This document provides a sketch of solutions to the exam. The provided solutions are intended as a guide to answering the questions, and are not meant as exhaustive. The written solutions would have to be worked out more completely.


This is the re-exam for Economics of Education, Winter 2015/2016. You have three hours to answer the following five questions. Link the problem at hand to Economics of Education. Your responses should draw on concepts, theories, models, and empirical findings that were covered in class. Apply them where appropriate, and tell the reader why they are relevant, or which parts are not so easily applied. You are free to make any reasonable assumptions that help you in answering, as long as you are specific and explicit. Also draft your responses also with an eye to clarity of exposition and structure.

Read all questions before you begin your work. Make sure to pace yourself. Also, you may choose to work on the questions in a different order, just mark clearly which question you are answering.

Gender Gaps in Educational Attainment

In most developed countries, an interesting reversal has taken place: While previously, men had higher educational attainment than women, on average, today women's educational attainment surpasses that of men — see Figure 1 for the most recently published OECD data.

Figure 1: Share of Population with Tertiary Education, by Gender, in OECD countries
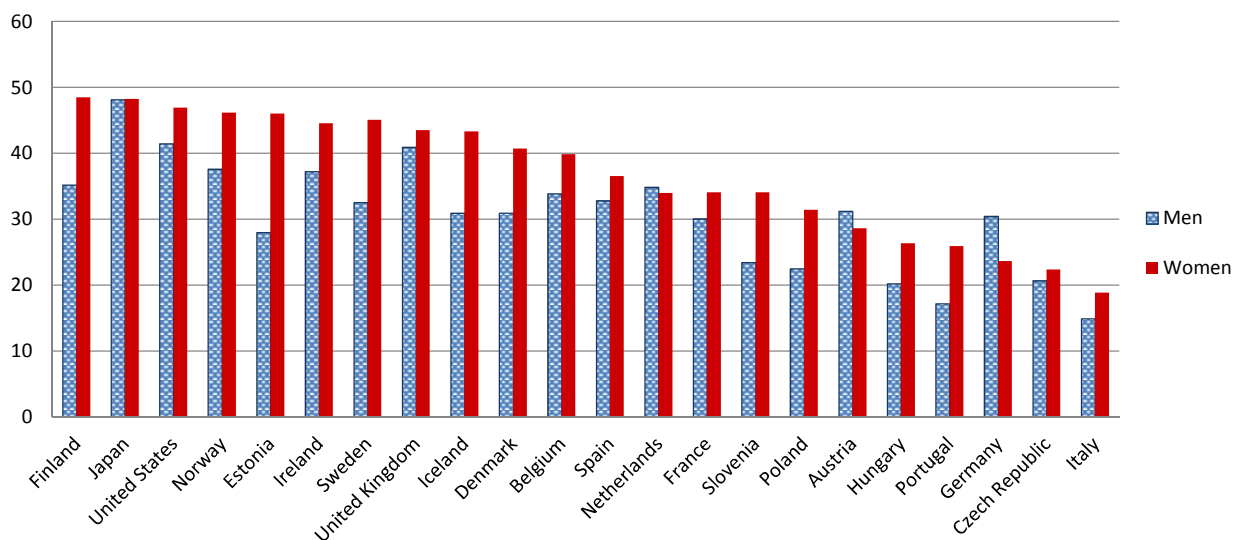
Note: Graph constructed from data in Table A1.1b of "Education at a Glance 2015," published by the OECD. Depicted is the share of 25-64 year-olds who have completed tertiary education. Tertiary education includes the following sub-categories: Short cycle tertiary, Bachelor's or equivalent, Master's or equivalent, and Doctoral or equivalent.

1. In Denmark, too, women today have a higher educational attainment than men. Which explanations can the classic human capital models provide for this finding?

(a) Think about Yoram Ben-Porath's classical human capital model. What explanations can this model provide for the fact that Danish women obtain more education than men? List all, and then evaluate the plausibility of the different explanations.

Solution:

In Ben-Porath's model, inputs in the human capital production are time, ability, and monetary expenditures. Determinants of the optimal individual demand are

- Direct cost of schooling. It would have to be higher for boys than girls. This would include tuition and books, for example.

- Expenditures/resources (public investments in education). Boys would have to be in resource-poorer schools, for example.

- Existing human capital: If girls entered with higher human capital, their acquisition of further human capital is more efficient. Their point of equality between marginal cost and benefit from further investments is achieved at higher investments than boys with lower initial human capital.

- Returns to education - if the relative gain to human capital next period vs. today is greater for women, they have a greater incentive to attend school longer. Note that in order for this *relative* relationship to hold, it could either be that women's wages today are lower (=lower opportunity costs) or their potential gains tomorrow (=return to education) are higher.

- Discount rate: discounting the future more reduces the perceived benefit of investing in education. Boys would have to have a higher discount rate (lower discount factor).

Plausibility?

- Direct cost: not plausible that boys pay higher tuition in Denmark, or have to spend more on books.

- Public expenditures: not plausibly different by gender. Schools in Denmark are mostly not segregated by gender, and it is difficult to argue that schools could target their resources to girls.

- Existing human capital. Possibly plausible if one takes into consideration the later maturation of boys than girls in kindergarten, for example. An early disadvantage could this way propagate to lower attainment later on.
  Furthermore, even though we have no evidence that boys' cognitive ability is lower than girls, there is some evidence for lower non-cognitive abilities - skills such as discipline, perseverance, etc., which are valued in the school context.

> A final argument that is sometimes heard in this context is that girls, taught by female teachers (so by teachers of their own gender) may have a lower non-monetary cost of education acquisition. In terms of this model, one could argue they have a higher productivity in the human capital production.
>
> - Differential returns: Plausible explanation. The big changes in the wage premia to education could possibly also explain the trend reversal.
>
>   Also, in the Danish case the gender segregated labor market could explain the different return to education for men and women.
>
> - Discount rate: possible explanation. More evidence needed.
>
> - Assumption of perfect capital markets = unlimited borrowing not credible.

(b) Which *additional or different* explanations could the model by Gary S. Becker and Nigel Tomes (1986) provide? Discuss both cases/parts they present. Pay attention to (possibly implicit) assumptions in their set-up.

> **Solution:**
>
> In Becker-Tomes, parents invest in their children's human capital.
>
> In the first case, perfect capital markets are assumed, so that parents can borrow against their children's future income. Parents will invest up to the point where the return on human capital equals the marginal interest rate. Determinants of optimal investment are discussed below:
>
> - Interest rate. But would men face a different marginal interest rate? Not likely, within the same country.
>
> - Ability - same as in Ben-Porath.
>
> - Public expenditures on education - same as in Ben-Porath.
>
> The assumption alluded to in the set-up is that human capital is assumed to translate 1-to-1 to earnings in their model. Thus, differential returns (as in Ben-Porath) are ruled out in the set-up. If we allowed the returns to differ, that would be a similar explanation as in Ben-Porath.
> Plausibility?
>
> - Interest rate not plausible. (Ability and public expenditures as above.)
>
> - Furthermore, one could argue that the model of parents investing for their children is less applicable in Denmark, with the relatively strong disconnect between parental income and financial support from the state.
>
> In the second case, parents cannot contract debt for their children. The constrained optimal investments are a function of

- Ability - see above

- Public expenditures - see above

- Parents' income: In order to explain lower attainment of boys, one would have to argue that the parents of boys are poorer on average than parents of girls.

- Parental altruism: Parents could feel less altruistic toward boys than daughters.

- Uncertainty about the market luck of children: One could envision two different cases: 1) parents expect the market to favor men relative to women (a gender wage gap, conditional on education, that favors men) - then, they would reduce investments because they are trading off their own current consumption against expected earnings of their sons. Increasing the son's future income lowers the marginal indirect utility through sons, which will be partly raised by reducing investments, and increased spending on own consumption lowers the marginal utility of this component. The second scenario could be that parents are much less certain of the luck of sons, and therefore invest less (because they have a lower expected utility from a more uncertain outcome, and receive a higher marginal utility from present consumption) - this depends on the functional form assumptions on the parents' indirect utility function.

Plausibility of the additional explanations in the second case?

- Parents' income: I do not know of evidence that parents of boys are poorer than parents of daughters. Unless there is other evidence, not the most plausible.

- Altruism: Even though possible in theory, if anything we have evidence for the contrary. Fathers spend substantially more time with their sons than with their daughters (and the reaction by mothers does not completely wipe out this effect). So I do not find this a plausible explanation for the gender gap favoring daughters.

- Market luck uncertainty: Possible, but not the most plausible explanation for such an economy-wide phenomenon. Furthermore, if one wants to link this to the *trend reversal* (rather than just the snapshot of today), one would have to assume that the uncertainty changed between the two genders.

(c) What would an economist recommend to politicians to do about the educational gap (which puts men at a disadvantage), on the basis of these human capital models? As an economist, think about efficiency.

> **Solution:**
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> In Ben-Porath, inequality is efficient in the sense that all individuals invest up to the point where their marginal cost equals their marginal benefit. Pushing men into higher attainment would lead them to a point where their marginal benefit is decreasing (by assumptions on the human capital production function), and it is outweighed by the marginal costs. So the recommendation would be to not do anything. If there are concerns about inequality in wages (outcomes!), redistribution of earnings may achieve the desired effect. But redistributing inputs into education is not efficient.
>
> In Becker-Tomes' first case, inequality in attainment is also efficient.
>
> In Becker-Tomes' second case, where education differentials may be due to wealth inequality, redistributive policies can be both equity- and efficiency-enhancing. But before an economist would recommend such a redistribution, he/she would examine whether indeed families with a son (remember in their model families consist of one child only) are more likely to be of lower wealth than families with a daughter.

2. Suppose one economist claimed that the returns to education are lower for boys, and that this is an explanation for the gender gap.

   Which methods have been suggested to measure returns to education? What are their advantages/disadvantages? (Make explicit references and give examples.)

> **Solution:**
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> - The Mincer earnings function is the prime method to measure returns to education. Advantage: uses easily available data (census cross-sections, only education and earnings, age/experience), and gives us a measure that can be compared across countries. Disadvantage: assumptions are not tenable (esp. synthetic cohorts), and can not plausibly recover causal effects of education.
>
> - Twin studies. Shared family background is controlled for by using only within-twin differences in education and earnings. But in terms of own characteristics, the same omitted variable bias may still be present.
>
> - Instrumental Variables/Natural Experiments. For full credit, you must describe at least one instrument that has been suggested, and evaluate their exogeneity, and describe the population that is affected by the instrument (for which we then learn about the returns to education).

3. Suppose parliament decides, after thorough discussion with the public, that inequality in educational outcomes is undesirable for Danish society. They decide to spend a certain sum on boosting boys' educational attainment.

   How should the money be spent most effectively? Cite specific papers that tell us what we know to inform our answer.

Solution:

- Cunha-Heckman 2007: They emphasize the dynamic formation of skills over the life cycle. Due to self-productivity and dynamic complementarity, the classic efficiency-equity tradeoff may not be present for early investments. They would argue in favor of investing in young boys, and then following up these investments. This relates to a second point made by Heckman with Carneiro: college readiness is formed throughout a child's life. Therefore, investments at the point of college-going will not make this investment in college more productive. Instead, the formative years need to be addressed. Credit constraints there may have prevented parents from investing fully (this is not related to the gender gap).

- We know that the literature on *resource effectiveness* has largely failed to identify a type of spending *in schools* that brings about greater increases in outcomes. All papers cited in lecture 12 are relevant. For example, Hanushek 1997 shows that financial school resources are not systematically related to student performance. This would mean that spending "on schools" in general is unlikely to bring about a boost in boys' educational attainment. Reducing class sizes is also not a sure-fire way of boosting attainment, as the results are mixed (examples are Krueger, 1999; Hoxby, 2000; Angrist and Lavy, 1999; Woessmann and West, 2006). Furthermore, the question is whether it is feasible to target spending by gender on schools.

- Specific tutoring and increased instructional time were identified by Dobbie and Fryer (2013) as boosting educational outcomes. Thus, spending on these items may be a way of spending "in schools" but with higher effectiveness.

- Milton Friedman's voucher plan would suggest to spend the money by giving it to parents, so they have a choice of school. Ideally, parents would then enroll their sons in the schools that ensure the best outcomes for them. This assumes that competition between schools would improve their effectiveness, that parents are fully informed, and that children are not limited geographically.