Introduction

Education is one of the largest sectors in the economy, and thus can be studied from a large amount of angles.

- Early Childhood Education (beyond just "being watched")
- Elementary/Secondary School
- Postsecondary Education

Education can be studied from a lot of angles:

Micro: Applying theories of labor economics and consumer theory to education.

Econometrics: Use data to analyze educational policies.

Macro: Investigate global demand for education-as-a-commodity.

Education System Basics

Returns to Education: There is a large return to education; those with a high school education tend to make far less than those with a bachelor's degree and up. Perceived value of being more education in private or public market.

Labor Market Outcomes: The more educated you are, the more likely to have a job; unemployment rates for high school graduates are higher than unemployment rates for college graduates.

Public Spending: Approximately 5–6% of GDP is spent on education in most OECD countries.

Funding Structure: Public schools are primarily funded through state and local governments — property taxes the largest source of funding for education, but federal government has started to fund more schools in recent years.

Growth of Education over Time: Claudia Goldin's 1993 paper "The Human-Capital Century and American Leadership" shows that the 20th century was really the century of greater and greater access and attainment in education.

Why Do We Get Educated?

Human Capital

What is human capital?

- Labor.
- Complexity or efficiency of work.

How does human capital differ from capital?

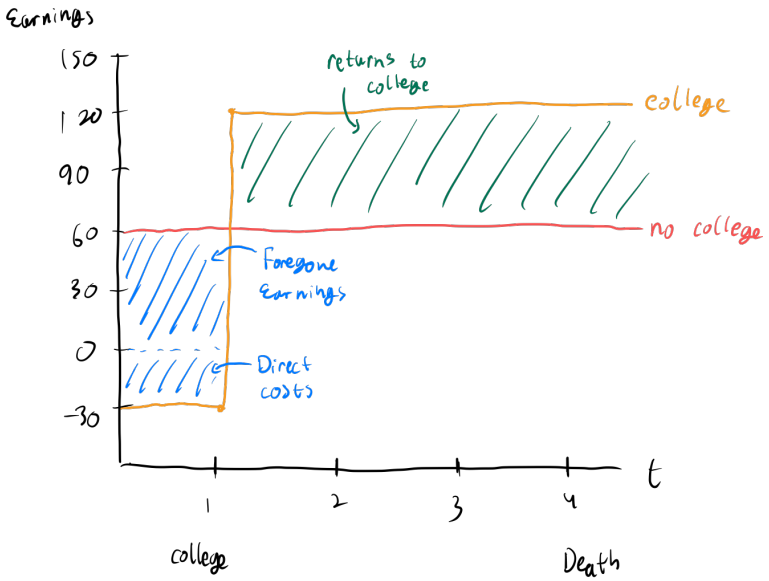
- Less static.
- Differential depreciation — potential for appreciation (people can skill up).
- Higher variance.
- Unionization/collective bargaining.
- Idea generation.
- Potentially greater mobility.
- Returns to human capital come in the form of wages — human capital is owned by the human that holds it.
- Cannot be collateralized.
- Divisibility (or lack thereof).

Education: how much?

Discrete Model: To college or not?

- Direct costs: tuition, room and board.
- Indirect costs: foregone earnings.
- Returns: expected future earnings (requires college degree or not).

We will assume that "college" is period 1, and college grads earn more post-college, and there is a discount rate r.



The discount rate of \$100 in $t > 0$ periods is worth $\frac{100}{(1+r)^t}$ in period 0 (aka today).

We generally think about r in terms of the interest rate — money today is worth more than money in the future due to the ability to invest.

The *present value* of a stream of money is found as follows:

$$\begin{aligned}
\text{PV} &= \frac{100}{(1+r)} + \frac{100}{(1+r)^2} + \cdots + \frac{100}{(1+r)^n} \\
&= \sum_{t=1}^{n} \frac{100}{(1+r)^t} && (1) \\
(1+r)\text{PV} &= 100 + \frac{100}{(1+r)} + \cdots + \frac{100}{(1+r)^{n-1}} \\
&= 100 + \sum_{t=1}^{n-1} \frac{100}{(1+r)^t} && (2) \\
(1+r)\text{PV} - \text{PV} &= 100 + \sum_{t=1}^{n-1} \frac{100}{(1+r)^t} - \sum_{t=1}^{n-1} \frac{100}{(1+r)^t} - \frac{100}{(1+r)^n} && (2)-(1) \\
r\text{PV} &= 100 - \frac{100}{(1+r)^n} \\
\text{PV} &= \frac{100}{r}\left(1 - \frac{100}{(1+r)^n}\right)
\end{aligned}$$

As n becomes larger, then the PV of the asset is larger. For example, if $n = 40$, $Y = 60,000$, and $r = 0.05$, then the PV of this revenue stream is approximately \$1 million.

Bringing this to the model, where F denotes direct tuition cost, Y_0 denotes earnings with no schooling, and Y_S denotes earnings with schooling (where school occurs in period 1).

$$\begin{aligned}
\text{PV}_0 &= \frac{Y_0}{(1+r)} + \frac{Y_0}{(1+r)^2} + \cdots + \frac{Y_0}{(1+r)^n} \\
\text{PV}_S &= -F + \frac{Y_S}{(1+r)^2} + \cdots + \frac{Y_S}{(1+r)^n} \\
\text{NPV}_S &= \text{PV}_S - \text{PV}_0 \\
&= \underbrace{-F - \frac{Y_0}{(1+r)}}_{\text{Cost}} + \underbrace{\sum_{t=2}^{n} \frac{Y_S - Y_0}{(1+r)^t}}_{\text{Benefit}} \\
&= -F - \frac{Y_0}{1+r} + \frac{Y_S - Y_0}{r}\left(1 - \frac{1}{(1+r)}\right)\frac{1}{1+r}
\end{aligned}$$

To find if education is worth it, we calculate if $\text{NPV}_S > 0$.

Continuous Model (or Mincer Model): To take an extra year of education or not?

- S is a discrete, integer choice (denoting a year of education).
- Y_S is salary after schooling for S years.
- There are zero direct costs of school.
- Years in labor force, K, are equivalent regardless of S.

We choose S where marginal benefit is equal to marginal cost.

$$\begin{aligned}
\text{PV}_S &= \text{PV}_{S+1} \\
\sum_{t=1}^{K} \frac{Y_S}{(1+r)^t} &= \sum_{t=2}^{K+1} \frac{Y_{S+1}}{(1+r)^t} \\
\frac{Y_S}{r}\left(1 - \frac{1}{(1+r)^K}\right) &= \frac{Y_{S+1}}{r}\left(1 - \frac{1}{(1+r)^K}\right)\frac{1}{1+r} \\
Y_S &= Y_{S+1}\frac{1}{1+r} \\
1 + r &= \frac{Y_{S+1}}{Y_S}
\end{aligned}$$

We choose school until the marginal rate of return is equal to the discount rate.