

73-250 - Intermediate Microeconomics

Recitation # 5 - March 2, 2001

Exercise # 1. This problem considers the determination of wages in a perfectly competitive labor market (i.e. a market in which both suppliers and demanders of labor treat the market wage as a fixed, given parameter when making their decisions).

Let the market demand curve for hours of work in a particular industry be given by the equation

$$H_D = Aw^{-1},$$

where w is the hourly wage and H_D is the number of hours of work demanded by the industry's firms in a given week at the wage w . A is a fixed constant.

On the supply side of the labor market, suppose that there are 1000 identical workers. Each worker's preferences over consumption-leisure bundles are summarized by the utility function

$$U(x_1, x_2) = x_1(x_2 + 100),$$

where x_1 is hours of leisure and x_2 is consumption (measured in \$). Suppose that each worker is willing to work a maximum of 100 hours during a given week. Recall that the budget constraint for a consumption-leisure problem states that a worker's expenditures on consumption must be equal to his/her income from working. In other words,

$$x_2 = w(100 - x_1),$$

where $100 - x_1$ is the number of hours that the worker works. Written in standard form, the budget constraint reads:

$$wx_1 + x_2 = 100w.$$

Each worker's goal is to choose x_1 and x_2 , so as to maximize his/her utility function subject to his/her budget constraint.

(a) Derive a typical worker's labor supply function $h(w)$. That is, express the optimal choice for x_1 as a function of w ; call this choice $x_1(w)$. Then calculate $h(w) = 100 - x_1(w)$, where $h(w)$ is the number of hours that a typical worker is willing to work when the wage is w .

(b) Use your answer from part (a) to derive the market supply curve $H_S(w)$, where $H_S(w)$ is the total number of hours that all 1000 workers are willing to work when the wage is w .

(c) Let $A = 200000$. Find the equilibrium wage (i.e. the wage at which $H_S(w) = H_D(w)$). How many hours of work are supplied in equilibrium? On a clearly-labelled diagram with the wage w on the y-axis and the number of hours on the x-axis, draw the labor demand and the labor supply curves, and indicate the equilibrium wage and hours worked.

(d) What are the elasticities of the market demand and supply functions for labor at the equilibrium wage?

(e) Now suppose that the government imposes a 20% tax on labor income. What is the new equilibrium wage (i.e. the cost of an hour of labor to a firm)? What is the after-tax wage? How many hours of work are supplied in equilibrium? On the same diagram as in part c) draw the new aggregate supply function, and indicate the new equilibrium wage and hours worked.