

Final Exam

Tuesday, December 19

2 hours, 30 minutes

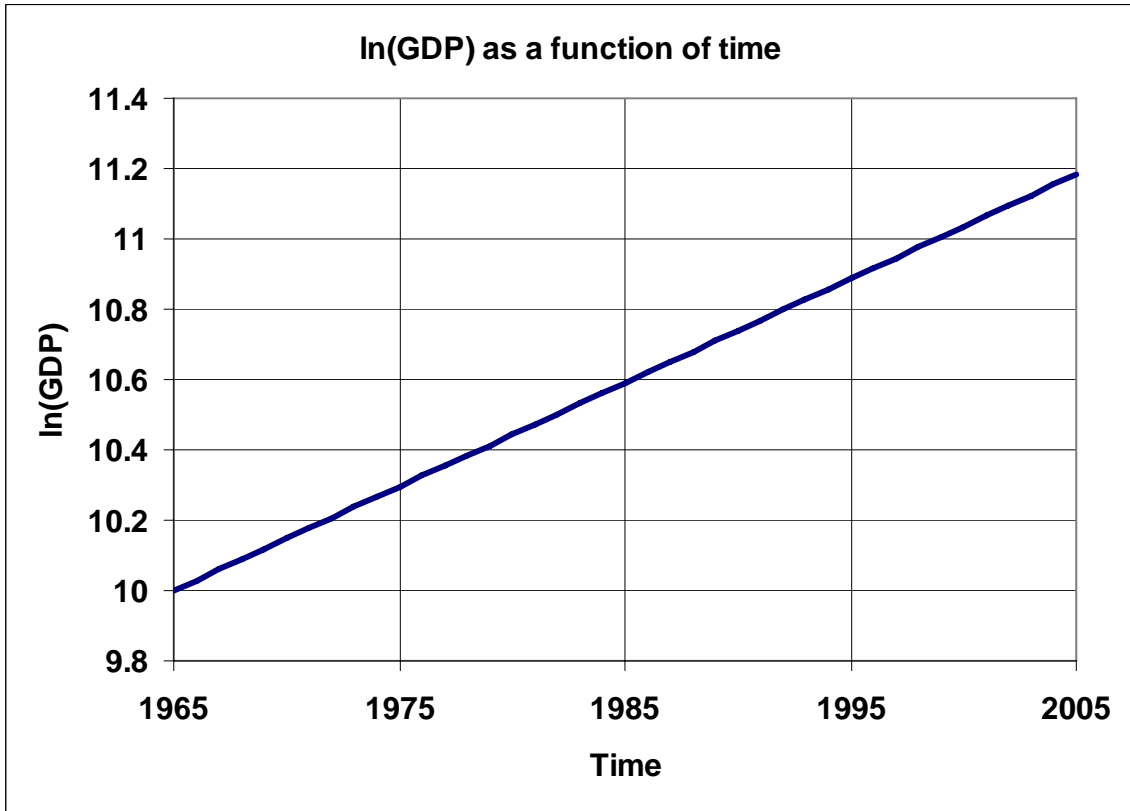
Name: _____

Instructions

1. This is closed book, closed notes exam.
2. No calculators of any kind are allowed.
3. Show all the calculations.
4. If you need more space, use the back of the page.
5. Fully label all graphs.

Good Luck ☺

1. (10 points). The next graph shows the $\ln(\text{GDP})$ of some country.



a. (5 pt). The GDP grows at constant rate. True/False, circle the right answer, and briefly explain why.

b. (5 pt). Based on the graph, the approximate growth rate of GDP is (circle one answer)

- i. 1.2%
- ii. 2%
- iii. 11.2%
- iv. 3%

2. (10 points). The next table provides data on prices and output in some artificial economy for the years 2000 – 2005. The goods are labeled 1 and 2, so that P_1, P_2, Q_1, Q_2 are prices and quantities of the two goods respectively.

Year	P_1	Q_1	P_2	Q_2
2000	1	40	3	20
2005	3	50	2	25

Calculate the inflation rate between the years 2000 and 2005 using 2000 as the base year.

3. (10 points). Consider the search model of unemployment, briefly described as follows.

	Unemployed	Employed
Fraction in population	U	$1 - U$
Utility	$V_u(b, p, t_b)$ + + -	$V_e(w, s, t_w)$ + - -
	b – unemployment insurance benefit p – probability of receiving a job offer t_b – tax on b	w – real wage s – separation rate (probability of losing the job) t_w – tax on w

The symbols “+” under a variable indicates that the utility is increasing in that variable, and “-” under a variable indicates that the utility is decreasing in that variable.

Distribution of wage offers: $H(w)$ gives the probability that an offer is at least w .

Illustrate with 3 fully labeled graphs the impact of an increase in the separation rate (s) on: (1) reservation wage w^* , (2) probability of acceptance of job offers $H(w^*)$, and (3) steady-state unemployment rate U^* .

4. (10 points). Consider the two-period model discussed in the notes. There are N identical consumers that live for two periods (1 and 2) and derive utility from consumption c_1 and c_2 in the two periods: $U(c_1, c_2)$. Consumers receive income y_1 and y_2 in the two periods and pay a lump sum tax t_1 and t_2 to the government. The consumers decide how much to consume in each period and how much to save in the first period. We denote the saving in the first period by s . Consumers can borrow and lend at real interest rate r , which is assumed exogenously given. Thus the budget constraints in the two periods are

$$BC_1: c_1 + s = y_1 - t_1$$

$$BC_2: c_2 = y_2 - t_2 + (1+r)s$$

The government collects tax revenues $T_1 = N \cdot t_1$ and $T_2 = N \cdot t_2$, and spends G_1 and G_2 in the two periods. The government can borrow and lend at real interest rate r with the constraint that the present value of spending = present value of taxes

$$G_1 + \frac{G_2}{1+r} = T_1 + \frac{T_2}{1+r}$$

State and prove the Ricardian equivalence theorem.

5. (10 points). Consider the model of optimal investment, briefly described as follows. A firm can produce output in two periods according to

$$Y_1 = A_1 K_1^\theta L_1^{1-\theta}$$

$$Y_2 = A_2 K_2^\theta L_2^{1-\theta}$$

where A_1, A_2 are productivity parameters, K_1, K_2 are physical capital, and L_1, L_2 are labor in the two periods. The firm owns the capital stock and the consumers own the firm. The capital stock evolves according to

$$K_2 = (1 - \delta)K_1 + I$$

where δ is depreciation and I is investment. The capital stock is exogenously given, and the firm can choose L_1, L_2, K_2, I . The profit in each period is

$$\pi_1 = Y_1 - wL_1 - I$$

$$\pi_2 = Y_2 + (1 - \delta)K_2 - w_2L_2$$

- a. (5 pt). Derive the optimal investment condition and provide economic interpretation of it.

- b. (5 pt). Suppose the demand for domestic investment goes up. Illustrate graphically the impact of this event on the capital market in an economy with trade deficit. State what happens to the equilibrium saving, investment, and trade deficit.

6. (10 points). Suppose that the public wants to hold currency/deposit ratio of $cd = 0.25$, and the required reserve/deposit ratio is $rd = 0.25$. The initial consolidated balance sheet of commercial banks is as follows:

Assets	Liabilities
$R = 5$	$D = 20$
$B_G = 7$	
$L = 8$	
20	20

- a. (5 pt). Find the monetary base, the money supply and the money multiplier in this economy.

- b. (5 pt). Now suppose that the FED performs an open market operation and buys government bonds from the commercial banks at the amount of 2. Find the new monetary base, the new money supply, the new currency held by the public, and show the new balance sheet of the commercial banks.

Assets	Liabilities
$R =$	$D =$
$B_G =$	
$L =$	

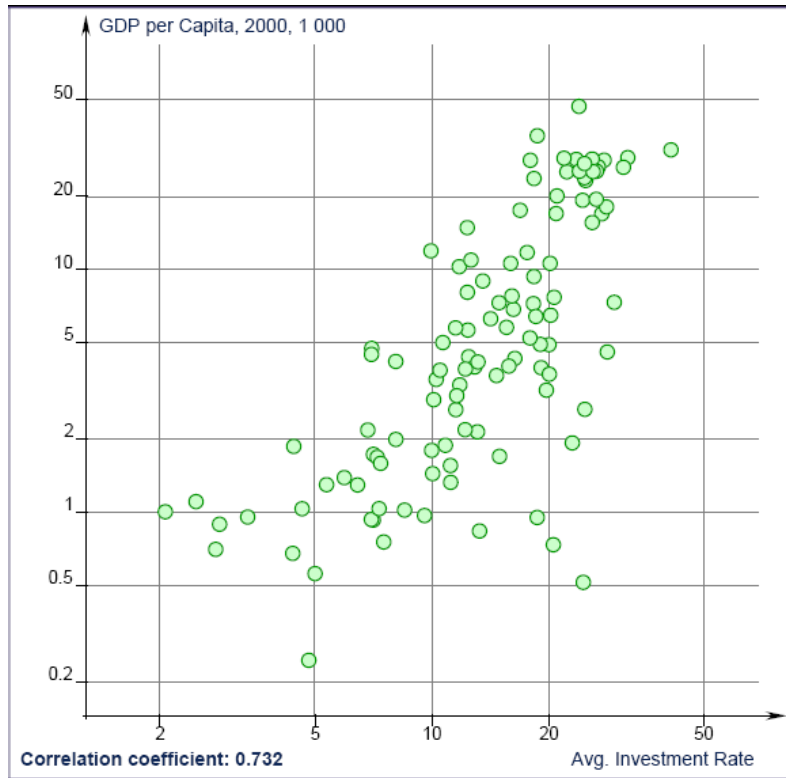
7. (10 points). Consider the Phelps expectation augmented Phillips curve model, $\pi_t = \pi_t^e - \beta(u_t - u_n)$, where π_t is inflation rate at time t , π_t^e the expectation of π_t at time $t - 1$, $\beta > 0$, u_t is the actual inflation rate at time t , and u_n is natural rate of unemployment.
- Draw the graph of the expectation augmented Phillips curve and illustrate the impact of inflationary policy on inflation and unemployment in the short run and in the long run. Assume that expectations are backward looking ($\pi_t^e = \pi_{t-1}$).

- b. (5 points). Using the same graph, explain Lucas' argument that inflationary policy for reducing unemployment is not effective even in the short run if expectations are rational.

8. (15 points). Consider the Solow model discussed in class. Output is produced according to $Y_t = A_t K_t^\theta L_t^{1-\theta}$, $0 < \theta < 1$. Capital evolves according to $K_{t+1} = K_t(1 - \delta) + I_t$, where δ is depreciation rate and I_t is investment. People save a fraction s of their income, and the total saving and total investment in this (closed) economy is $S_t = I_t = sY_t$. The population of workers (and the total population) grows at rate n , i.e. $L_{t+1} = (1 + n)L_t$.
- a. (5 pt). Derive the law of motion of capital per worker and plot its graph for a fixed level of TFP.

- b. (5 points). According to the Solow model, will the growth in standard of living continue forever? Explain with the help of a graph.

- c. (5 pt). The following graph shows the relationship between average investment rate and GDP per capita in a large sample of countries. Based on this graph, is the prediction of the Solow about the relationship between investment rate and GDP per capita consistent with the data? Explain your answer.



9. (15 points). Let P and P^* be the price indexes in the domestic economy and foreign economy respectively. Suppose that the price index is a weighted average of traded goods (indexed by T) and non-traded goods (indexed by N):

$$P = \alpha P^T + (1 - \alpha) P^N \quad 0 \leq \alpha \leq 1$$

$$P^* = \beta P^{*T} + (1 - \beta) P^{*N} \quad 0 \leq \beta \leq 1$$

- a. Assuming that: (1) the weights on traded and non-traded goods in the price index are fixed for both countries, (2) the ratio of prices of non-traded to traded goods is fixed in both countries, and (3) the PPP holds for traded goods, write the relationship between the growth of the exchange rate (\hat{e}), the domestic inflation (π) and foreign inflation (π^*).

- b. How would you test whether the relationship in part (a) holds in the data?

- c. The growth rate of the domestic money supply is 7%, the growth rate of the foreign money supply is 5%, the growth rate of the domestic real GDP is 3% and the growth rate of the foreign real GDP is 2%. Using the quantity theory of money and assuming that the money velocity is fixed, what will happen to the domestic currency? (Will it depreciate, appreciate and by how much). Show your calculations.