

# Homework 4

ECON 380  
UNC Chapel Hill

Name: \_\_\_\_\_

ONYEN: \_\_\_\_\_

This homework is due on **October 30** by **2:25PM**. You must turn in your work on a printed copy of this document in order for it to be graded. Your assignment must be stapled and in the correct order. Non-stapled assignments will automatically receive a 10 point deduction.

## Present Value

1. Suppose Mallory lives for two periods,  $t = 1, 2$ . In period 1, she could either directly enter the labor force and earn \$30,000, or she could enroll in college where her costs would be \$45,000. In period 2, Mallory will either earn \$30,000 if she chose to enter the workforce in period 1, or \$120,000 if she went to college in the first period. All transactions occur at the beginning of each period.
  - (a) What is the net present value of Mallory's earnings if she decides to directly enter the labor force in period 1 and her discount rate is 5%? **[2 pts]**
  - (b) What is the net present value of Mallory's earnings if she decides to go to college in period 1 and her discount rate is 5%? **[2 pts]**
  - (c) At a discount rate of 5%, what path (college vs. non-college) maximizes Mallory's present value of lifetime earnings? **[2 pts]**

- (d) At a discount rate of 25%, what path (college vs. non-college) maximizes Mallory's present value of lifetime earnings? **[4 pts]**
- (e) At what discount rate would Mallory be indifferent between directly entering the labor force and going to college? Call this rate  $r_{id}$ . **[4 pts]**
- (f) How does Mallory's optimal decision change depending on the relationship between her discount rate  $r$  and  $r_{id}$ ? That is, what is Mallory's choice if  $r < r_{id}$ ? What if  $r > r_{id}$ ? **[4 pts]**
2. Kalani can either start to work the day she turns age 18 or go to college for 4 years before entering the labor force. Either way, she will retire the day she reaches age 65. If she starts work at 18, she will earn \$35,000 each year. If she goes to college, she will pay \$12,000 per year in tuition, but will earn \$55,000 per year once she starts to work. All payments (including tuition) are paid at the end of the year. Finally, Stella has a discount rate of 7%. Use the "NPV Template" Excel File on Sakai to answer the following questions.
- (a) What is the net present value of Kalani's earnings if she directly enters the labor force? **[2 pts]**
- (b) What is the net present value of Kalani's earnings if she goes to college before entering the labor force? **[2 pts]**

(c) What is Kalani's optimal choice? [2 pts]

(d) State one discount rate that would change Kalani's optimal choice. [2 pts]

### The Returns to Schooling

3. Consider the wage-schooling locus described in Table 1.

Table 1: Cyril and Pam's Wage-Schooling Locus

Years of Schooling	Earnings	MRR
11	\$20,000	---
12	\$25,000	
13	\$29,000	
14	\$32,500	
15	\$34,500	
16	\$36,000	
17	\$37,000	

(a) Fill in the marginal rate of return to schooling for years 12 - 17. [3 pts]

(b) Suppose Cyril follows this wage-schooling locus. His discount rate is  $r_C = 9\%$ . What is his optimal level of schooling? [2 pts]

(c) Suppose Pam follows this wage-schooling locus. Her discount rate is  $r_P = 15\%$ . What is her optimal level of schooling? [2 pts]

Suppose Archer has the same discount rate as Cyril,  $r_A = 9\%$ . However, Archer has a higher ability level than Cyril,  $A^A > A^C$  and his wage-schooling locus is shown in Table 2.

Table 2: Archer's Wage-Schooling Locus

Years of Schooling	Earnings	MRR
11	\$22,000	---
12	\$32,000	
13	\$40,000	
14	\$47,000	
15	\$53,000	
16	\$58,000	
17	\$62,000	

- (d) Fill in Archer's marginal rate of return to schooling for years 12 - 17. **[3 pts]**
- (e) What is Archer's optimal schooling level? **[2 pts]**
- (f) Sketch the wage-schooling loci for Cyril and Archer on the same plot (years of school on the x-axis, earnings on the y-axis). Label the point on each respective locus that a researcher would observe. **[4 pts]**
- (g) Suppose we don't account for the differing wage-schooling loci of these individuals and estimate the marginal rate of return by comparing Cyril's wage/schooling outcome to Archer's wage/schooling outcome. What is the estimated MRR? **[4 pts]**
- (h) Compare your naive estimate of the marginal rate of return from part (f) to the true marginal rate of return to the 15<sup>th</sup> year of education for Cyril and Archer. Is our estimate higher than the true marginal rate of return, or lower than the true marginal rate of return for the 15<sup>th</sup> year of education for these individuals? **[4 pts]**
4. Read Heckman (2006). In 4-5 sentences, summarize the article. Type your response and attach it to the back of this packet. **[4 pts]**

## Signaling Model

5. Suppose there are two types of persons: high and low-ability. A particular diploma costs a high-ability person \$15,000 and costs a low-ability person \$25,000. Firms wish to use education as a screening device where they intend to pay \$40,000 to workers without a diploma and \$ $K$  to those with a diploma. In what range must  $K$  be to make this an effective screening device? [4 pts]

6. Suppose the market is populated by two types of workers. NeNes have an inherently low productivity level and make up 70% of the population. A NeNe produces \$1,000,000 for a firm over their lifetime. Cynthias, on the other hand, have an inherently high productivity level and make up 30% of the population and produce \$1,200,000 for a firm over their lifetime. Employers cannot observe a worker's type at the time of hiring. [4 pts]

Firms follow the rule of thumb that workers who obtain at least  $\bar{y}$  years of college are assumed to be Cynthias and are paid a lifetime salary of \$1,200,000. Workers with less than  $\bar{y}$  years of education are assumed to be NeNes and are paid \$1,000,000. Cynthias have a cost of \$30,000 for each year of college, while NeNes have a per year cost of \$50,000. What threshold for  $\bar{y}$  will create an equilibrium such that only Cynthias obtain the threshold education level?

## Human Capital and Development

Directions: Type your answers to the following questions and attach them to the back of this packet.

7. Read Borjas 6.6 and the introduction to Duflo (2001). In 4-6 sentences, briefly summarize (i) the policy experiment analyzed in the paper and (ii) the results regarding how the policy affected schooling and labor market outcomes. What is estimated range of the rate of return to schooling? **[4 pts]**
8. Read the introduction to Jensen (2010) and answer the following questions.
- (a) Jensen argues that the perceived rate of return to education is likely different than the actual rate of return to education, especially in developing countries. In 3-4 sentences, describe two of the factors he provides that might drive this difference and explain which rate of return (perceived versus actual) is likely smaller in low-income nations. **[2 pts]**
- (b) In 4-6 sentences, briefly describe (i) the intervention analyzed in the paper and (ii) the results of the intervention. Is the estimated effect of the intervention the same for students across income groups? **[2 pts]**

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### FOR GRADING:

Question:	1	2	3	4	5	6	7	8	Total
Points:	18	8	24	4	4	4	4	4	70
Score:									