# Labor Economics Field Exam
## June 2021

**Instructions**

This is a closed book examination. No written materials are allowed. You can use a calculator.
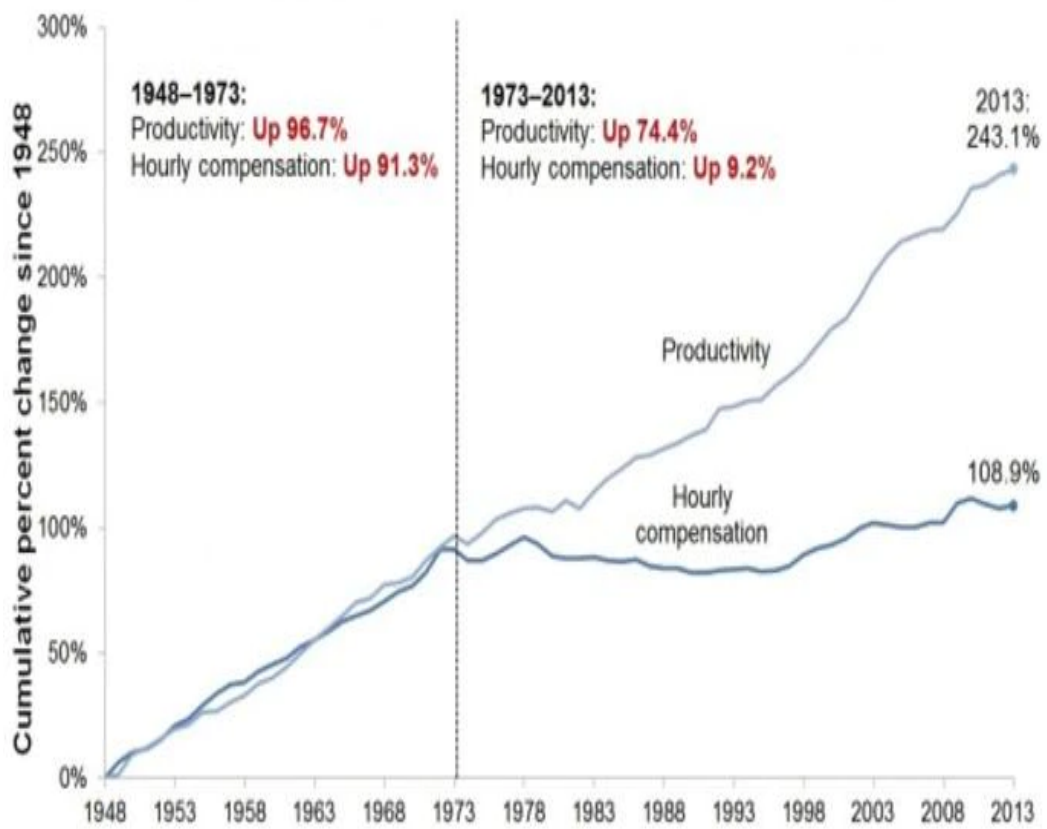
You have **3 hours** to complete the exam. The exam is composed of three questions. Each question is worth 100 points. You must obtain at least **75 points** in at least two of the three questions to pass the exam in your field.

Please answer each question in separate booklets.

**First Question. 100 Points**

Consider the figure on the next page. It documents the evolution of changes in labor productivity (output of goods and services divided by labor hours devoted to the production of the output) and hourly wages from 1948 to 2013. The two variables increased at the same rate until the early seventies. But then they diverged, with productivity increasing by 74.4% and hourly wages by 9.2%. The question asks you to think about the determinants of the divergence that started in the early seventies.

1. (15 points) Describe the main factors that you believe determined the divergence between the changes in productivity and hourly wages.

2. (15 points) Rank the factors in order of importance and explain why you believe this is the correct ranking.

3. (15 points) Consider only the first factor in your ranking. Write down a model that accounts for this factor.

4. (15 points) Using your model, show the effect of your factor on productivity and hourly wages.

5. (10 points) Using your model, derive a testable implication that enables you to determine whether your model is consistent with available data.

6. (10 points) Discuss the data you need to test the implication you just derived.

7. (10 points) Suppose you want to estimate the model parameters. What estimation method would you use to estimate the model? (If you were using general functions up to this point, replace them with specific functional forms).

8. (5 points) Describe the steps needed to implement the method.

9. (5 points) Pick one parameter in your model and describe which data and which variation in the data would allow you to identify that parameter.

The chart, titled "Cumulative percent change since 1948," shows:

- **1948–1973:** Productivity: Up 96.7%; Hourly compensation: Up 91.3%
- **1973–2013:** Productivity: Up 74.4%; Hourly compensation: Up 9.2%
- 2013: 243.1% (Productivity)
- 108.9% (Hourly compensation)

**Second Question. 100 Points**

Consider a setting with individuals of either low productivity ($l$) or high productivity ($h$). Education, $e$, is continuous and publicly observed, but productivity is not. The productivity of the low type is $y_l(e) = \beta_1$, while the productivity of the high type is $y_h(e) = \beta_1 + \beta_2 e$. The costs of obtaining education differ between the two types: $c_l(e) = \frac{3}{2}e^2$ and $c_h(e) = e^2$. Firms compete for workers a la Bertrand (assume there are many firms in the market) after observing the educational attainment of the workers.

(1) [15 points] Characterize the levels of education workers would obtain if ability were perfectly observable. Show that there is no separating Perfect Bayesian equilibrium (PBE) in which high types obtain their "first-best" education level.

(2) [15 points] Show that there exist separating equilibria in which low types obtain their first-best education level. What is the minimum level of education for high types that supports such an equilibrium?

(3) Assume we are in the separating PBE you found in (2). Denote by $s_h$ the share of high-productivity individuals in the economy and thus $1 - s_h$ is the share of low-productivity individuals. Suppose a researcher observes workers' education and productivity. She estimates the following regression specification:

$$y = a_0 + a_1 \cdot e + \eta$$

   (i) [10 points] What estimand will $\hat{a}_1$ recover?

   (ii) [5 points] Does it represent the causal effect of additional education on productivity?

   (iii) [5 points] In Equilibrium, what is the average effect of increasing educational attainment?

(4) [10 points] Now suppose there is a compulsory schooling requirement of $\bar{e}$, where $0 < \bar{e} < \frac{\alpha_2}{4}$. What is the minimum level of education for high types that supports a PBE in which low types obtain $\bar{e}$? Is this more or less than in (2)? Explain why.

(5) [10 points] Now suppose that $y_l(e) = y_h(e) = \alpha_1 + \alpha_2 e$. Characterize education levels of low and high types in all PBE of this game. Describe the education levels of low and high types in all the PBEs of this game.

(6) Briefly describe the model in Farber and Gibbons (1996). Specifically:

    (i) [10 points] What are the main assumptions?

    (ii) [10 points] What are the three predictions of the employer learning model?

(7) [10 points] Describe the main findings in Lange (2007). What are their implications on the role of signaling in explaining the returns to education?

### Third Question. 100 Points

### Part 1: minimum wage (50 points)

Consider an economy with three factors: unskilled workers ($i = u$), skilled workers ($i = s$), and capital $K$. There is a representative firm with a concave production function $F(L_u, L_s, K)$. This firm produces the single consumption good, which is sold in a competitive market and is the numeraire in this economy (so its price is normalized to 1). There is a fixed endowment of capital $\bar{K}$, and the market for capital is competitive. If the prevailing wage for workers of type $i$ is $w_i$, then the mass of workers of that type willing to work for the representative firm is $L_i^S(w_i) = A_i w_i^\beta$. Throughout the question, assume that the minimum wage never binds for skilled workers.

**Item 1 (7 points)** Start with a competitive labor market with no minimum wage. What are the equilibrium conditions that fully determine factor prices $w_u, w_s, r$ and employment levels $L_u^D$, $L_s^D$ in this economy? Write them down.

**Item 2 (3 points)** Suppose a minimum wage $\bar{w}$ is introduced in this competitive economy, at a level higher than the competitive wage for unskilled workers. How do the equilibrium conditions change, compared to the previous item?

**Item 3 (8 points)** Sketch a supply-demand graph for unskilled labor, including a minimum wage. Point the equilibrium quantities and wages for Items 1 and 2, and highlight the employment effect of the minimum wage.

**Item 4 (7 points)** Which curve determines the magnitude of employment effects of the minimum wage in this competitive economy? What element(s) of the model determines the slope of that curve? Provide a specific, concrete example of a situation where the employment effects would be stronger, in the context of this model.

**Item 5 (10 points)** For the remaining items in this part, suppose that the representative firm is a monopsonist. Write down the equilibrium conditions that fully determine factor prices $w_u, w_s, r$ and employment levels $L_u^D$, $L_s^D$ in this economy.

**Item 6 (15 points)** Now consider the introduction of a minimum wage with monopsony. Sketch supply-demand graphs for each of the following four cases. Include a curve for marginal cost of labor if needed.

(i) without a minimum wage, highlighting how the monopsony level of employment compares to the competitive one;

(ii) with a small, but binding, minimum wage, such that there is no job rationing;

(iii) and (iv) should both feature job rationing. They should have different qualitative predictions regarding the introduction of the minimum wage.

### Part 2: Training on the job (20 points)

Consider a competitive, partial equilibrium labor market model with general and firm-specific human capital. Suppose that firms might provide training that increases worker human capital, by paying a convex cost.

**Item 7 (10 points)** In his classic book from 1964, Human Capital, Becker discusses whether an employer would be willing to provide training in perfectly competitive labor markets. Would training in general skills ever be provided? If so, under which condition?

**Item 8 (10 points)** Acemoglu and Pischke (1998) propose a model where firms have stronger incentives to provide training in general skills, compared to Becker's model. Briefly explain the central elements of that model and why do they lead to more training in general skills.

### Part 3: Search frictions (30 points)

**Item 9 (8 points)** In frictional models of labor markets, jobs are formed when a firm meets a suitable worker that is willing to work there. In that case, there will be positive "match rents." Describe what those match rents are, as precisely as possible. If you wish, you may do so by writing a simple formula. If you do that, define each component of the formula.

**Item 10 (8 points)** How are wages set in the classic Diamond-Mortensen-Pissarides (DMP) model? How does that relate to match rents?

**Item 11 (14 points)** Consider the model of Burdett-Mortensen (1998), with wage posting, search frictions, on-the-job search, and ex-ante identical workers and firms. What is the surprising result of that model? Briefly explain the model mechanics that generates that result.