

# Lecture 21: Compensation Based on Education

## Compensation in Organizations

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## Discussion

From the perspective of a social planner, should people with more education be paid more?

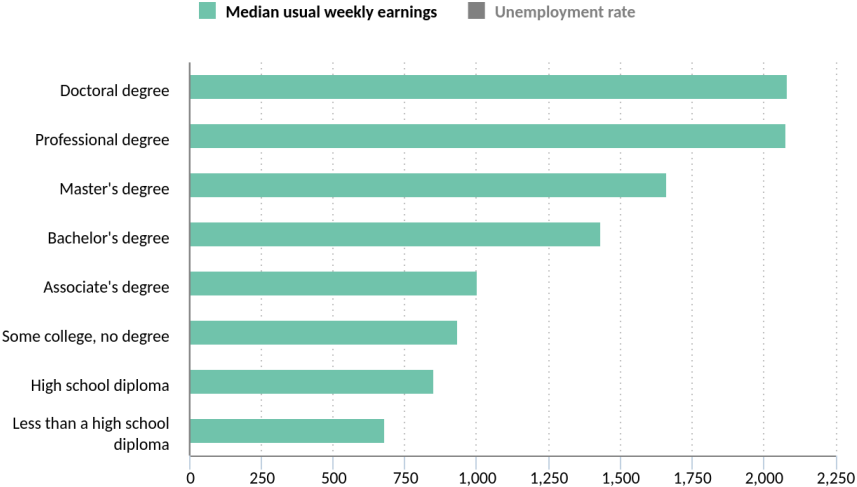
## Discussion

From the perspective of an individual organization, should people with more education be paid more?

Blair and Chung (2022)

# Average Salary by Level of Education in the U.S.

Earnings and unemployment rates by educational attainment, 2022



# Why Are More Educated People Paid More?

- ▶ Selection: People who are more productive tend to get an education
  - ▶ Education is not making them productive.
  - ▶ Rather, it signals that they are already productive.
- ▶ Treatment: Education makes people more productive.

# The Returns to Education

- ▶ Suppose we econometrically decompose a person's income:

$$\underbrace{I}_{\text{income}} = \beta \cdot \underbrace{E}_{\text{education}} + \underbrace{a}_{\text{latent productivity}}$$

- ▶  $\beta$  is the return to education, and it is important for policymakers.
- ▶ Discussion: Why?
- ▶ You cannot typically just regress income on education, because education is correlated with latent productivity.
- ▶ This is exactly the selection effect we talked about on the last slide.
- ▶ There is an entire literature trying to estimate the returns to education ( $\beta$ ).

## But Wait...

- ▶ This class is about compensation within organizations.
- ▶ It is not about setting education policy. So what do we care about?
- ▶ Organizations care about hiring productive people.
- ▶ Whether education made them productive or they were productive prior to being educated is not the main concern.
- ▶ It can be a big concern if an organization pays members to go to school.
- ▶ Then knowing the return to education matters, because the org. is encouraging education directly.



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Signaling Role of Education

How Much Is Signaling vs. Returns to Education?

## Removing the Return to Education

- ▶ It is relatively straightforward to think about how the returns to education works.
- ▶ If I learn to read, I can receive and follow directions.
- ▶ If I learn to prepare a centrifuge, I can work in certain types of labs.
- ▶ But suppose the return to education is 0.
- ▶ Does it still make sense for an organization to pay higher wages to more educated people?
- ▶ Thinking through this question also helps us ask when an organization should ever pay people based on an observable characteristic.

## Model (Job Market Signaling)

- ▶ There is a single worker and two firms
- ▶ Worker is either high productivity ( $t = H$ ) with prob.  $p$  or low productivity ( $t = L$ ) with prob.  $1 - p$ .
- ▶ Profit from hiring low-skill is 0 and high-skill is  $\pi > 0$
- ▶ First, the worker can acquire education  $E = 1$  at cost  $c_t$  where  $c_H < c_L$  (Why?) or not ( $E = 0$ ) at cost 0.
- ▶ After observing education each firm posts a wage Bertrand style.
- ▶ After observing the wage, the worker chooses a firm. Assume the worker flips a coin when indifferent.

## Model: Important Feature

- ▶ Importantly firms do not observe productivity.
- ▶ They do know the probability the person is high or low productivity.
- ▶ This is equivalent to knowing the fraction of the population that is each type.
- ▶ They also see education.
- ▶ We need to understand how beliefs change when a firm sees a high education person.

## Solving the Model

See the Board!

# Solution

## Theorem 1

*The following are equilibrium outcomes under the assumption that  $c_H < \pi < c_L$ :*

- ▶ *Only high productivity workers get an education*
  - ▶ *No one gets an education, and firms believe those with an education have the same probability of being high productivity than those without.*
  - ▶ *Everyone gets an education, and firms believe those without an education are low productivity.*
- 
- ▶ It is clear that education can serve as a signal of productivity.
  - ▶ This is true even when the return to education is 0.

## Beliefs are Self-Confirming

- ▶ If firms believe educated people are productive, education becomes valuable.
- ▶ If firms believe educated people are no different than non-educated, education is worthless.

## Education as a Costly Signal

- ▶ Notice that we needed the assumption that  $c_H < \pi < c_L$
- ▶ The opportunity cost of education for high productivity people must be much less than for low productivity people.
- ▶ Discussion: Is this true?
- ▶ This is necessary for education (or anything) to be a signal.
- ▶ Analogy: advertising
- ▶ It allows productive people to separate themselves, because it is too costly for low productivity people to follow.
- ▶ As we discussed, it is not sufficient (we also need the right beliefs!)



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## Aryal et. al. (2022)

- ▶ The authors call the total effect of education on wage the “private return.”
- ▶ In our language this is the signaling effect plus the returns to education.
  - ▶ Key idea: if something shifts education that employers do not observe, we can uncover the private return!
  - ▶ Discussion: why?
- ▶ They call the returns to education (the direct productivity increase) the “social return.”
  - ▶ Key idea: if something shifts education that employers do observe, we can uncover the social return!
  - ▶ Discussion: why?

## A Natural Experiment

- ▶ Norway extended compulsory schooling from 7 to 9 years between 1960 and 1975.
- ▶ Crucially, it rolled out the program across the country slowly.
- ▶ Jobs are concentrated in the central cities, but workers come from across the country.
- ▶ For example, Oslo implemented the law in 1967 but surrounding areas implemented it as early as 1961 and as late as 1971.
- ▶ If you grew up in a central city, employers likely understood how the law impacted your schooling decisions.
- ▶ If you grew up in one of the many outlying regions, they likely did not.

## A Natural Experiment

- ▶ We can analyze how the reform impacted wages of those who grew up in central regions to get the social return.
- ▶ We can analyze how the reform impacted wages of those who grew up in non-central regions to get the private return.
- ▶ Norway also has mandatory military service and thus administers an IQ test to males.
- ▶ So we can ask whether education could be a signal.

## Should We Expect Signaling?

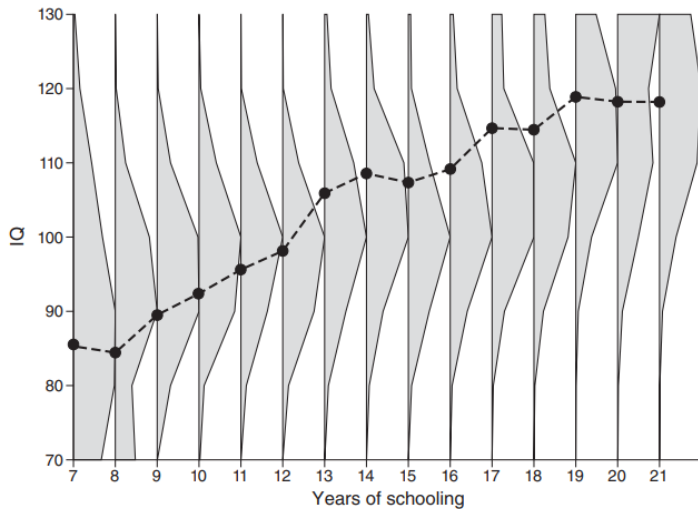


FIGURE 1. CONDITIONAL PROBABILITY DENSITY OF IQ TEST SCORES ON SCHOOLING

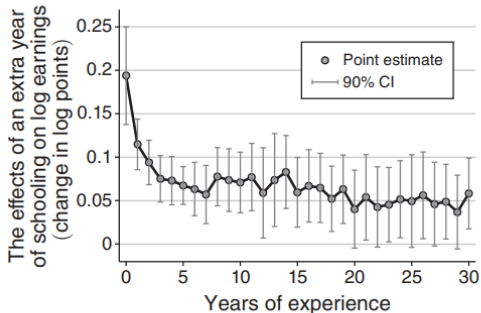
# Did the Law Increase Schooling?

TABLE 1—FIRST-STAGE ESTIMATES ON YEARS OF SCHOOLING

	Full sample (1)	Hidden IV sample (2)	Transparent IV sample (3)
<i>Instrument</i>			
Exposure to compulsory schooling reform	0.237 (0.025)	0.228 (0.034)	0.240 (0.032)
<i>Controls</i>			
Municipality fixed effects	✓	✓	✓
Cohort fixed effects	✓	✓	✓
<i>F</i> -statistic (instrument)	87.7	45.7	55.5
Sample mean years of schooling	12.36	12.27	12.50
Standard deviation years of schooling	2.50	2.46	2.56
Number of observations	14,746,755	8,697,979	6,048,776

# Did The Law Increase Wages?

Panel A. Hidden IV estimates



Panel B. Transparent IV estimates

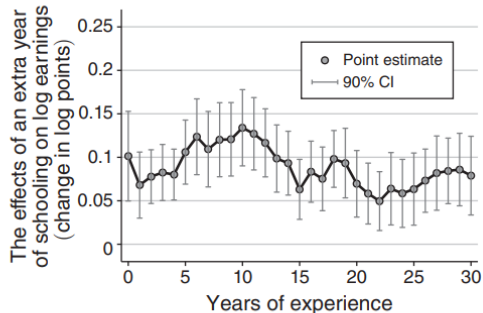


FIGURE 3. HIDDEN AND TRANSPARENT IV ESTIMATES OF THE RETURNS TO SCHOOLING

## Signaling and the Private Returns to Education

- ▶ The initial private return is 19.8 percent.
- ▶ But this value decreases rapidly to 5.5 percent as a worker is employed.
- ▶ Employers put only a 16.4 percent weight on the initial education signal from workers.
- ▶ Confirms an old adage: your degree matters most for your first job, then your first job matters.



## The Returns to Education (Social Return)

- ▶ The social return is estimated to be 5.5 percent.
- ▶ The private return converges to the social return as signaling vanishes!
- ▶ Bottom-line: the authors estimate that of the total wage return to education, 70 percent is a productivity increase from education while 30 percent is signaling.