$$\widehat{\text{earn}}_i = 17.48 - 0.107 \cdot \text{prize}_i - 0.26 \cdot \text{age}_i + 0.79 \cdot \text{priorearn}_i$$
$$\phantom{\widehat{\text{earn}}_i =} (2.41) \quad (0.055) \quad\quad (0.04) \quad\quad\quad (0.06)$$

The lottery prize and earnings variables are measured in thousands of dollars.

a. **(7 points)** Construct a 95% confidence interval for the effect of the lottery prize on earnings.

b. **(7 points)** Predict earnings for a 50-year old individual who won a lottery prize of $20K$, and who was making 15K prior to winning the lottery.

c. **(4 points)** Suppose we are concerned that there is a variable missing from this regression. This omitted variable is positively related to earnings, and positively related to the lottery prize. What is the sign of the bias on the coefficient on prize from omitting this variable? In other words, without this variable we estimated the effect of the prize to be -0.107. If we included this omitted variable in the regression, the effect of prize on earnings would be b. What is the sign of $-0.107 - b$?

d. **(6 points)** Suppose we think that the effect of the lottery prize differs depending on the value of prior earnings. In order to analyze this we estimate the regression

$$\widehat{\text{earn}}_i = 15.07 - 0.013\text{prize}_i - 0.26\text{age}_i + 0.99\text{priorearn}_i - 0.0078\text{priorearn}_i \times \text{prize}_i$$
$$\phantom{\widehat{\text{earn}}_i =} (2.76) \quad (0.077) \quad (0.04) \quad\quad (0.13) \quad\quad\quad (0.0045)$$

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Test whether the coefficient on the interaction is equal to zero at the 5% level, against the alternative that it differs from zero.

e. **(6 points)** Predict the effect of an additional dollar of prize money for someone with prior earnings equal to 10K.

2. **(30 points)** Suppose we are interested in estimating the effect of a job training program on earnings. We have data, for voluntary job training program, on earnings after the training program (Y_i), an indicator variable for whether the individual participated in the training W_i, and a variable measure earnings prior to the training (X_i).

a. **(9 points)** How would you test the null hypothesis that average earnings are the same for individuals who received the training and individuals who did not receive the training, against the alternative that they are different, at the 10% level?

b. **(6 points)** How would you construct a 95% confidence interval for the difference in average earnings between the individuals who took part in the training program and those who did not?

c. **(5 points)** What do you expect the sign of the correlation between pre-program earnings and post-program earnings to be?

d. **(5 points)** What do you expect the sign of the correlation between pre-program earnings and program participation to be?

e. **(6 points)** Based on the previous two answers, what do you expect for the sign of the difference between β_1 and γ_1 in the following two regressions?

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

and

$$Y_i = \gamma_0 + \gamma_1 W_i + \gamma_2 X_i + \varepsilon_i$$

Question 9 (Econometrics, 60 minutes). We have a random sample of size n from some population. For each individual i, there are variables (Y_i, Z_i, A_i), where we interpret Z_i as a noisy measure of A_i. We observe (Y_i, Z_i) for $i = 1, \ldots, n$, but we do not observe A_i. The structural model is

$$
\begin{aligned}
Y_i &= \beta_0 + \beta_1 A_i + U_i \\
Z_i &= A_i + V_i \qquad (i = 1, \ldots, n),
\end{aligned}
$$

where the latent (unobserved) random variables A_i, U_i, and V_i have mean 0 and are all uncorrelated with each other. In addition, we assume that $\beta_1 > 0$.

a. **(10 points)** Work out the covariance matrix for (Y_i, Z_i) (i.e., express the two variances and one covariance in terms of the model parameters β_1, $\text{Var}(A_i)$, $\text{Var}(U_i)$, $\text{Var}(V_i)$).

b. **(25 points)** Consider the linear predictors

$$
E^*(Y_i \mid 1, Z_i) = \pi_0 + \pi_1 Z_i,
$$

$$
E^*(Z_i \mid 1, Y_i) = \alpha_0 + \alpha_1 Y_i.
$$

Show that

$$
\pi_1 \leq \beta_1 \leq 1/\alpha_1.
$$

Provide a procedure that uses the data on (Y_i, Z_i) for $i = 1, \ldots, n$ to provide estimates of these lower and upper bounds for β_1. Explain why the estimates are consistent.

c. **(25 points)** Now suppose that there are two noisy measures of A_i, with

$$
\begin{aligned}
Y_i &= \beta_0 + \beta_1 A_i + U_i \\
Z_{i1} &= A_i + V_{i1} \\
Z_{i2} &= A_i + V_{i2} \qquad (i = 1, \ldots, n),
\end{aligned}
$$

where the latent (unobserved) random variables A_i, U_i, V_{i1}, and V_{i2} have mean 0 and are all uncorrelated with each other. Show that now β_1 is identified, and use your analysis to provide a consistent estimator of β_1 using the data on (Y_i, Z_{i1}, Z_{i2}) for $i = 1, \ldots, n$.