

**EXAMINATION 3 VERSION B**  
**“Wage Structure, Mobility, and Discrimination”**  
**April 19, 2022**

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators, calculators with alphabetical keyboards, computers, wireless devices and mobile phones are NOT permitted. Point values for each question are noted in brackets. Maximum total points are 100.

**I. Multiple choice:** Please circle the one best answer to each question. [1 pt each, 8 pts total]

- (1) Since about 1980 in the U.S.,
- wage inequality has increased within groups of workers with the same education and experience.
  - the returns to education have increased.
  - the returns to experience have increased.
  - all of the above.
- (2) Rosen’s “superstar phenomenon” is most likely to characterize the earnings of
- surgeons.
  - electricians.
  - fiction writers.
  - portrait painters.
- (3) Consider a regression line  $y = \beta_1 + \beta_2 x + \varepsilon$ , where  $x$  denotes parent earnings and  $y$  denotes child earnings. If the slope  $\beta_2$  equals zero,
- the child’s earnings are independent of the parent’s earnings.
  - the child’s earnings exactly equal the population average.
  - there is no intergenerational mobility.
  - the child has no earnings.
- (4) Over the last century, average wages across U.S. states have
- fallen.
  - converged.
  - diverged.
  - neither converged or diverged.
- (5) Negative selection of immigrants means immigrants
- are forced to come to the U.S. by natural disaster or civil unrest.
  - earn less than native workers.
  - had lower-than-average skills in their home country.
  - earn less in the U.S. than they earned in their home country.
- (6) So called “audit studies” or “field experiments” provide evidence that employers take race into account in
- promoting employees.
  - job assignments.
  - hiring.
  - setting wages.
- (7) Becker’s theory of *employee* discrimination concludes that discrimination
- causes segregation.
  - decreases wages for the discriminated group.
  - decreases employment for the discriminated group.
  - all of the above.
- (8) Suppose red and yellow workers are equally productive, but red workers have *less elastic* labor supply to an employer than yellow workers. If the employer is a discriminating monopsonist, which group will get the higher wage?
- Red workers.
  - Yellow workers.
  - Red and yellow workers will get the same wage, because they are equally productive.
  - Cannot be determined from the information given.

**II. Problems:** Please insert your answer to each question in the box provided. You may use margins and graphs for scratch work. Only the answers in the boxes will be graded.

(1) [Measuring inequality: 14 pts] Suppose the lowest third of workers all have an annual wage of \$24 thousand, the middle third all have an annual wage of \$72 thousand, and the highest third all have an annual wage of \$144 thousand.

Third	Annual wage	Share of total earnings	Cumulative share
Lowest	\$24 thousand	%	%
Middle	\$72 thousand	%	%
Highest	\$144 thousand	%	%

a. [2 pts] Compute the mean annual wage.

\$	thousand
\$	thousand

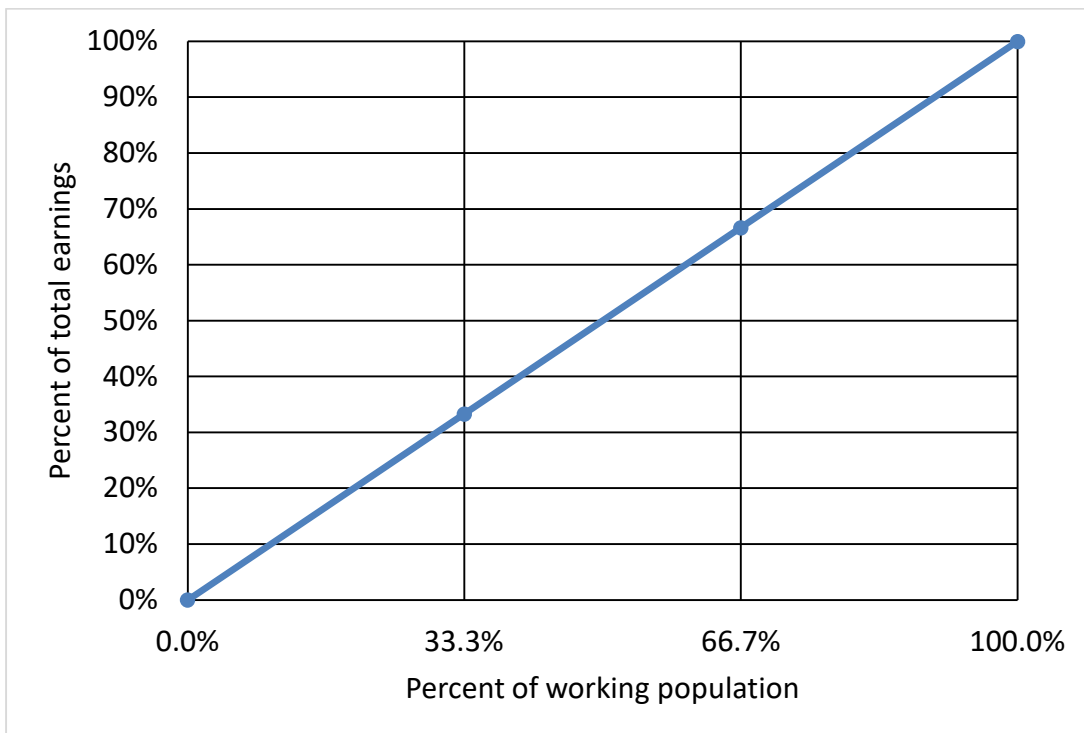
b. [2 pts] Compute the median annual wage

c. [6 pts] Compute the shares and cumulative shares in the table above. Check your work carefully.

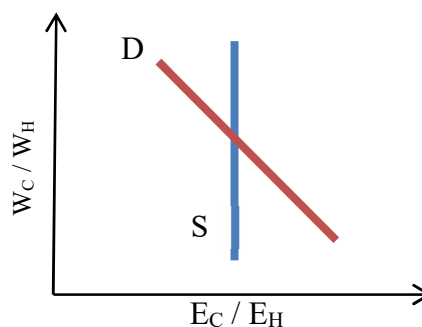
d. [2 pts] **Using a straightedge**, plot the Lorenz curve for wages in the graph below.

e. [2 pts] Compute the Gini coefficient to three decimal places.

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(2) [Skill-biased technical change: 8 pts] The graph at right shows short-run demand and supply for college-educated workers *relative* to high-school-educated workers. Here  $E_C$  is the number of college-educated workers,  $E_H$  is the number of high-school-educated workers,  $W_C$  is the average wage of college-educated workers, and  $W_H$  is the average wage of high-school-educated workers. As the graph shows, relative supply is perfectly inelastic in the short run because the quantities of workers change slowly.



Suppose the elasticity along the relative demand curve, called the *elasticity of substitution*, is estimated to equal

$$\left| \frac{\% \text{ cha } (E_C/E_H)}{\% \text{ chan } (W_C/W_H)} \right| = 1.6 .$$

Suppose over a decade, relative supply ( $E_C/E_H$ ) shifts **right 8%**, as more people attend college.

- If nothing else changed, would the relative wage ( $W_C/W_H$ ) increase or decrease?
- By how much?

%

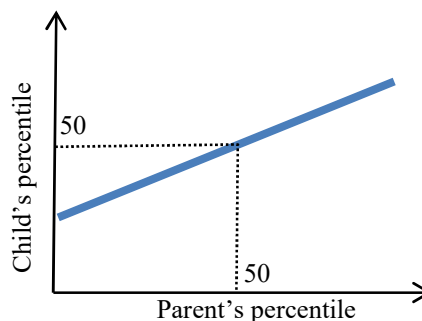
Suppose that in fact, the relative wage ( $W_C/W_H$ ) **increased by 10%** over the same period.

- Should we conclude that the relative demand curve *shifted right* or *shifted left*, or *remained constant*?
- By how much?

%

[Hint:  $\text{elasticity of substitution} = \frac{\% \text{ shift in relative demand} - \% \text{ shift in relative supply}}{\% \text{ change } (W_C/W_H)} .$ ]

(3) [Intergenerational mobility: 4 pts] Suppose an ordinary least squares (OLS) regression line is fitted to data on the incomes of parents and the incomes of their children 30 years later. In particular, assume incomes are measured as percentiles of the distribution. Suppose the slope coefficient is estimated to be **0.40** and recall that the estimated line necessarily passes through the two medians (50,50).



- If a parent's income is at the 30th percentile, what is the predicted value (or conditional mean) of the child's income?
- If a parent's income is at the 90th percentile, what is the predicted value (or conditional mean) of the child's income?

percentile
percentile

(4) [Migration decision: 6 pts] Suppose the average annual wage in Big City is \$60 thousand and the average annual wage in Country Town is \$40 thousand. Assume for simplicity that there is no difference in the cost of living. Also assume that the typical young worker's discount rate is 10%.

- a. Compute the present discounted value of the young worker's stream of earnings in Big City. [Hint: Use the approximation formula  $\frac{1+r}{r}W$ .]
- b. Compute the present discounted value of the young worker's stream of earnings in Country Town. [Hint: Use the same approximation formula.]
- c. Compute the moving cost for the marginal worker, indifferent between moving or not from Country Town to Big City.

\$	thousand
\$	thousand
\$	thousand

(5) [Joint migration decision: 6 pts] Two married workers, A and B, live in Des Moines, but are contemplating a move to Los Angeles. Worker A's net present value of earnings in Des Moines is \$800 thousand and net present value of earnings in Los Angeles is \$850 thousand. Worker B's net present value of earnings in Des Moines is \$700 thousand and net present value of earnings in Los Angeles is \$900 thousand. Each worker's moving cost is \$100 thousand.

- a. Assuming Workers A and B remain together, will they move to Los Angeles? Why or why not?

- b. Is Worker A a tied mover, a tied stayer, or neither? Why?

- c. Is Worker B a tied mover, a tied stayer, or neither? Why?

(6) [Roy model: 6 pts] Suppose Country X and Country Y each have workers whose skill (S) ranges from 0 to 100. The relationship between wages and skill in Country X is given by  $W_X = 150 + S$ . The relationship in Country Y is given by  $W_Y = 10 + 3S$ . Assume that moving costs are \$20.

a. [4 pts] For what range of values of S will workers in Country X want to migrate to Country Y? Show your work and circle your final answer.

b. [2 pts] Is this immigrant flow positively or negatively selected? Justify your answer.

(7) [Immigration cohorts: 4 pts] Suppose we have the following Census data on average earnings.

	2010 Census	2020 Census	2030
Native-born workers	\$50,000	\$50,000	
New immigrants	\$25,000	\$20,000	
Immigrants who have been in the U.S. for ten years	\$60,000	\$27,500	(b)

- a. Compute the percent change experienced by an individual immigrant worker in that individual's earnings over ten years.
- b. Using your answer to part (a), forecast the average earnings of immigrants who have been in the U.S. for ten years in 2030—that is, the element in the table above marked “(b)”.

%
\$

(8) [Oaxaca decomposition: 6 pts] Suppose we have computed the following statistics using data on hourly wages (W) and schooling (S) for a large sample of green and blue workers.

	Regression equation	Average years of schooling
Green workers	$\ln(W_G) = 1.0 + 0.12 S_G$	15
Blue workers	$\ln(W_B) = 0.9 + 0.10 S_B$	14

a. Compute the raw log wage differential—that is,  $\overline{\ln(W_G)} - \overline{\ln(W_B)}$ .

b. Compute the log wage differential due to schooling.

c. Compute the log wage differential due to discrimination in the labor market, in Oaxaca's definition.

(9) [Employer preference discrimination: 18 pts] Suppose a firm's production function is given by  $q = 6\sqrt{E_G + E_B}$ , where  $E_G$  is the number of green workers employed by the firm and  $E_B$  is the number of blue workers employed by the firm. There are no other inputs besides labor. Clearly, green and blue workers are perfect substitutes in production. A little calculus shows that the marginal product of labor (either type) is given by  $MP_E = 3/\sqrt{E_G + E_B}$ . Suppose the market wage of green workers is **\$20** and the market wage of blue workers is **\$10**. Also assume the price of the firm's output is **\$20**.

- a. First, suppose the firm does not discriminate. How many workers will it hire of each type? How much output does it produce? How much profit does it enjoy?

Now suppose the firm discriminates against blue workers, with discrimination coefficient  $d$ . That is, the firm perceives the cost of blue workers as being  $(1+d)$  times their actual wage.

- b. If  $d = 0.2$ , how many workers will it hire of each type? How much output does it produce? How much profit does it enjoy?

- c. If  $d = 2.0$ , how many workers will it hire of each type? How much output does it produce? How much profit does it enjoy?

(10) [Monopsony wage discrimination: 16 pts] A certain employer enjoys monopsony power over two groups of workers. Supply of green workers to this employer is given by  $w_G = 8 + (E_G/20)$ . Supply of blue workers to the same employer is given by  $w_B = 4 + (E_B/10)$ . The value of marginal product of all workers is constant and equal to **\$20**.

- a. Recall that if labor supply is a straight line, then marginal labor cost is also a straight line, with the same intercept and twice the slope of labor supply. Give the equation for marginal labor cost for each group of workers.

$MLC_G =$	$MLC_B =$
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- b. What level of employment ( $E_G$  and  $E_B$ ) will the employer choose for each group?

- c. What wage ( $w_G$  and  $w_B$ ) will the employer pay each group?

- d. Suppose the government imposes a minimum wage of \$15 for all workers. Now what level of employment ( $E_G$  and  $E_B$ ) will the employer choose for each group?



**III. Critical thinking:** Write a one-paragraph essay answering one question below (your choice). [4 pts]

(1) It is sometimes alleged that many consumers do not like to buy cars from women. If true, how would this affect the allocation of women and men to jobs at car dealerships? Why?

(2) The Affordable Care Act required employer-provided health insurance to cover pre-existing health conditions (that is, health problems before the employee was hired). Did this law likely *increase* or *decrease* worker turnover? Why?

Circle the question you are answering and write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of exam]