Economics 480 — Analysis of Labor Markets

Professor Woodbury

1. The wage rate subsidy (WRS) is a policy that has been suggested to remedy the lack of coverage of the working poor by the present tax–transfer system. Consider the following WRS scheme, which has all the elements of WRS systems actually proposed:

\[ S = r(w_t - w_m), \]

where:

\( S \) = the subsidy paid by the government to a worker for each hour worked;
\( r \) = the subsidy rate chosen by policy makers;
\( w_t \) = the target wage rate (also chosen by policy makers);
\( w_m \) = the market wage rate facing an individual worker.

For example, if policy makers choose a 50 percent subsidy rate (so that \( r = 0.5 \)) and a target wage of $8.00 per hour, then someone who earned a market wage of $6.00 per hour would, for every hour worked, receive a subsidy from the government of $1.00. [To see this, substitute the values of \( r, w_t, \) and \( w_m \) into the above equation for \( S \) and solve: \( S = 0.5 \times (8.00 - 6.00) = 0.5 \times 2.00 = 1.00 \). So the worker would get a $1.00 per hour subsidy in addition to the $6.00 per hour market wage.]

a. In the "Graph to accompany problem 1," draw the wage line facing a worker whose market wage is $6.00 per hour, and label it "\( w = 6.00 \)." Note that the time period being considered is one year. Label on the graph the income (number of dollars) that the worker would earn if she worked 4000 hours this year. How much would she earn if she worked 2000 hours this year?

b. Draw on the graph an indifference curve that results in an equilibrium number of hours worked of 2000. Label the indifference curve \( U_1 \). Also, label the equilibrium point A, and label the equilibrium number of hours (2000) \( L_0 \).

c. Briefly explain why point A is an equilibrium. That is, given the indifference curve \( U_1 \) that you have drawn, why wouldn't she work 1000 hours this year? Or 3000 hours this year?
d. Next, draw the wage line that this worker would face if the WRS scheme described above went into effect \((r = 0.5, w_t = $8.00)\). Label this new wage line "WRS". Label on the graph the income the worker would now earn if she worked 4000 hours this year. How much would she now earn if she worked 2000 hours this year?

e. Draw on the graph a second indifference curve that results in an equilibrium number of hours worked for this worker, now that she faces a WRS. (Use your judgement in deciding where to place the indifference curve and where the new equilibrium will be. I always try to use "linear blow-ups.") Label the indifference curve \(U_2\). Also, label the equilibrium point \(C\), and label the equilibrium number of hours \(L_1\).

f. What is the impact of the WRS on labor supply in your diagram? (That is, what is the "total effect" — has labor supply increased, decreased, or remained the same?)

g. Show the income and substitution effects of the WRS in your graph. Label the income effect "I.E.," and the substitution effect "S.E." (Add whatever lines or curves you need to decompose the total effect into income and substitution effects.)

h. Why is the labor supply impact of the WRS as it is in your diagram? (That is, if hours of work increased, why? If they decreased, why? If they remained constant, why?)

i. What is the effect of the WRS on the worker's earnings?
j. How would you respond to someone who claimed that a WRS would definitely increase the labor supply of low–wage workers?

k. The WRS has never been seriously advocated as the mainstay of the welfare system, only as a supplement to the current system. Why would it not make sense to have a WRS as the main (or only) program in reformed welfare system?
Figure to accompany problem #1
2. This problem addresses the following assertion: "The major force behind the increased labor force participation of married women is technological change in home productivity, not increased wages and labor market opportunities for women."

a. The accompanying diagram shows (a) two home production functions for a representative woman and (b) the wage line she faces. Label the home production function that shows lower home productivity HPF_1, and the one showing higher home productivity HPF_2. Label the wage line WL.

b. Suppose that the woman is at the point labeled 4000 (consuming 4000 hours a year of leisure and doing no work at home or in the labor market), but she has decided to work and is trying to choose between work at home and work in the labor market. How will she decide to spend her first few hours of work (at home or in the market), if her home production function is HPF_1?

Why?

How will she spend her first few hours of work (at home or in the market) if her home production function is HPF_2?

Why?

c. In the figure, show the complete set of opportunities this woman has for producing Z, either through work at home or in the market. You will need to add two curves to the figure: One for the case where home productivity is HPF_1 and another for the case where it is HPF_2. Label the point where this representative woman becomes more efficient at producing Z through market work S_1 in the first case, and S_2 in the second.

d. For a woman whose home production function is HPF_1, find the optimal number of hours spent working at home, working in the market, and taken as leisure by taking the following steps. First, add to the diagram an indifference curve (shaped and placed on the graph in a way that is reasonable) tangent to the opportunity set that goes with HPF_1. Label this curve U_1. Why is the indifference curve shaped as you have drawn it?

Label the tangency between the indifference curve you drew and the opportunity set
E₁ (for initial equilibrium). Carefully drop verticals to the Time axis, and label the number of hours spent doing home work HH₁; the number of hours spent in market work HM₁; and the number of hours spent in leisure L₁. (Suggestion: Use brackets or arrows to label these distances.)

e. Now find the optimal number of hours worked at home, in the market, and in leisure for a woman whose home production function is HPF₂. First, add to the diagram a second indifference curve, but make this one tangent to the opportunity set that goes with HPF₂. Label the tangency E₂ (for second equilibrium). Again, carefully drop verticals to the TIME axis and label the number of hours spent doing home work HH₂; the number of hours doing market work HM₂; and the number of hours spent in leisure L₂.

Is HH₂ greater than, less than, or about the same as HH₁?

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Is HM₂ greater than, less than, or about the same as HM₁?

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Is L₂ greater than, less than, or about the same as L₁?

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f. Based on what you have done, what is the effect of an increase in home productivity on this woman’s labor market behavior?

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Figure to accompany Problem #2
3. The accompanying graph shows the production technology for spacecraft on Plant Zork. A spacecraft producer who wants to produce 10 spacecraft could use, for example, 12 machines (K) and 3 workers (L); 6 machines and 3 workers; or 6 machines and 12 workers.

a. Suppose that a spacecraft producer is using 6 machines and 6 workers to produce output of 10 spacecraft. What is the marginal product of labor?

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b. Suppose that the rental rate of capital (r) is $12 per machine hour, and the wage rate (w) is $12 per hour. Also suppose that the spacecraft producer has decided to spend $144 per hour on producing spacecraft. What is the maximum number of machines that the producer can use, given input prices and the chosen level of total outlay?

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Plot this point on the graph and label it A.

What is the maximum number of workers that the producer can use, given input prices and the total outlay of $144?

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Plot this point on the graph and label it B.

Draw on the graph the isocost line that show the various combinations of capital and labor that the producer can buy for $144 per hour, and label this TC0.

What is the maximum number of spacecraft that the producer can manufacture, given input prices and total outlay of $144?

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Label the point showing this maximum C.

c. Now suppose that the wage rate increases to $24 per hour. (The rental rate of capital is still $12 per hour.) If the spacecraft producer decides to still spend $288 per hour on producing spacecraft, what will be the maximum number of machines that the producer can use, given input prices and the chosen level of total outlay?

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Plot this point on the graph and label it D.

What is the maximum number of workers that the producer can use, given the new input prices and total outlay of $144?

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Plot this point on the graph and label it E.

Draw on the graph the isocost line that show the various combinations of capital and labor that the producer can now buy for $144 per hour, and label this TC0'.

What is the maximum number of spacecraft that the producer can now manufacture, given the new input prices and total outlay of $144?

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Label the point showing this maximum F.

d. What is the total effect (that is, total change in output) that resulted from the increase in the wage from $12 to $24?

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e. How much of this change can be attributed to substitution of capital for labor (that is, a substitution effect)?

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f. How much of this change can be attributed to a change of scale (that is, a scale effect)?

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4. If Union A increases its wage from $8.00 per hour to $10.00 per hour, the demand for its workers will fall from 20,000 to 10,000. If Union B increases its wage from $10.00 per hour to $12.00 per hour, the demand for its workers will fall from 33,000 to 30,000. Which union faces the more elastic demand curve? For a given percentage increase in the wage, will either of these unions increase the total earnings (hourly wages times number of hours worked by all workers) of its members?

5. The tax that is currently used to finance the administrative costs of the Unemployment Insurance system is called the Federal Unemployment Tax (or FUT). FUT is paid to the federal government by employers through a payroll tax similar to the Social Security payroll tax. Currently every employer pays 1 percent of each worker's annual earnings, up to $8,000, to the federal government. As a result, the most an employer would pay in a year for a particular worker would be $(8,000)(0.01) = 80$.

Suppose that total employment in the U.S. is 110 million; total labor cost is $2,000 billion; and FUT payroll taxes are $2.0 billion.

a. What percentage of total labor cost is accounted for by the FUT?

b. Suppose that Congress is considering an increase in the FUT from 1 percent to 2 percent (the tax base of $8,000 per worker would remain unchanged). What is the percentage increase in the FUT tax rate that is Congress considering?

c. Suppose that the economy-wide long-run total elasticity if demand for labor is $-1.0$; that the scale elasticity is $-0.7$; and that the substitution elasticity is $-0.3$. What will be the effect of the proposed increase in the FUT on employment (that is, what will be the decrease in employment)?

d. How much of the change that you predicted in part c is attributable to the scale effect?

e. How much of the change that you predicted in part c is attributable to the substitution effect?