Labor Supply

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Overview

- Measure labor force
- Facts of labor force
- Theory of labor supply
- Labor supply of women
- Labor supply over life cycle

Measuring the Labor Force

The Current Population Survey (CPS) classifies all persons aged 16 or older into one of three categories: the employed(E), unemployed(U), and out of the labor force.

Size of labor force is

$$LF = E + U$$

Labor force participation rate is the fraction of population(P) that is in the labor force

$$LPR = \frac{LF}{P}$$

Employment rate

$$ER = \frac{E}{P}$$

Unemployment rate

$$UR = \frac{U}{LF}$$

Hence

$$ER + UR \neq 1$$

Basic Facts about Labor Supply

TABLE 2-1 Labor Force Participation Rates of Men, 1900–2009

Sources: U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Years to 1970*, Washington, DC: Government Printing Office, 1975; U.S. Bureau of the Census, *Statistical Abstract of the United States*, Washington, DC: Government Printing Office, various issues.

Year	All Men	Men Aged 25–44	Men Aged 45–64	Men Aged over 65
1900	80.0	94.7	90.3	63.1
1920	78.2	95.6	90.7	55.6
1930	76.2	95.8	91.0	54.0
1940	79.0	94.9	88.7	41.8
1950	86.8	97.1	92.0	45.8
1960	84.0	97.7	92.0	33.1
1970	80.6	96.8	89.3	26.8
1980	77.4	93.0	80.8	19.0
1990	76.4	93.3	79.8	16.3
2000	74.7	93.1	78.3	17.5
2009	72.0	91.0	80.8	21.9

[3] For more detailed discussions of the trends in labor supply in the United States and in other countries, see John H. Pencavel, "Labor Supply of Men: A Survey," in Orley C. Ashenfelter and Richard Layard, editors, *Handbook of Labor Economics*, vol. 1, Amsterdam: Elsevier, 1986, pp. 3–102; and Mark R. Killingsworth and James J. Heckman, "Female Labor Supply: A Survey," in ibid., pp. 103–204. See also Mark R. Killingsworth, *Labor Supply*, Cambridge: Cambridge University Press, 1983.

[4] See Tammy Schirle, "Why Have the Labor Force Participation Rates of Older Men Increased since the Mid-1990s?" *Journal of Labor Economics* 26 (October 2008): 549–594.

Figure:

Basic Facts about Labor Supply

TABLE 2-2 Labor Force Participation Rates of Women, 1900–2009

Sources: U.S. Bureau of the Census, *Historical Statistics of the United States, Colonial Years to 1970*, Washington, DC: Government Printing Office, 1975, p. 133; and U.S. Department of Commerce, *Statistical Abstract of the United States, 2011*, Washington, DC: Government Printing Office, 2011, Table 596.

Year	All Women	Single Women	Married Women	Widowed, Divorced, or Separated
1900	20.6	43.5	5.6	32.5
1910	25.4	51.1	10.7	34.1
1930	24.8	50.5	11.7	34.4
1940	25.8	45.5	15.6	30.2
1950	29.0	46.3	23.0	32.7
1960	34.5	42.9	31.7	36.1
1970	41.6	50.9	40.2	36.8
1980	51.5	64.4	49.9	43.6
1990	57.5	66.7	58.4	47.2
2000	60.2	69.0	61.3	49.4
2009	59.2	64.2	61.4	49.3

Figure:

Basic Facts about Labor Supply

TABLE 2-3 Labor Supply in the United States, 2010 (persons aged 25–64)

Source: U.S. Bureau of Labor Statistics, *Current Population Survey*, March 2010. The average number of hours worked is calculated in the subsample of workers. The percent of workers in part-time jobs refers to the proportion working fewer than 30 hours per week.

	Labor Force Participation Rate		Annual Hours of Work		Percent of Workers in Part-Time Jobs	
	Men	Women	Men	Women	Men	Women
All persons	85.4	72.4	2,031	1,797	5.8	15.5
Educational attainment:						
Less than 12 years	74.0	48.2	1,763	1,617	9.4	18.5
12 years	83.1	68.2	1,949	1,755	5.8	15.8
13–15 years	85.6	75.0	2,030	1,771	6.2	16.3
16 years or more	91.6	80.4	2,182	1,878	4.6	14.1
Age:						
25–34	89.9	74.5	1,930	1,749	7.0	14.4
35–44	91.6	76.1	2,084	1,798	4.3	15.8
45–54	86.9	76.5	2,089	1,853	4.6	14.2
55–64	70.5	60.8	2,015	1,777	8.0	18.6
Race:						
White	86.2	74.0	2,079	1,799	5.3	16.6
Black	77.2	71.9	1,934	1,832	6.3	10.9
Hispanic	87.4	65.9	1,879	1,739	7.5	14.9

Figure:

Theory of labor supply

Worker's consideration

- work or not
- given work, how many hours per day

Worker's trade-off

- benefit: labor income(wage)
- cost: disutility of working

The Worker's Preferences

The neoclassical model of labor-leisure choice

- Utility function $U = f(C, L)$
- Indifference Curve: locus of points of (C, L) that generate a particular utility

FIGURE 2-2 Indifference Curves

Points X and Y lie on the same indifference curve and yield the same level of utility (25,000 utils); point Z lies on a higher indifference curve and yields more utility.
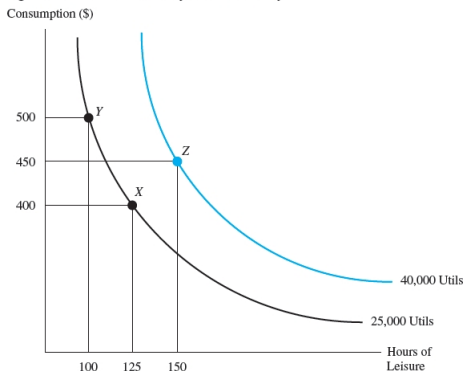
Indifference Curve

Indifference curve have four properties:

- Indifference curves are downward sloping
- Higher indifference curves indicate higher levels of utility
- Indifference curves do not intersect
- Indifference curves are convex to the origin

Indifference Curve

The slope of an indifference curve

$$\frac{\triangle C}{\triangle L} = -\frac{MU_L}{MU_C}$$

- MU_L is marginal utility of leisure defined as the change in utility resulting from an additional hour devoted to leisure activities, holding constant the amount of goods consumed.
- MU_C is the marginal utility of consumption.
- Marginal rate of substitution(MRS) in consumption is defined as the absolute value of the slope of an indifference curve.
- Hence MRS is the number of consumption goods compensated for giving up additional unit leisure time, holding utility constant.

Indifference Curve

FIGURE 2-4 Differences in Preferences across Workers

(*a*) Cindy's indifference curves are relatively steep, indicating that she requires a substantial bribe to give up an additional hour of leisure. (*b*) Mindy's indifference curves are relatively flat, indicating that she attaches a much lower value to her leisure time.
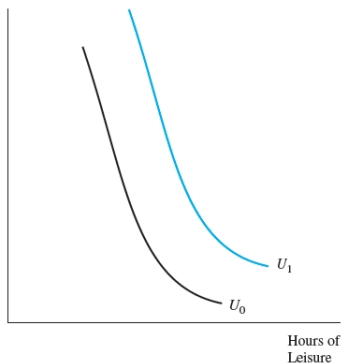
(*a*) Cindy's Indifference Curves
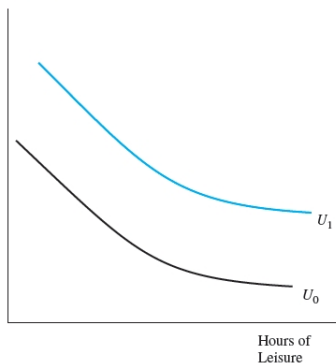
(*b*) Mindy's Indifference Curves

Figure:

Budget constraint

The person's consumption of goods and leisure is constrained by her time and by her income.

$$C = wh + V$$

Income=Non-labor income(V) + Labor income(wh)

Let T the total hours, $T = h + L$, then budget constraint can rewritten as

$$C = w(T - L) + V = (wT + V) - wL$$

Budget constraint

Point E is the endowment point, telling the person how much she can consume if she does not enter the labor market. The worker moves up the budget line as she trades off an hour of leisure for additional consumption. The absolute value of the slope of the budget line is the wage rate.
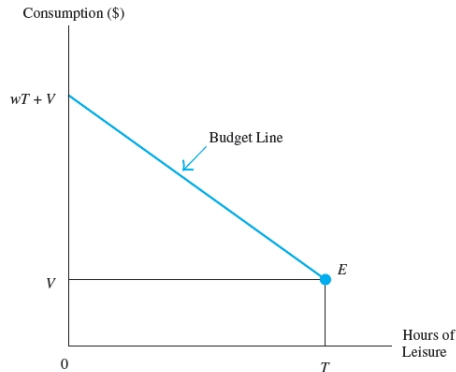
Figure:

The Hours of Work Decision

Goal of individual: choose the particular combination of goods and leisure that maximizes her utility given budget constraint.

FIGURE 2-6 An Interior Solution to the Labor-Leisure Decision
A utility-maximizing worker chooses the consumption-leisure bundle given by point P, where the indifference curve is tangent to the budget line.
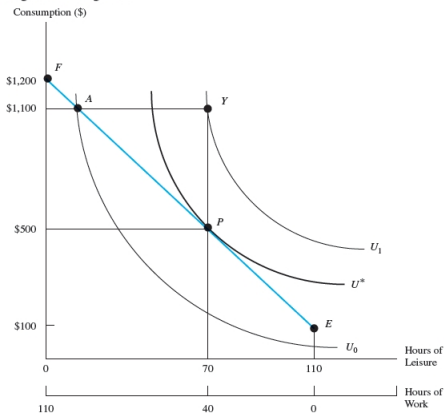
Figure:

The Hours of Work Decision

At the tangency, the slope of the indifference curve equals the slope of the budget line

$$\frac{MU_L}{MU_C} = w$$

At the chosen level of consumption and leisure,

- LHS is marginal rate of substitution, meaning value of consumption need to be compensated for giving up 1 unit leisure time,
- RHS is value can be compensated for giving up 1 unit leisure time in the market.
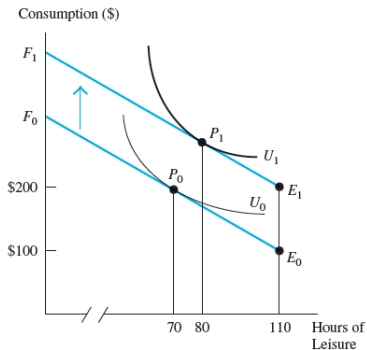
The Hours of Work Decision

Alternatively, rewrite it as

$$\frac{MU_L}{w} = MU_C$$

- LHS, therefore, gives the number of utilities received from spending an additional dollar on leisure.
- RHS gives the number of utilities received from spending an additional dollar on consumption goods.
- At optimal point, the last dollar spent on leisure activities buys the same number of utilities as the last dollar spent on consumption goods.
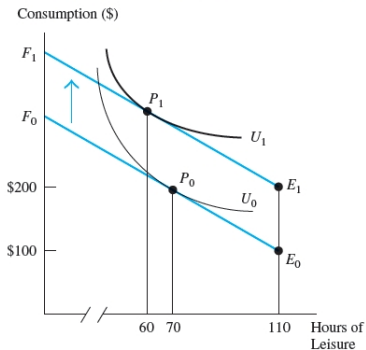
The Hours of Work Decision

FIGURE 2-7   **The Effect of a Change in Nonlabor Income on Hours of Work**

An increase in nonlabor income leads to a parallel, upward shift in the budget line, moving the worker from point P_0 to point P_1. (a) If leisure is a normal good, hours of work fall. (b) If leisure is an inferior good, hours of work increase.

(a) Leisure Is a Normal Good

(b) Leisure Is an Inferior Good

Figure:

The Hours of Work Decision

- Holding wages constant, the impact of the change in non-labor income on the number of hours worked is called income effect.
- A commodity is normal(inferior) good when increase in income, holding the prices of all goods constant, increase(decrease) its consumption.
- There is some evidence supporting that leisure is normal, we will assume this case in our analysis, then the income effect implies that an increase in non-labor income, holding the wage rate constant, reduces hours of work.

The Hours of Work Decision

FIGURE 2-8 **The Effect of a Change in the Wage Rate on Hours of Work**

A change in the wage rate rotates the budget line around the endowment point E. A wage increase moves the worker from point P to point R, and can either decrease or increase hours of work.
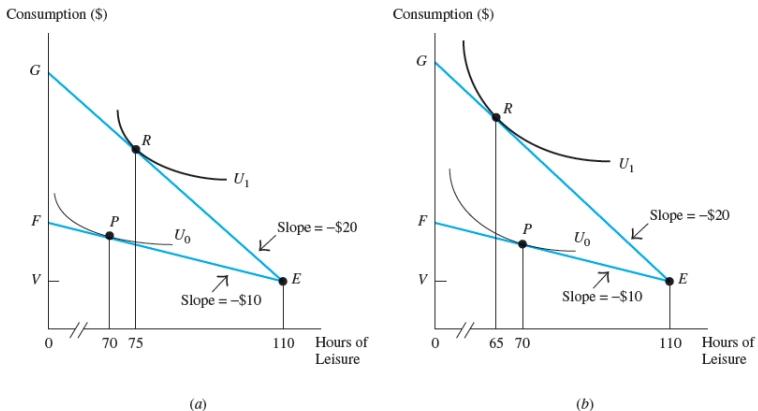

Figure:

The Hours of Work Decision

wage increase has two effect: increase the wage income and makes leisure more expensive

- when income increase, leisure tends to increase given it is normal good,
- when leisure is getting more expensive, however, people will tend to consume less leisure.

The Hours of Work Decision

It helps to think of the move from point P to point R as a two-stage move. The move from initial position P to final position R can be decomposed into a first-stage move from P to Q and a second-stage move from Q to R.

FIGURE 2-9 Decomposing the Impact of a Wage Change into Income and Substitution Effects

An increase in the wage rate generates both income and substitution effects. The income effect (the move from point P to point Q) reduces hours of work; the substitution effect (the move from Q to R) increases hours of work.
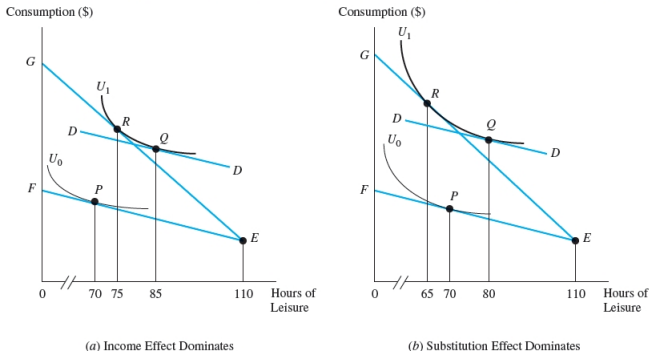

(a) Income Effect Dominates

(b) Substitution Effect Dominates

Figure:

The Hours of Work Decision

- Move from P to Q arises from a change in the worker's income, holding wages constant. This income effect increases the demand for leisure.
- Move from Q to R is called the substitution effect, it illustrates what happens to the worker's consumption bundle as the wage increases, holding utility constant.The substitution effect implies that an increase in the wage rate, holding real income constant, increase hours of work.
- The "two-stage" analysis doesn't describe people's behavior but only for understanding.

The Hours of Work Decision

To summarize the relation between hours of work and the wage rate:

- An increase in the wage rate increases hours of work if the substitution effect dominates the income effect.
- An increase in the wage rate decrease hours of work if the income effect dominates the substitution effect.

To Work or Not to Work

What is the determinant of entering labor market?

In other words, why do people choose to work?

To Work or Not to Work

FIGURE 2-10 **The Reservation Wage**
If the person chooses not to work, she can remain at the endowment point E and get U_0 units of utility. At a low wage (w_{low}), the person is better off not working. At a high wage (w_{high}), she is better off working. The reservation wage is given by the slope of the indifference curve at the endowment point.
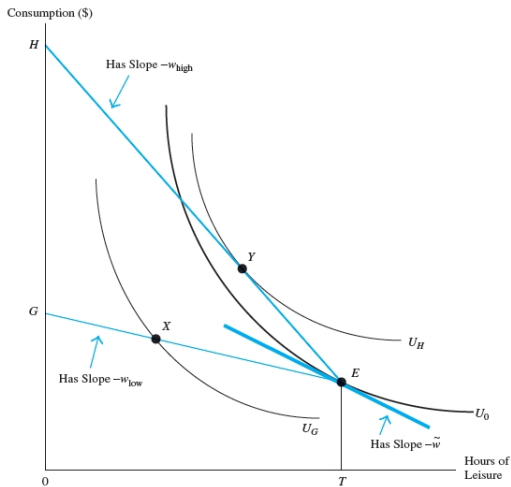
Figure:

To Work or Not to Work

- The figure indicates that there is a wage rate, call it $\tilde{w}$, that makes people indifferent between working and not working, we call this wage reservation wage.
- Question: can you calculate the reservation wage given the utility function $U(C,L) = C^{\alpha}L^{1-\alpha}$, non-labor income V, total time T?

To Work or Not to Work

- The definition of the reservation wage implies that the person will not work at all if the market wage is less than the reservation wage
- The person will enter the labor market if the market wage exceeds the reservation wage.
- A high reservation wage makes it less likely that a person will work.
- The assumption that leisure is a normal good implies that the reservation wage rises as non-labor income increases.
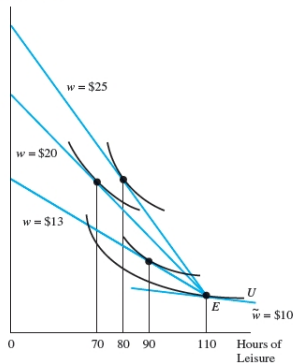
The Labor Supply Curve

The predicted relation between hours of work and the wage rate is called the labor supply curve

**FIGURE 2-11**   Deriving a Labor Supply Curve for a Worker

The labor supply curve traces out the relationship between the wage rate and hours of work. At wages below the reservation wage ($10), the person does not work. At wages higher than $10, the person enters the labor market. The upward-sloping segment of the labor supply curve implies that substitution effects are stronger initially; the backward-bending segment implies that income effects may dominate eventually.

(a) Optimal Consumption Bundles
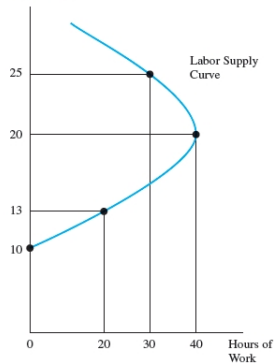
(b) Relation between Optimal Hours of Work and the Wage Rate

The Labor Supply Curve

Market labor supply is the aggregate of individual workers.

FIGURE 2-12 Derivation of the Market Labor Supply Curve from the Supply Curves of Individual Workers
The market labor supply curve "adds up" the supply curves of individual workers. When the wage is below $\tilde{w}_A$, no one works. As the wage rises, Alice enters the labor market. If the wage rises above $\tilde{w}_B$, Brenda enters the market.
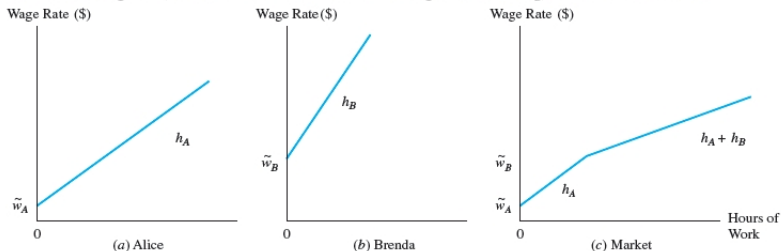
Figure:

The Labor Supply Curve

To measure the responsiveness of hours of work to changes in the wage rate, we define the labor supply elasticity as

$$\sigma = \frac{\text{percent change in hours of work}}{\text{percent change in wage rate}} = \frac{\triangle h/h}{\triangle w/w} = \frac{\triangle h}{\triangle w}\frac{w}{h}$$

- For example, the worker's wage is initially $10 per hour and that she works 1,900 hours per year. The worker gets raise to $20 per hour, and she decides to work 2,090 hours per year. This worker's labor supply elasticity can then be calculated as

The Labor Supply Curve

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$$\sigma = \frac{\text{percent change in hours of work}}{\text{percent change in wage rate}} = \frac{10\%}{100\%}$$

Labor Supply of Women

- Some facts of labor supply of women
- Some explanations

Labor Supply of Women: Facts

TABLE 2-4
International Differences in Female Labor Force Participation Rate (women aged 15–64)

Source: U.S. Bureau of the Census, *Statistical Abstract of the United States, 2006*, Washington, DC: Government Printing Office, Table 1343.

Country	1980	1990	2003
Australia	52.7	62.1	66.4
Canada	57.8	67.6	70.4
France	54.4	57.8	62.0
Germany	52.8	56.7	64.0
Greece	33.0	43.6	50.2
Ireland	36.3	43.8	56.2
Italy	39.6	45.9	46.8
Japan	54.8	60.3	64.2
Korea, South	—	51.2	54.3
Mexico	33.7	—	42.4
New Zealand	44.6	63.0	67.6
Portugal	54.3	62.9	67.2
Spain	32.2	41.2	50.7
Sweden	74.1	80.4	75.0
Turkey	—	36.7	26.9
United Kingdom	58.3	66.5	67.8
United States	59.7	68.5	71.7

Figure:

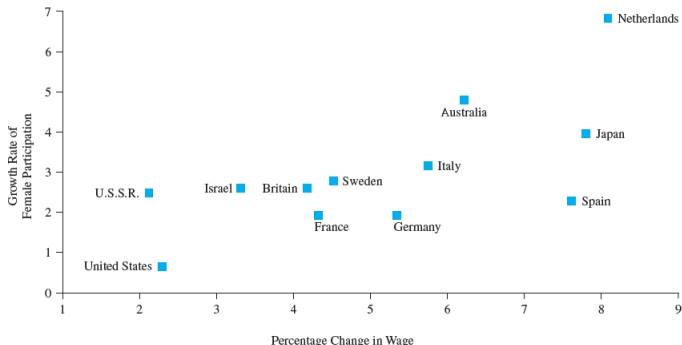# Labor Supply of Women: Facts

Two suggested key results:

- there are substantial differences across countries in women's labor force participation rates.
- the data reveal that these countries experienced a common trend: rising female labor force participation during the past few decades.

Labor Supply of Women: wage

- Our theoretical discussion highlights the role of changes in the wage rate as a key determinant of the increase in female labor force participation.
- In fact, the real wage of women increased substantially in most countries.

FIGURE 2-13 Cross-Country Relationship between Growth in Female Labor Force and the Wage, 1960–1980

Source: Jacob Mincer, "Intercountry Comparisons of Labor Force Trends and of Related Developments: An Overview," *Journal of Labor Economics* 3 (January 1985), Part 2): S2, S6.

Labor Supply of Women: reservation wage

- The increase in the labor force participation rates of women could also be due to a decline in women's reservation wage.
- It is likely that an increase in the number of children raises a woman's reservation wage and reduces the probability that the woman will work.
    - In fact, if a woman has children under the age of six, her probability of working falls by nearly 20 percentage points.
    - Between 1950 and 2000, the total lifetime fertility of the average adult woman declined from 3.3 to 2.1 children, so the reduction in fertility probably contributed to the increase in female labor force participation.

Labor Supply of Women: home production and others

- The model suggests that women's labor supply may be more responsive to wage changes than men's labor supply, a rise in the real wage will then draw many women out of the household production sector and move them into the market sector.

- Female labor force participation rates also are influenced by technological changes in the process of household production.

- Others including changes in cultural and legal attitudes toward working women as well as the social and economic disruptions brought about by two world wars and the Great Depression.

Policy Application : Welfare Programs and Work Incentives

There are a lot of income maintenance programs, what is the impact of these programs on work incentives?

- Cash grant
- The Earned Income Tax Credit(EITC)

Policy Application : Cash grant

Cash grant

- the eligible persons are given a cash grant of $500 per month as long as they remain outside the labor force.
- If these persons enter the labor market the government officials immediately assume that they no longer need public assistance and then dropped from the welfare rolls.

Policy Application : Cash grant

FIGURE 2-14 **Effect of a Cash Grant on Work Incentives**

A take-it-or-leave-it cash grant of $500 per month moves the worker from point P to point G, and encourages the worker to leave the labor force.
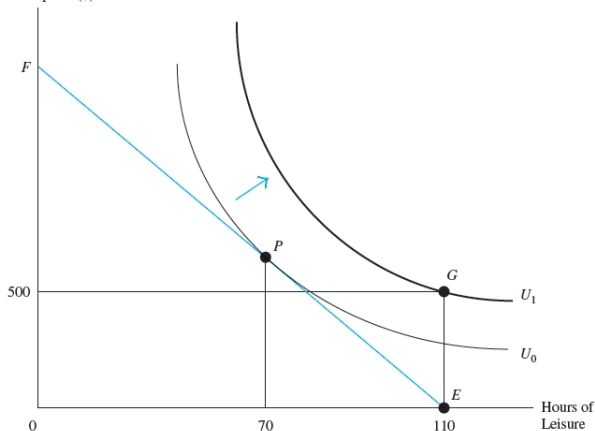

Figure:

Policy Application : Welfare Programs

An alternative Welfare program

- Although welfare recipients can work, the amount of the cash grant is often reduced by some specified amount for every dollar earned in the labor market.
- Prior to 1996, for example, the AFDC grant was reduced by 67 cents for every dollar that the woman earned in the labor market

Many of studies found that the AFDC program reduced labor supply by 10 to 50 percent from the level of work effort that would have found the absence of the program, and the values of the labor supply elasticities generally fell in line with the consensus estimates described above.

Policy Application : Welfare Programs

An example with 50 cents for each dollar and wage equals to 10

FIGURE 2-15   Effect of a Welfare Program on Hours of Work

A welfare program that gives the worker a cash grant of $500 and imposes a 50 percent tax on labor earnings reduces work incentives. In the absence of welfare, the worker is at point P. The income effect resulting from the program moves the worker to point Q; the substitution effect moves the worker to point R. Both income and substitution effects reduce hours of work.
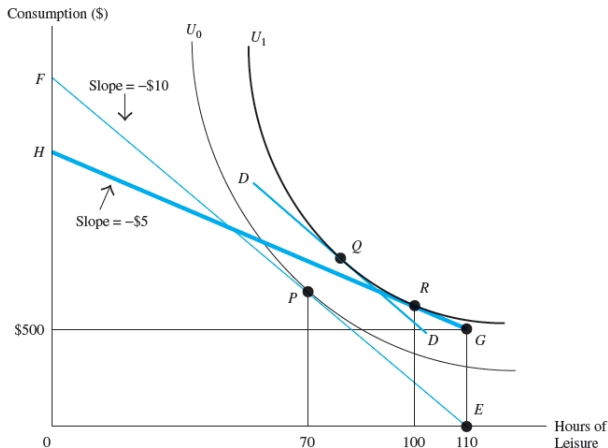
Policy Application : The Earned Income Tax Credit

Earned Income Tax Credit (EITC):

- began in 1975, it has been expanded substantially since.
- By 2007, it was the largest cash-benefit entitlement program in the United States, granting nearly $40 billion to low-income households.

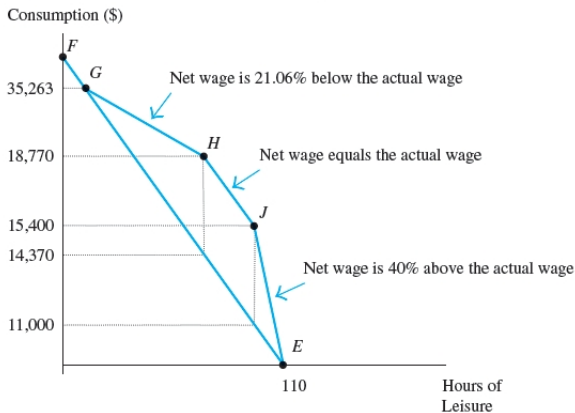# Policy Application : The Earned Income Tax Credit

E.g. Consider a household composed of a working mother with two qualifying children.

- In 2005, for example, this woman could claim a tax credit of up to 40 percent of her earnings as long as she earned less than $11,000 per year, resulting in a maximum credit of $4,400.
- This maximum credit would be available as long as she earned between $11,000 and $14,370.
- After reaching the $14,370 threshold, the credit would begin to be phased out.
- In particular, each additional dollar earned reduces the credit by 21.06 cents.

Policy Application : The Earned Income Tax Credit

FIGURE 2-16   **The EITC and the Budget Line (not drawn to scale)**

In the absence of the tax credit, the budget line is given by *FE*. The EITC grants the worker a credit of 40 percent on labor earnings as long she earns less than $11,000. The credit is capped at $4,400. The worker receives this maximum amount as long as she earns between $11,000 and $14,370. The tax credit is then phased out gradually. The worker's net wage is 21.06 cents below her actual wage whenever she earns between $14,370 and $35,263.

Consumption ($)

Policy Application : The Earned Income Tax Credit
## How does the EITC affect labor supply?

FIGURE 2-17   The Impact of the EITC on Labor Supply

The EITC shifts the budget line, and will draw new workers into the labor market. In (a), the person enters the labor market by moving from point P to point R. The impact of the EITC on the labor supply of persons already in the labor market is less clear. In the shifts illustrated in (b) and (c), the worker reduced hours of work.
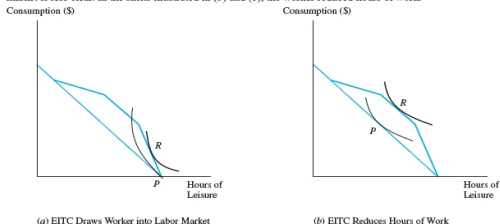
(a) EITC Draws Worker into Labor Market

(b) EITC Reduces Hours of Work
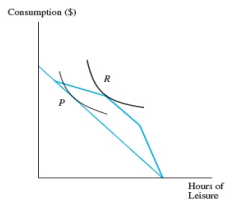
(c) EITC Reduces Hours of Work

Policy Application : The Earned Income Tax Credit

Therefore, the theory suggests that the EITC has two distinct effects on labor supply.

- First, the EITC increases the number of labor force participants
- Second, the EITC may change the number of hours worked by persons who would have been in the labor force even in the absence of the program.

Policy Application : The Earned Income Tax Credit

The available evidence confirms the theoretical prediction that the EITC draws many new persons into the labor force.

TABLE 2-5 The Impact of the Earned Income Tax Credit on Labor Force Participation

Source: Nada Eissa and Jeffrey B. Liebman, "Labor Supply Response to the Earned Income Tax Credit," *Quarterly Journal of Economics* 111 (May 1996): 617.

	Participation Rate before Legislation (%)	Participation Rate after Legislation (%)	Difference (%)	Difference-in-Differences (%)
Treatment group—eligible for the EITC:				
Unmarried women with children	72.9	75.3	2.4	
Control group—not eligible for the EITC:				2.4
Unmarried women without children	95.2	95.2	0.0	

Figure:

Labor Supply over the Life Cycle: theory

So far we only analyze the labor decision at a time point, while in fact today's labor decision may have impact on tomorrow's decision, hence this decision might not be constant over life cycle

FIGURE 2-18 The Life Cycle Path of Wages and Hours for a Typical Worker

(a) The age-earnings profile of a typical worker rises rapidly when the worker is young, reaches a peak at around age 50, and then wages either stop growing or decline slightly. (b) The changing price of leisure over the life cycle implies that the worker will devote relatively more hours to the labor market when the wage is high and fewer hours when the wage is low.
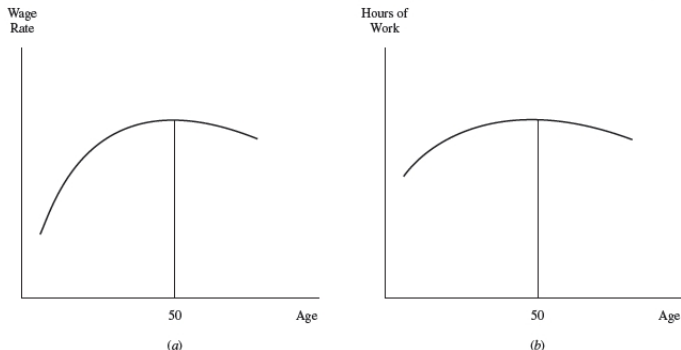

Figure:

Labor Supply over the Life Cycle: theory

FIGURE 2-19 Hours of Work over the Life Cycle for Two Workers with Different Wage Paths

Joe's wage exceeds Jack's at every age. Although both Joe and Jack work more hours when the wage is high, Joe works more hours than Jack only if the substitution effect dominates. If the income effect dominates, Joe works fewer hours than Jack.
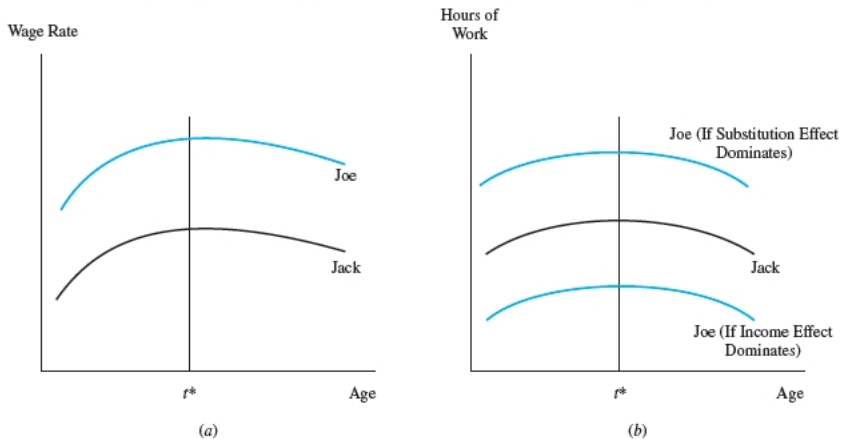

Figure:

Labor Supply over the Life Cycle

It predicts a link between wages and labor force participation rates:

- suppose the reservation wage is roughly constant over time, then participation rates are like to be low for young workers, high for workers in their prime working years, and low again for older workers

Labor Supply over the Life Cycle: labor force participation rate

FIGURE 2-20
Labor Force Participation Rates over the Life Cycle, 2010

Source: U.S. Bureau of Labor Statistics, *Annual Demographic Supplement of the Current Population Surveys*, 2010.
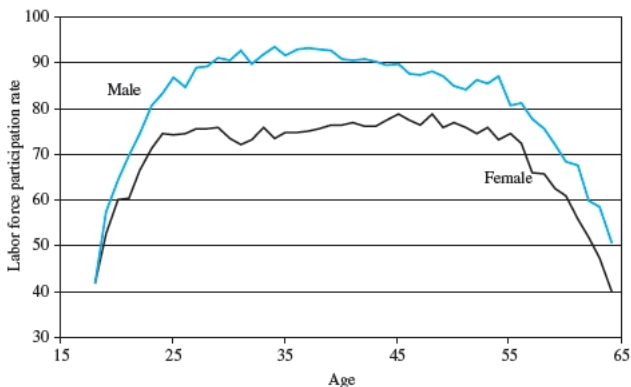
Figure:

Labor Supply over the Life Cycle: inter-temporal substitution hypothesis

- The theoretical prediction that people allocate their time over the life cycle so as to take advantage of changes in the price of leisure is called the inter-temporal substitution hypothesis.
- The inter-temporal substitution hypothesis implies that the correlation between changes in hours of work and changes in the wage should be positive: as a worker ages, an increase in the wage rate should increase hours of work.

Labor Supply over the Life Cycle: hours of work

FIGURE 2-21
Hours of Work over the Life Cycle, 2010

Source: U.S. Bureau of Labor Statistics, *Annual Demographic Supplement of the Current Population Surveys*, 2010.
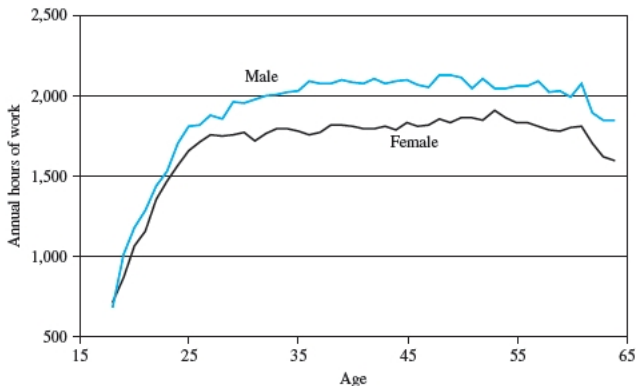
Figure:

Labor Supply over the Business Cycle

- Not only respond to change in life cycle, but also respond to change in business cycle.
- Do recessions motivate many persons to enter the labor market in order to make up the income of family members who have lost their jobs?
- or do the unemployed give up hope of finding work in a depressed market and leave the labor force altogether?

Labor Supply over the Business Cycle

- added worker effect: secondary worker who are currently out of the labor market are affected by the recession because the main breadwinner becomes unemployed or faces a wage cut
- discouraged worker effect: many unemployed workers find it almost impossible to find jobs during a recession and simply give up.

There is overwhelming evidence that the discouraged worker effect dominates the correlation between labor force participation and the business cycle, which also implies BLS might underestimate unemployment rate.

The Decline in Work Attachment among Older Workers

There has been a marked drop in labor force participation among older men.

why?

- health condition
- pension benefit
- social security benefit

The Decline in Work Attachment among Older Workers

Is it linked to the deteriorating health of this particular age group?

- Not necessary, at the same time that their labor market attachment was weakening, the life expectancy of white men aged 50 rose from 22 to 29.2 years between 1939 and 2007.

The Decline in Work Attachment among Older Workers

Increase in pension benefits:

- The fraction of men who were covered by pension programs other than Social Security rose from 26 percent in 1950 to 66 percent in 1990.
- The probability that men aged 58 to 63 work falls by 18 percentage points if they have private pension plans

The Decline in Work Attachment among Older Workers

Increased generosity of the Social Security system:

- Social Security benefits increased by about 20 percent during the early 1970s
- During the 1980s, a period when real wages fell for many workers, real Social Security benefits remained roughly constant.

However, the evidence suggests that at most 15 percent of the decline in participation rates of older workers can be attributed to the increase in Social Security retirement benefits. E.g. notch babies.

Policy Application: Social Security Disability Program

Social Security Disability Program:

the monthly disability benefit equals the Social Security retirement benefits that the worker would have received had he or she continued working until age 65, regardless of the worker's age at the time the disability occurred.

Policy Application: Social Security Disability Program

An US study: examined the labor supply decisions of the disability applicant who are rejected by the government, it turns out that fewer than half of the rejected applicant go back to work after the final determination of their case.

- This result has been interpreted as indicating that the men who receive disability benefits would not have been in the labor force even in the absence of such a program.

Policy Application: Social Security Earnings Test

The Social Security earnings test:

- until 2000, retirees between the ages of 65 and 69 who received Social Security benefits, $10,000 per year, could have earned up to $17,000 per year without affecting their retirement benefits,
- but if exceeding this threshold, $1 of Social Security benefits was withheld for every $3 earned above the exempt amount,
- if the retiree earns more than 47,000, the retiree forfeits his entire Social Security benefits.
- the earnings test did not apply to workers who are 70 or older,
- in 2000 the earnings test was eliminated.

Policy Application: Social Security Earnings Test

FIGURE 2-22 The Impact of the Social Security Earnings Test on Hours of Work

The Social Security earnings test (which taxes retirees when they earn more than $17,000 per year) generates the budget "line" *HGFE*. The repeal of the earnings test moves retirees to budget line *H'E*. The first retiree (worker 1) would not change his hours of work; the second retiree would reduce his hours; and the third retiree might increase or decrease his hours, depending on whether substitution or income effects dominate.
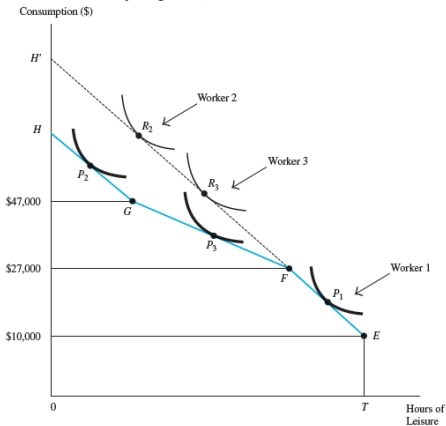
Figure: