# Unit 09.
# Human Capital Investment



1

## Why Doesn't Everyone Earn the Same Amount of Money?

- Wage and income vary primarily due to
  - Differences in worker skills, talents, and experiences
    - Highly skilled jobs pay more because the employees have to go through a lot (education, training, etc.) in order to perform these jobs. Only high pay can entice them to go through that.
  - Differences in the amenities and characteristics of the alternative jobs
    - Jobs that offer nice amenities (nice location, good environment, etc.) pay less. Jobs that have more stress and risk pay more, other things equal.

2

## Earnings for Selected Occupations

- The best source of occupational information is the Occupational Outlook handbook, published by the U.S. Bureau of Labor Statistics and updated every other year. The website is at http://www.bls.gov/oco/

| Occupation | 2010 Median Pay | Entry Level Education |
|---|---|---|
| Financial analysts | $74,350 | Bachelor's degree |
| K-6 teachers | $51,380 | Bachelor's degree |
| Real estate agents | $42,680 | High school or equivalent |
| Cashiers | $18,500 | Less than high school |

3

## How to Earn More Income?

- There may be many ways of earning more income. But the most sure way is to have an post-graduate education.
- Education is just one form of what we call "human capital investment".
- Investment is the act of investing; laying out money or capital in something with the expectation of profit. There are two forms of investment
  - Financial investment - Generate interest earnings in the future
  - Human capital investment - Leads to higher productivity in the labor market and therefore higher future earning capacity

4

## Forms of Human Capital Investment

- Formal schooling
  - Pursue a higher degree, Take a two-week class in word processing or painting
- On-the-job training and experiences
  - Usually people receive lower salary during job training. This lower salary is a form of investment
- Investment in health
  - Exercising, physician visits, dental checkups, and good nutrition -> fewer days of sickness per year, longer life expectancy, and higher productivity on the job and household activities.
- Migration from one city, state, or country to another
  - Opportunity cost is the money invested – people give up opportunities back where they used to live.

5

## How to Compare Financial Investment with Human Capital Investment?

- From a financial perspective only
  - The kind of investment that gives you a higher future return is better.
- Note benefits other than financial
  - Knowledge has its own rewards other than just financial return.
  - It makes you a more informed citizen, a more informed consumer, etc.
- However in this chapter we will only deal with the financial aspect of this comparison.

6

## Cost-Benefit Analysis of Human Capital Investment

- What is the rule of decision?
  - A cost-benefit approach
    - If the benefit of human capital investment > the cost of human capital investment then human capital investment is a wise investment decision, otherwise it is not.




## An Example

- John is 18. He is thinking about going to college for 4 years in order to get a BS degree, starting from next year. He expects to retire at the age of 65.
  - Without a BS degree, annual earning is $21,000 next year with $1,000 increase per year
  - With a BS degree, annual earning is 10,000 more every year, compared to without a BS degree.
  - University tuition and other costs are $8,000 per year
  - Financial investment interest rate = 6%



## What's The Cost of Human Capital Investment in This Example?

- The cost would include the following items:
  - Tuition
  - Opportunity cost = foregone income
- Because these costs occur in different years, they need to be converted into either Present Value or Future Value. In this case, a Present Value approach is convenient (one can also use FV in this case, just pick a holding period).



## Cost Each Year

- Cost=tuition + opportunity cost
  - Year 1 cost = 8000+21000=29000
  - Year 2 cost = 8000+22000=30000
  - Year 3 cost = 8000+23000=31000
  - Year 4 cost = 8000+24000=32000
- Because these costs occur in different years, one needs to convert them to Present Values (PV) before adding them up to total cost.



## PV of Cost Each Year

- PV of Year 1 cost = 29000*(1/(1+r)^1)
  = 29000*(1/(1+6%)^1)=27358.49
- PV of Year 2 cost = 30000*(1/(1+r)^2)
  = 30000*(1/(1+6%)^2)=26699.89
- PV of Year 3 cost = 31000*(1/(1+r)^3)
  = 31000*(1/(1+6%)^3)=26028.20
- PV of Year 4 cost = 32000*(1/(1+r)^4)
  = 32000*(1/(1+6%)^4)=25347.00



## Total Cost

- Total cost is the sum of all PVs for all years when cost incur
- Total Cost = PV of year 1 cost + PV of year 2 cost +PV of year 3 cost +PV of year 4 cost
  = 27358.49 + 26699.89 + 26028.20 +25347.00
  = 105,433.58

## Benefits of Human Capital Investment

- Benefits are the difference between the future streams of annual earnings John expects with and without his BS degree
  - Here another assumption needs to be made – retirement age. We need to know how many years one is going to benefit from getting this degree. Often we assume the retirement age to be 65.



## PV of the Benefits of Human Capital Investment

- We made an assumption that the difference is $10,000 per year from Year 5 (when John is 23 and starts working with his degree [23-18=5]) to Year 47 (when John is 65 and retires [65-18=47]). The first year of earning will be discounted for 5 years.
  - Here the tricky part is to get the years right. Note every thing is converted to current year, when John is 18.
  - He will go to school next year when he is 19.
  - He will stay in school for four years, when he is 19, 20, 21, and 22.
  - When he starts working with a degree he is 23.
  - He will get this benefit of higher income from age 23 until he retires at age 65.
  - So the first year of benefit is 5 years from now (age 23 – age 18).
  - The last year of benefit is 47 years from now (age 65 – age 18).



## PV of the Benefits of Human Capital Investment

- So the task is to convert all these future benefits into PVs, and then add them up.
- You probably can see now that I assume the benefit per year is the same for a reason – if the benefit is not the same one has to convert them separately for each year. Given that they are the same, we can apply PVFS to simplify things.



- The PV of total benefit
  - = 10,000 * (1/(1+r)^5 + … + 1/(1+r)^47)
  - =10,000*[PVFS (r=6%, n=47)-PVFS(r= 6%, n=4)]
  - =10,000*(15.589028-3.645106)
  - =10,000*12.123922
  - =121,239
- Note because the PVFs start at 5 (instead of 1), one cannot directly apply PVFS formulas.
- To make it doable without a spreadsheet, one can add ((1/(1+r)^1 +1/(1+r)^2 +1/(1+r)^3 +1/(1+r)^4) to make it PFVS (r, n=47). Then you can subtract off that same term, ((1/(1+r)^1 +1/(1+r)^2 +1/(1+r)^3 +1/(1+r)^4), which is equivalent to PVFS (r, n=4).



## So What's The Decision?

- PV of Cost: $ 105,433
- PV of Benefit: $ 121,239
- Benefit > Cost
- It's worthwhile for John to go to school next year to get a BS degree.



## Rate of Return on Education

- The previous example shows that basically, an investment in present value of $ 105,433, when invested in a BS degree, will generate $10,000 more income after graduation until retirement. One can ask the question: If this amount were invested in financial investments, what kind of interest rate is needed to generate such an income stream?
- This interest rate is called the "rate of return on education".

## Rate of Return on Education

- If you invest $ 105,433, what interest rate do you need in order to generate $10,000 per year from age 23 to age 65?
  - Setup: 10,000 * (1/(1+r)^5+ … + 1/(1+r)^47 ) = 105,433
  - This can only be solved using numerical methods. In this case, rate of return r = 7.1%
  - Another way of comparing investments
    - 7.1% (return on human capital investment >6% (return on financial investment)
    - Thus human capital investment is better financially



## General Characteristics of Rate of Return on Education

- Of course the previous example is a very simplified situation. But we can learn some general things about the rate of return on education.
  - Rate of return declines with each additional year of schooling
    - Each additional year of schooling increases the opportunity cost of any succeeding years of schooling -> Cost increased
    - Each additional year of schooling reduces the remaining years during which an individual works, shortening the expected stream of benefits of added schooling -> Benefit reduced
    - Principle of diminishing marginal productivity -> Benefit reduced

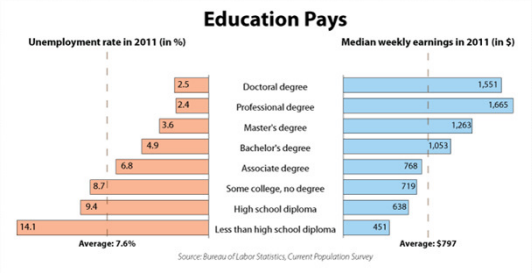


## General Characteristics of Rate of Return on Education

- Rate of return declines the older you are when you get additional schooling
  - The older you are, the less years you gain benefits from additional schooling -> Benefit reduced
- Rate of return declines the longer it takes you to finish school.
  - Tuition costs get higher, the opportunity cost gets higher (more years for you to work less than full capacity) -> Cost increased
  - The years you can reap the benefits decreases – Benefit reduced



## Empirical Data




http://www.bls.gov/emp/ep_chart_001.htm