

Chapter 9. Quantitative

1. Suppose that the marginal cost of an additional unit of human capital is given by $MC = 400$. The marginal benefit is given by $MB = 800 - 25HC$, where HC is the number of units of human capital.
 - (a) Graph MB and MC as a function of HC .
 - (b) Calculate the optimal level of human capital investment, HC^* .
 - (c) The growing importance of computer skills in today's economy leads firms to place a greater premium on human capital investments. As a result, the marginal benefit of an additional unit of human capital increases to $MB' = 800 - 20HC$. Answer parts (a) and (b) given this change in the value of human capital investment.
2. Consider an individual who lives for two periods. In the first period, the individual will either work or go to school (but not both). In the second period, the individual will work regardless of what was done in the first period. If the individual foregoes schooling and decides to work, she will earn \$200 in period 1 and \$250 in period 2. If she decides to get an education in the first period, her wage in period 2 will be \$575. The direct cost of schooling in period 1 is \$100.
 - (a) If the individual's discount rate is 10%, will she work or go to school in the first period if her utility is a function of income only?
 - (b) Calculate the internal rate of return.
3. Billy and Bob are both 50 years old and work at the same firm. Billy is a more able individual and presently earns \$90,000/year; Bob earns \$50,000/year. They have the opportunity to enroll in a job-training course for a one-time cost of \$10,000. The raise to which they are entitled depends on how much they learn in the course. Again, since Billy is more able, he expects to earn an additional \$2,000/year, while Bob expects to earn only an additional \$1,000/year. Both workers have a discount rate of 5%.
 - (a) If both workers expect to work until age 60 (i.e., ten more years), will either opt to take the course?
 - (b) What is the minimum number of years each worker needs to work before retiring if the course is to be a wise investment?
4. Suppose there are two jobs in the economy: bankers and farmers. The job of banker requires a college diploma; farming does not. The wage of bankers (conditional on having a college diploma) is given by $\omega_b = a_b$, where a_b is one's productivity in the banking industry. The wage of farmers is given by $\omega_f = a_f$, where a_f is one's productivity in the farming industry.

- (a) If the average productivity (a_b) of those employed in the banking industry is 25, what is the average wage of bankers? If the average productivity (a_f) of those in the farming industry is 5, what is the average wage of farmers?
- (b) What is the estimated return to a college diploma?
- (c) If all bankers had instead decided to forego college and become farmers, their average productivity in farming (a'_f) would be 3. If all farmers had instead decided to go to college and become bankers, their average productivity in banking (a'_b) would be 20. What is the actual return to a college diploma for those who chose to become bankers? What would the actual return to education be for those who chose to become farmers?
5. Consider the signaling model explanation of wage determination. Assume that a low ability white individual is equally productive as a low ability minority (both have a productivity of 5) and a high ability white individual is equally productive as a high ability minority (both have a productivity of 10). Half of all whites and half of all minorities are high ability. Firms assume that white individuals with more than e years of schooling must be high ability workers. However, because minority households have less wealth on average than white households, firms do not assume that minority workers with less than e^* years of schooling are low ability (as it may instead simply reflect the greater cost of schooling for those from families with fewer resources). As a result, firms pay different wages to white workers based on their schooling relative to e , but treat all minorities the same regardless of their schooling.
- (a) What wages will firms pay to high and low ability white workers? How many years of schooling will high and low ability white workers obtain?
- (b) What wages will firms pay to high and low ability minority workers? How many years of schooling will high and low ability minority workers obtain?