

Problem Set II
Econ 350, Winter 2021
James J. Heckman
Due January 27th, 2021

- I. Consider the following model of wages, tasks, and skills. There are two tasks: A and B . These are demanded in the market (e.g., occupations, etc.). Associated are two skills: S_1 and S_2 (e.g., cognitive and noncognitive). (See Acemoglu and Autor, 2011; Deming, 2017; Heckman and Sedlacek, 1985 *JPE*, for background.)

T_j is the quantity of task j skills (formed from S_1 and S_2). (I drop individual i subscripts.) People with different skill endowments have comparative advantages in tasks. People have a skill vector (S_1, S_2) . It maps into tasks (T_A, T_B) via the following equations:

$$T_A = \alpha_A + \beta_A^1 S_1 + \beta_A^2 S_2$$

$$T_B = \alpha_B + \beta_B^1 S_1 + \beta_B^2 S_2$$

Tasks are demanded in the market. People can perform only one task at a time (i.e., they can't do both simultaneously). Aggregates of tasks \bar{T}_A, \bar{T}_B , along with aggregate capital K , determine total output: $Y = F(\bar{T}_A, \bar{T}_B, K)$.

$$F_1 > 0 \quad F_2 > 0 \quad F_3 > 0$$

$$F_{11} < 0 \quad F_{22} < 0 \quad F_{33} < 0$$

F operates under constant returns to scale. Aggregation is in terms of the sums of the persons using A and B in the market, respectively.

Market prices for tasks are determined from competitive equilibrium:

$$\begin{aligned}\pi_A &= \frac{\partial F}{\partial T_A} \\ \pi_B &= \frac{\partial F}{\partial T_B} \\ \pi_K &= \frac{\partial F}{\partial K}\end{aligned}$$

- (A) Define and distinguish comparative and absolute advantage in choice of tasks.
- (B) What are skill prices in terms of task prices π_A, π_B ? As aggregate endowment of S_1 increases, what is the effect on π_A, π_B ? (E.g., suppose everyone wakes up with twice as much S_1 . Also consider the case where only the bottom half of the S_1 distribution has a 25% increase in endowment.)
- (C) Use this model to compare the wages earned of two groups (for example, female and male workers with different skill endowments). How does this model affect the interpretation of the comparisons in Part C of Problem Set I? What is the meaning of a quantile (e.g., median) difference in wages between males and females if male S_1 relative endowment is half that of females, but their S_2 endowments are the same? What is the meaning of the comparison of

median wages over time if male participation is declining, as you demonstrated in Problem I? How does this map into estimates of discrimination?

(D) What is the causal effect of gender in this model?

- II. Suppose that you change the conditions of Problem I so that there are two sectors producing different outputs, and $(\bar{T}_A^1, \bar{T}_B^1, K^1)$ and $(\bar{T}_A^2, \bar{T}_B^2, K^2)$ are allocations to each sector. $F^j(\bar{T}_A^j, \bar{T}_B^j, K^j)$ $j = 1, 2$ are technologies in each sector. They have properties analogous to those assumed for F in Problem I. Sector 2 is more B intensive than Sector 1. Answer Part I questions in this environment. When are prices of skills uniform across sectors? When are they non-uniform? How would you test for uniform pricing? Describe how to test for uniform pricing of skills across sectors.
- III. Answer the questions embedded in the “Two Interpretations of the Mincer Equation” handout.

References

- Acemoglu, D. and D. H. Autor (2011). Skills, tasks and technologies: Implications for employment and earnings. In O. C. Ashenfelter and D. Card (Eds.), *Handbook of Labor Economics*, Volume 4B, Chapter 12, pp. 1043–1171. Amsterdam: Elsevier.
- Deming, D. (2017). The growing importance of social skills in the labor market. *The Quarterly Journal of Economics* 132(4), 1593–1640.
- Heckman, J. J. and G. L. Sedlacek (1985, December). Heterogeneity, aggregation, and market wage functions: An empirical model of self-selection in the labor market. *Journal of Political Economy* 93(6), 1077–1125.