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CHAPTER 2

2-1. How many hours will a person allocate to leisure activities if her indifference curves between consumption and goods are concave to the origin?

A worker will either work all available time or will not work at all. As drawn in Figure 1, point *B* is preferred to points *A* and *C*. Thus, the worker chooses not to enter the labor market. As drawn in Figure 2, point *C* is preferred to both points *A* and *B*. Thus, the worker chooses not to consume any leisure and to work all available time.

Figure 1

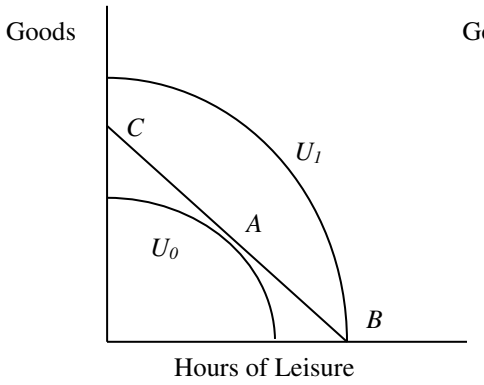
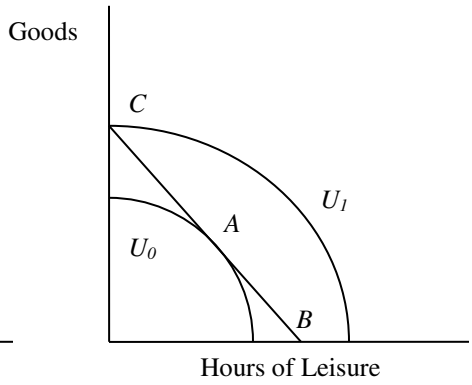


Figure 2



2-2. 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?

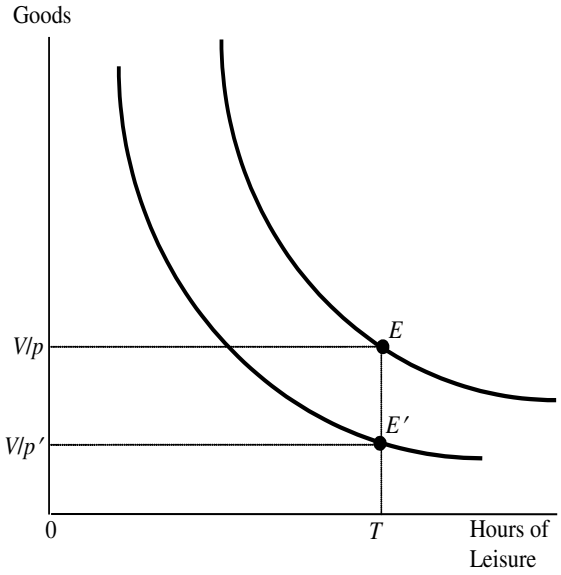
Suppose the price of market goods increases from p to p' and the person's non-labor income is V. If she chooses not to work, she can purchase V/p' units of consumption after the price change, whereas she could have consumed V/p units of consumption prior to the price increase. Thus, her endowment point 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 is on the next page.]

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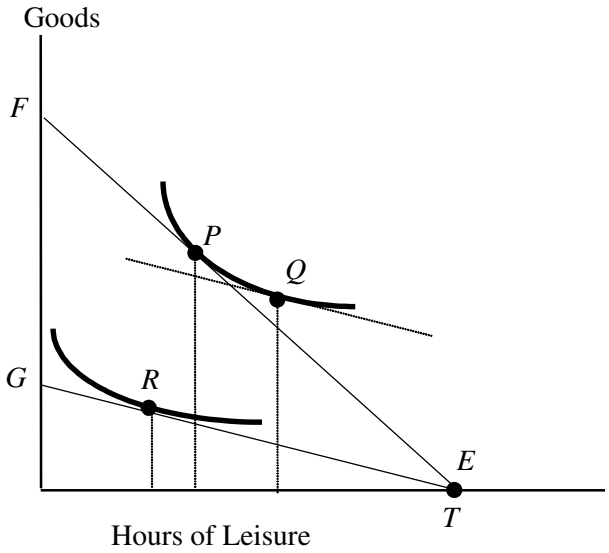
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Figure A.



To simplify the illustration of the effect on hours of work, assume that $V = 0$. The increase in the price of goods shifts the budget line from *FE* to *GE* in Figure B below, moving the worker from *P* to point *R*. This shift induces both an income effect and a substitution effect. 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 *P* to point *Q* in Figure B. 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 *Q* to *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.

Figure B.



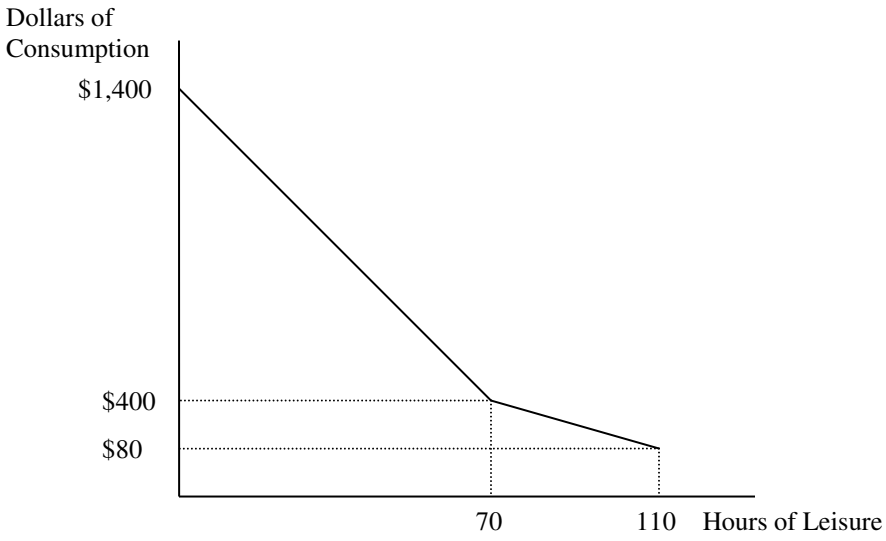
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2-3. Tom earns $15 per hour for up to 40 hours of work each week. He is paid $30 per hour for every hour in excess of 40. Tom faces a 20 percent tax rate and pays $4 per hour in child care expenses for each hour he works. Tom receives $80 in child support payments each week. There are 110 (non-sleeping) hours in the week. Graph Tom's weekly budget line.

- If Tom does not work, he leisures for 110 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 70 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 110 hours (70 hours at the overtime wage), he will not leisure at all, but he will consume $80 + $8(40) + $20(70) = $1,800.

Tom's weekly budget line is pictured below.



2-4. Cindy gains utility from consumption *C* and leisure *L*. The most leisure she can consume in any given week is 110 hours. Her utility function is $U(C, L) = C \times L$. This functional form implies that Cindy's marginal rate of substitution is C / L. Cindy receives $660 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 equals

$$C/L = \$660/110 = \$6.00.$$

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2-5. Currently a firm pays 10% of each employee's salary into a retirement account, regardless of whether the employee also contributes to the account. The firm is considering changing this system to a 10% match, meaning that the firm will match, up to 10% of each employee's salary, the employee's contributes into the account. Some people at the firm think this change will lead employees to save more and therefore to be able to afford to retire, while others at the firm believe this will lead employees to have less retirement savings and therefore be less able to afford to retire. Explain why either point of view could be correct.

Either point of view may be correct. The first assumes that the new matching system will encourage workers to save at least 10% of their salary into the retirement account, because it is matched. In essence, each dollar of personal savings receives an automatic and immediate 100% return. Alternatively, if the workers feel that they simply cannot save for retirement, then the change to a matching system may result in fewer dollars saved for retirement as the workers save very little (say 2%) and the firm then only matches the 2%. With this example, a worker's retirement account is receiving 4% of his or her salary each year compared to the 10% it received before the change. Clearly, the matching system provides fewer funds for retirement if the workers are not "savers" during their worklife.

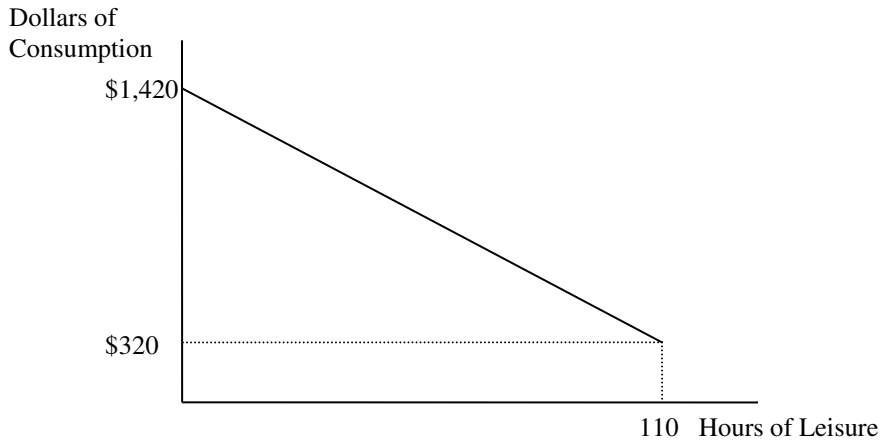
2-6. Shelly's preferences for consumption and leisure can be expressed as

$$U(C, L) = (C - 100) \times (L - 40).$$

This utility function implies that Shelly's marginal utility of leisure is $C - 100$ and her marginal utility of consumption is $L - 40$. There are 110 (non-sleeping) hours in the week available to split between work and leisure. Shelly earns $10 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 110 hours and consumes $320. If she does not leisure at all, she consumes $320 + $10(110) = $1,420. Shelly's weekly budget line, therefore, is:



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(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 10 hours and consumes \$320 + \$10(10) = \$420. Thus, her MRS when doing this is:

$$MRS = \frac{MU_L}{MUc} = \frac{C - 100}{L - 40} = \frac{420 - 100}{100 - 40} = \frac{320}{60} = \$5.33 .$$

(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 110 hours and consumes \$320. Thus,

$$w_{RES} = \frac{320 - 100}{110 - 40} = \frac{220}{70} = \$3.14 .$$

(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: $C = 320 + 10(110 - L)$.

$$w = MRS$$

$$10 = \frac{C - 100}{L - 40}$$

$$10 = \frac{320 + 10(110 - L) - 100}{L - 40}$$

$$10L - 400 = 1320 - 10L$$

$$L = 186.$$

Thus, Shelly will choose to leisure 86 hours, work 24 hours, and consume \$320 + \$10(24) = \$560 each week.

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2-7. Explain why a lump sum government transfer can entice some workers to stop working (and entices no one to start working) while the earned income tax credit can entice some people who otherwise would not work to start working (and entices no one to stop working).

A lump sum transfer is associated with an income effect but not a substitution effect, because it doesn't affect the wage rate. Thus, if leisure is a normal good, a lump sum transfer will likely cause workers to work fewer hours (and certainly not cause them to work more hours) while possibly enticing some workers to exit the labor force all together. On the other hand, the Earned Income Tax Credit raises the effective wage of low-income workers by 40 percent (at least for the poorest workers). Thus, someone who had not been working faces a wage that is 40 percent higher than it otherwise was. This increase may be enough to encourage the person to start working. For example, if a worker's reservation wage is $10.00 per hour but the only job she can find pays $8.00 per hour, she will not work. Under the earned income tax credit, however, the worker views this same job as paying $11.20 per hour, which exceeds her reservation wage. Furthermore, the EITC cannot encourage a worker to exit the labor force, as the benefits of the EITC are received only by workers.

2-8. In 1999, 4,860 TANF recipients were asked how many hours they worked in the previous week. In 2000, 4,392 of these recipients were again subject to the same TANF rules and were again asked their hours of work during the previous week. The remaining 468 individuals were randomly assigned to a "Negative Income Tax" (NIT) experiment which gave out financial incentives for welfare recipients to work and were subject to its rules. Like the other group, they were asked about their hours of work during the previous week. The data from the experiment are contained in the table below.

	Total Number Of Recipients	Number of Recipients Who Worked At Some Time in the Survey Week		Total Hours Of Work By All Recipients in the Survey Week	
		1999	2000	1999	2000
TANF	4,392	1,217	1,568	15,578	20,698
NIT	468	131	213	1,638	2,535
Total	4,860	1,348	1,781	17,216	23,233

(a) What effect did the NIT experiment have on the employment rate of public assistance recipients? Develop a standard difference-in-differences table to support your answer.

	Employment Rate			
	1999	2000	Diff	Diff-in-Diff
TANF	27.7%	35.7%	8.0%	
NIT	28.0%	45.5%	17.5%	9.5%

The NIT increased the probability of employment by 9.5 percentage points. Note that the percent numbers are found by dividing the "Number of Recipient" columns (2nd and 3rd of original) by the Number of Recipients column (1st of original).

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(b) What effect did the NIT experiment have on the weekly hours worked of public assistance recipients who worked positive hours during the survey week? Develop a standard difference-in-differences table to support your answer.

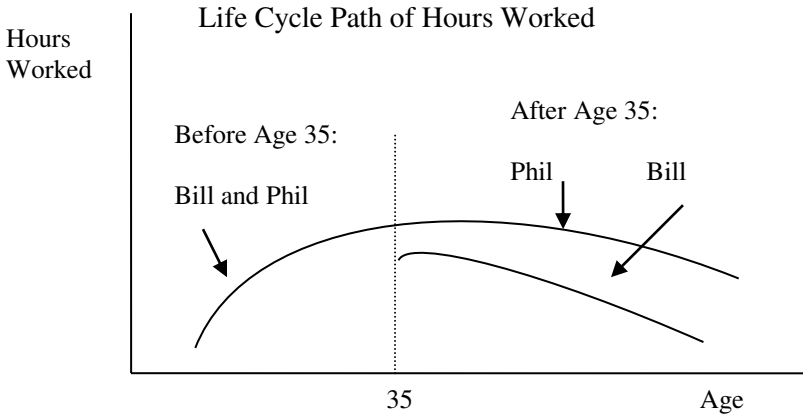
	Weekly Hours Worked Per Working Person			
	1999	2000	Diff	Diff-in-Diff
TANF	12.8	13.2	0.4	
NIT	12.5	11.9	-0.6	-1.0

The NIT decreased weekly hours worked, of those working, by 1 hour. Note that the average weekly hours of work per persons is found by the "Total Hours of Work" columns (4th and 5th of original) by the Number of Recipients column (1st of original).

2-9. 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.

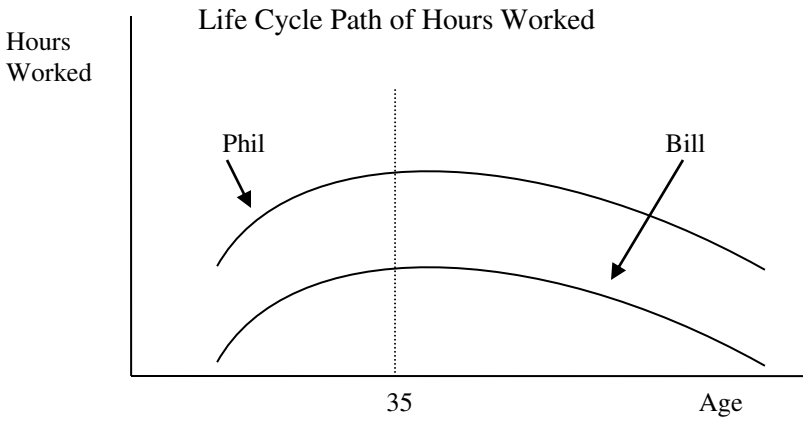


(b) Compare the life cycle path of hours of work between the two workers if Bill had always known he would receive (and, in fact, does receive) a one-time inheritance at the age of 35.

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. (The graph is on the next page.)

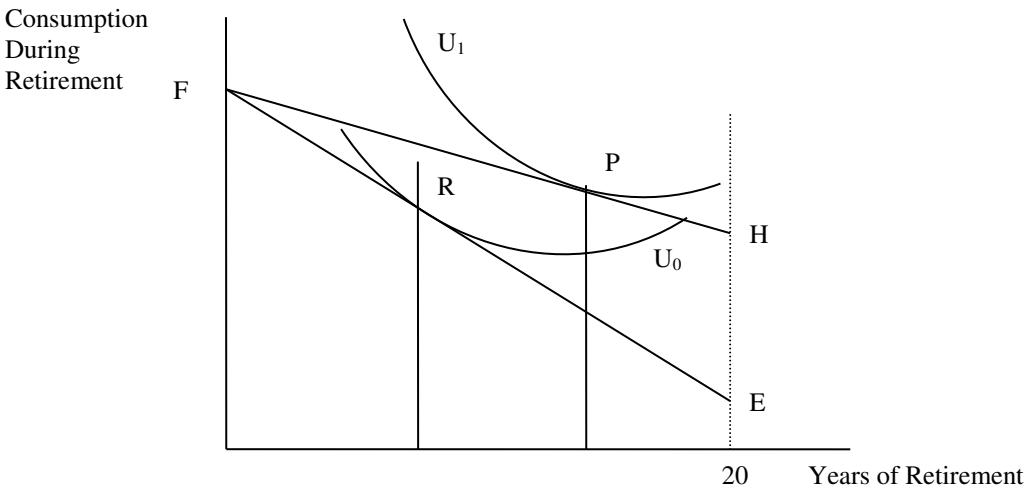
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2-10. Under current law, most Social Security recipients do not pay federal or state income taxes on their Social Security benefits. Suppose the government proposes to tax these benefits at the same rate as other types of income. What is the impact of the proposed tax on the optimal retirement age?

Suppose social security benefits are the only pension benefits available to a retiree. The tax, therefore, can be interpreted as a cut in pension benefits. The cut in pension benefits shifts the budget line from *FH* to *FE* in the figure below, shifting the worker from point *P* to point *R*. (Note that *FE* and *FH* are both downward sloping, indicating that total retirement consumption is greater the later in life one retires.) This shift generates both income and substitution effects. Both of these effects, however, work in the same direction. First, the tax reduces the retiree's wealth, reducing her demand for leisure, and leading her to retire later (the income effect). At the same time, the tax reduces the "wage" that retirees receive when retired, effectively increasing (in relative terms) the wage they earn while working and generating a substitution effect that leads to more work hours, thus further delaying retirement. Under normal conditions, therefore, a tax on pension benefits will increase the optimal retirement age (i.e., workers will delay retirement and have fewer years of retirement).



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2-11. A worker plans to retire at the age of 65, at which time he will start collecting his retirement benefits. Then there is a sudden change in the forecast of inflation when the worker is 63 years old. In particular, inflation is now predicted to be higher than it had been expected so that the average price level of market goods and wages is now expected to be higher. What effect does this announcement have on the person's preferred retirement age:

(a) if retirement benefits are fully adjusted for inflation?

There will be no effect on the person's retirement decision if retirement benefits are fully adjusted for inflation as nothing changes in the person's calculations in real terms: the relative magnitudes of prices, wages and retirement benefits are the same with or without inflation. The person faces the same choice, so his decision does not change.

(b) if retirement benefits are not fully adjusted for inflation?

If retirement benefits are not adjusted for inflation, the purchasing power of retirement benefits falls. If the person does not retire, he can enjoy the same consumption as he would without inflation as wages are assumed to fully adjust for inflation. If he retires at 65, his benefits are worth less in real terms (they can buy him less consumption) with inflation than without, so he cannot afford the same consumption path as before. Hence, his choice set over the years of retirement and consumption lies below the original (pre-inflation) choice set except at one point—where he does not retire at all. Thus, as long as leisure (i.e., years of retirement) and consumption are normal goods, the income and substitution effects both lead to the individual retiring later in life.

2-12. Presently, there is a minimum and maximum social security benefit paid to retirees. Between these two bounds, a retiree's benefit level depends on how much she contributed to the system over her work life. Suppose Social Security was changed so that everyone aged 65 or older was paid $12,000 per year regardless of how much she earned over her working life or whether she continued to work after the age of 65. How would this likely affect hours worked of retirees?

Labor force participation is likely greatest for those retirees whose social security income is low (below $12,000 per year). Thus, the change in benefits offers these retirees a pure (positive) income effect. These retirees should reduce their hours worked if not leave the labor force all together after the age of 65.

In contrast, the policy change offers all retirees who would have earned more than $12,000 per month a pure (negative) income effect. These retirees will become more likely to work, or, if already working, more likely to work more hours after the age of 65.

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2-13. Over the last 100 years, real household income and standards of living have increased substantially in the United States. At the same time, the total fertility rate, the average number of children born to a woman during her lifetime, has fallen in the United States from about three children per woman in the early twentieth century to about two children per woman in the early twenty-first century. Does this suggest that children are inferior goods?

The conventional wisdom (and empirical evidence) suggests that children are normal goods. Economically, children are a lot more expensive today than they were 100 years ago (consider education, housing, clothing, entertainment expenses). Children also produce less for the household in the 21st century than they did 100 years ago.

The biology/evolution argument is that infant mortality rates have also fallen dramatically over the last 100 years, so a woman needs to have fewer children to be more confident that some of her children will reach adulthood.

2-14. 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.

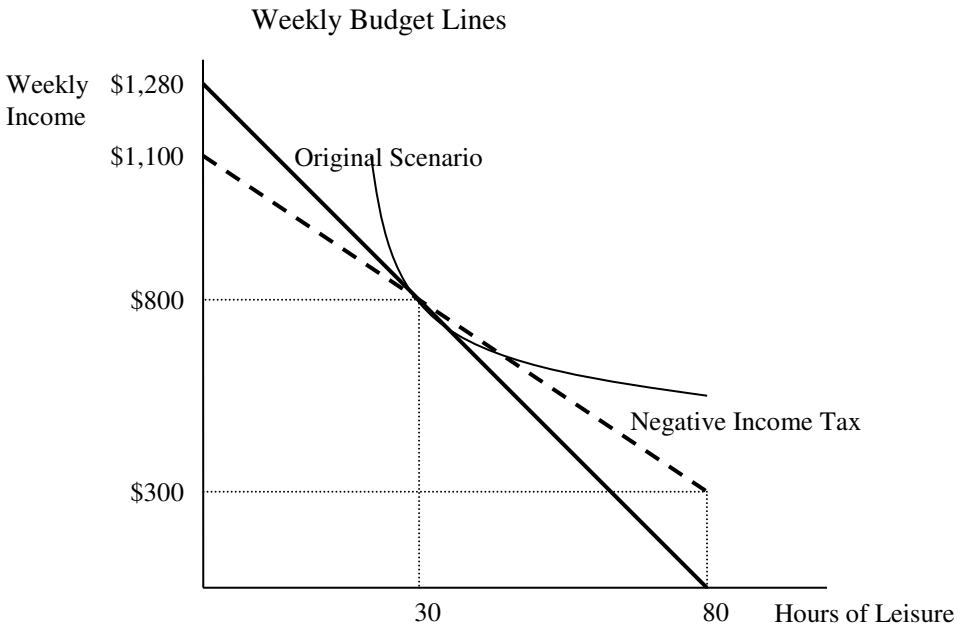
Under the original scenario, let I be total weekly income, L be hours of leisure, and H be hours worked. The worker's after-tax wage rate is 80% of $20 which equals $16 per hour. Thus, when the worker works all 80 hours in the week, she earns $16 x 80 = $1,280 and her budget line is described by $I =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

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(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?

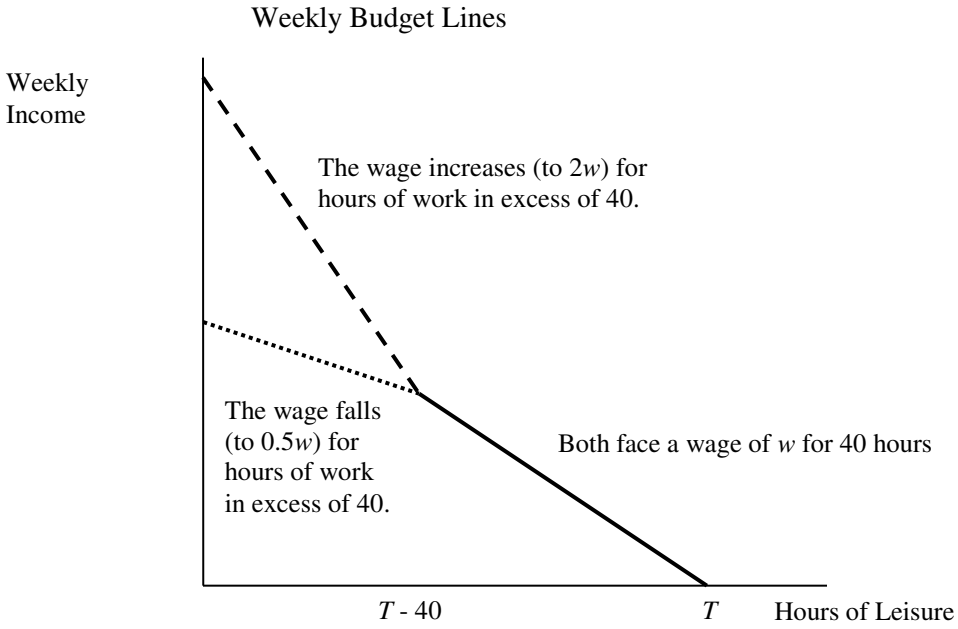
In this particular case, the worker's utility will increase under the negative income tax because she could have continued to leisure 30 hours each week and receive $800 (which was her outcome before the negative income tax) but instead the worker ***decides*** to leisure more (and consume less). This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

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2-15. The absolute value of the slope of the consumption-leisure budget line is the after-tax wage, *w*. Suppose some workers earn *w* for up to 40 hours of work each week, and then earn 2*w* for any hours worked thereafter (called overtime). Other workers may earn *w* for up to 40 hours of work each week, and then only earn 0.5*w* thereafter as working more than 40 hours requires getting a second job which pays an hourly wage less than their primary job. Both types of workers experience a "kink" in their consumption-leisure budget line.

(a) Graph in general terms the budget line for each type of worker.



(b) Which type of worker is likely to work up to the point of the kink, and which type of worker is likely to choose a consumption-leisure bundle far away from the kink?

The worker who experiences a decrease in her wage after working 40 hours is (more) likely to work exactly 40 hours as the marginal benefit of working experiences a negative jump down at this point.

In contrast, the worker who experiences an overtime premium after working 40 hours is (more) likely to not work exactly 40 hours. Because of the overtime premium, once the worker hits 40 hours of work, the worker experiences a positive jump up in the marginal benefit of working. Put differently, this worker may opt to only work 20 or 30 hours, but if she finds herself having worked 40 hours because the $T - 40^{th}$ hour of leisure was not as valuable as w, then it is very likely that she will also find that the $T - 41^{st}$ hour of leisure is not as valuable as $2w$, and therefore she works the 41^{st} hour (and possibly quite more).

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