**Fall 2016 Mark Kuperberg**

**LLS: Education in America**

**Week 7: Education and Economic Growth**

**Readings:**

Hanushek and Woessmann (henceforth H/W), “How Much Do Educational Outcomes Matter in OECD Countries”, 2010 (Read up to p. 30)

“Does Education Matter for Economic Growth” (Optional and Unreadable)

**Discussion Questions:**

1) The last discussion question in Week 1 was “Is it possible to agree with both Coleman and Goldin/Katz? In a deep sense, this is the puzzle that the entire course will try to solve.”

When I wrote that, it was more of a hope than a plan because I really had no idea how to resolve the puzzle. So, briefly, what are the contradictions:

a) There is a disconnect between what people think schools can accomplish and what Coleman and subsequent research shows they have accomplished.

b) There is a disconnect between the fact that education definitely improves individual earnings and Coleman’s view that schools accomplish so little.

c) There is a disconnect between the analysis at the macro level (as in Goldin/Katz and other studies) that countries which grow faster and have higher GDP’s also have high levels of education and the analysis at the micro level that schools are ineffective institutions.

3) The resolution (or at least part of the resolution) may be to distinguish two aspects of how schools affect human capital: educational attainment vs. educational achievement. What is the difference between these concepts?

4) **Disclaimer:** This week’s reading is yet another Hanushek article (co-authored). This is not a course on Hanushek’s Collected Works nor is it a propaganda machine for the Hanushek world view. The article this week makes a very clear distinction between attainment and achievement, and this is central in my view, to a resolution of the various disconnects mentioned above. So, to illustrate that this is not just Hanushek, I have placed as an optional reading a super complex econometric paper that reaches the same conclusion (which I myself can barely understand).

5) When Goldin/Katz talk about education, are they talking about attainment or achievement?

6) Discussion question 6) and 7) of Week 4 were:

Week 4 6): On p. 871 Hanushek writes, “A variety of researchers documents that the earnings advantages to higher achievement on standardized tests are quite substantial...[a] one standard deviation increase in mathematics performance at the end of high schools translates into 12 percent higher annual earnings”. This may be news to some people.

Week 4 7): In equation (2) Hanushek does something that I think is very problematic. He takes the insight above and calls “cognitive skills” a measure of school quality and the earnings generated by cognitive skills (the coefficient γ) as the return to school quality. Why might this be problematic?”

Is Hanushek’s discussion in the above questions about attainment or achievement?

7) The reason I said that Hanushek’s definition of school quality was problematic can be seen in equation (2) p. 7 of this week’s reading. What are the determinates of human capital that are found on the right hand side of the equation? How many of these factors are related to what goes on in schools? Would Coleman disagree with this equation?

8) A normal person would measure school quality by how much schooling inputs affect human capital (the coefficient β2). Having now become experts at Hanushekian analysis, what do you think Hanushek believes to be the importance of β2 in equation (2)?

9) In Box 1, H/W distinguish between two theories of economic growth. You can ignore all this. Just to note: the growth theory in G/K is the first type: the neoclassical (Solow) growth theory.

10) **The results in Table 2 are the whole ball of wax with respect to this article.** The way to read the Table is that each column is a different regression equation with different variables included and different coefficients for those variables.

11) Column 1 is a regression where the dependent variable is economic growth (the average growth rate for each country over 1960-2000).

a) The independent variables are:

i) Initial years of schooling (which is the average years of schooling in each country in 1960),

ii) Initial GDP per capita (which is the GDP per capita in each country in 1960). As H/W state this is to control for the fact that poorer countries in the OECD (this is not true everywhere) tended to grow faster than richer countries.

b) The coefficient value (ie. how the independent variable affects economic growth) is listed next to the variable, and the number in parenthesis under the coefficient tells you if the variable is statistically significant: if the number is greater than 2, then the variable is statistically significant at the 5% level (there is only a 5% chance that one would have gotten that value of the coefficient if the true value had been zero).

c) So, in Column (1) does educational attainment (understood as "Initial years of schooling" have a statistically significant effect on economic growth **[Just think, you actually know how to answer this question]**.

12) Column (2) adds Cognitive skills (which is H/W's measure of educational achievement and their definition of school quality) to the regression in column (1):

a) Do Cognitive skills have a statistically significant effect on economic growth?

b) Does Initial years of schooling still have a statistically significant effect on economic growth? Why do you think this is (think about our discussion of Coleman)?

c) Look at the R2(adj.) at the bottom of the columns. Does adding Cognitive skills to the regression help explain more of the variation in economic growth rates across OECD countries?

13) If you can answer the above questions about Table 2, you understand the heart of the paper. Figure 2 plots Table 2 visually, but it does so in a very subtle way[[1]](#footnote-1) that we will discuss in class (this will be the most advanced statistical point I will make in the course).

14) Compare Figure 2 to Figure 7 which plots Cognitive skills (ie. test scores) against Expenditure per Pupil. How tight is the relationship in Figure 2 vs. the relationship in Figure 7? Hanushek may be dogmatic, but his dogma is not without truth.

15) The coefficient on test scores in Table 2 Column 2 is 1.864. Taken at face value, this says that a 1 standard deviation increase in test scores (which corresponds to 100 points on the tests) will increase the yearly economic growth rate by 1.864%. This is a CRAZY BIG number that can’t literally be true. To put it in perspective, the average growth rate of the U.S. during this period was 2.5%. This means that if you could increase student scores by 1 standard deviation, economic growth in the U.S would increase to 4.364% (which would be an increase of 75%). This number is SO BIG that there is now a cottage industry applying it to U.S. education and getting all kinds of miraculous results.[[2]](#footnote-2)

16) Let’s try to cut this number down to size:

a) A 1 standard deviation improvement in test scores is a very big change. In a normal distribution, 1 standard deviation around the mean encompasses 66% of the distribution. This means that a 1 standard deviation increase in test scores would take a student who is now at the mean (at the 50th percentile score) and raise their score to a score that was previously only achieved by the top 17%. So any remotely reasonable increase in test scores is significantly smaller than 1 standard deviation.

b) Because there are many omitted variables in Table 2, Col 2 compared to equation (2) p. 7, the included variables (Test Scores, Initial years of schooling, and Initial GDP) are, as a group, getting credit for all of the positive effects of variables that are influencing economic growth that are not in the regression. Individually, they get credit to the extent to which they are positively correlated with these variables. So, for example, if stable families increase test scores and economic growth, then the test score variable is going to get the credit for the stable family effect to the degree that the two variables are correlated.

c) As you will see in Section 5, it takes a long time for improvements in test scores (assuming there really is an effect) to affect economic growth.

17) In Section 3, H/W look at other causes of growth that are important when comparing developing countries, but as they correctly argue, not relevant when comparing developed countries (you cand skim/skip this).

18) In Section 4, H/W look at different levels of schooling and skills. I would judge their analysis combined with the work of other researchers described there as a bit of a mess with respect to the relative importance of different levels of skills and schooling. To see if you got one of the subtleties in this section: would H/W say G/K’s emphasis on increased college education would improve growth in the U.S.? How about in the other OECD countries?

19) In Section 5, H/W calculate the economic impact of improving test scores (like the cottage industry that I referred to above) for 3 different increases in test scores in the 2 different types of growth models. Turns out this requires some amount of work because H/W assume that the test scores rise to their new higher level gradually as the schools improve and they have to calculate how quickly the newly skilled workers enter the labor force and the old deadwood retires.

From my perspective, this is a nice math problem, but it is akin to calculating how many angels one can fit on the head of a pin: a) it assumes there are angels (ie. test scores by themselves have these very big effects), and b) you know how to arrange them on the head of the pin (ie. you know how to improve test scores). Needless to say, the effects are enormous.

20) So, how does any of this resolve some of the contradictions mentioned in Question 1) above?

a) Achievement, attainment and ability are all positively correlated with one another, why?

b) When one calculates the effects of attainment on individual earnings or a nation’s GDP, maybe most of what you are finding is the effect of achievement [Think H/W Table 2].

c) Achievement and ability are positively correlated, but may be more affected by non-school factors than school factors. You have to go to school (attainment) to learn stuff (achievement), but how much you learn may be more dependent on non-school factors [Think Coleman]. When we look at differences in achievement between individuals and across schools, maybe what we are mostly seeing is differences in non-school inputs.

d) The relationship between attainment and achievement may be stronger at different periods of time. Maybe in 19th to mid 20th century America, attainment was more tightly related to achievement than it is now? So maybe G/K were correct about the past but not about what educational attainment can accomplish in the future.

21) All of this brings up the subject for next week: **What is the best way to arrange the angels on the head of the pin?**

1. Technically, Figure 2 plots the part of Economic Growth that is not explained by Initial years of schooling and Initial GDP/per capita against the part of Test Scores that is not explained by Initial years of schooling and Initial GDP/per capita (now, say that 3 times fast). [↑](#footnote-ref-1)
2. See for example, “The Economic and Fiscal Consequences of Improving U.S. Educational Outcomes”, Washington Center for Equitable Growth, January 2015 [↑](#footnote-ref-2)