B.E. International Program

Faculty of Economics, Thammasat University

EE 474 Health Economics

Semester 1/2014

Problem Set 2

Due 6 November 2014 (In Class)

There are four questions in total. Each of them is worth 10 points.

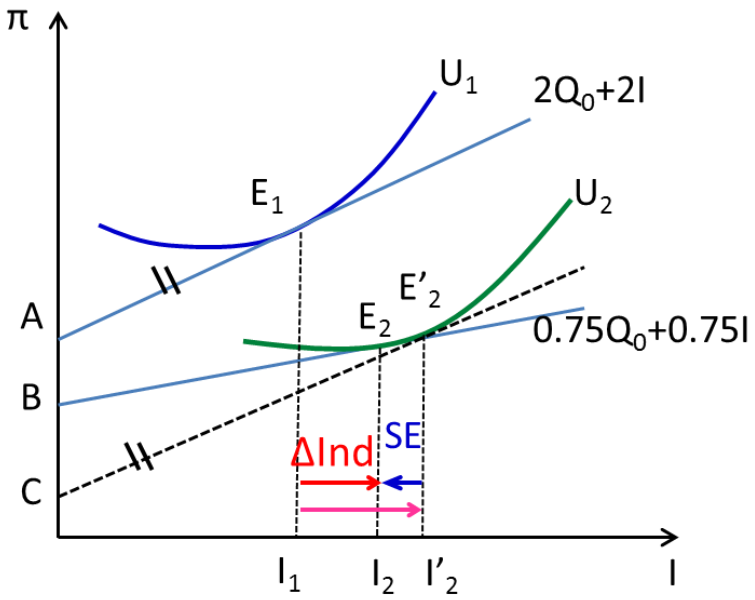
1. Suppose the physician's utility function depends on the net income (π) and inducement (I), assuming that physicians dislike inducing patient demand. Moreover, the physician's net income is given by the function:

$$\pi = mQ_0 + mI,$$

where m is the profit rate ($m > 0$), Q_0 is the amount of patient care without inducement, and I is the inducement level.

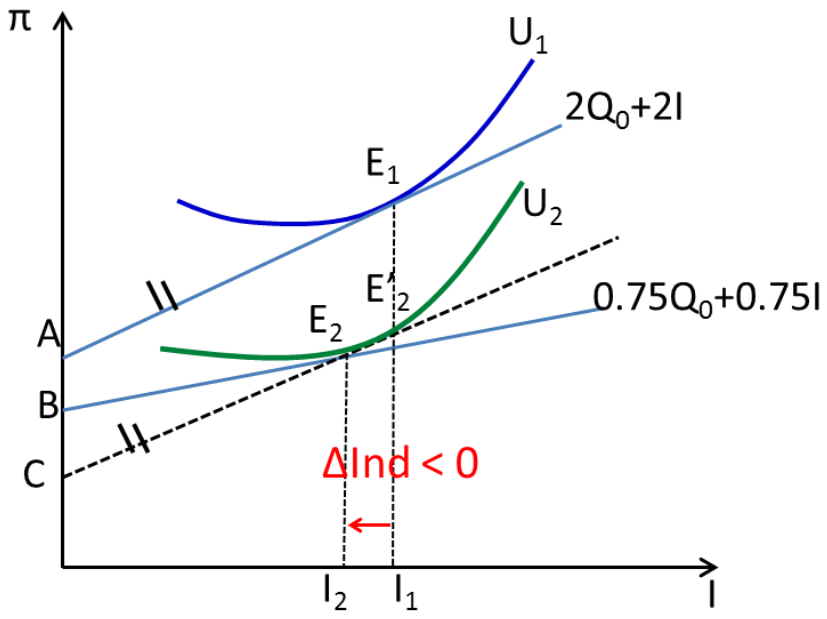
a. (6 points) Suppose that $m = 2$. Draw an indifference curve to illustrate the trade-off between the physician's net income (π) and inducement (I), given that physicians dislike inducing patient demand. Identify the optimal inducement level (I^*), and illustrate how the optimal inducement level (I^*) if the profit rate (m) decreases to 0.75. Assume that the physician responds to lowered profit rate by increasing influence on patient demand. [Note: you do not need to do any calculation here.]

Ans. The new optimal inducement level is at I_2. See figure below.



b. (4 points) Re-draw the diagram in part (a), but assume that there is no income effect. What happens to the optimal inducement level?

Ans. See figure below.



2. Consider the information in the following table.

Number of Workers (N)	Wage ($/N)	Additional Lab Test from Each Worker (MP_L)	Price Per Lab Test (MR)
1	10	2.25	20
2	12	2	20
3	14	1.75	20
4	16	1.5	20
5	18	1.25	20
6	20	1	20
7	22	0.75	20
8	24	0.5	20
9	26	0.25	20

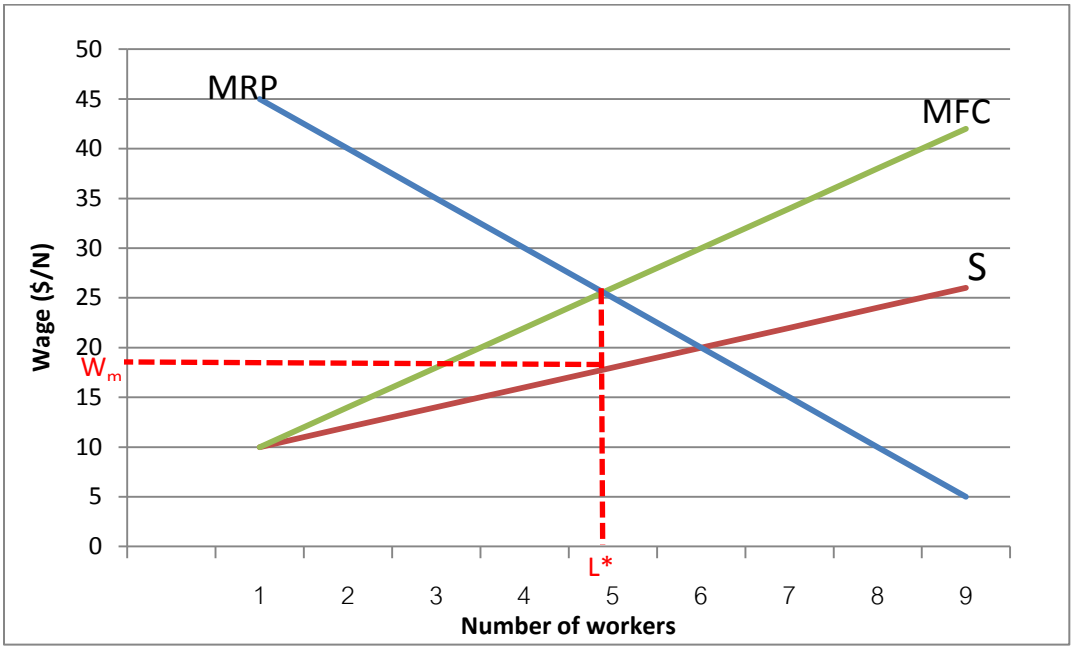
a. (5 points) Construct the demand for labor and the supply of labor curves based on the above information, and illustrate the equilibrium level of workers hired. What is the competitive equilibrium wage? [Hint: First, you need to calculate the marginal revenue product (MRP) for each number of workers.]

Ans. **w* = 20** (i.e. w* is where wage = MRP = MP x MR). This implies that N* = 6 persons.

Number of Workers (N)	Wage ($/N)	MP	MR	MRP	MFC
1	10	2.25	20	45	10
2	12	2	20	40	14
3	14	1.75	20	35	18
4	16	1.5	20	30	22
5	18	1.25	20	25	26
6	20	1	20	20	30
7	22	0.75	20	15	34
8	24	0.5	20	10	38
9	26	0.25	20	5	42

b. (5 points) Suppose now that there is a single buyer of labor in this market (i.e. there is a monopsonist). Draw a diagram to illustrate the optimal number of workers hired by the monopsonist. [Hint: you need to calculate marginal factor cost (MFC).]

Ans. See MFC in the table shown in part (a). The optimal number of workers hired by the monopsonist is L*, which occurs where MRP=MFC. In this case, the optimal number of workers (round number) is 4 workers.



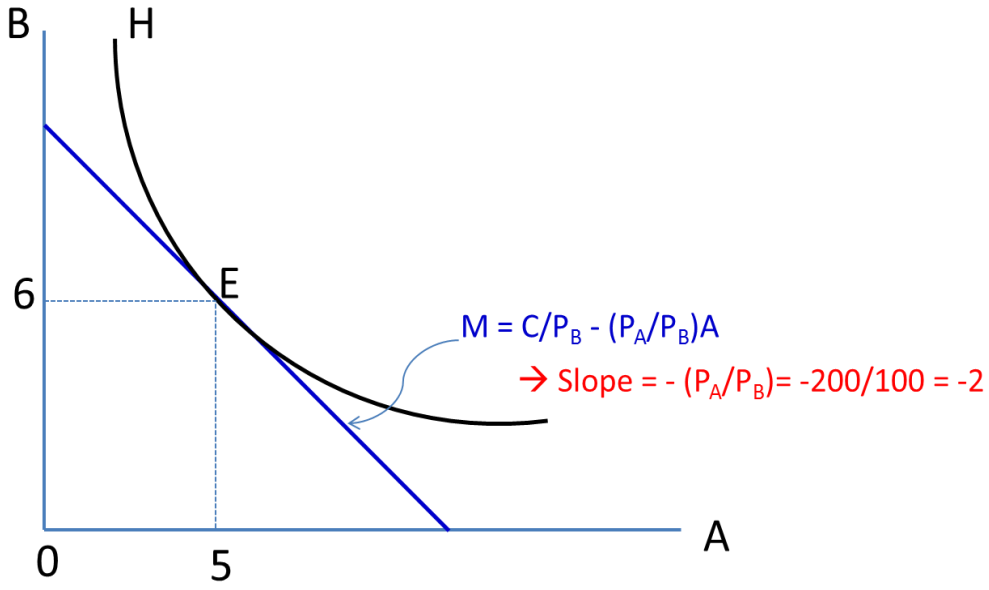
3. Suppose that a patient's health status depends on two prescription drugs: A and B, and the production function for his health is given by: $H = f(A, B)$. Assume that A and B can substitute for each other.

Suppose further that P_A = \$200 and P_B = \$100, and at these prices the patient chooses to consume 5 units of A and 6 units of B.

a. (4 points) Draw an isoquant of the heath production function and the budget line, where B is on the vertical axis. Determine the slope of the budget line, and calculate the total cost of care.

Ans. Slope of the budget line = -2.

Total cost of care = P_A*A + P_B*B = (5*\$200) + (6*\$100) = \$1,600.



b. (6 points) Suppose now that the patient buys an insurance policy that covers 90% of spending on drug *A* (i.e. 10% coinsurance rate) and requires a fixed copayment of $20 on drug *B*. With this insurance, the patient has an incentive to substitute *A* for *B*. Let the consumption of *A* increases from 5 to 6.5 units and the consumption of *B* decreases from 6 to 5 units. Calculate the slope of the new budget line and the total cost of care. How much of the cost does the patient pay out-of-pocket, and how much does the insurance company pays?

Ans. For the patient, the prices of A and B after buying insurance are:

$P'_A = 0.1 * \$200 = \$20$ and $P'_B = \$20$.

- ⇨ The slope of the new budget line = -20/20 = -1.
- ⇨ Total cost that the patient pays out of pocket = (6.5*$20) + (5*$20) = $230
- ⇨ Total cost that the insurance company pays = (6.5*$180) + (5*$80) = $1,570
  - ⇨ Total cost of drugs with insurance = $1,800.

Thus, with insurance, the patient substitutes drug A for drug B, and the total cost increases by $200.

4. Consider the following table which depicts the stages of development for a new drug.

	Research		Protected		Expired	
	t = 1	t = 2	t = 3	t = 4	t = 5	t = 6
Cost	150	200	10	10	10	10
Revenue	0	0	200	150	100	50

a. (5 points) Suppose that the discount rate (r) is 0.10. Calculate the net present value (NPV) of this project. Should the pharmaceutical company invest in this new drug development?

Ans.

$$NPV = \frac{(0-150)}{1.1} + \frac{(0-200)}{(1.1)^2} + \frac{(200-10)}{(1.1)^3} + \frac{(150-10)}{(1.1)^4} + \frac{(100-10)}{(1.1)^5} + \frac{(50-10)}{(1.1)^6} = 15.18$$

⇨ Yes, the company should invest in this new drug development.

b. (5 points) Suppose now that the discount rate (r) is 0.15, should the company undertake this project? Show your calculation of the new NPV.

Ans.

$$NPV = \frac{(0-150)}{1.15} + \frac{(0-200)}{(1.15)^2} + \frac{(200-10)}{(1.15)^3} + \frac{(150-10)}{(1.15)^4} + \frac{(100-10)}{(1.15)^5} + \frac{(50-10)}{(1.15)^6} = -14.65$$

⇨ No, the company should NOT invest in this new drug development because NPV < 0.