Final Exam ECON3715/4715 – Labour Economics
Autumn 2019

This exam has 5 questions, with 16 sub-questions. Each sub-question counts equally. When answering the questions on the exam you should be brief and to the point! Make sure to write clearly. Difficult to decipher answers will not be counted!

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1. In this question you have to indicate whether you think the statement is true or false and explain why. You do not get any points if you only state whether the statement is true or false.

   (a) Theory of compensating differentials assumes that workers select jobs based on their skills.

   > False. The theory of compensating differences assumes that workers select jobs based on their tastes for job-attributes.

   (b) Becker's model of taste-based discrimination predicts that employer discrimination is unlikely to persist in the long run.

   > True. The Becker model of employer taste-based discrimination predicts that discrimination is unprofitable. If employer discrimination results in a wage differential between workers from the minority and majority group, discriminatory employers will have lower profits because they hire the wrong number of workers and/or hire the wrong type of workers. In a perfectly competitive market with free entry and exit it is expected that in the long run all discriminatory firms disappear. If however the market is not perfectly competitive or if there exist also customer discrimination, discriminatory firms can exist in the long run.

   (c) Any allocation on an efficient contract curve satisfies allocative efficiency.

   > False. Any allocation on an efficient contract curve is pareto efficient, but may not necessarily satisfy allocative efficiency, while any allocation on a strongly efficient contract curve satisfies both allocative efficiency and pareto efficiency.

(d) Sequential job search theory predicts that a higher cost of job search increases unemployment duration.

False. In contrast, an individual with a higher cost of job search has a higher marginal costs of search. This decreases the asking wage

$$\widetilde{w} = b - c + P(w \geq \widetilde{w}) \times \frac{E(w - \widetilde{w} | w \geq \widetilde{w})}{r}$$

and the individual will accept job offers with lower wage offers and the expected unemployment duration will therefore be shorter.

(e) The principal-agent model predicts that workers with higher risk aversion are paid a lower performance-related pay.

True. There is a fundamental trade-off between providing incentives and insurance in the principal-agent model. The higher risk aversion an agent has, the more he/she dislikes the risk imposed in a performance pay, and thus desires a lower performance pay component. The formula for the performance-pay related component of the optimal contract in a traditional principal-agent model is as follows:

$$\alpha_1^* = \frac{1}{1 + rk\sigma^2}$$

where r is the risk aversion of the agent (with CARA utility), k is the agent's cost of effort, and σ^2 is the riskiness of firm performance. Higher r lowers the optimal performance pay component, α_1^*.

2. This question is about: Parey, M., Ruhose, J, Waldinger, F., and N. Netz. (2017). The Selection of High-Skilled Emigrants. *Review of Economics and Statistics* 99(5): 776–792. The authors consider the following Roy model of migration:

$$\log w_0 = \theta_0 + \epsilon_0, \tag{1}$$

$$\log w_1 = \theta_1 + \epsilon_1, \tag{2}$$

$$\text{Migrate} = 1 \text{ if } \theta_1 + \epsilon_1 > \theta_0 + \epsilon_0 + c, \tag{3}$$

where w_1 are earnings abroad, w_0 are earnings at home, c are migration costs, and log-earnings further consist of an observed (θ_j) and an unobserved (ϵ_j) component.

(a) Explain how migration costs and differences in earnings at home and abroad affect workers' migration choices in this model.

- If migration costs c increase, then equation (3) implies that the net gains from migration are lower, so fewer people will migrate.
- If earnings abroad $(\theta_1 + \epsilon_1)$ increase, then equation (3) implies that the net gains from migration are higher, so more people will migrate.
- If earnings at home $(\theta_0 + \epsilon_0)$ increase, then equation (3) implies that the net gains from migration are lower, so fewer people will migrate.

(b) The authors assume that the vector $(\theta_0, \theta_1, \epsilon_0, \epsilon_1)$ is jointly normally distributed with means $(\mu_0, \mu_1, 0, 0)$, variances $(\sigma^2_{\theta_0}, \sigma^2_{\theta_1}, \sigma^2_{\epsilon_0}, \sigma^2_{\epsilon_1})$ and the correlation between θ_0 and θ_1 is ρ_θ. Using the formula for a joint normal distribution, they derive an expression for $E(\theta_0 \mid \text{Migrate} = 1)$ as follows:

$$\begin{aligned} E(\theta_0 \mid \text{Migrate} = 1) &= E(\theta_0 \mid \theta_1 + \epsilon_1 > \theta_0 + \epsilon_0 + c) \\ &= \mu_0 + \left(\rho_\theta - \frac{\sigma_{\theta_0}}{\sigma_{\theta_1}}\right) D, \end{aligned} \tag{4}$$

where D is a positive term. Using $E(\theta_0 \mid \text{Migrate} = 1)$, the authors define positive and negative selection. Explain these terms.

$E[\theta_0 \mid Migrate = 1]$ can be interpreted as expected earnings at home (related to the observable component) for individuals that choose to migrate. This is a counterfactual; since individuals choose to migrate, one can not observe their earnings at home, i.e., the counterfactual situation in which they hadn't migrated.

We start by noting that $E[\theta_0] = \mu_0$. In this context, we can interpret positive and negative selection as follows:

- Positive selection, i.e., $E[\theta_0 \mid Migrate = 1] > \mu_0$, says that the expected earnings at home for individuals that choose to migrate are higher than the overall expected earnings in the home country. This implies that workers with the highest potential earnings in their home country choose to migrate.
- Negative selection, i.e., $E[\theta_0 \mid Migrate = 1] < \mu_0$, says that the expected earnings at home for individuals that choose to migrate are lower than the overall expected earnings in the home country. This implies that workers with the lowest potential earnings in their home country choose to migrate.

(c) Consider that the correlation ρ_θ between earnings at home θ_0 and earnings capacity abroad θ_1 is equal to 1, such that individuals that tend to have high earnings at home also tend to have high earnings abroad, and vice versa. Explain whether and how the direction of selection depends on σ_{θ_0} and σ_{θ_1}?

Note that $SD(\theta_0) = \sigma_{\theta_0}$ and $SD(\theta_1) = \sigma_{\theta_1}$, so these terms relate to the variability of observable components of earnings at home and abroad, respectively. Setting $\rho_\theta = 1$, we can see this simple model implies that the direction of selection depends only on relative inequality $\frac{\sigma_{\theta_0}}{\sigma_{\theta_1}}$ across destinations.
If the potential destination is less equal than home ($\sigma_{\theta_1} > \sigma_{\theta_0}$), migrants will be positively selected: $E[\theta_0 \mid Migrate = 1] > \mu_0$. Intuitively, the positively selected migrants benefit from the upside opportunities in less equal countries.
If the potential destination country is more equal ($\sigma_{\theta_1} < \sigma_{\theta_0}$), migrants will be negatively selected: $E[\theta_0 \mid Migrate = 1] < \mu_0$. Intuitively, the negatively selected migrants benefit from the insurance of a compressed wage distribution in more equal countries.

(d) Imagine that there is a sudden increase in the migration cost c. How does this affect the direction of selection in this model?

Differences in mean earnings across destinations net of migration costs, i.e., $(\mu_0 + c - \mu_1)$, enter the term D. Since this term is positive regardless of the size of $(\mu_0 + c - \mu_1)$, the direction of selection is not affected. Thus, in this model, migration costs and differences in mean earnings between home and abroad have strong effects on migration probabilities (see (a)), but they have no effect on the direction of selection.

3. This question is about: Arcidiacono, P., P. Bayer, and A. Hizmo. (2010). Beyond Signaling and Human Capital: Education and the Revelation of Ability. *American Economic Journal: Applied Economics* 2(4): 76-104.

(a) What are the sources of returns to education in the human capital model and in the signaling model?

- In the pure human capital, education increases individuals' productivity. Since education is costly (either opportunity costs/foregone earnings while in school or direct costs/tution fees), each individual makes an optimal decision to invest in education, comparing costs and benefits of education. Different individuals may decide to choose different levels of education if they have different discount rates or if their marginal returns to education differ (e.g., by ability). High ability may attend more education if their marginal returns to education are higher (or if they also tend to have lower discount rates). Returns to education arise as more education individuals have higher (learnt) productivity.

- In the pure signaling model, education signals individuals' productivity. There is asymmetric information in the labor market - employers don't observe workers productivity and must infer this from other observables (e.g., education). If workers differ in their innate ability, so that some are born more productive than others, and if high ability individuals have lower costs of taking education (e.g., lower effort of studying), then there can exist a separating equilibrium in the labor market where education has a signaling value. High ability workers choose to attend more education in order to signal to potential employers their productivity. Thus, education provides a solution to the asymmetric information problem. Returns to education arise as more education individuals have higher (innate) productivity.

(b) Arcidiacono et al. (2010) discuss the concepts of *employer learning* and the *ability revelation* role of education. Explain these terms.

Employer learning:

- Consider a labor market with asymmetric information where employers are not (fully) informed about job applicants' true productivity. Starting wages would thus depend on employers' prediction regarding workers' productivity, which they infer based on other observables (e.g., education). However, if workers' output is observed once they are hired and output is correlated with workers' productivity, then this provides additional "noisy signals" of productivity. As employers observe new measures of workers' output over time (as workers' get more experience), workers' true productivity can be predicted with more precision. This process is referred to as employer learning.

Ability revelation role of education:

- The authors argue that certain types of educations (e.g., college degree) would allow individuals to directly reveal key aspects of their own ability to the labor market. In the US context, the authors argue that "resumes of recent college graduates typically include information on grades, majors, standardized test scores, and, perhaps even more importantly, the college attended." If these factors are highly correlated with individuals' ability, then such factors provide a rich set of signals to employers and allow them to form more precise predictions regarding workers' productivity. The authors state however that this argument does not apply all types of educations.

(c) To test for employer learning and ability revelation, the authors estimate a version of the following equation separately for high school and college graduates:

$$w_i = \beta_0 + \beta_{AFQT} AFQT_i + \beta_{AFQT,x} \left(AFQT_i \times x_i \right) + f\left(x_i\right) + \varepsilon_i \tag{5}$$

where w_i are log-wages, $AFQT_i$ is an ability test score and x_i is labor market experience. An extract from their main results is provided in Table 1. Discuss whether the results in columns (1)-(4) are consistent with employer learning and/or ability revelation for high school and college graduates, respectively.

Table 1. The Effects of AFQT on Log Wages for High School and College Graduates.

	High school		College		Test: College=HS *P*-values	
Model	(1)	(2)	(3)	(4)	(5)	(6)
Standard. AFQT	0.0060	0.0078	0.1485**	0.1420**	0.000	0.000
	(0.0130)	(0.0129)	(0.0350)	(0.0354)		
AFQT × exper/10	0.1261**	0.1183**	0.0122	0.0198	0.026	0.050
	(0.0176)	(0.0173)	(0.0480)	(0.0472)		
R^2	0.1631	0.1874	0.1678	0.1821		
Observations	11,795	11,772	4,112	4,112		
Additional controls	No	Yes	No	Yes	No	Yes
Experience measure: Years since left school for the first time <13						

Notes: All specifications control for urban residence, a cubic in experience, and year effects. Specifications (2) and (4) also control for region of residence and for part-time versus full-time jobs. In specification (5), we report the *p*-values for the difference in the coefficients of specifications (1) and (3). Similarly, specification (6) compares (2) and (4). The White/Huber standard errors in parenthesis control for correlation at the individual level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

If employers do not initially observe ability, but learn about it over time, the weight placed on AFQT should be small initially and increase with experience. This means that the coefficient β_{AFQT} should be close to zero, and with employer learning $\beta_{AFQT,x}$ should be positive and sizable. On the other hand, if employers directly observe AFQT, the returns to AFQT should be high initially and should not change much over time. Thus, ability revelation translates to a large β_{AFQT} and a relatively small $\beta_{AFQT,x}$.
The evidence in Table 1, columns (1)-(2), is consistent with the view that there is employer learning in the high school labor market, while columns (3)-(4) suggest that a college degree plays the role of ability revelation.

4. Statistical discrimination. Consider a labor market that consists of two types of workers; majority workers (group A) and minority workers (group B). Suppose that employers in this labor market do not discriminate based on taste.

(a) Employers screen workers using an entrance test, and offer starting wages based on each worker's test score T_i and average test score $\overline{T}_G$ in worker's group as:

$$w_i = \alpha_G T_i + (1 - \alpha_G)\overline{T}_G, \tag{6}$$

where α_G is between 0 and 1 and $G = \{A, B\}$. Consider a worker k from group A and a worker j from group B. The two workers get identical scores on the entrance test, i.e., $T_k = T_j = T$. Both workers are 'high-performers' in the sense that their test scores exceed the average test scores in their respective groups, so that an employer is considering to hire these workers. What are the two reasons for why these two workers could be offered different starting wages?

The first reason for wage differentials in this case:

- Differences in group averages, i.e., $\overline{T}_A \neq \overline{T}_B$. Equation (6) suggests that even if $T_k = T_j$ and $\alpha_A = \alpha_B$, workers k and j can be offered different starting wages if the employer is statistically discriminating and test scores don't perfectly predict worker productivity. For instance, if minority workers tend to perform worse and the employers is using this information to predict worker worker j's productivity, then eq (6) suggests that worker j could be paid lower starting wages than worker k.

The second reason for wage differentials in this case:

- Differences in noise of signals, i.e., $\alpha_A \neq \alpha_B$. Equation (6) suggests that even if $T_k = T_j = T$ and $\overline{T}_A = \overline{T}_B = \overline{T}$, if $T \neq \overline{T}$, then workers k and j can be offered different starting wages if the marginal returns to signals differ across groups. For instance, if employers perceive signals from minority workers to be more noisy, such that a lower weight is placed on test score for minority workers ($\alpha_B < \alpha_A$), then eq (6) suggests that worker j could be paid lower starting wages than worker k.

(b) Consider that workers k and j are hired by the same employer, wages are set annually at the start of each year and a noisy measure of workers' productivity is observed by the employer at the end of each year. Discuss whether differences in wages across the two workers are expected to persist in the long-run.

Noisy measure of workers' productivity provide additional information to employers about workers over time. If wages can be adjusted flexibly over time, then one would also expect employers to adjust workers' wages over time as a function of the updated information they hold regarding workers' productivity. If the two workers are identical with respect to their true productivity over time, then we should not expect to see differences in their wages in the long-run. If, however, productivity is time-varying and it develops depends differently for the two workers over time, then differences in wages may persist.

5. Efficiency wages. Consider an economy with identical, perfectly competitive firms, each possessing a short-run production function

$$Q = F(E(w) \cdot L) \tag{7}$$

where Q is output, L is the number of employed workers, E is the effort level of workers, and w is the real wage. The price of output equals 1. We allow workers' effort level to depend on the wage they are offered, such that $E'(w) > 0$ and $E(0) = 0$. All workers are assumed to have identical wage-productivity relationships.

   (a) Derive the first-order conditions for a profit-maximizing firm in this economy and provide an intuition for the efficiency wage w^e formula.

A profit-maximizing firm solves the following problem:

$$\max_{w,L} \pi = F(E(w)\cdot L) - w\cdot L$$

The FOCs are as follows:

$$\begin{aligned}\frac{\partial \pi}{\partial L} &= F' \cdot E(w) - w = 0 &\longrightarrow \quad F' = \frac{w}{E(w)} \\ \frac{\partial \pi}{\partial w} &= F' \cdot E'(w) \cdot L - L = 0 &\longrightarrow \quad F' = \frac{1}{E'(w)}\end{aligned}$$

which gives:

$$E'(w) \cdot \frac{w}{E(w)} = 1 \qquad and \qquad F' \cdot E(w) = w$$

Each firm hires labor up to the point where its marginal product equals this efficiency wage

$$F' \cdot E(w^e) = w^e$$

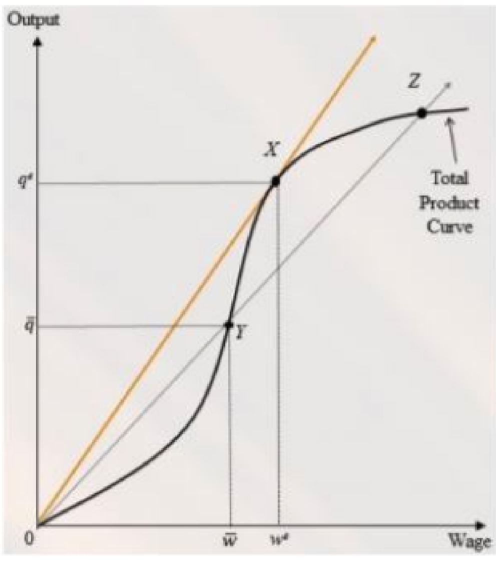
The optimal wage satisfies the condition that the elasticity of effort with respect to the wage is unity.

$$E'(w^e) \cdot \frac{w^e}{E(w^e)} = 1$$

That is the wage rate that minimizes wage costs per efficiency unit of labor.

Students may also show and discuss Figure 11-5 of Borjas (2016), reproducted av Figure 1 below, to provide the intuition.

Figure 1



(b) The employers can not monitor the workers' effort. Explain the no-shirking labor supply curve and the equilibrium level of unemployment in this economy.

If shirking is not a problem, the market clears at wage w* (where supply S equals demand D). If monitoring is expensive, the threat of unemployment can keep workers in line. If unemployment is high (point F), firms can attract workers who will not shirk at a very low wage. If unemployment is low (point G), firms must pay a very high wage to ensure that workers do not shirk. This gives an upward-sloping no-shirking labor supply curve in Figure 2(a) below. The efficiency wage w_{NS} is given by the intersection of the no-shirking supply curve (NS) and the demand curve. The equilibrium level of unemployment in this economy is given by $E - E_{NS}$.

Figure 2