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 final exam for Economics of Education, Winter 2013. You have three hours to answer the following five questions. 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.* Also, you may choose to work on the questions in a *different order*: All questions can be answered independently (with the exception of question 5.)

Human Capital Effects of the Crisis in Greece

The global recession has led to important increases in unemployment since 2008, particularly in Southern Europe. In the case of Greece, the OECD notes: "Since the onset of the global recession in 2008, the rise in unemployment among 25-64 year-olds has equally affected those with and without an upper secondary education, rising by more than 10 percentage points in both cases, up to more than 17% in 2011. [...] Young people were hardest hit by the impact of the economic crisis, whatever their level of qualification. Among young adults (25-34 year-olds), the unemployment rate between 2008 and 2011 increased by more than 13 percentage points to reach 23% among those with an upper secondary or post-secondary non-tertiary education, and more than 26% among those with tertiary qualifications."[1] Among workers younger than 25, the unemployment rate increased from 22.1% in 2008 to 55.3% in 2012.[2]

(1) If many workers are currently laid off, what can economic theory say about their human capital and wage in the future? How will their productivity with another employer be affected by losing their current match with a firm? How might employers be affected?

> **Solution:**
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> Think of specific versus general human capital, or the type of training workers received by firms. If the firm had provided training that generated mostly general human capital, workers' wages must have been near their productivity level. (See the theory covered in class). When they are re-matched to a new employer, they should receive a similar wage because their human capital of the general on-the-job training is portable, as productive at the new firm as at the old firm (minus general depreciation of human capital and obsolescence). But if training had been mostly specific, workers and firms lose this human capital investment when the workers are laid off and separated from their current match. Workers were only receiving a small

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[1]Source: OECD Education at a Glance, 2012, Country Note Greece.

[2]eurostat table: Unemployment rate by sex and age groups - annual average, Last update: 31-10-2013, found at http://epp.eurostat.ec.europa.eu/portal/page/portal/employment_unemployment_lfs/data/database.

mark-up over their outside option (to reduce turnover by the firm), so their wage would fall by this mark-up. Their productivity at a new firm will be as if they had not received any training, because firm-specific training only improved productivity within that firm. Firms will be less productive with new hires, who lack this specific training, and would have to invest in training again. Therefore, employers are less productive too after a separation from a specifically trained worker.

(2) What does this strong increase in unemployment imply for the private demand for education? High unemployment implies that the opportunity cost of schooling is low. Are there other factors determining demand? You may want to distinguish between different age groups or schooling levels (primary school, secondary post-compulsory education, university education; older versus younger workers).

Solution:

Compulsory education: The length of schooling is mandated, so parents are not allowed to take their children out of school before they have stayed the minimum length. But quality of schooling might change - see questions 3) and 4).

Post-compulsory secondary as well as university education: Should everybody attend higher education? Draw on classical human capital model, where optimal private demand for education results from the balancing of current costs (monetary, and non-monetary, especially opportunity cost of foregone wages) against future benefits. Net benefits depend, among other things, on the productivity of the investment and the return to education. If parents are not allowed to leave negative bequests to children, credit constraints may also lead to a constrained optimum being different from the unconstrained demand for schooling.

1. Factors increasing private demand: higher youth unemployment implies lower opportunity cost of schooling, which is one factor determining optimal private demand for schooling.

2. But factors lowering private demand:
   1) Crisis ⇒ lower public expenditures ⇒ lower productivity of private investments if public and private expenditures are complements in human capital production ⇒ lower optimal investment.
   2) Expected return to education might have decreased. Especially if unemployment also increased for those with an upper secondary education. Productivity low because of high aggregate unemployment?
   3) Families might be credit constrained, in terms of cash flow (think of parents who become unemployed). May lead to children choosing to work now instead of further investments, because these might be too

expensive in terms of foregone parental utility from lowered consumption.

This means that even though the cost of schooling decreased, other forces might be strong enough to offset this, so that aggregate schooling does not increase. Therefore, government may want to allocate biggest spending cuts to other areas than schooling and training, to not reduce investment by too much.

Tertiary education: This might be the moment for re-training for older workers (again because of low opportunity costs); if workers realize that their unemployment is not only temporary but structural... think about Skill-biased Technological Change and more global changes in worker productivity.

(3) Imagine the crisis led to a strong increase in university attendance and graduation rates. How would wages of the newly educated workers develop, relative to previous cohorts? Address the wage premium of educated versus less educated workers. Find *at least two approaches* to answer.

Solution:

Several ways of answering this question:

1. Signaling (Spence, 1973): If education has a signaling component, a surge in new graduates will be partly from people who previously found education not attractive. These are either of lower quality, or credit constrained. The probability that the credit constrained will find education more attractive in the crisis than before is rather low. So it is likely that the change in composition comes from lower quality students who just have even lower opportunity costs now. This would imply that firms react to this decreased quality by lowering the premium to highly educated.

2. Quality of schooling: Overcrowding (class size) and reduced school resources will make human capital production less productive at any given year (finances cut in response to pressures to balance budget). See the articles we covered on class size and schooling quality. If the same diploma now produces less human capital, the wage premium to educated workers should fall for the new cohort, holding everything else constant (most importantly, the relative productivity of a given amount of human capital among the educated and less educated).

3. Macro factors, supply effects: a) overeducation. If the supply of graduates increases substantially, general equilibrium effects would imply that the education premium decreases (especially if coupled with lower quality), so the educated should receive lower wages at first, but then see b):

4. Macro factors, supply effects: b) for a strong shift in the supply of graduates, long-run interaction effects might occur. Think of technological change, firms changing their allocations of input (shares of highly skilled versus low skilled, capital etc.), or the production function actually changing in response to the new shares of productive inputs.

Bonus, not part of the question: Uneducated workers. Initially: incumbent workers see their demand increase relative to a situation without a strong education expansion, because there will be fewer incoming un-educated workers as more stay in school. In the long run, wages might also increase because of productivity gains from working with more educated colleagues. All this, however, will be at least partly offset by reduced demand for labor by the recession itself.

(4) Next, think about the human capital production that occurs not only in schools but within families throughout childhood. Even though compulsory schooling will not be altered, is there reason to believe that human capital accumulation might be affected by the crisis?

Solution:

Life-cycle skill formation - Human capital production in families (Cunha and Heckman, 2007).

1. Expected return to investing in human capital - might be increased or decreased from the crisis, unclear ex ante. Refer to some previous answers for arguments either way.

2. Parents might have fewer (financial) resources to invest in their children, decreasing early investments which propagate into the future by reducing the productivity of later investments.

3. Many of the important factors in human capital production are not only financial. Teaching socio-emotional skills, for example, can be low-cost but very productive (directly and through cross-productivity). In that sense, human capital accumulation is not necessarily lowered through worse labor market prospects of parents. Some might even say that if unemployment of parents increases a lot, parents have more time to spend with their children.

(5) Now turn your attention to the long-run consequences of the crisis, and the effects of the educational and human capital responses you described in the previous parts. How do you think will the Greek economy and society be affected by changes in human capital accumulation?

Solution:
Macro: Education and growth, but the empirical evidence for this is not as

strong as one would hope (see class examples). There is a much stronger effect of education quality / human capital quality on macro growth. **If** the crisis really increased educational attainment, might be beneficial to growth in the long run, through the quality and innovativeness of the Greek labor force. But if school quality falls for the individual student, either because public investment decreases due to budget cuts or because of overcrowding, increase in aggregate years of schooling might not have a strong impact on growth. Again, see the distinction of quality versus quantity measures of schooling examined by Woessmann.

Also, if human capital investment decreases because of a lower anticipated return, other investments might become more sought after.

One could also link changes in educational attainment to the effects of education on crime and health. If education is increased through the crisis, improved crime and health outcomes might boost the recovery by lowering social costs. But the question remains whether these effects are causal? The papers by Lochner and Moretti, and Lleras-Muney, suggest they are. Also, it is not clear whether the effects these authors have identified will persist if there are society-wide changes in educational attainment. The typical analyses are partial-equilibrium.