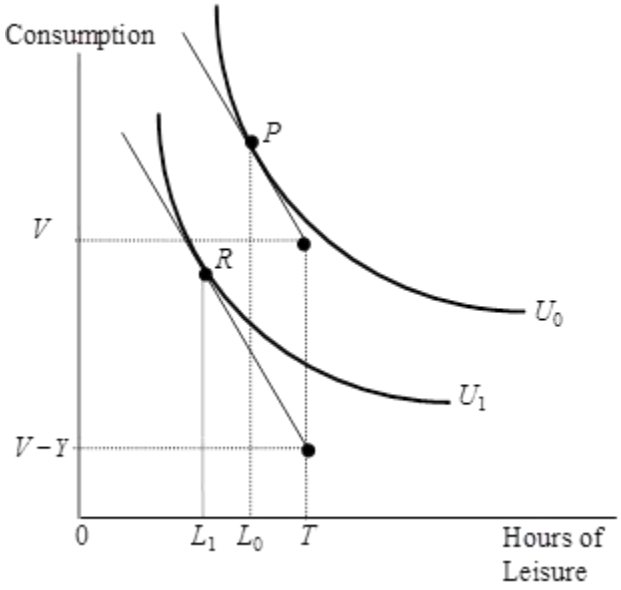
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CHAPTER 2

2-1. It is costly to commute to work, and the cost typically involves both time and money.

(a) Suppose that a worker's commute involves traveling a long distance on a highway that is about to start charging toll fees of $\$Y$. There is no other way for the person to get to their job. What will happen to hours of work as a result of this increase in commuting costs?

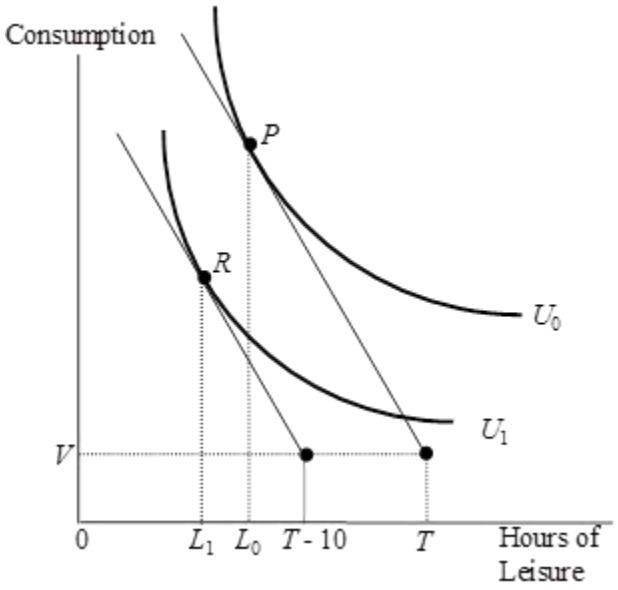


In the absence of the toll fees, the worker would choose point P and work $T - L_0$ hours. If it costs $\$Y$ to get to work, the budget line shifts down by $\$Y$, and the worker would then choose point R and would work $T - L_1$ hours. The introduction of toll fees, therefore, acts like an income effect, reducing the demand for leisure and lengthening the work week.

(b) Suppose a worker's current job is located very near to their house, so that the time it takes to commute to work is essentially zero. The firm is considering a move to another town, and it will then take the worker 10 hr per week to get to and from work, regardless of how many hours the worker actually decides to work. What will happen to the worker's hours of work (defined as hours actually spent on the job) as a result of this increase in commuting costs?

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To determine what happens to hours of work, it is important to distinguish between hours actually spent at work and hours spent commuting. In the absence of time commuting costs, the worker would choose point *P* and work $T - L_0$ hours. If it takes 10 hr to commute, the worker would then choose point *R* and would spend a *total* of $T - L_1$ hours either commuting or working. Note, however, that the number of hours actually spent working declines from $T - L_0$ to $(T - 10) - L_1$. Even though the commuting costs induce an income effect, reducing the total number of hours spent consuming leisure, hours spent at work actually decline because so much of the leisure time released by the income effect is spent commuting.

(c) Why do the different types of commuting costs have different effects on hours of work?

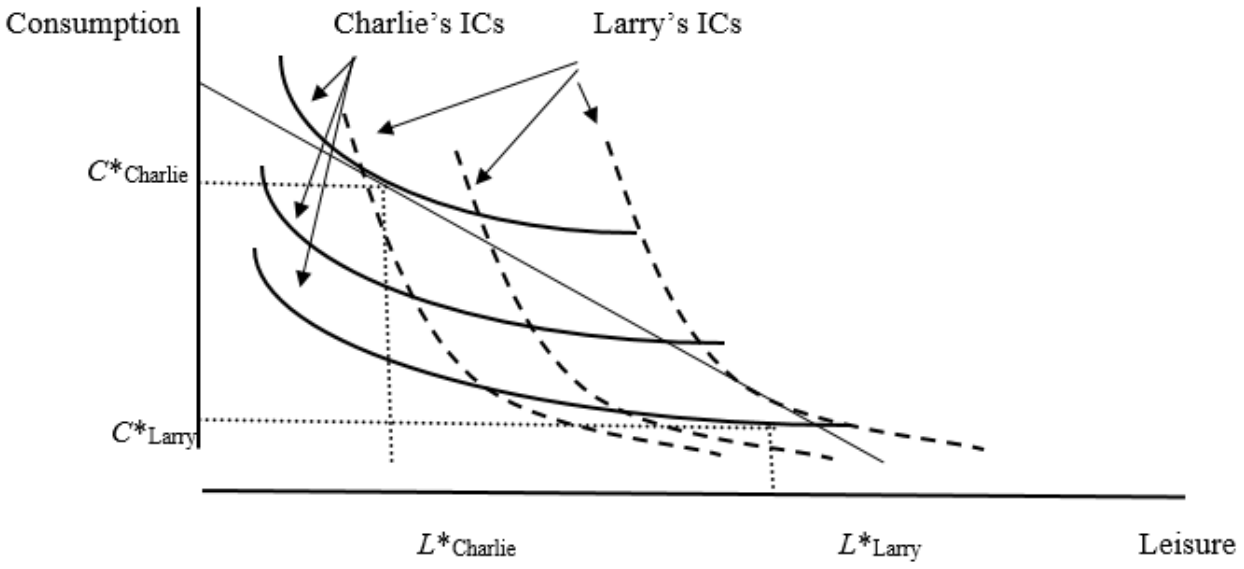
A toll increases hours of work, while an increase in "time" commuting costs decreases hours of work. The one common result in both parts of the problem is that hours of leisure declines. In the presence of time commuting costs, however, the reduction in leisure time is "consumed away" by the increase in the amount of time that it takes to get to work.

2-2. Charlie and Larry both face the same budget line for consumption and leisure. At every possible consumption–leisure bundle on the budget line, Charlie always requires marginally more leisure than does Larry in order to be equally happy when asked to forego a dollar of consumption. Using a standard budget line, graph several indifference curves and the optimal consumption–leisure bundle for both people. Which person optimally chooses more consumption? Which feature of indifference curves guarantees this result?

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Because Charlie requires receiving more leisure than Larry when giving up consumption, Charlie's indifference curves are flatter relative to Larry's. This feature—shallower or flatter indifference curves—results in that person (Charlie) optimally choosing more of the *Y*-axis good. Similarly, Larry's indifference curves are steeper relative to Charlie's, because Larry does not need to receive as much leisure when giving up consumption. This feature—steeper indifference curves—results in that person (Larry) optimally choosing more of the *X*-axis good. These ideas are all incorporated in the graph below where the solid lines represent an assortment of indifference curves for Charlie and the dashed lines represent an assortment of indifference curves for Larry.



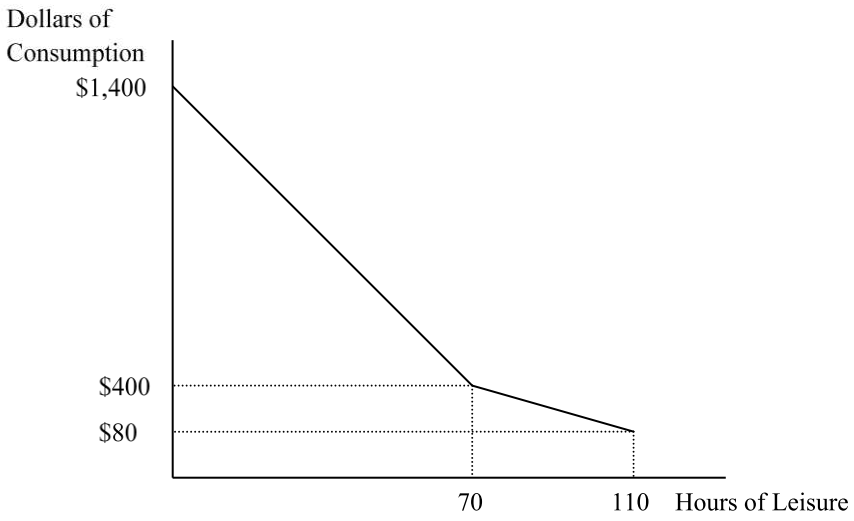
2-3. Tom earns $15 per hour for up to 40 hr of work each week and $30 per hour for every hour in excess of 40. Tom also faces a 20% tax rate, pays $4 per hour in childcare expenses for each hour he works, and receives $80 in child support payments each week. There are 110 (non-sleeping) hours in the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

- If Tom does not work, he leisures for 110 hr and consumes $80.
- For all hours Tom works up to his first 40, his after-tax and after-childcare wage equals $(80\%\text{ of }\$15)-\$4=\$8$ per hour. Thus, if he works for 40 hr, he will be able to leisure for 70 hr and consume $\$80+\$8(40)=\$400$.
- For all hours Tom works over 40, his after-tax and after-childcare wage equals $(80\%\text{ of }\$30)-\$4=\$20$. Thus, if he works for 110 hr (70 hr 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.

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2-4. Cindy gains utility from consumption *C* and leisure *L*. The most leisure she can consume in any given week is 110 hr. 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, $w_{RES} = \text{MRS}$ at maximum leisure equals

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

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 the employee's contribution into the account up to 10% of each employee's salary. Some people at the firm think this change will lead employees to save more and therefore be more able to afford to retire at a younger age, while others believe this change will lead employees to save less for retirement 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 their 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 work-life.

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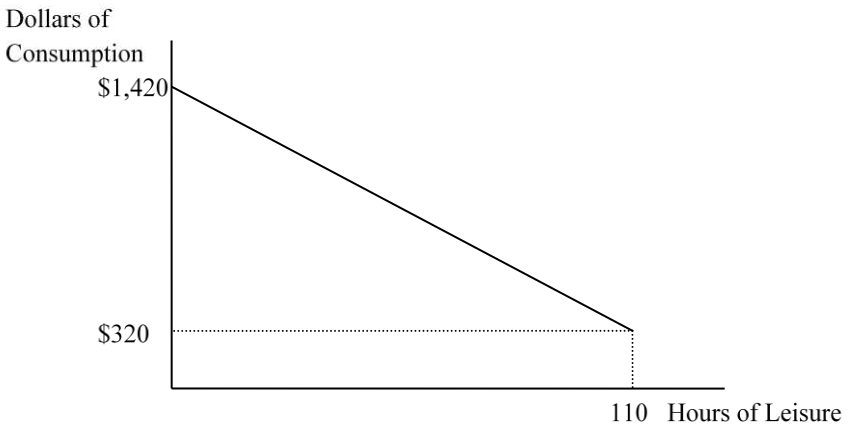
2-6. Shelly's preferences for consumption and leisure can be expressed as

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

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 hr in the week available to split between work and leisure. Shelly earns $10 per hour after taxes. She also receives $320 worth of assistance benefits each week regardless of how much she works.

(a) Graph Shelly's budget line.

If Shelly does not work, she leisures for 110 hr and consumes $320. If she does not leisure at all, she consumes $\$320+\$10(110)=\$1,420$. Shelly's weekly budget line, therefore, is:



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

If Shelly leisures for 100 hr, she works for 10 hr and consumes $\$320+\$10(10)=\$420$. Thus, her MRS when doing this is:

$$\text{MRS}=\frac{\text{MU}_L}{\text{MU}_C}=\frac{C-100}{L-40}=\frac{420-100}{100-40}=\frac{320}{60}=\$5.33.$$

(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 hr and consumes $320. Thus,

$$w_{\text{RES}}=\frac{\text{MU}_L}{\text{MU}_C}=\frac{C-100}{L-40}=\frac{320-100}{110-40}=\frac{220}{70}=\$3.14.$$

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

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

$$
\begin{aligned}
w &= \text{MRS} \\
10 &= \frac{C - 100}{L - 40} \\
10 &= \frac{320 + 10(110 - L) - 100}{L - 40} \\
10L - 400 &= 1{,}320 - 10L \\
L &= 86.
\end{aligned}
$$

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

2-7. Explain why receiving a cash grant from the government 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 altogether. On the other hand, the Earned Income Tax Credit raises the effective wage of low-income workers by 40% (at least for the poorest workers). Thus, someone who had not been working faces a wage that is 40% 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 they can find pays $8.00 per hour, they will not work. Under the earned income tax credit, however, the worker views this same job as paying $11.20 per hour, which exceeds their 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.

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	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 (second and third columns of the original table) by the Number of Recipients column (first column of the original table).

(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 hr. Note that the average weekly hours of work per person is found by dividing the "Total Hours of Work" columns (fourth and fifth columns of the original table) by the Number of Recipients column (first column of the original table).

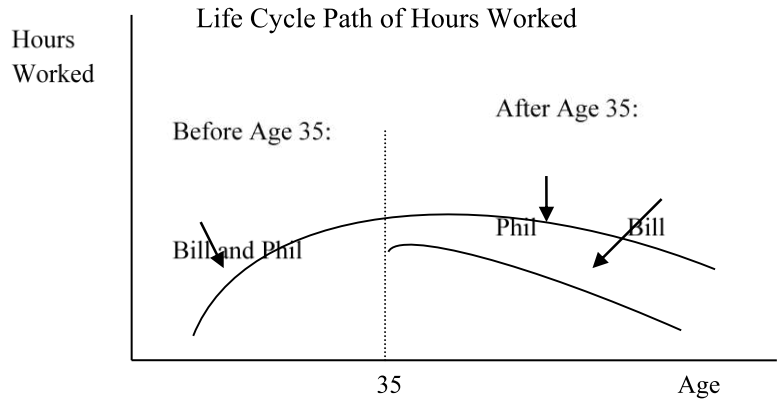
2-9. Consider two workers with identical preferences, Phil and Bill. Both workers have the same life cycle wage path in that they face the same wage at every age, and they know what their future wages will be. Leisure and consumption are both normal goods.

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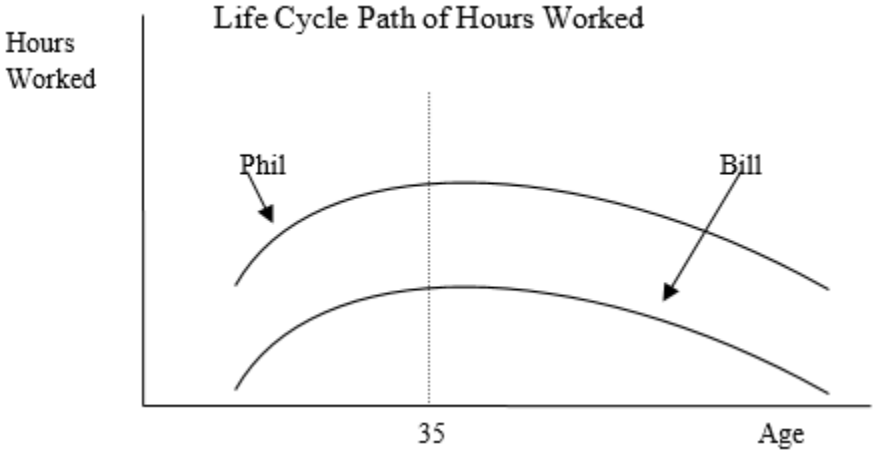
(a) Compare the life cycle path of hours of work between the two workers if Bill receives a one-time, unexpected inheritance at the age of 35.

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. See the following graph.



(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. See the following graph.

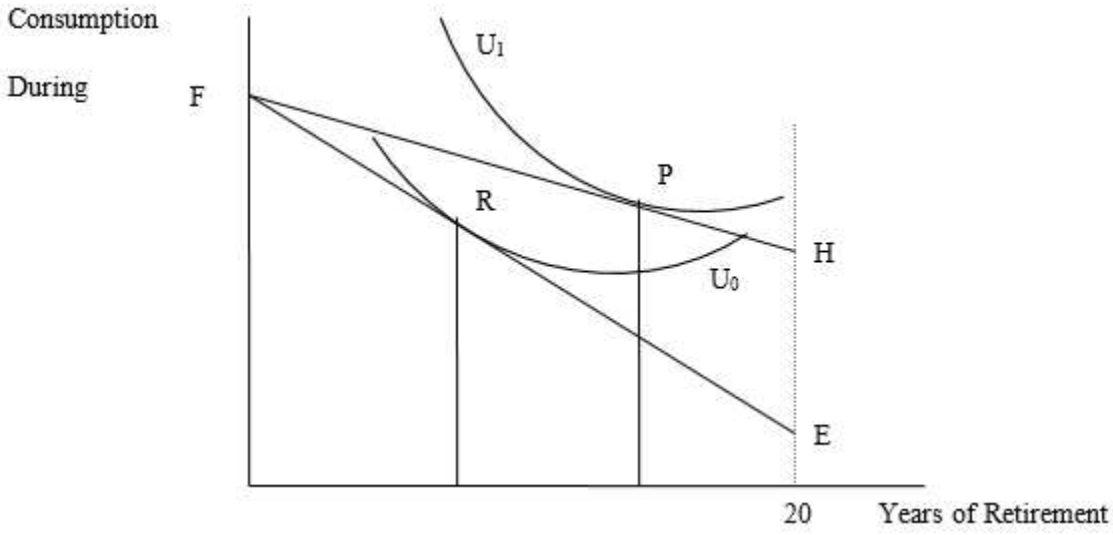


2-10. Under current law, most social security recipients do not pay federal or state income taxes on their social security benefits. Suppose the government proposes to tax these benefits at the same rate as other types of income. What is the impact of the proposed tax on the optimal retirement age?

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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 meaning that one has fewer years of retirement.) This shift from *FH* to *FE* 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 their demand for leisure, and leading them 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).



2-11. A worker plans to retire at the age of 65, at which time they will start collecting their 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 set, so their decision does not change.

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(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, they can enjoy the same consumption as they would without inflation as wages are assumed to fully adjust for inflation. If they retires at 65, their benefits are worth less in real terms (they can buy them less consumption) with inflation than without, so they cannot afford the same consumption path as before. Hence, their choice set over the years of retirement and consumption lies below the original (preinflation) choice set except at one point—where they do 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 they contributed to the system over their work-life. Suppose social security was changed so that everyone aged 65 or older was paid $12,000 per year regardless of how much they earned over their working life or whether they continued to work after the age of 65. How would this likely affect the number of hours worked by 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 altogether 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.

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, given by the average number of children born to a woman during her lifetime, has fallen from about three children per woman in the early 20th century to about two children per woman in the early 21st 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, etc.). Children also produce less for the household in the 21st century than they did 100 years ago.

There is also a biology/evolution argument that infant mortality rates have 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. This argues against children being an inferior good as the "good" in question can be thought of as the number of offspring who live long enough to procreate.

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2-14. Consider a person who can work up to 80 hr each week at a pretax wage of $20 per hour but faces a constant 20% payroll tax. Under these conditions, the worker maximizes their utility by choosing to work 50 hr each week. The government proposes a NIT whereby everyone is given $300 each week and anyone can supplement their income further by working. To pay for the NIT, the payroll tax rate will be increased to 50%.

(a) On a single graph, draw the worker's original budget line and their budget line under the NIT.

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 hr in the week, they earn $\$16 \times 80 = \$1,280$ and their budget line is described by $I = 1,280 - 16L$. Notice that when $L = 80$, the worker earns $0. And when $L = 30$, the worker earns $\$16 \times 50 = \$800$.

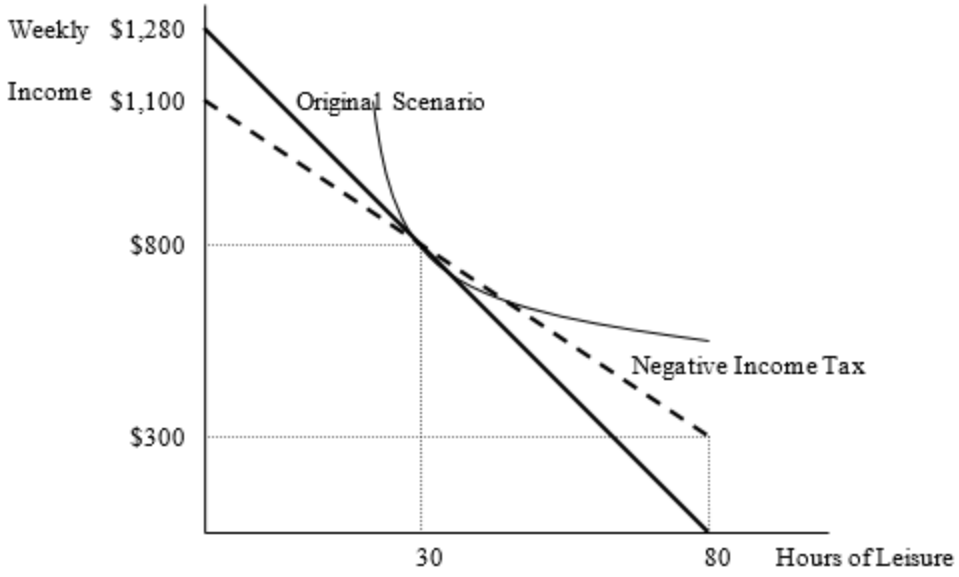
Under the NIT, the worker is given $300 each week, but now their after-tax wage rate is 50% of $20 which equals $10 per hour. In this case, when the worker works all 80 hr in the week, they earn $\$10 \times 80 + \$300 = \$1,100$ and their budget line is properly described by $I = 1,\ 100 - 10L$. Notice that when $L = 80$, the worker receives $300. And when $L = 30$, the worker receives $\$300 + \$10 \times 50 = \$800$.

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

Weekly Budget Lines

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

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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 NIT (because $L = 30$ was the optimal choice without the NIT). 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 NIT, the worker will move in that direction, which requires them to increase L (hours of leisure) and concurrently decrease H (hours of work).

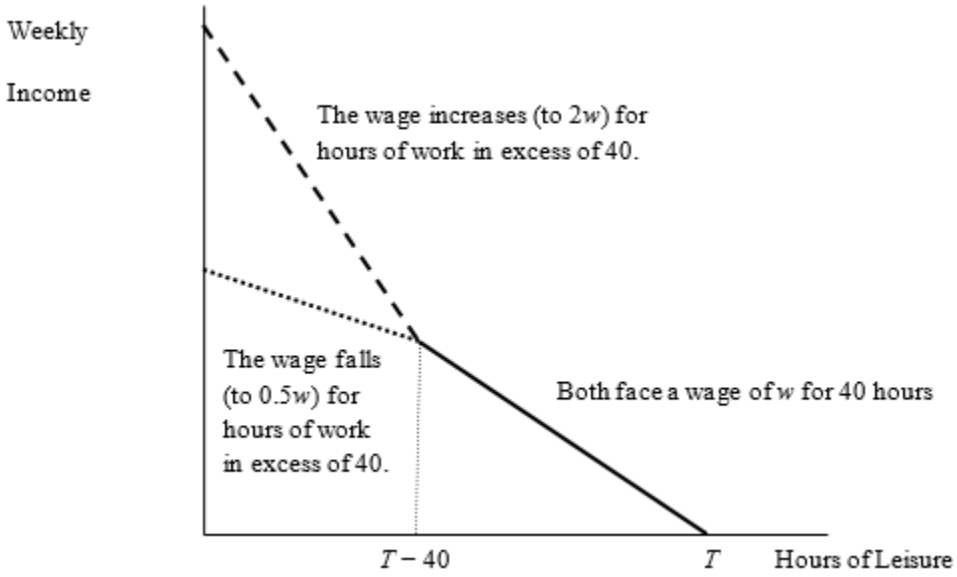
(c) Will the worker's utility be greater under the NIT?

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

2-15. The absolute value of the slope of the consumption–leisure budget line is the after-tax real wage, w. Suppose some workers earn w for up to 40 hr of work each week, and then earn $2w$ for any hours worked thereafter (called overtime). Other workers earn w for up to 40 hr of work each week, and then only earn $0.5w$ thereafter as working more than 40 hr 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.

Weekly Budget Lines



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(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 their wage after working 40 hr is more likely to work exactly 40 hr 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 hr is more likely to not work exactly 40 hr. Because of the overtime premium, once the worker hits 40 hr 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 hr, but if they find themself having worked 40 hr because the $T-40$th hour of leisure was not as valuable as w, then it is very likely that they will also find that the $T-41$st hour of leisure is not as valuable as $2w$, and therefore they work the 41st hour (and possibly quite more).

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