

Assignment #1 Answers

Question 1

Debbie is about to choose a career path. She has narrowed her options to two alternatives. She can either become a marine biologist or a concert pianist. Debbie lives two periods. In the first, she gets an education. In the second, she works in the labor market. If Debbie becomes a marine biologist, she will spend \$15,000 on education in the first period and earn \$472,000 in the second period. If she becomes a concert pianist, she will spend \$40,000 on education in the first period and then earn \$500,000 in the second period.

If you assume that all costs and wages are paid at the BEGINNING of the period:

(a) Suppose Debbie can lend and borrow money at a 5 percent annual rate. Which career will she pursue? What if she can lend and borrow money at a 15 percent rate of interest? Will she choose a different option? Why?

Debbie will compare the present value of income for each career choice and choose the career with the largest present value. If the discount rate is 5 percent,

$$PV_{Biologist} = -\$15,000 + \$472,000/(1.05) = \$434,523.81$$

and

$$PV_{Pianist} = -\$40,000 + \$500,000/(1.05) = \$436,190.48.$$

Therefore, she will become a pianist. If the rate of interest is 15 percent, however, the present value calculations become

$$PV_{Biologist} = -\$15,000 + \$472,000/(1.15) = \$395,434.78$$

and

$$PV_{Pianist} = -\$40,000 + \$500,000/(1.15) = \$394,782.61.$$

In this case, Debbie becomes a biologist. As the interest rate increases, the worker discounts future earnings more, lowering the returns from investing in education.

(b) Suppose musical conservatories raise their tuition so that it now costs Debbie \$60,000 to become a concert pianist. What career will Debbie pursue if the discount rate is 5 percent?

Debbie will compare the present value of being a biologist from part (a) with the present value of becoming a pianist. The relevant present values are:

$$PV_{Biologist} = -\$15,000 + \$472,000/(1.05) = \$434,523.81$$

and

$$PV_{Pianist} = -\$60,000 + \$500,000/(1.05) = \$416,190.48.$$

Debbie will, therefore, become a biologist.

If you assume that all costs and wages are paid at the END of the period:

(a) Suppose Debbie can lend and borrow money at a 5 percent annual rate. Which career will she pursue? What if she can lend and borrow money at a 15 percent rate of interest? Will she choose a different option? Why?

Debbie will compare the present value of income for each career choice and choose the career with the largest present value. If the discount rate is 5 percent,

$$PV_{Biologist} = -\$15,000/(1.05) + \$472,000/(1.05)^2 = \$413,832.20$$

and

$$PV_{Pianist} = -\$40,000/(1.05) + \$500,000/(1.05)^2 = \$415,419.50.$$

Therefore, she will become a pianist. If the rate of interest is 15 percent, however, the present value calculations become

$$PV_{Biologist} = -\$15,000/(1.15) + \$472,000/(1.15)^2 = \$343,856.33$$

and

$$PV_{Pianist} = -\$40,000/(1.15) + \$500,000/(1.15)^2 = \$343,289.22.$$

In this case, Debbie becomes a biologist. As the interest rate increases, the worker discounts future earnings more, lowering the returns from investing in education.

(b) Suppose musical conservatories raise their tuition so that it now costs Debbie \$60,000 to become a concert pianist. What career will Debbie pursue if the discount rate is 5 percent?

Debbie will compare the present value of being a biologist from part (a) with the present value of becoming a pianist. The relevant present values are:

$$PV_{Biologist} = -\$15,000/(1.05) + \$472,000/(1.05)^2 = \$413,832.20$$

and

$$PV_{Pianist} = -\$60,000/(1.05) + \$500,000/(1.05)^2 = \$396,371.88.$$

Debbie will, therefore, become a biologist.

Question 2

Suppose Carl's wage-schooling locus is given by

| <u>Years of Schooling</u> | <u>Earnings</u> |
|---------------------------|-----------------|
| 9 | \$18,500 |
| 10 | \$20,350 |
| 11 | \$22,000 |
| 12 | \$23,100 |
| 13 | \$23,900 |

14

\$24,000

Derive the marginal rate of return schedule. When will Carl quit school if his discount rate is 4 percent? What if the discount rate is 12 percent?

The marginal rate of return is given by the percentage increase in earnings if the worker goes to school one additional year.

| <u>Schooling</u> | <u>Earnings</u> | <u>MRR</u> |
|------------------|-----------------|------------|
| 9 | \$18,500 | |
| 10 | \$20,350 | 10.0 |
| 11 | \$22,000 | 8.1 |
| 12 | \$23,100 | 5.0 |
| 13 | \$23,900 | 3.5 |
| 14 | \$24,000 | 0.4 |

Carl will quit school when the marginal rate of return to schooling falls below his discount rate. If his discount rate is 4 percent, therefore, he will quit after 12 years of schooling; if his discount rate is 12 percent, he will quit after 9 years of schooling.

Question 3

We went through the answer to this in class.