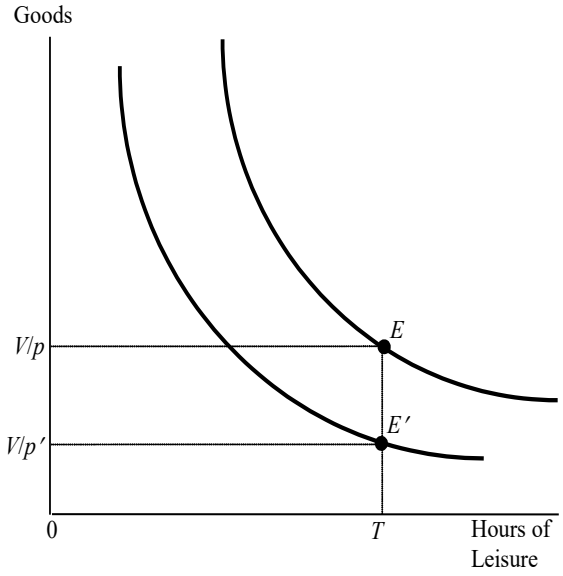
Answers
Chapter 2 Practice

1. **What is the effect of an increase in the price of market goods on a worker's reservation wage, probability of entering the labor force, and hours of work?**

Suppose the price of market goods increases from p to p' and the person's non-labor income is V. If she chooses not to work, she can purchase V/p' units of consumption after the price change, whereas she could have consumed V/p units of consumption prior to the price increase. Thus, her endowment point has moved from E to E' in Figure A (on the next page). Under normal conditions, including that leisure is a normal good, the indifference curve is steeper as we move up a vertical line, indicating that the slope of the indifference curve is steeper at E than at E'. Thus, an increase in the price of goods lowers the reservation wage and makes the person more likely to work.

Figure A



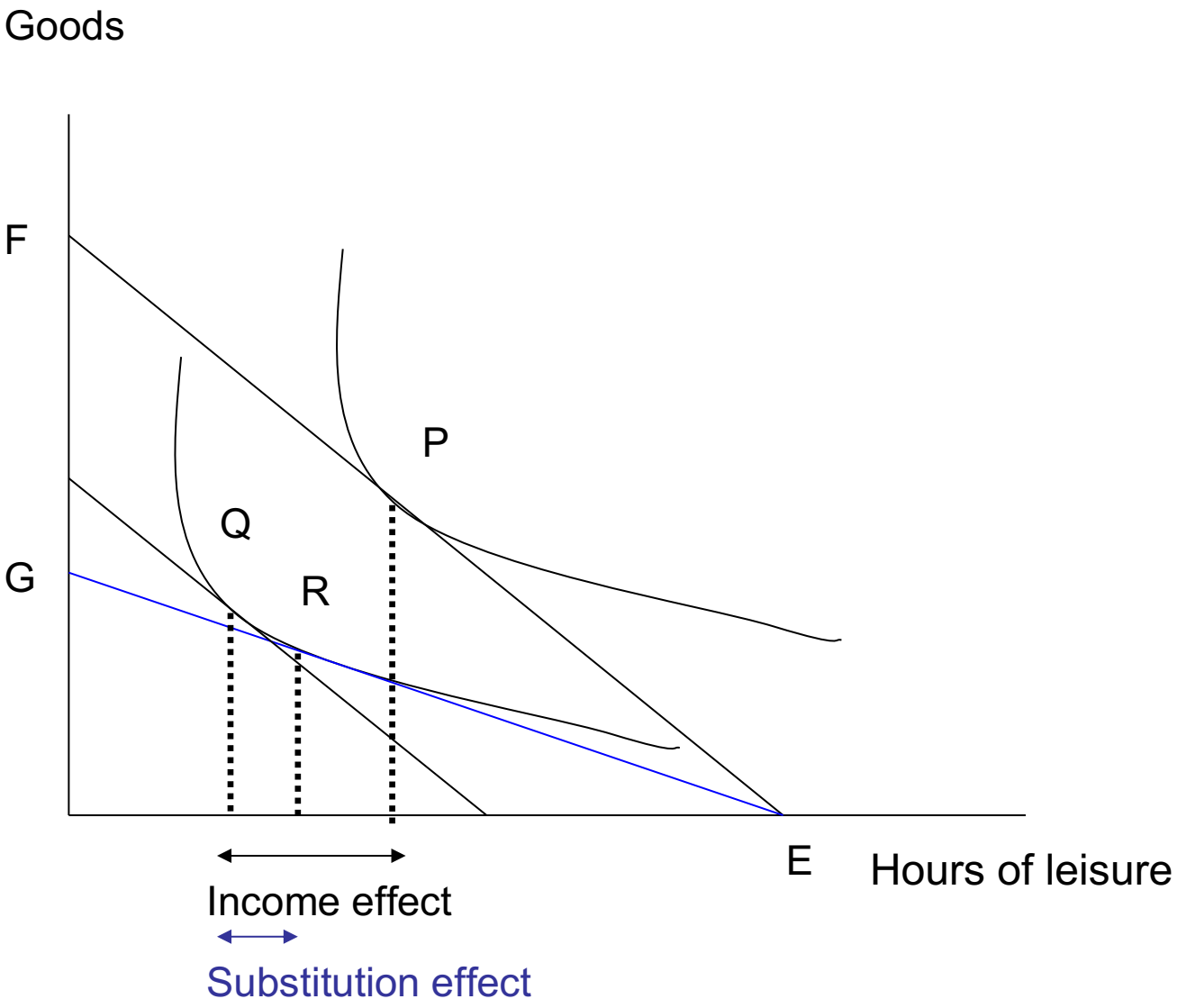
To simplify the illustration of the effect on hours of work, assume for simplicity that $V = 0$. The increase in the price of goods shifts the budget line from FE to GE, moving the worker from P to point R.

This shift induces both an income effect and a substitution effect.

The price increase also reduces the worker's wealth, lowering the demand for leisure and leading to more hours of work (the income effect). This income effect is illustrated by the move from P to Q.

The price increase lowers the person's real wage rate, increasing the demand for leisure and leading to fewer hours of work (the substitution effect). This substitution effect is illustrated by the move from point Q to point R.

As drawn the income effect dominates the substitution effect and the price increase lowers the demand for leisure and increases hours of work. It is, of course, possible for the substitution effect to dominate the income effect (not pictured), so that hours of work decreases. Thus, without further restrictions on preferences, an increase in the price of market goods has an ambiguous effect on hours worked.

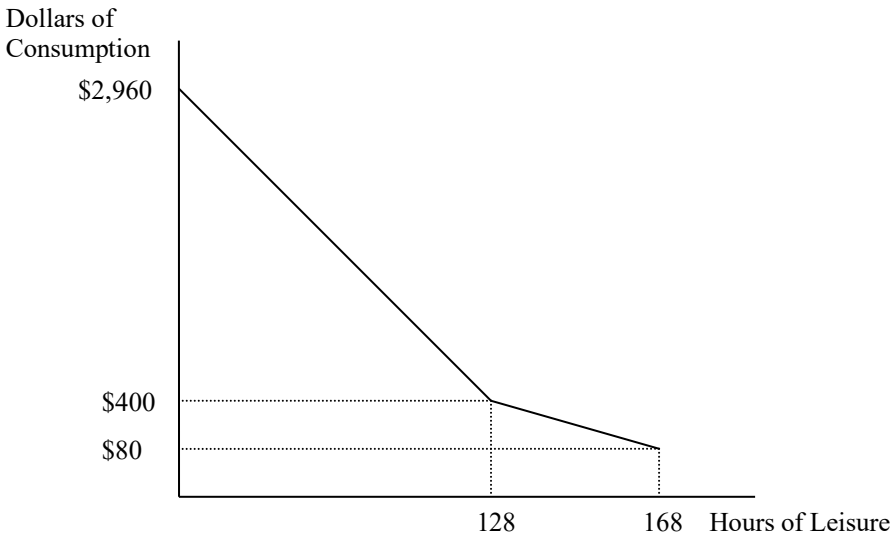


2. **Tom earns $15 per hour for up to 40 hours of work each week. He is paid $30 per hour for every hour in excess of 40. Tom faces a 20 percent tax rate and pays $4 per hour in child care expenses for each hour he works. Tom receives $80 in child support payments each week. There are 168 hours in the week. Graph Tom's weekly budget line.**

- If Tom does not work, he leisures for 168 hours and consumes $80.
- For all hours Tom works up to his first 40, his after-tax and after-child care wage equals (80 percent of $15) – $4 = $8 per hour. Thus, if he works for 40 hours, he will be able to leisure for 128 hours and consume $80 + $8(40) = $400.

- For all hours Tom works over 40, his after-tax and after-child care wage equals (80 percent of \$30) – \$4 = \$20. Thus, if he works for 168 hours (128 hours at the overtime wage), he will not leisure at all, but he will consume \$80 + \$8(40) + \$20(128) = \$2,960.

Tom's weekly budget line is pictured below.



3. **Cindy gains utility from consumption *C* and leisure *L*. The most leisure she can consume in any given week is 168 hours. Her utility function is *U(C,L) = C × L*. This functional form implies that Cindy's marginal rate of substitution is *C / L*. Cindy receives \$630 each week from her great-grandmother, regardless of how much Cindy works. What is Cindy's reservation wage?**

The reservation wage is the *MRS* when not working at all. Thus, w_{RES} = *MRS* at maximum leisure = *C / L = \$630 / 168 = \$3.75.*

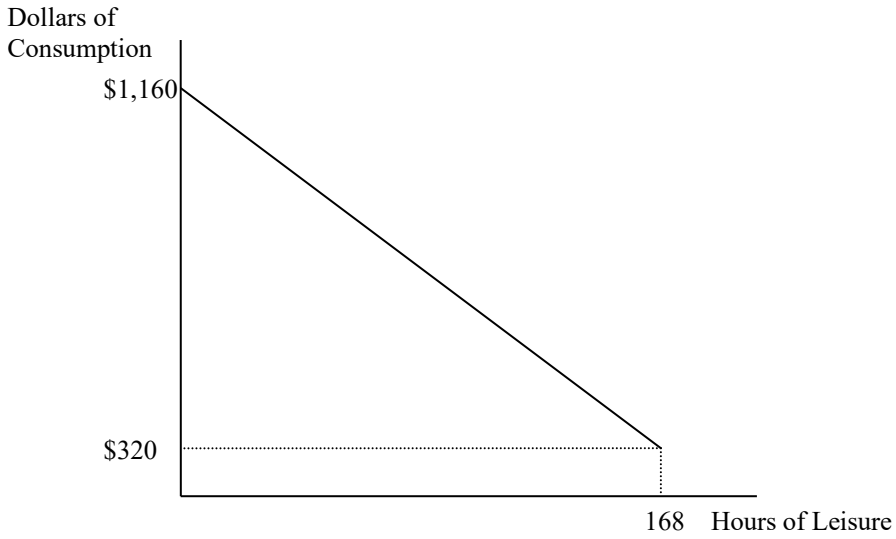
4. **Shelly's preferences for consumption and leisure can be expressed as**

$$U(C,L) = (C - 200) \times (L - 80).$$

This utility function implies that Shelly's marginal utility of leisure is *C – 200* and her marginal utility of consumption is *L – 80*. There are 168 hours in the week available to split between work and leisure. Shelly earns \$5 per hour after taxes. She also receives \$320 worth of welfare benefits each week regardless of how much she works.

(a) Graph Shelly's budget line.

If Shelly does not work, she leisures for 168 hours and consumes \$320. If she does not leisure at all, she consumes \$320 + \$5(168) = \$1,160. Shelly's weekly budget line, therefore, is pictured below.



(b) What is Shelly's marginal rate of substitution when *L* = 100 and she is on her budget line?

If Shelly leisures for 100 hours, she works for 68 hours and consumes \$320 + \$5(68) = \$660. Thus, her MRS when doing this is:

$$MRS = \frac{MU_L}{MUc} = \frac{C-200}{L-80} = \frac{660-200}{100-80} = \frac{460}{20} = \$23\,.$$

(c) What is Shelly's reservation wage?

The reservation wage is defined as the MRS when working no hours. When working no hours, Shelly leisures for 168 hours and consumes \$320. Thus,

$$w_{RES} = \frac{320-200}{168-80} = \frac{120}{88} \approx \$1.36\,.$$

(d) Find Shelly's optimal amount of consumption and leisure.

Her optimal mix of consumption and leisure is found by setting her MRS equal to her wage and solving for hours of leisure given the budget line: $C = 320 + 5(168–L)$.

$$w = MRS$$

$$5 = \frac{C-200}{L-80}$$

$$5 = \frac{320+5(168-L)-200}{L-80}$$

$$5L - 400 = 960 - 5L$$

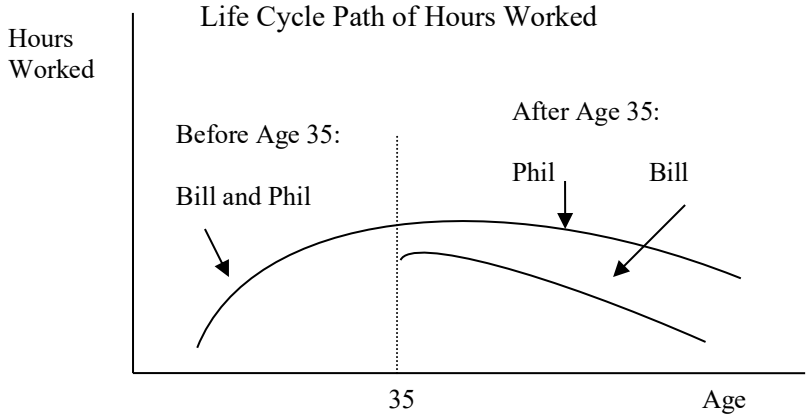
$$L = 136.$$

Thus, Shelly will choose to leisure 136 hours, work 32 hours, and consume \$320 + \$5(32) = \$480 each week.

5. **Consider two workers with identical preferences, Phil and Bill. Both workers have the same life cycle wage path in that they face the same wage at every age, and they know what their future wages will be. Leisure and consumption are both normal goods.**

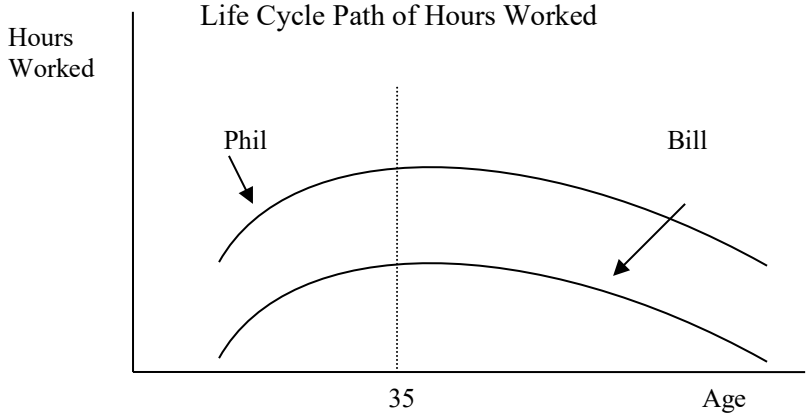
(a) Compare the life cycle path of hours of work between the two workers if Bill receives a one-time, unexpected inheritance at the age of 35.

Because the workers have the same life cycle wage path and the same preferences, they will have the same life cycle path of hours of work up to the unexpected event. An inheritance provides an income effect for Bill with no substitution effect, and thus, he will work fewer hours (or at least not more hours) than Phil from the age of 35 forward.



(b) Compare the life cycle path of hours of work between the two workers if Bill had always known he would receive (and, in fact, does receive) a one-time inheritance at the age of 35.

In this case, because the inheritance is fully anticipated, and because it offers the same income effect with no substitution effect, Bill will work fewer hours (or at least not more hours) than Phil over their entire work lives.



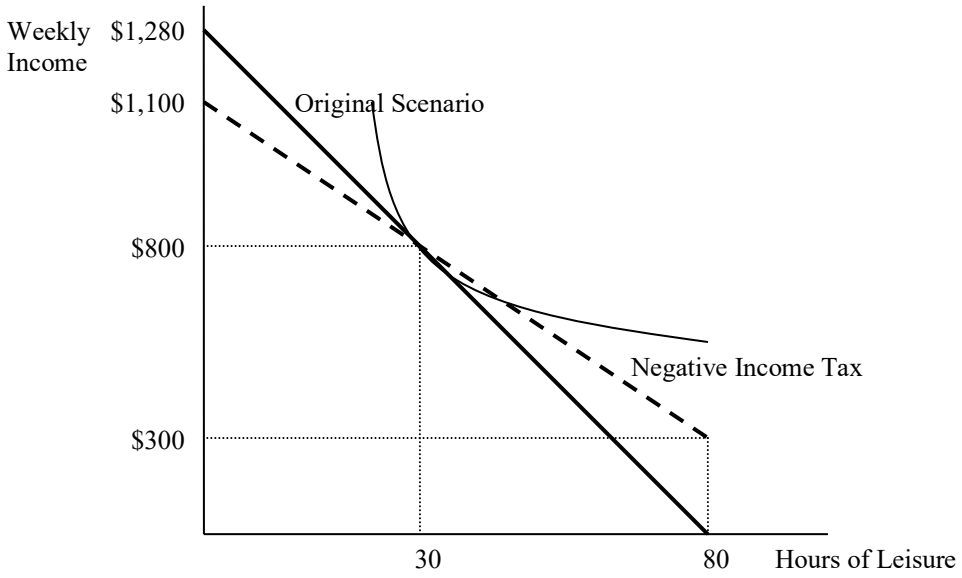
6. **Consider a person who can work up to 80 hours each week at a pre-tax wage of $20 per hour but faces a constant 20% payroll tax. Under these conditions, the worker maximizes her utility by choosing to work 50 hours each week. The government proposes a negative income tax whereby everyone is given $300 each week and anyone can supplement her income further by working. To pay for the negative income tax, the payroll tax rate will be increased to 50%.**

(a) On a single graph, draw the worker's original budget line and her budget line under the negative income tax.

Under the original scenario, let I be total weekly income, L be hours of leisure, and H be hours worked. The worker's after-tax wage rate is 80% of $20 which equals $16 per hour. Thus, when the worker works all 80 hours in the week, she earns $16 x 80 = $1,280 and her budget line is described by $I = 1280 - 16L$. Notice that when $L = 80$, the worker earns $0. And when $L = 30$, the worker earns $16 x 50 = $800.

Under the negative income tax, the worker is given $300 each week, but now her after-tax wage rate is 50% of $20 which equals $10 per hour. In this case, when the worker works all 80 hours in the week, she earns $10 x 80 + $300 = $1,100 and her budget line is properly described by
$I = 1100 - 10L$. Notice that when $L = 80$, the worker receives $300. And when $L = 30$, the worker receives $300 + $10 x 50 = $800.

The two budget lines for both scenarios are graphed on the next page.



(b) Show that the worker will choose to work fewer hours if the negative income tax is adopted.

To answer this question, one needs to find where the budget lines intersect. Setting the budget lines equal and solving for L reveals that the budget lines intersect at $L = 30$. Thus, the indifference curve that is tangent to the original budget line at $L = 30$ must not be tangent to the budget line under the negative income tax (because $L = 30$ was the optimal choice without the negative income tax). In particular, the worker's original indifference curve must be below the new budget line to the right of $L = 30$. Therefore, when faced with the negative income tax, the worker will move in that direction, which requires her to increase L (hours of leisure) and concurrently decrease H (hours of work).

(c) Will the worker's utility be greater under the negative income tax?

In this particular case, the worker's utility will increase under the negative income tax because she could continue to leisure 30 hours each week and receive $800 (which was her outcome before the negative income tax) but instead the worker ***decides*** to leisure more (and consume less). This change in behavior must increase her utility.