14.01 Problem Set 6

Please note that this problem set is due over two weeks
and is worth 1.5x the credit of a weekly pset, so plan ahead for it to
take longer than a weekly pset

Due at 5pm on Noveber 17th, 2023
Late problem sets are **not** accepted.

1 True, False, or Uncertain? (20 Points)

1. *(5 Points)* For a worker, if a rise in wages yields a lower choice of leisure that proves leisure is an inferior good.

2. *(5 Points)* Policy interventions such as price controls can improve efficiency when markets are not competitive.

3. *(5 Points)* In a two-period intertemporal consumption model where consumption in both periods is a normal good, an increase in the interest rate leads to an increase in consumption in period 1 of a utility maximizing household.

4. *(5 Points*) Consider a monopsonist who only hires labor to produce a certain good. His marginal cost curve is always below the labor supply curve.

2 Monopsony and Labor Supply (45 Points)

Consider a small town where there is only one employer: a coal mine. Since the owner of the mine is the sole employer of this town they have monopsony power. The market for coal is competitive, so the mine takes the price of coal p as given. We normalize the price of coal to one.

Suppose that the workers in this town have identical preferences over consumption and labor, which yields the aggregate labor supply

$$L = w^{\theta}$$

where w are wages, i.e. the cost of labor. There are N identical workers in this town. Suppose the coal mine has the following production function:

$$F(L) = A\sqrt{L}$$

where A is constant, and recall that the firm takes the price of coal $p = 1$ as given.

1. *(5 Points)* Suppose the firm behaved competitively in the labor market, what is the equilibrium wage and labor?

Now suppose from now on that the coal mine internalizes that its hiring decisions affect wages. When the coal mine behaves like a monopsonist it solves

$$\max \pi = F(L) - w(L) \times L$$

where $F(L)$ is the production function and $w(L)$ is the inverse labor supply

2. *(5 Points)* Derive an expression for the firm's marginal cost of labor, and compare it with the case when the firm takes wages as given. Provide an economic intuition.

3. *(5 Points)* From the firm's optimality condition, derive a markdown relationship between the marginal product of labor and the wage. Markdown means that the firm's marginal product of labor will be above the wage. How does the markdown depend on the elasticity of labor supply? Provide an economic intuition.

4. *(10 Points)* What is the equilibrium wage? Compare it with the case where the coal mine behaves competitively and provide an economic intuition for the difference. How does the equilibrium wage depend on θ and A? Provide an economic intuition.

5. *(10 Points)* Draw in a general graph (that is, not only for the functional form assumptions of this exercise) with labeled axes the labor supply curve, the marginal product of labor, and the firm's marginal cost. Show the equilibrium labor and wage when the labor market is competitive and under monopsony. Are there any losses in efficiency due to monopsony? If so, show them in the graph and provide an economic intuition.

6. *(5 Points)* Consider a government trying to set a minimum wage to maximize total surplus in the labor market. What minimum wage should it set?

7. *(5 Points)* True or False? Provide an economic intuition: a minimum wage always reduces employment.

3 Labor Supply(35 Points)

Suppose that workers in Cambridge have identical preferences over consumption an leisure, given by

$$U(c, l) = \log c + \log l$$

Where c is consumption, and l is leisure. We normalize a worker's total hours to one. Let p denote the price of the consumption good and w denote the wage. Cambridge workers get a welfare transfer from the government equal to $p \times T$.

1. *(5 Points)* Write down and graph the worker's budget constraint.

2. *(5 Points)* Find the optimal level of consumption and hours of work for a worker in Cambridge, as a function of w, p and T.

3. *(5 Points)* How does the worker labor supply depend the welfare transfer T? Provide an economic intuition

4. *(5 Points)* How does an increase in wages impact the labor supply compared to a decrease in prices? Provide an economic intuition.

5. *(10 Points)* Suppose initially $W = 0$, $w = 1$ and $p = 1$ and suddenly wages increase to $w' = 2$. Calculate the worker's optimal choice of consumption and leisure before and after the change in wages. In a graph, show how we can decompose this change into a substitution and income effect, and provide an economic intuition of both effects. You **are not** required to quantify the size of the income and substitution effects.

Suppose from now on that $W = 0$, $p = 1$, and there are N identical workers in Cambridge, and labor demand is given by

$$L = N - w$$

6. *(5 Points)* Find the equilibrium wage and aggregate labor. How do they depend on the quantity of workers, N? Provide an economic intuition.

4 Intertemporal Consumption (30 Points)

Consider a two-period model of consumption choice by an individual. Suppose she receives an income I_1 in the first period and I_2 in the second period (in addition to her savings). Let c_1 denote this individual's consumption in period one and c_2 her consumption in period two. The interest rate is r, so if she receives $1 + r$ dollars in period two for every dollar saved in period one. Assume that the price of consumption in both periods is equal to one.

1. *(5 Points)* Let s denote this consumer's savings in period one. Write down the consumer's budget constraint in period one and period two, and combine them to obtain the intertemporal budget constraint. Draw the intertemporal budget constraint in a graph with c_1 on the x axis and c_2 on the y axis.

2. *(5 Points)* Does an increase in the interest rate make this consumer richer or poorer? Provide an economic intuition.

Suppose this consumer's preferences are given by

$$U(c_1, c_2) = \log c_1 + \beta \log c_2$$

where $\beta \in (0, 1)$ is the discount factor, which represents that consumers do not like postponing consumption. From now on, assume $I_2 = 0$.

3. *(5 Points)* Write down the consumer's intertemporal choice problem, and solve for the optimal choice of c_1 and c_2.

4. *(10 Points)* Now suppose the interest rate r increases to r'. How does this consumer's choices change? Provide an economic intuition. In the same graph, draw the intertemporal budget constraint, the indifference curve tangent to the budget constraint and show the consumer's optimal choices. Plot the new budget constraint and the indifference curve that is tangent to the new budget constraint, as well as the consumer's new choices.

5. *(5 Points)* Using the consumer's optimal choices, find an expression for consumption growth, that is $\frac{c_2}{c_1}$, as a function of the interest rate r and the discount factor β. When is consumption growing? That is, provide a condition so that $\frac{c_2}{c_1} > 1$. Provide an economic intuition.

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