Economics 2 Professor Emmanuel Saez
Fall 2024

PROBLEM SET 3 SOLUTIONS

DUE ON GRADESCOPE BY 11:59PM ON MONDAY, NOVEMBER 4

Student name:

Student ID:

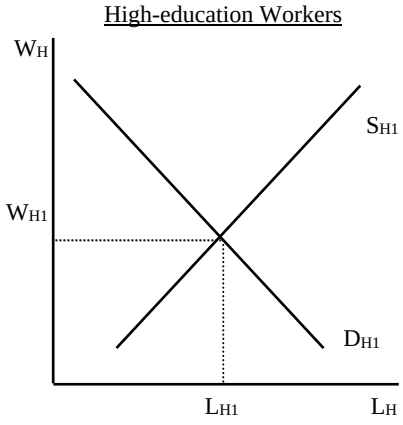
You may work together on the problems, but your answers must be ***in your own words*** and ***handwritten***. You also must ***list the other students with whom you worked*** here:

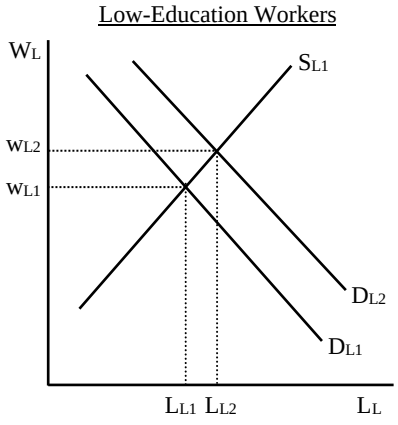
For all questions be sure to explain your answers and to use graphs whenever asked to. Write your answers in the spaces below.

1. (1 pt) Consider the markets for low-education and high-education labor in the United States. Describe how each of the following developments is likely to affect the wages of workers with a college degree relative to other workers.

a. There is increased demand for installing solar panels, which is work done by non-college graduates.

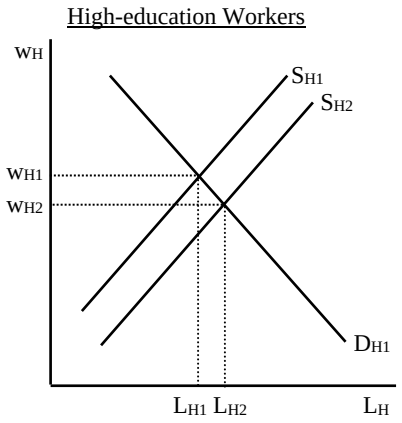
The rise in the price of the output produced by non-college grad workers will increase the marginal revenue product of the workers. (Recall that MRP_L is equal to MP_L times MR (or price, assuming that the industry is competitive).) Thus, the demand curve for low-ed workers will shift out (from D_{L1} to D_{L2}). The wage of low-education workers will rise (from w_{L1} to w_{L2}). Nothing will happen in the market for high-education workers, so the wage and employment of high-education workers will remain unchanged. Thus the increase in the demand for goods and services produced by low-education workers will raise the wage of low-education workers relative to high-education workers, and so it will decrease inequality.

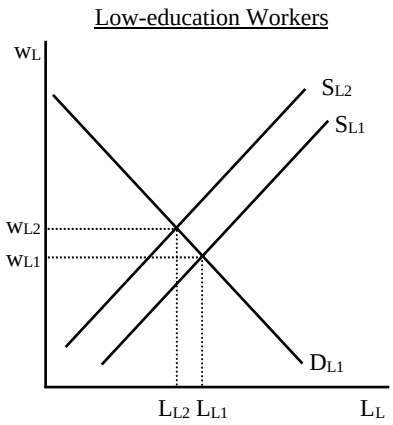




b. A larger fraction of people go to college so that there are more college graduate workers (and fewer non-college graduates).

If some low-education workers become high-education workers, this means that at any given wage for low-education workers, the quantity of low-education labor supplied is lower; and at any given wage for high-education workers, the quantity of high-education labor supplied is higher. That is, the supply curve of low-education labor shifts to the left (from S_{L1} to S_{L2}) and the supply of high-education workers shifts to the right (from S_{H1} to S_{H2}). The employment of low-education workers falls (from L_{L1} to L_{L2}) and their wages rise (from w_{L1} to w_{L2}). And the employment of high-education workers rises (from L_{H1} to L_{H2}) and their wages fall (from w_{H1} to w_{H2}). Thus, inequality falls.



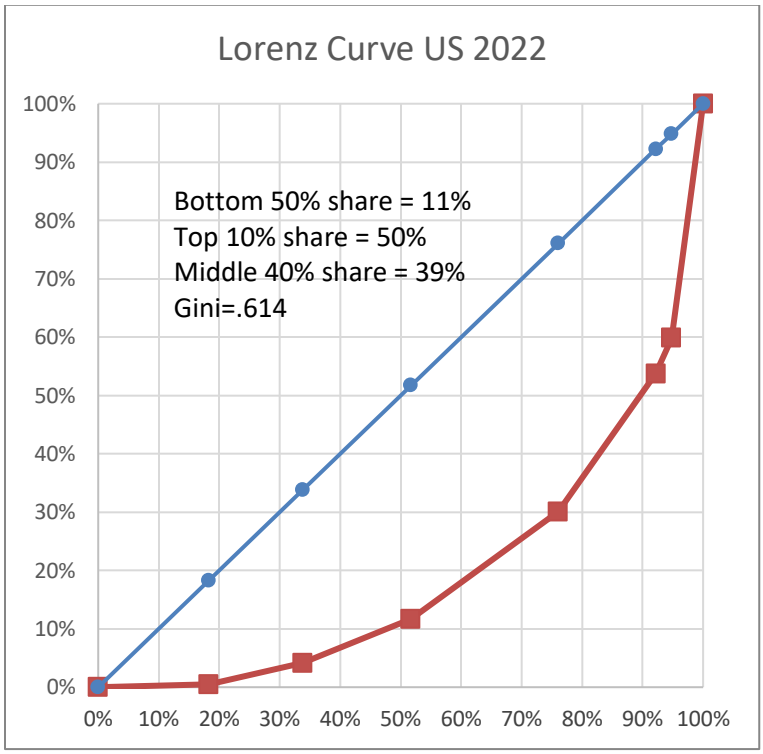


2. **1.5 pts.** Here is the most recent distribution of income in the United States from income tax data from IRS tax statistics. This is annual income that each taxpayer reports (can be a single person or a married couple with their dependent children)

Individual Income Statistics for Year 2022

Income bracket	Number of taxpayers	Amount of income (in $million)
Under $15,000	29,392,477	71,612
$15,000 to $30,000	24,863,933	552,405
$30,000 to $50,000	28,847,954	1,138,003
$50,000 to $100,000	39,111,531	2,790,459
$100,000 to $200,000	25,982,949	3,583,241
$200,000 to $250,000	4,164,641	926,175
$250,000 or more	8,364,645	6,080,868
Total	**160,728,129**	**15,142,763**

a. Use this table to compute the fraction of taxpayers with income below $15K, below $30K, below $50K, below $100K, below $200K, below $250K and the fraction of total income that each of these groups earn. Then plot the corresponding points of the Lorenz curve in the standard Gini type diagram. Complete the Lorenz curve assuming straight lines to connect the dots.



b. From your Lorenz curve above, deduce the approximate shares of total income earned by the bottom 50%, the next 40%, and the top 10%. What is the approximate Gini coefficient? [can do this with excel/computer help or just by hand if your graph above is neatly done]

See graph

c. In reality, the Lorenz curve is not a straight line between the points. Would the true Lorenz curve display a higher or lower Gini coefficient than the one you've drawn with straight lines. Why?

The Lorenz curve would be curly instead of a straight line and hence this would lead to a large area and hence the Gini would be higher.

3. (.5 pts) Consider a worker who is planning to retire 10 years from now and is thinking about not working for the next year and instead completing a one-year Master's program. If they do not complete the program, they will earn $A one year from now, $A two years from now, and so on through 10 years from now. If they complete the program, they will pay $B one year from now and then earn $C each of the subsequent 9 years. Assume the worker's only concern is their financial well-being. Explain whether the worker should do the Master's program or not based on the values of A, B, C as well as the interest rate r.

The two work strategies involve different timing of costs and earnings. In one, the worker earns $A for each of the next five years. In the other, the worker earns nothing next year (and, in fact spends $B on education), but then earns $C in the subsequent four years.

To figure out which strategy has the highest financial rewards, the worker needs to compare the present value of the two strategies. Calculating present value takes into account the fact that money received in the future is worth less to someone than money received today. The present value of the first option is:

$$\frac{\$A}{(1+i)} + \frac{\$A}{(1+i)^2} + \frac{\$A}{(1+i)^3} + \frac{\$A}{(1+i)^4} + \frac{\$A}{(1+i)^5} + \frac{\$A}{(1+i)^6} + \frac{\$A}{(1+i)^7} + \frac{\$A}{(1+i)^8} + \frac{\$A}{(1+i)^9} + \frac{\$A}{(1+i)^{10}}$$

where i is the interest rate (expressed as a decimal). The present value of the second option is:

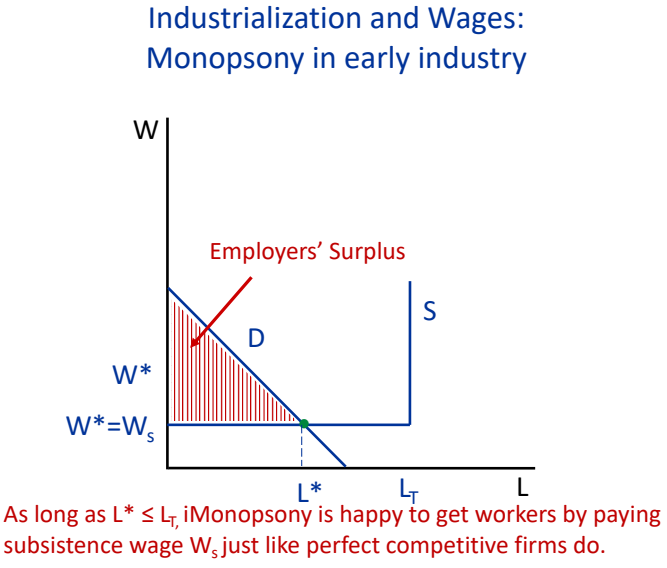
$$\frac{-\$B}{(1+i)} + \frac{\$C}{(1+i)^2} + \frac{\$C}{(1+i)^3} + \frac{\$C}{(1+i)^4} + \frac{\$C}{(1+i)^5} + \frac{\$C}{(1+i)^6} + \frac{\$C}{(1+i)^7} + \frac{\$C}{(1+i)^8} + \frac{\$C}{(1+i)^9} + \frac{\$C}{(1+i)^{10}}.$$

If all the worker cares about is their financial well-being, they want to choose whichever strategy has the higher present value.

4. (2 pts) In class, we considered the labor market model for industrial workers in a transition from an economy with only subsistence workers to an economy with industry. The labor supply curve for industrial workers is flat at wage W equal subsistence wage W_s when $L<=L_T$ (total number of workers available) and then becomes vertical when $L=L_T$. The demand curve is downward sloping and shifts out as industry develops.

a. Let us consider the case where there is monopsony power for employers in industry. How does this affect W and L and deadweight loss in the early phase of industrialization (when $L<L_T$ in the competitive case)? Explain why graphically.

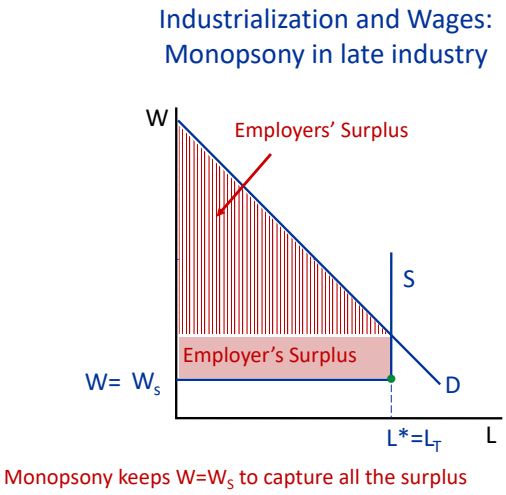
Monopsony chooses (L,W) on the supply curve that maximizes the employer surplus. The outcome is the same as in competitive case with $W=W_S$ as workers get no surplus and employer gets all the surplus. There is no deadweight loss. Monopsony power does not change the outcome relative to competitive case.



b. How does this affect W and L and deadweight loss in the late phase of industrialization

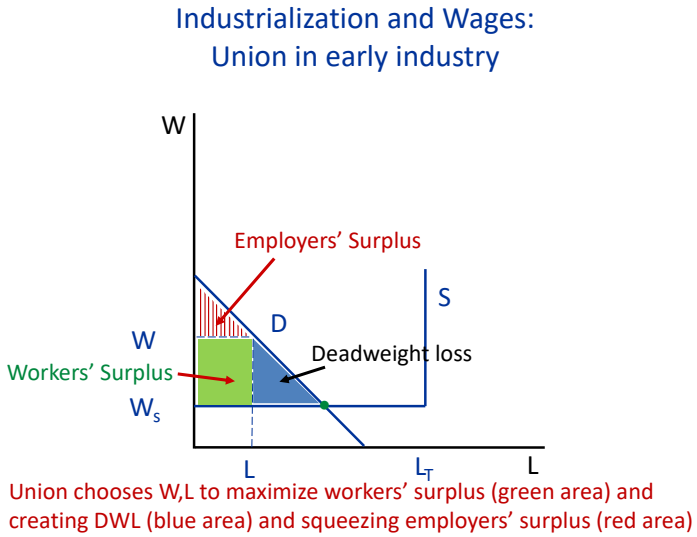
(when $L=L_T$ in the competitive case)? Explain why graphically.

Monopsony chooses (L,W) on the supply curve that maximizes the employer surplus. In this case, monopsony chooses $W= W_S$. Workers get no surplus and employer gets all the surplus. There is no deadweight loss (because quantity L stays at L_T). Monopsony power transfers the workers' surplus to the employer with no deadweight loss.



c. Let us now consider the case where there is a union for industrial workers that decides how many workers L to supply while employers are competitive. How does this affect W and L and deadweight loss in the early phase of industrialization (when $L<L_T$ in the competitive case)? Explain why graphically.

Union chooses (L,W) on the demand curve that maximizes the industrial workers surplus. In this case, union chooses $W> W_S$ and L will be smaller than competitive case. There is deadweight loss. Union power transfers some of the employer surplus to the workers' and also creates some deadweight loss.

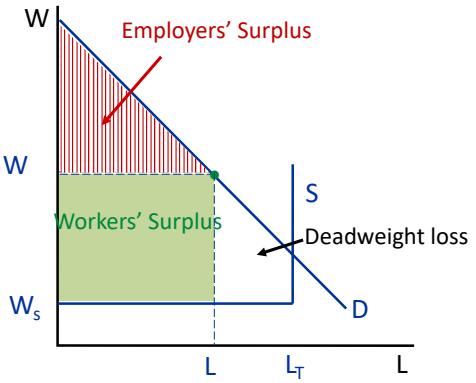


d. How does this affect W and L and deadweight loss in the late phase of industrialization (when $L=L_T$ in the competitive case)? Explain why graphically.

Union chooses (L,W) on the demand curve that maximizes the workers' surplus. In this case, there are two possibilities based on how high demand curve is.

If demand curve is only moderately high (somewhat advanced industrialization), union will be willing to reduce L below L_T to increase wage above W*. In which case, there is some deadweight loss.

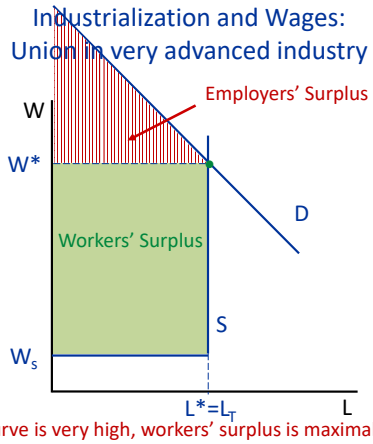
Industrialization and Wages:
Union in somewhat advanced industry



Union chooses (W,L) on demand curve to maximize workers' surplus (green area) creating DWL and squeezing employers' surplus (rea area)

If demand curve is very high (very advanced industrialization), union will keep $L= L_T$ and W=W* as in the competitive case. There is no deadweight loss. Union power does not change the outcome relative to competitive case.

Industrialization and Wages:
Union in very advanced industry



If demand curve is very high, workers' surplus is maximal at $L=L_T$ and union does not change anything relative to competitive equilibrium