Written Exam at the Department of Economics summer 2018

Family Economics

Final Exam

June 7, 2018

(3-hour closed book exam)

Answers only in English.

This exam question consists of 4 pages in total, 3 after this front page.

NB: If you fall ill during an examination at Peter Bangsvej, you must contact an invigilator in order to be registered as having fallen ill. In this connection, you must complete a form. Then you submit a blank exam paper and leave the examination. When you arrive home, you must contact your GP and submit a medical report to the Faculty of Social Sciences no later than seven (7) days from the date of the exam.

Be careful not to cheat at exams!

- You cheat at an exam, if during the exam, you:
- Make use of exam aids that are not allowed
- Communicate with or otherwise receive help from other people
- Copy other people's texts without making use of quotation marks and source referencing, so that it may appear to be your own text
- Use the ideas or thoughts of others without making use of source referencing, so it may appear to be your own idea or your thoughts
- Or if you otherwise violate the rules that apply to the exam

Draft your responses with an eye to clarity of exposition and structure as well as to showing your understanding of the concepts learned in class. Link the problem at hand to economic theory. You are free to make any reasonable assumptions that help you in answering, as long as you are specific and explicit.

Make sure to *pace yourself*. You may choose to work on the questions in a different order.

Massive Open Online Courses

For the past couple of years, online learning has greatly expanded as an alternative to regular schools and universities. Massive, open, online courses, or MOOCs, have become hugely popular. Players in this industry, such as the Khan Academy, Coursera, or edX, have millions of registered learners. The *New York Times* declared 2012 "the year of the MOOC." Some characteristics of MOOCs that are relevant for an economic analysis are:

- They are "massive," meaning that there is hardly a limit to how many people can use the same material that was generated once. This would lead to a steadily declining per/user cost schedule as the number of users increases. Think of a natural monopoly like railroads.

- Some internet courses are taught by the very best professors in the field, at top institutions such as Harvard and MIT. There is no restriction on where students have to be to engage with content from those elite institutions.

- MOOCs mostly focus on adult self-learners, but there are also courses that are appropriate for elementary and secondary school students, such as the Khan Academy (teaching math from grade 3-level and up).

- Some courses lead to certification, while others do not come with a diploma at the end.

Questions

1. Use the classical Ben Porath human capital model to analyze how two aspects of MOOCs influence optimal individual demand for education.

   Questions 1.a) to 1.c) are below. You may use the following:

   The optimal share of time in schooling in period t by individual i is S_{it}^*:

   $$S_{it}^* = \left[\frac{\beta_{t+1}}{\beta_t} \frac{\alpha}{1+\rho} \frac{1}{H_{it} + \gamma_t/\beta_t} \left(A_i H_{it} E_{it}\right)^\alpha \right]^{\frac{1}{(1-\alpha)}},$$

   where

   - β_t and β_{t+1} are the wage-returns to human capital in periods t and $t+1$,
   - H_{it} is i's human capital in period t,
   - A_i is personal initial learning ability,
   - E_{it} are public inputs (for ex. expenditures) into schooling in period t,
   - γ_t is the direct cost of schooling in period t,
   - α is the parameter of the human capital production function, ρ is the discount rate.

   (1.a) **Cost of schooling:** A successful MOOC teaches many students from a single set of content. We would expect this MOOC to be cheaper per student than a teacher that teaches to a single class.

   How does a decreased cost influence demand for education? (Stay within the model for individual demand here—do not analyze competition between online and regular courses.)

   (1.b) **Public inputs on schooling** Alternatively, one could imagine teachers in regular classrooms use content from MOOCs as additional material.

   i. How would demand for schooling change if we interpret this as in increase in resources put into education (E_{it} in the model)?

   ii. Would the response be homogenous across the population, or would a specific group of students react more strongly? Use the following derivative.

   $$\frac{\partial S_{it}^*}{\partial E_{it}} = \frac{\alpha}{(1-\alpha)} E_{it}^{\frac{\alpha}{(1-\alpha)}-1} \left[\frac{\beta_{t+1}}{\beta_t} \frac{\alpha}{1+\rho} \frac{1}{H_{it} + \gamma_t/\beta_t} \left(A_i H_{it}\right)^\alpha \right]^{\frac{1}{(1-\alpha)}}$$

   (1.c) Discuss briefly why the Ben-Porath model is appropriate to study MOOCs.

2. The Economist writes on January 12, 2017: "Besides costs, the second problem for MOOCs to solve is credentials. Close colleagues know each other's abilities, but

modern labour markets do not work on the basis of such relationships. They need widely understood signals of experience and expertise, like a university degree or baccalaureate, however imperfect they may be. [...] The MOOCs' answer is to offer microcredentials like nanodegrees and specialisations."

Credentials are often provided after students pay a fee, and after going through an exam or test of their learning outcomes.

Use sorting models to analyze this topic.

(2.a) What is the basic framework and assumptions in which Spence developed his 1973 signalling model? What was the objective?

(2.b) Very briefly highlight which key ingredient of the model is alluded to in the quote from the Economist.

(2.c) Why are credentials necessary at all? Which conditions could make credentialling less important?

(2.d) Think about empirical tests of signalling versus human capital models.

Does the "need for credentials" prove that there is no human capital gain from MOOCs?

Could a simple comparison between earnings of individuals who completed certified courses, and individuals who completed courses that do not give a credential at the end, be a test of signaling versus human capital models?

3. For this final question, we contrast the return from completing a class in two different settings: a regular program at Harvard, vs. one of their online classes.

(3.a) What is the main difference between taking an online class from Harvard and (being allowed to) enrolling in regular Harvard and taking a physical class there? How would the difference be reflected in wage returns?

(3.b) One reason why returns to a class (or degree) from Harvard are generally high is that they supposedly have the world's best professors. Discuss what you know about teacher value added, and how it would apply to the two types of courses.