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

Figure A

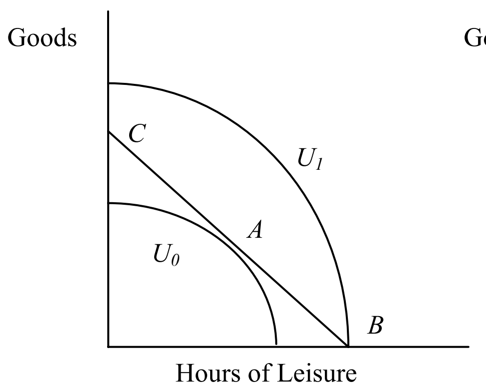
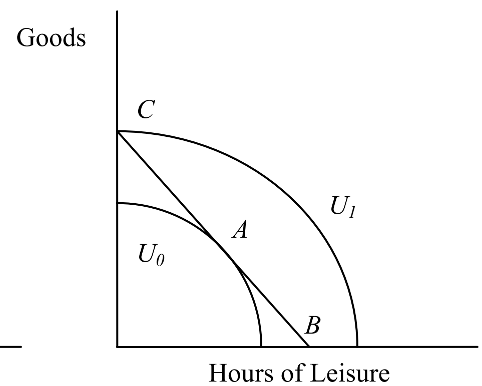


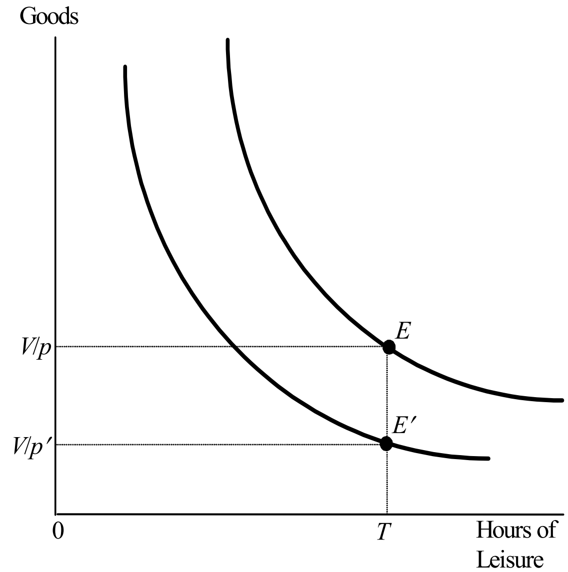
Figure B



2-2. **What is the effect of a rise in the price of market goods on a worker's reservation wage, probability of entering the labor force, and hours of work?**

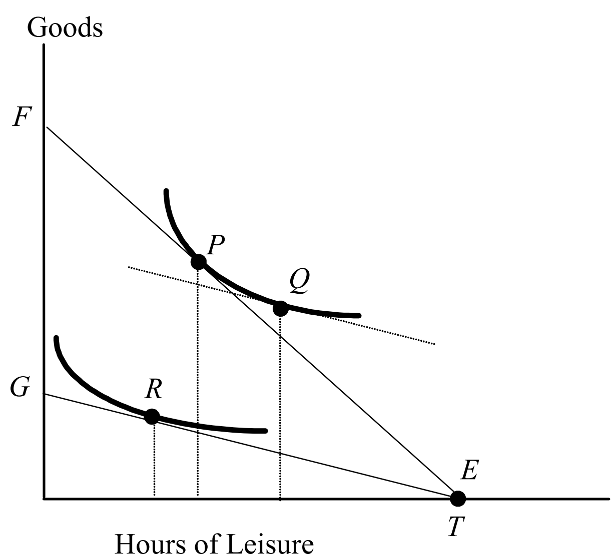
Suppose the price of market goods increases from p to p' and the person's non-labor income is V. If she chooses not to work, she can purchase V/p' units of consumption after the price change, whereas she could have consumed V/p units of consumption prior to the price increase. Thus, her endowment point has moved from E to E' in Figure A. As long as 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 in effect lowers the person's real wage rate, increasing the demand for leisure and leading to fewer hours of work. 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. 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.

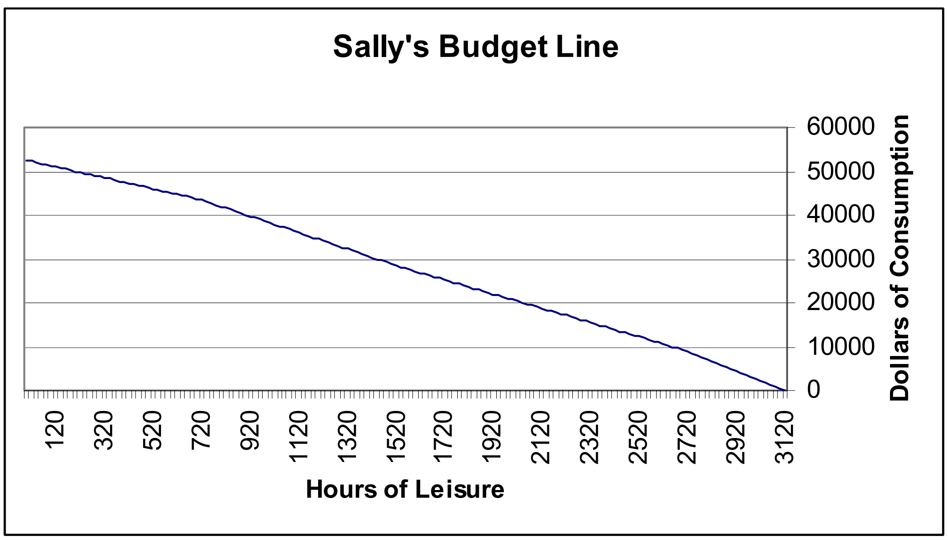
Figure B.



2-3. Sally can work up to 3,120 hours each year (a busy social life and sleep take up the remaining time). She earns a fixed hourly wage of $25. Sally owes a 10 percent payroll tax on the first $40,000 of income. Above $40,000 of income, there is no payroll tax. Sally also faces a progressive income tax rate. There is no income tax on the first $10,000 of income. From $10,000 up to $60,000, the marginal income tax rate is 25 percent. Above $60,000, the marginal income tax rate is 50 percent. Graph Sally's budget line.

Sally's budget line will have kinks at gross income levels of $10,000, $40,000, and $60,000. As her wage is $25 per hour, these kinks occur after 400 hours, 1,600 hours, and 2,400 hours of work respectively, or, similarly, at 2,720, 1,520, and 720 hours of leisure.

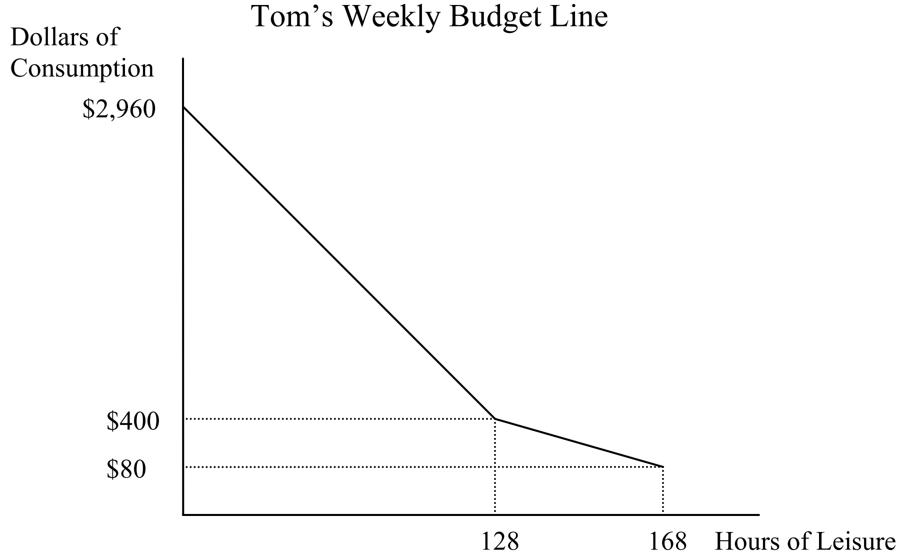
- From 0 to 400 hours, Sally's after-tax wage is $22.50 (90 percent of $25). If she works exactly 400 hours, her after-tax income is $9,000.
- From 400 to 1,600 hours, Sally's after-tax wage is $16.25 (65 percent of $25). If she works exactly 1,600 hours, her after-tax income is $9,000 + $16.25 (1600-400) = $28,500.
- From 1,600 to 2,400 hours, Sally's after-tax wage is $18.75 (75 percent of $25). If she works exactly 2,400 hours, her after-tax income is $28,500 + $18.75 (2400-1600) = $43,500.
- From 2,400 to 3,120 hours, Sally's after-tax wage is $12.50 (50 percent of $25). If she works exactly 3,120 hours, her after-tax income is $43,500 + $12.50 (3120-2400) = $52,500.



2-4. 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 hour in the week. Graph Tom's weekly budget line.

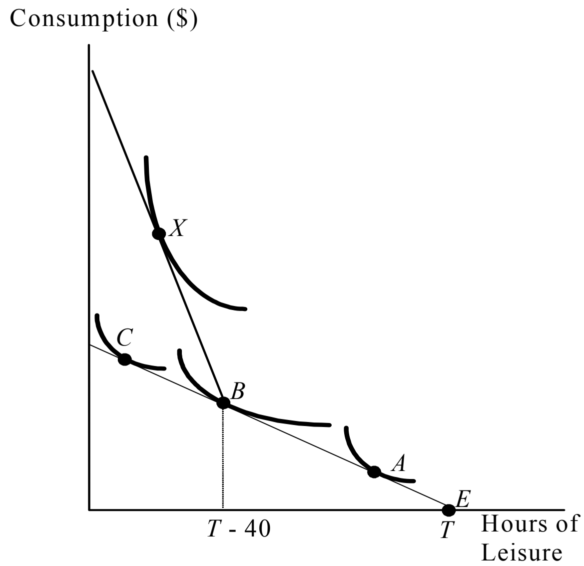
- If Tom does not work, he leisures for 168 hours and consumes $80.
- For all hours Tom works up to his first 40, his after-tax and after-child care wage equals (80 percent of $15) – $4 = $8 per hour. Thus, if he works for 40 hours, he will be able to leisure for 128 hours and consume $80 + $8(40) =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



2-5. What happens to a worker's desired hours of work if employers pay an overtime premium equal to "time and a half"(that is, 1.5 times the straight-time wage) for any hours worked in excess of 40 hours? What would happen to hours of work if the overtime premium were raised to double the straight-time wage?

The availability of overtime pay generates a new (steeper) segment of the budget line originating at the point where the person works 40 hours per week. The figure below illustrates three different possibilities. If the person works 40 hours per week (person B), he or she will be better off by moving to the tangency point labeled X. This person, therefore, will take advantage of the overtime pay and work more hours. If the person is working more than 40 hours per week initially (as is the case for person C), the move from C to X involves both income and substitution effects, and hence we cannot determine which effect dominates. If the person works many fewer than 40 hours per week (person A) he or she will not be affected by the possibility of overtime pay. If the overtime pay were increased to double-pay, it would steepen the line segment originating at 40 hours of work, and perhaps induce some of the persons like A to take advantage of the overtime pay. Person B would continue to work more than 40 hours under a double-time rate, while the double-time rate would have an ambiguous effect on the hours worked of person C.



2-6. A person owns a small farm near a large city and must decide whether to work on that small farm or take a job in the city. Her utility depends on her income per day, *Y*, and the number of hours allocated to leisure activities, *L*. Daily income from farm work is:

$$Y_f = 20h_f - h_f^2,$$

where h_f is hours of work on the farm; and daily income from the city job is:

$$Y_C = 14h_C,$$

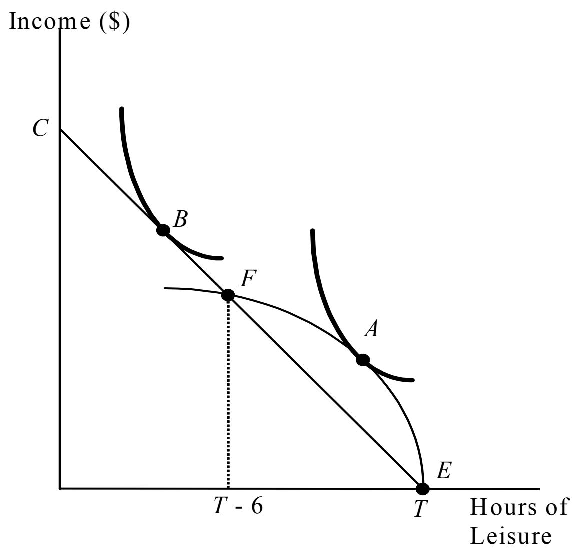
where h_C is hours of work in the city.

To calculate the budget lines associated with each of the opportunities, it is easiest to work through a numerical calculation of what a worker's earnings would be if he or she allocated 1 hour, 2 hours, 3 hours, etc., to each of the sectors *and* worked in that sector exclusively. This calculation leads to:

	Total Earnings		Marginal Earnings	
Hours of Work	Farm	City	Farm	City
1	19	14	19	14
2	36	28	17	14
3	51	42	15	14
4	64	56	13	14
5	75	70	11	14
6	84	84	9	14
7	91	98	7	14
8	96	112	5	14

(a) If she can work on the farm or in the city, but not both, which sector would she choose?

The table above suggests the budget line associated with working exclusively in the city is given by *CE* and on the farm is the parabola *FE*. As a result, if a worker can only work in either the city or on the farm, a worker with indifference curves like person A is better off working on the farm, while a worker with indifference curves like person B is better off in the city.



(b) If she can work both on the farm and in the city, how would she allocate her time?

If a worker can allocate her time to both the city and the farm, the worker is then better off allocating the first few hours of work to the farm sector. As the table indicates, the first hour allocated to the farm sector generates \$19 worth of income, the second hour generates \$17, the third hour generates \$15, the fourth hour generates \$13, and so on. The worker is thus best off by allocating the first three hours to the farm sector and working any remaining hours she wishes in the city where each additional hour of work generates a constant \$14.

2-7. 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 $U(C,L) = C \times L$. 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 $= C / L = \$630 / 168 = \$3.75$.

2-8. The utility function of a worker is represented by $U(C, L) = C \times L$, so that the marginal utility of leisure is C and the marginal utility of consumption is L. Suppose this person currently has a weekly income of \$600 and chooses to enjoy 70 hours of leisure per week. How many additional dollars of income would it take to entice the worker to work 10 more hours?

Initially the person's utility is $U(C,L) = U(600,70) = 600 \times 70 = 42{,}000$. She would agree to work 10 more hours (i.e., give up 10 hours of leisure) if the increase in consumption would allow her to achieve at least the same level of utility. Letting Y be her new total income, therefore, Y must solve $60Y = 42{,}000$, which requires $Y = \$700$. Thus, the person's income would have to rise by \$100 to compensate her for the loss of 10 hours of leisure.

2-9. You can either take a bus or drive your car to work. A bus pass costs \$5 per week, whereas driving your car to work costs \$60 weekly (parking, tolls, gas, etc.). You spend half-an-hour less on a one-way trip in your car than on a bus. How would you prefer to travel to work if your wage rate is \$10 per hour? Will you change your preferred mode of transportation if your wage rate rises to \$20 per hour? Assume you work five days a week and time spent riding on a bus or driving a car does not directly enter your utility.

Taking a bus will save you \$55 a week, but it will cost you 5 hours of leisure time due to the longer commute. Since the price of leisure is equal to the wage rate, the monetary value of the time lost is \$50 when the hourly wage is \$10 and \$100 when the hourly wage is \$20. Therefore, it makes sense for you to take a bus to work if you are paid \$10 per hour, but you will switch to driving your car if your wage increases to \$20 per hour.

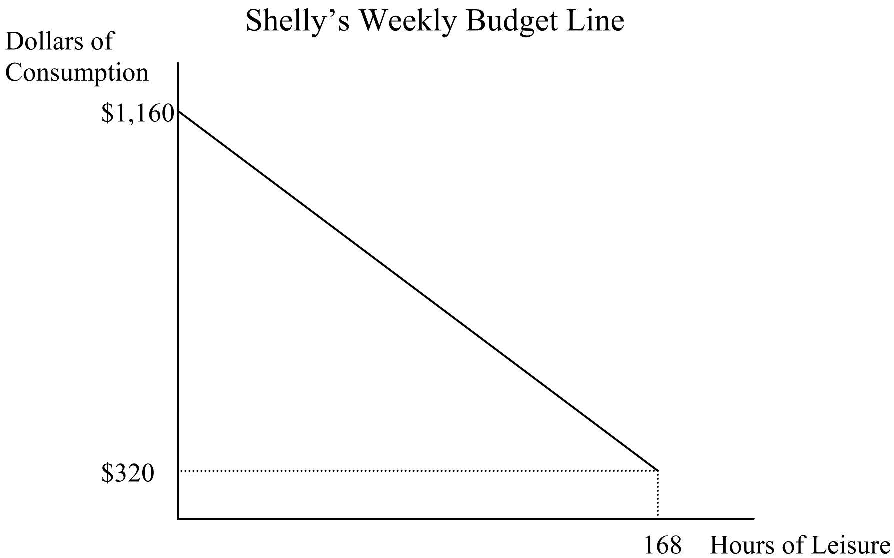
2-10. Shelly's preferences for consumption and leisure can be expressed as

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

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.



(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.

2-10. Among single, college-educated women aged 22 – 25, average annual hours worked is 2,160 and the average wage is \$22.50. If the average wage increases to \$25 per hour, average annual hours worked increases to 2,340. What is the elasticity of labor supply for this group of workers?

The elasticity of labor supply is

$$\sigma = \frac{\%\Delta L_S}{\%\Delta w} = \frac{\frac{2{,}340 - 2{,}160}{2{,}160}}{\frac{25.00 - 22.50}{22.50}} = \frac{1/12}{1/9} = 0.75\,.$$

2-11. Mike's utility for consumption and leisure is $U(C,L) = C \times L$ so that his marginal rate of substitution between leisure and consumption is *C/L*. There are 168 hours in the week and he earns \$10 per hour.

(a) What is Mike's optimal amount of consumption and leisure?

Mike's optimal mix of consumption and leisure is found by setting his MRS equal to his wage and solving for hours of leisure given that the budget line is $C = 10(168–L)$.

$$w = MRS$$

$$10 = \frac{C}{L}$$

$$10L = 1680 - 10L$$

$$L = 84.$$

Thus, Mike will choose to leisure 184 hours, work 84 hours, and consume \$10(84) = \$840 each week.

(b) If the government starts a welfare policy that pays *B* to all non-workers and pays \$0 to all workers, at what value of *B* will Mike opt out of the labor force in order to go on welfare?

Given our answer in part (a), we know that if Mike opts to work, his utility will be $u_{work}(840,84)$ = 840(84) = 70,560. If he opts out of the labor market, his utility will be $u_{welfare}(B,168) = 168B$. Mike will not work, therefore, as long as $u_{welfare} \geq u_{work}$, which requires that $B \geq \$420$.

2-12. 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. On the other hand, the Earned Income Tax Credit raises the effective wage of low-income workers by 20 percent (at least for the poorest workers). Thus, someone who had not been working faces a wage that is 20 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 \$6.50 per hour but the only job she can find pays \$6.00 per hour, she will not work. Under the earned income tax credit, however, the worker views this same job as paying \$7.20 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.

2-13. 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.

(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.