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**EXAMINATION 3 VERSION A**  
**“Wage Structure, Mobility, and Discrimination”**  
**April 23, 2024**

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, 10 pts total]

(1) By definition of “median,” half of all workers earn more than the median wage and half earn less. In the U.S., the median wage is

- a. less than the average wage.
- b. greater than the average wage.
- c. equal to the average wage.

(2) Perfect equality implies a Gini coefficient of

- a. negative one.
- b. zero.
- c. one-half.
- d. one.
- e. infinity.

(3) Expansion of international trade has likely increased the

- a. relative demand for unskilled workers in the U.S.
- b. relative demand for skilled workers in the U.S.
- c. relative supply of unskilled workers in the U.S.
- d. relative supply of skilled workers in the U.S.

(4) Mass production technology, such as television, tends to make the distribution of earnings among entertainment stars

- a. more equal.
- b. more unequal.
- c. Mass production technology has no effect on the distribution of earnings.

(5) The net gain to migration depends positively on

- a. wages in the source region.
- b. wages in the destination region.
- c. moving costs.
- d. All of the above.

(6) A worker is more likely to move,

- a. the older the worker is.
- b. the more education the worker has.
- c. both (a) and (b).
- d. neither (a) nor (b).

(7) Positive selection of immigrants means

- a. only people who really want to come to the U.S. actually immigrate to the U.S.
- b. immigrants earn more than native workers.
- c. immigrants had higher-than-average skills in their home country.
- d. immigrants earn more in the U.S. than they earned in their home country.

(8) Most workers who quit a job

- a. take another job immediately at a higher wage.
- b. are unemployed for a while, then take another job at a higher wage.
- c. take another job immediately at a lower wage.
- d. are unemployed for a while, then take another job at a lower wage.

(9) Oaxaca’s decomposition is primarily intended to separate gaps in earnings due to discrimination from gaps in earnings due to differences in

- a. risk of injury on the job.
- b. human capital.
- c. employer monopsony power.
- d. labor demand.
- e. all of the above.

(10) One study found that the price of baseball cards of white players was 10 to 13 percent higher than the price of equally accomplished black players. This is evidence for the theory of

- a. preference-based employer discrimination.
- b. preference-based employee discrimination.
- c. preference-based customer discrimination.
- d. statistical discrimination.
- e. monopsony wage discrimination.

(11) Suppose an employer receives job applications from a blue worker and a green worker with identical education and experience qualifications. If the employer has experienced more frequent quits by blue workers in the past, the employer may offer the job to the green worker. This would be an example of

- a. preference-based employer discrimination.
- b. preference-based employee discrimination.
- c. preference-based customer discrimination.
- d. statistical discrimination.
- e. monopsony wage discrimination.

(12) According to estimates of the Oaxaca decomposition, differences in schooling and region of residence account for

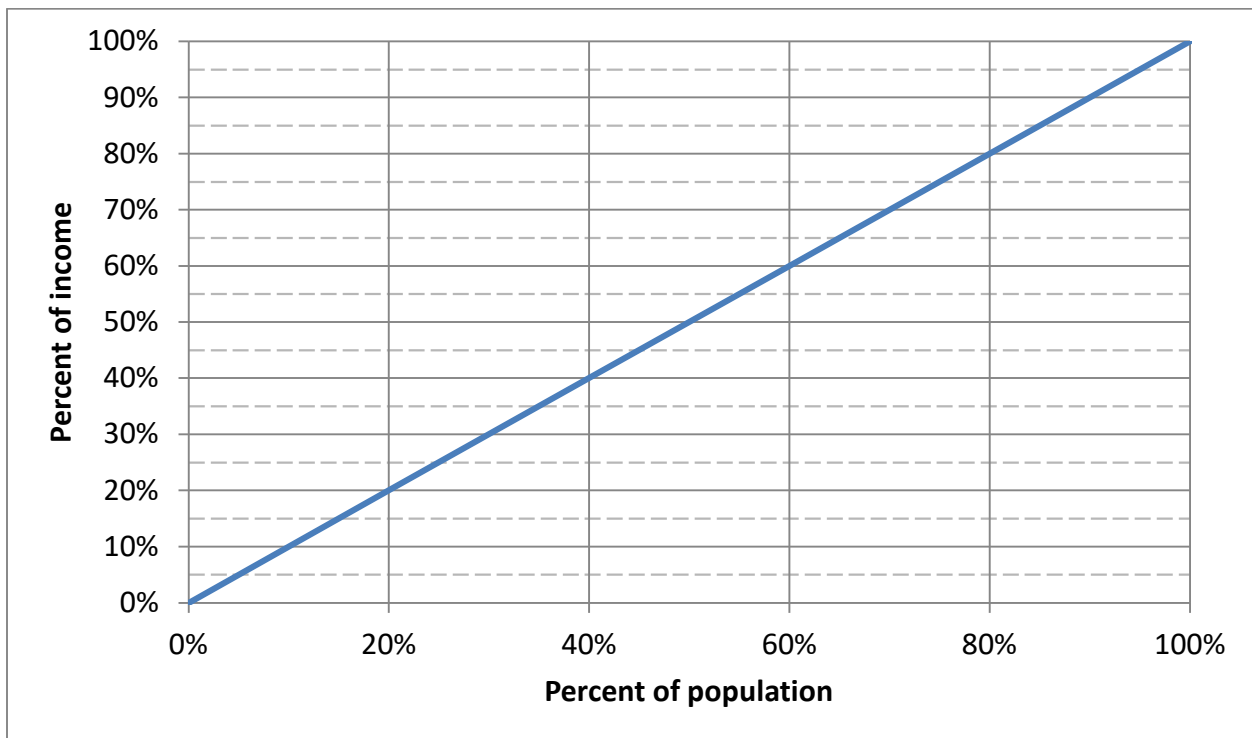
- a. almost none of the female-male wage differential.
- b. roughly half of the female-male wage differential.
- c. most of the female-male wage differential.

**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] U.S. money income shares by household quintile for 2020 were reported as follows.<sup>1</sup>

Quintile	Income share	Cumulative share
Lowest quintile	3%	%
Second quintile	8%	%
Third quintile	14%	%
Fourth quintile	23%	%
Fifth quintile	52%	%

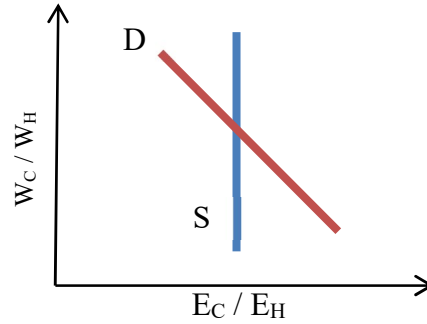
- a. [5 pts] Compute the cumulative shares and insert them in the right-hand column above.
- b. [5 pts] Sketch the Lorenz curve in the graph below.



c. [4 pts] The area between the Lorenz curve and the diagonal line is 0.226 while the area below the Lorenz curve is 0.274. Compute the Gini coefficient of inequality.

<sup>1</sup> Guzman, G., & Kollar, M. A. (2023). *Income in the United States: 2022*, Current Population Reports, P60-273 September 2021. See figure 3, p. 6. These data include nonlabor income.

(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

$$\left| \frac{\% \text{ change } (E_C/E_H)}{\% \text{ change } (W_C/W_H)} \right| = 1.4 .$$

Suppose over a decade, relative supply ( $E_C/E_H$ ) shifts **right 7%**, as more people attend college.

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

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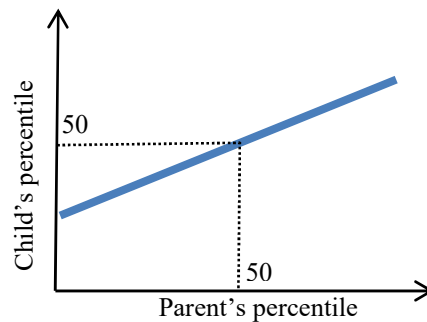
Suppose that in fact, the relative wage ( $W_C/W_H$ ) **increased by 10%** over the same period.

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

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[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 **0.30** and recall that the estimated line necessarily passes through the two medians (50,50).



- a. If a parent's income is at the 40th percentile, what is the predicted value (or conditional mean) of the child's income?
- b. If a parent's income is at the 80th percentile, what is the predicted value (or conditional mean) of the child's income?

percentile
percentile

(4) [Migration decision: 6 pts] A young worker currently resides in City A, earning \$30,000 per year. However, in City B, the same worker can earn \$40,000 per year. Assume for simplicity that there is no difference in the cost of living. Also assume that the worker's discount rate is 5%.

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

\$	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 Boston. Worker A's net present value of earnings in Des Moines is \$600 thousand and net present value of earnings in Boston is \$1000 thousand. Worker B's net present value of earnings in Des Moines is \$800 thousand and net present value of earnings in Boston is \$700 thousand. Each worker's moving cost is \$50 thousand.

- a. Assuming Workers A and B remain together, will they move to Boston? 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  $W_X = 10 + 3S$ . The relationship in Country Y is given by  $W_Y = 50 + S$ . 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	\$40,000	\$30,000	
Immigrants who have been in the U.S. for ten years	\$60,000	\$44,000	(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)”.

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(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	$\ln(W_G) = 1.2 + 0.10 S_G$	14
Blue workers	$\ln(W_B) = 0.9 + 0.08 S_B$	10

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  $q = 12\sqrt{E_G + E_B}$ , 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  $MP_E = 6/\sqrt{E_G + E_B}$ . 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 **\$10**.

- 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  $d = 1.5$ , 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  $w_G = 2 + (E_G/10)$ . Supply of blue workers to the same employer is given by  $w_B = 8 + (E_B/20)$ . 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) Could the following occupations be characterized by Sherwin Rosen’s “superstar” phenomenon? Why or why not?

- a. Brain surgeon.
- b. Pianist.

(2) We have discussed several economic theories of discrimination.

- a. What theory predicts that discriminating employers will have *lower* profits than nondiscriminating employers? Briefly explain why they have lower profits.
- b. What theory predicts that discriminating employers will have *higher* profits than nondiscriminating employers? Briefly explain why they have higher profits.

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]