Labor Supply

Introduction to Labor Supply

Labor facts

- Men: labor force participation rates declined from 80% in 1900 to 71% in 2010.
- Women: labor force participation rates rose from 21% in 1900 to 60% in 2010.
- Hours worked fell from 40 to 34 per week during the same time period.

Measuring the Labor Force

The Current Population Survey (CPS) classifies all persons aged 16 or older into one of three categories:

1. The employed 2. The unemployed 3. out of the labor force

The employed

- A worker must have been at a job with pay for at least 1 hour, or worked at least 15 hours on a nonpaid job

The unemployed

- A worker must either be on a temporary layoff from a job, or have no job but be actively looking for work in the four-week period prior to the reference week

Measuring the Labor Force

Current population survey (CPS)

- Labor Force = Employed + Unemployed
  - LF = E + U
  - Size of LF does not tell us about "intensity" of work.

- Labor Force Participation Rate
  - LFPR = LF/P
  - P = civilian adult population 16 years or older not in institutions.

Measuring the Labor Force

Current population survey (CPS)

- Employment: Population Ratio (percent of population that is employed).
  - EPR = E/P
- Unemployment Rate
  - UR = U/LF

Measuring the Labor Force

Labor force measurement relies on subjectivity and likely understates the effects of a recession.

Hidden unemployed: persons who have given up in their search for work and have therefore left the labor force.

The employment rate (E/P) can be a better measure of fluctuations in economic activity than the unemployment rate.

E - the number of persons employed

U - the number of persons unemployed

LF- the size of the labor force

P- population

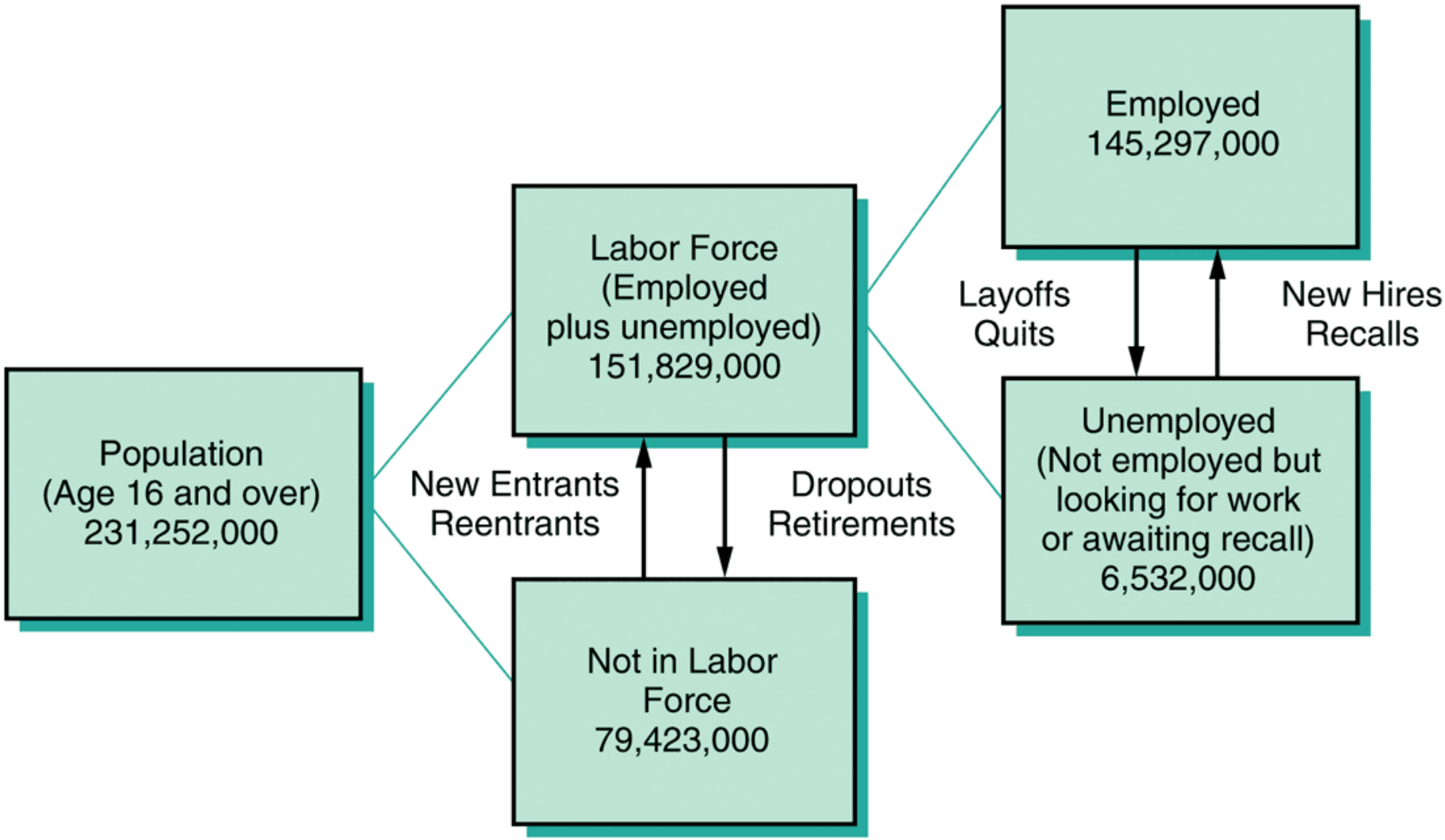
$$LF = E + U$$

$$Labor\ \ force\ \ participation\ \ rate = \frac{LF}{P}$$

$$Employment\ \ rate = \frac{E}{P}$$

$$Unemployment\ \ rate = \frac{U}{LF}$$

Labor Force Status of the U.S. Adult Civilian Population, April 2007



Basic Facts about Labor Supply

- Labor force participation rates of men
- Labor force participation rates of women
- Average weekly hours of work of production workers

Labor Force Participation Rates of Men (U.S.), 1900-2010

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	74.8	93.1	78.3	17.5
2010	71.2	90.6	78.4	22.1

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.

Labor Force Participation Rates of Women (U.S.), 1900-2010

Year	All Women	Single Women	Married Women	Widowed, Divorced, or Separated
1900	20.6	43.5	5.6	32.5
1920	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	59.9	68.9	61.1	49.0
2010	58.6	63.3	61.0	48.8

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.

Labor Force Participation Facts

Labor force participation (LFP) is greatest for all groups during the ages of 25 to 55.

LFP increases with education.

LFP has decreased for men over the age of 65 from 63% in 1900 to under 22% by 2010.

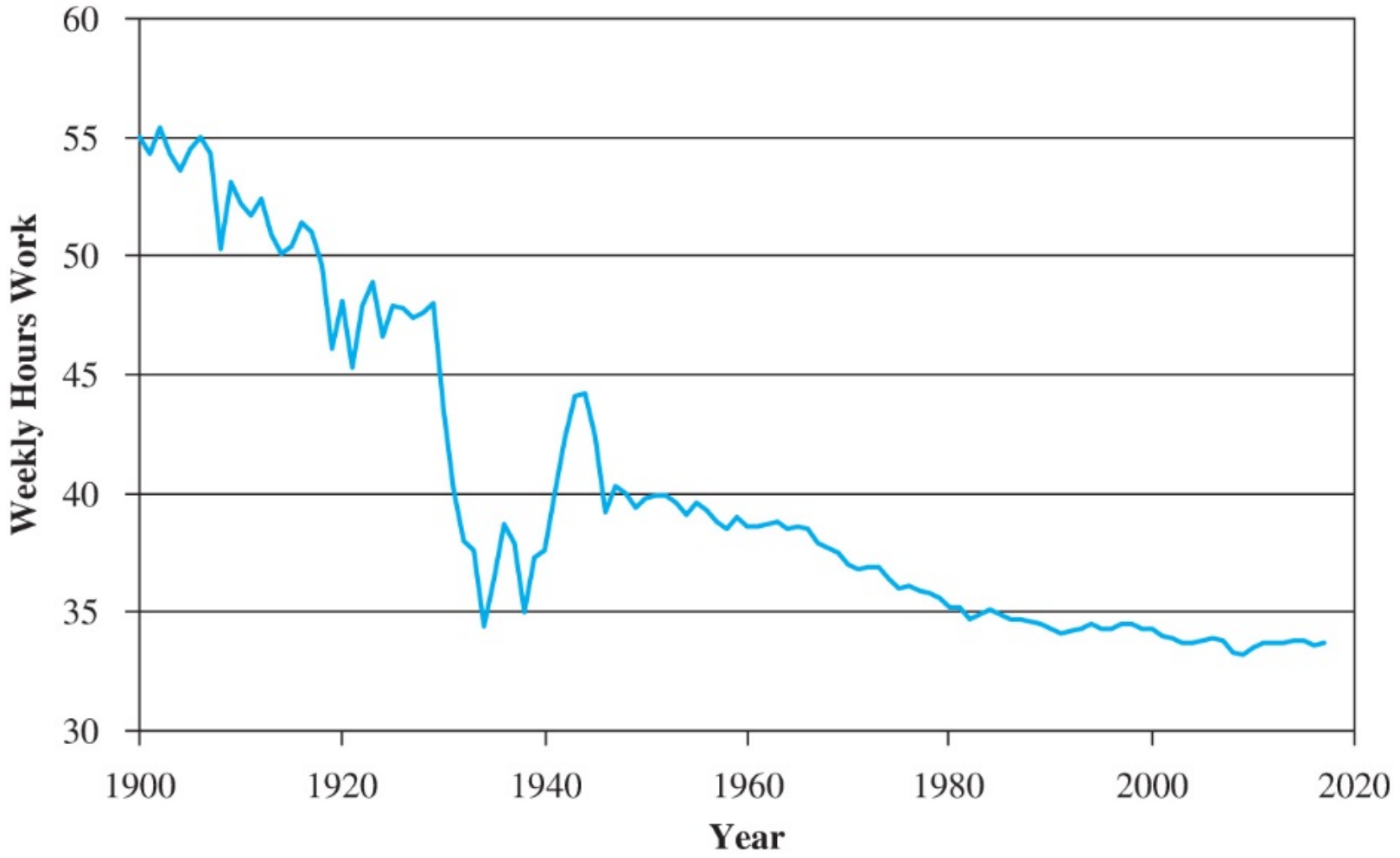
Labor Force Participation Facts

More women than men work part-time.

More men who are high school drop outs work than women who are high school drop outs.

White men have higher participation rates and hours of work than black men.

Average weekly hours of work of production workers, 1900-2013



Labor Supply in the United States, 2005 (persons aged 25-64)

Source: U.S. Bureau of Labor Statistics, *Current Population Survey,* March 2005. 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	86.1	71.4	2,153	1,810	3.6	14.8
Educational attainment:						
Less than 12 years	74.8	47.8	1,972	1,659	5.1	16.3
12 years	83.8	67.0	2,104	1,782	4.1	15.4
13–15 years	87.6	75.8	2,136	1,797	4.6	15.7
16 years or more	91.8	79.9	2,247	1,876	4.0	14.8
Age:						
25–34	90.2	73.1	2,078	1,744	4.5	15.5
35–44	91.4	75.7	2,196	1,812	2.9	15.9
45–54	87.6	75.9	2,190	1,881	3.7	13.3
55–64	70.1	56.8	2,080	1,778	7.7	17.8
Race:						
White	86.8	72.9	2,183	1,799	4.4	17.2
Black	77.7	73.4	2,019	1,873	4.7	8.8
Hispanic	89.0	62.7	2,055	1,785	2.8	12.7

Labor Force Participation Rates of Men and Women (Thailand), 1980-2009

Year	Men	Women
1980	86.9	75.5
1985	87.5	75.6
1990	87	75.1
1995	83.3	66.3
2000	81.3	66.1
2005	81.1	66.2
2009	80.7	65.5

Source: http://databank.worldbank.org

Employees % of men employment by sectors (Thailand), 1980-2009

Year	Agriculture	Industry	Services
1980	67.8	12.6	19.6
1985	67.2	12.6	20.2
1990	63.1	15.5	21.3
1995	50.8	22	27.3
2000	49.8	20.4	29.7
2005	44.2	21.6	34.1
2009	43.7	21.2	35.1

Source: http://databank.worldbank.org

Employees % of women employment by sectors (Thailand), 1980-2009

Year	Agriculture	Industry	Services
1980	74.1	7.8	18.1
1985	64.1	16.5	25.2
1990	65	12.3	22.1
1995	53.4	17.1	27.5
2000	47.5	17.3	37
2005	40.7	18.7	40.5
2009	39	17.6	43.3

Source: http://databank.worldbank.org

Neo-Classical Model of Labor-Leisure Choice

Utility Function

- Measure of satisfaction individuals receive from consumption (C) of goods and leisure (L).

- U = f(C, L)
  - U is an index.
  - The higher is U, the happier is the person.

Decision

- Individual may make a decision about
  - Work or not work
  - If they work, how many working hours?
  - Occupation and Industry
  - How long to work at this job? Migration?
- Simple Model
  - Trade off between leisure and consumption
  - Hours of leisure = total hours – working hours
  - work more can generate more income and can consume more
- So, we need
  - Indifferent curve (IC)
  - Budget Line
  - Maximization of Satisfaction (utility)

The Worker's Preferences

Neoclassical model of labor-leisure choice

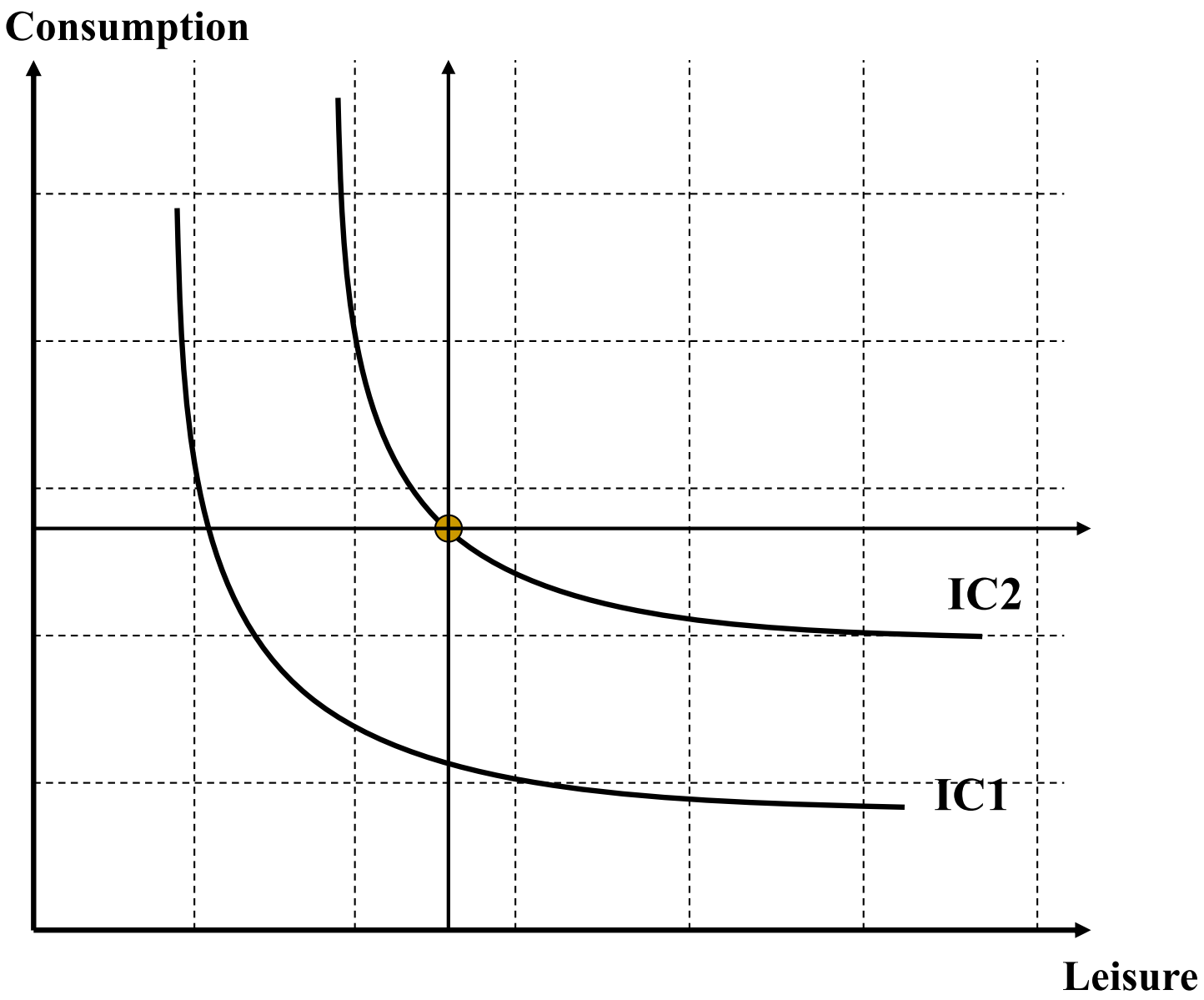
- The model isolates the factors that determine whether a particular person works and, if so, how many hours she chooses to work

- The representative person in our model receives satisfaction both from the consumption of goods (C) and from the consumption of leisure (L)

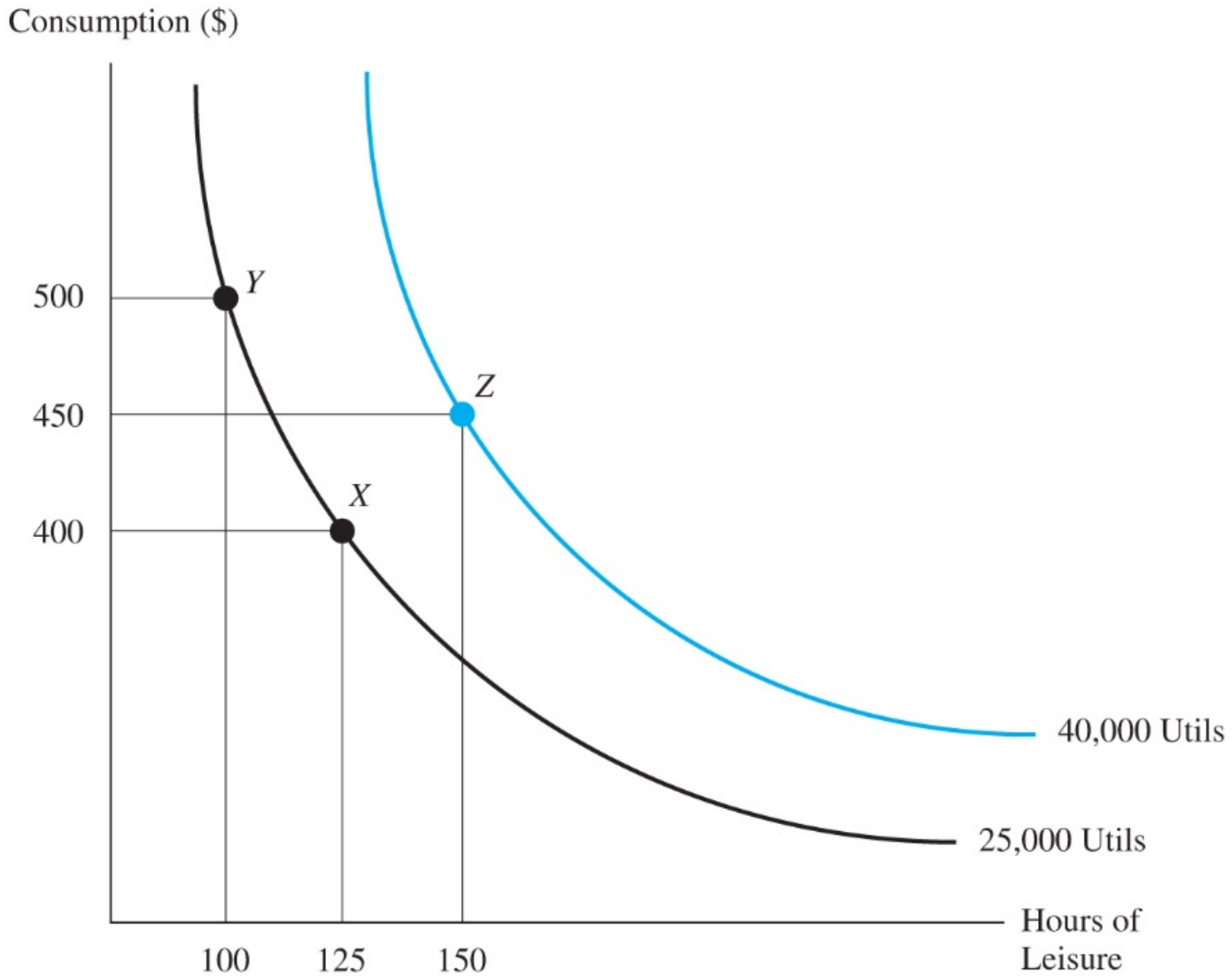
Utility

- The utility function transforms the person's consumption of goods and leisure into an index U that measures the individual's level of satisfaction or happiness
- The higher the level of index U, the happier the person
- We make assumption that buying more goods or having more leisure hours both increases the person's utility

$$U = f(C, L)$$


Consumption
IC2
IC1
Leisure

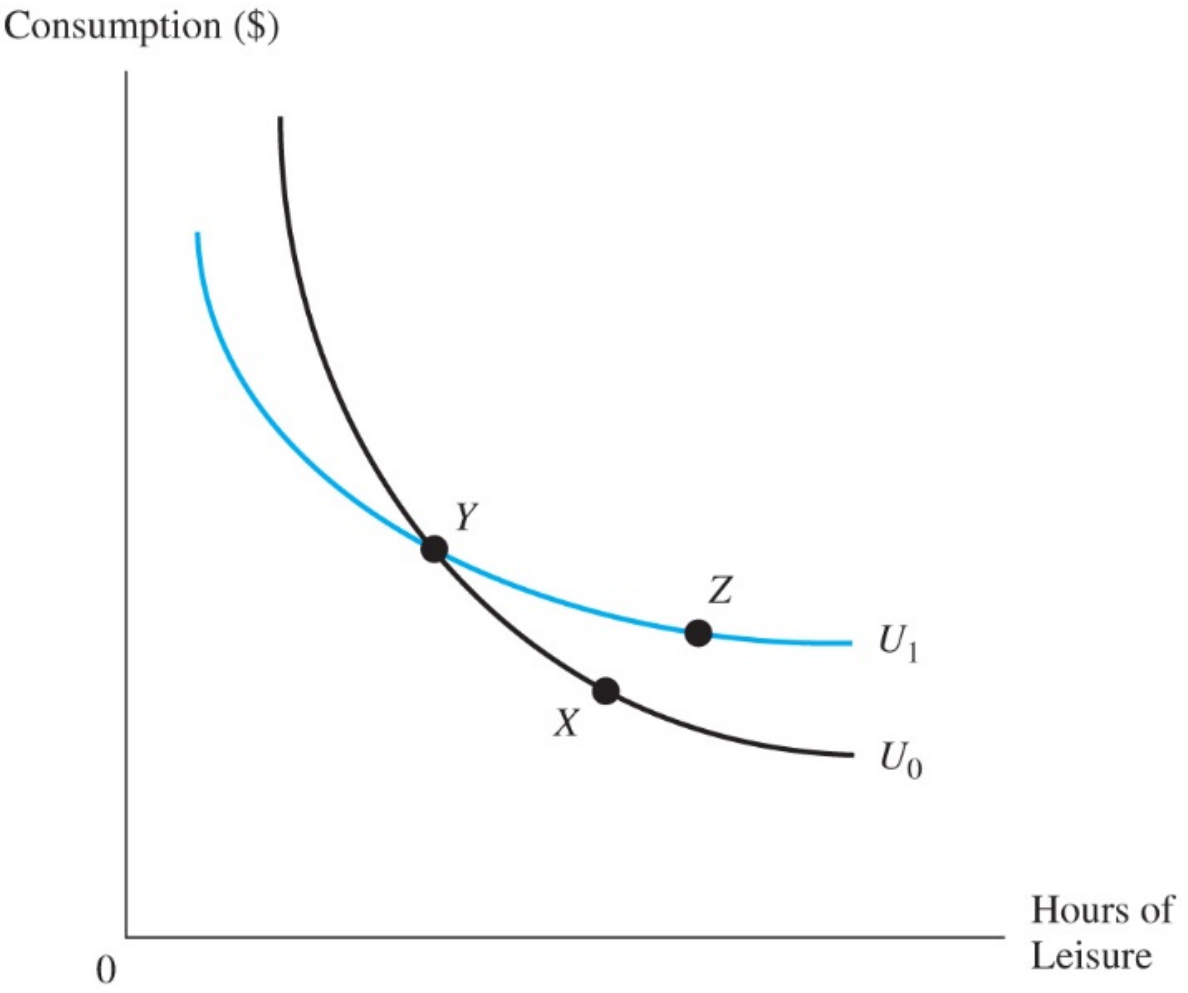
Indifference Curves (IC)



Indifference curves have 4 important properties

1. Indifferent curves are downward sloping
2. Higher ICs indicate higher levels of utility
3. ICs do not intersect
4. ICs are convex to origin→ Diminishing marginal rate of substitution

Indifference Curves Cannot Cross



The Slope of an Indifference Curve

The marginal utility of leisure (MU_L)

- The change in utility resulting from an additional hour devoted to leisure activities, holding constant the amount of goods consumed

The marginal utility of consumption (MU_C)

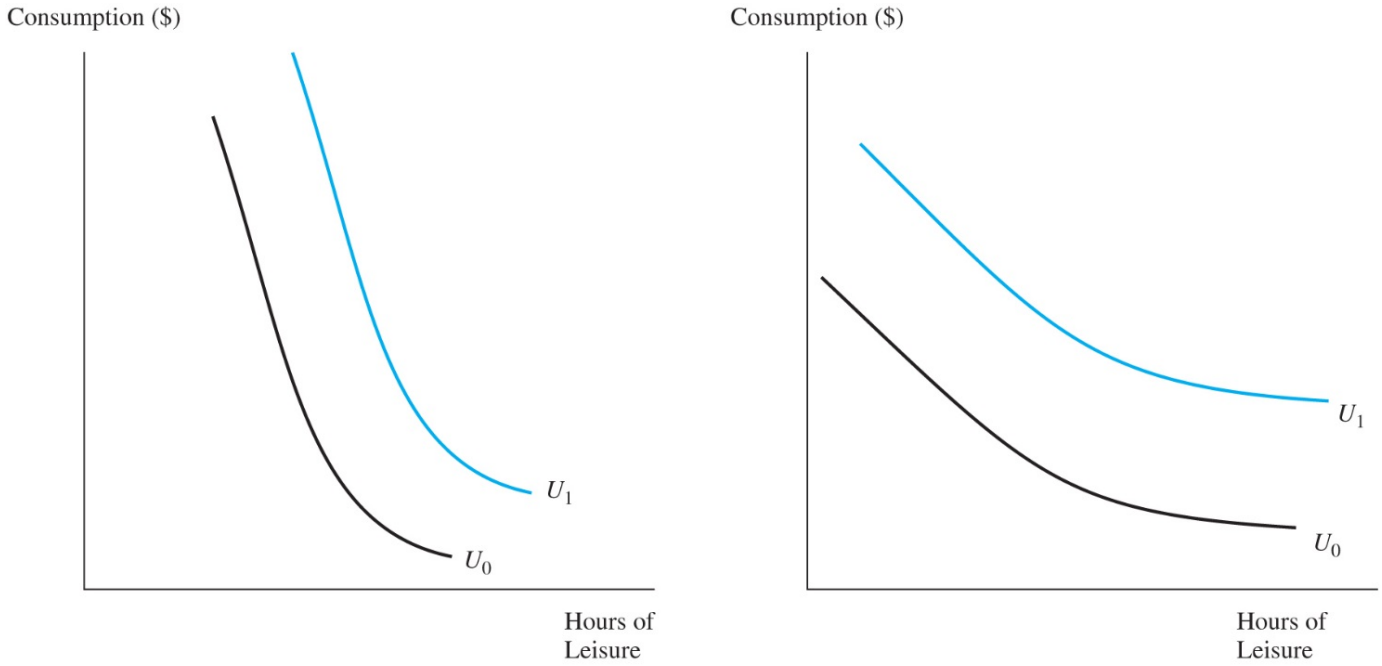
- The change in utility if the individual consumes one more dollar's worth of goods, holding constant the number of hours devoted to leisure activities

Marginal rate of substitution (MRS) in consumption

- The slope of the indifference curve measures the rate at which a person is willing to give up some leisure time in return for additional consumption, while holding utility constant

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

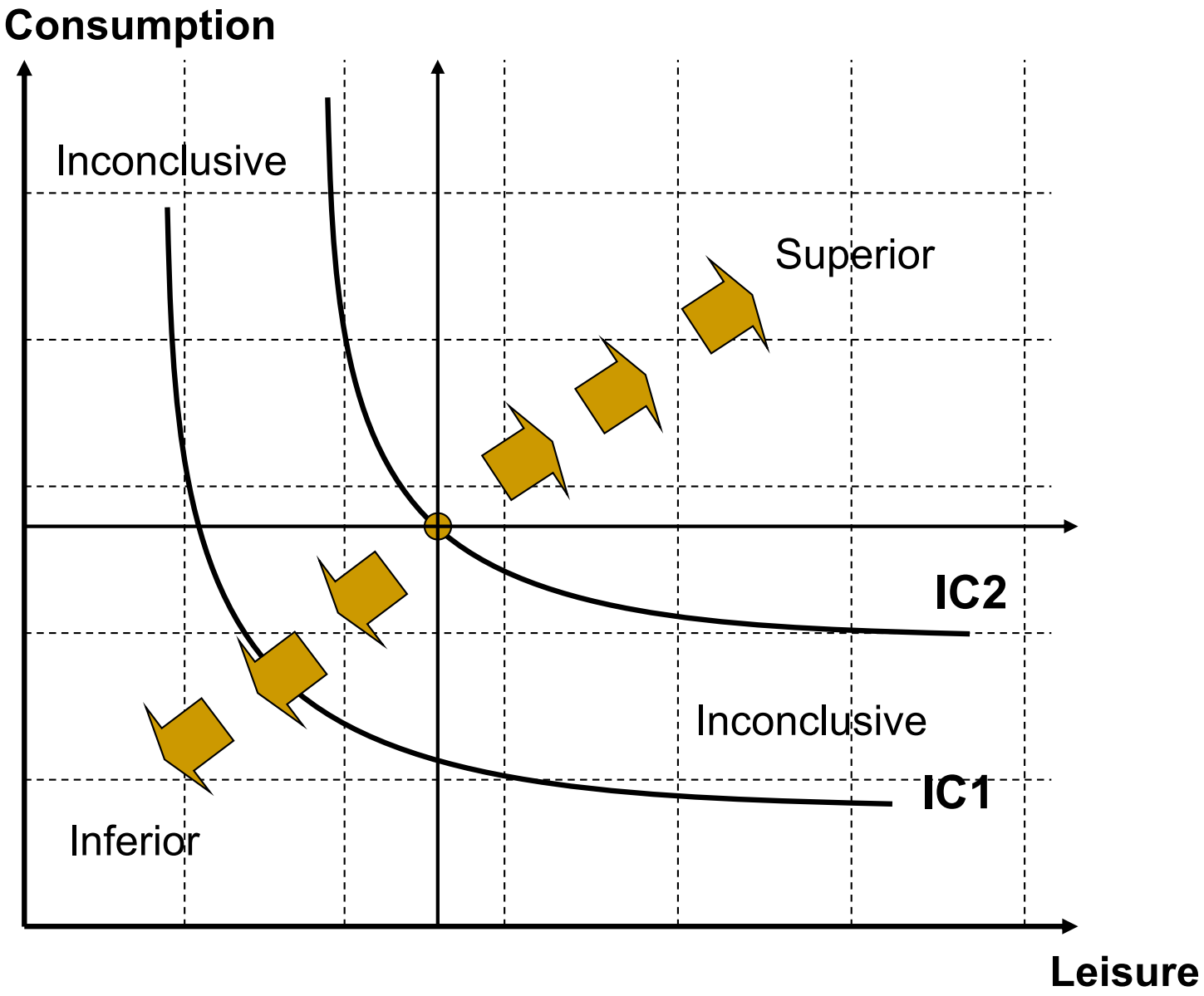
Differences in Preferences across Workers



(*a*) Cindy's Indifference Curves

(*b*) Mindy's Indifference Curves

Workers with steeper indifference curves value their leisure relatively more than workers with shallower indifference curves.


Consumption
Inconclusive
Superior
IC2
Inconclusive
IC1
Inferior
Leisure

Slope of IC

- The shape of IC can show the worker's preference about the degree of loving to work or take leisure.
- This show by the slope of IC or MRS, the higher MRS (without considering the negative sign) implies to prefer leisure than consumption whereas the steeper slope of IC means to prefer consumption than leisure
- So, we can classify individual into two groups which are "workaholic" and "leisure lover"
- Important factors to determine the decision are personality, occupation, and individual circumstances

Example A.2.2.1 Let individual utility being $U(C,l)=C^{0.5}l^{0.5}$,this is called Cobb-Douglas utility function, thus

$$MU_C=\frac{\partial U(C,l)}{\partial C}=0.5C^{0.5-1}l^{0.5}=0.5C^{-0.5}l^{0.5} \qquad (\because \frac{\partial cx^n}{\partial x}=cnx^{n-1})$$

$$MU_l=\frac{\partial U(C,l)}{\partial l}=0.5C^{0.5}l^{0.5-1}=0.5C^{0.5}l^{0.5-1}$$

Thus, the $MRS_{lC}=\frac{\Delta C}{\Delta l}=-\frac{MU_l}{MU_C}=-\frac{0.5C^{0.5}l^{-0.5}}{0.5C^{-0.5}l^{0.5}}=-\frac{C}{l}$. Increasing in l may decrease the MRS. The slope (without considering sign) is decrease means that willing to tradeoff consumption for leisure is decreasing when we have more leisure. In this case, the MRS follows the law of diminishing marginal utility.

Example A.2.2.2 Let individual utility being $U(C,l)=C+L$, thus $MU_C=1$ and $MU_l=1$, the $MRS_{lC}=-1$. This case shows the constant MRS, which implies to the perfectly substitution between leisure and consumption. You can directly see from utility function that increasing in consumption 1 unit will increase utility 1 util as same as increasing one unit of leisure.

The Budget Constraint

- The budget constraint defines the worker's opportunity set, indicating all of the consumption – leisure baskets the worker can afford.

The Budget Constraint

V = Nonlabor income

h = The number of hours the person will allocate to the labor market during the period

w = The hourly wage rate

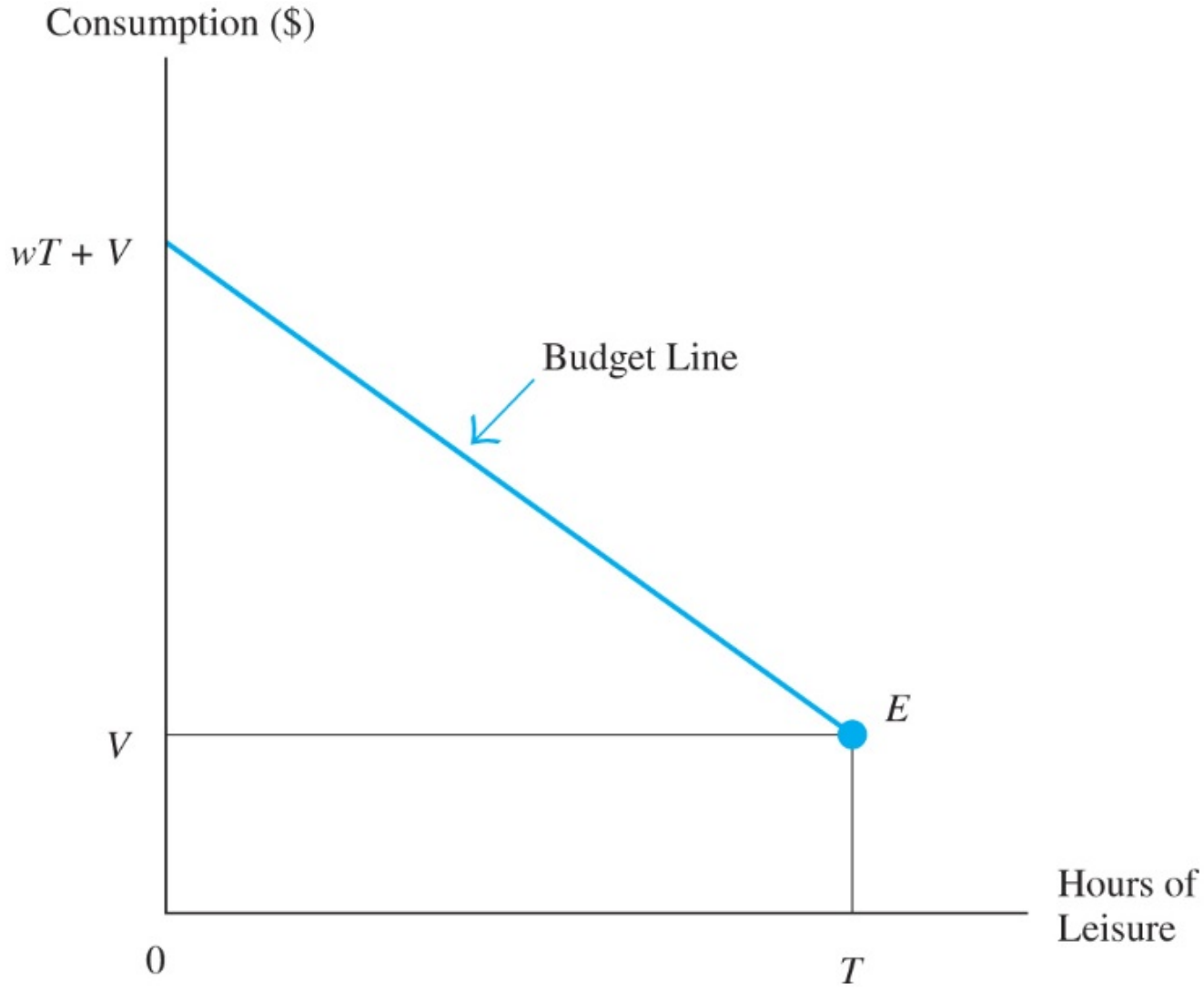
$$C = wh + V$$

$$T = h + L$$

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

$$C = (wT + V) - wL$$

Graphing the Budget Constraint



The Hours of Work Decision

- The person will choose the level of goods and leisure that lead to the highest possible level of the utility index U- given the limitations imposed by the budget constraint

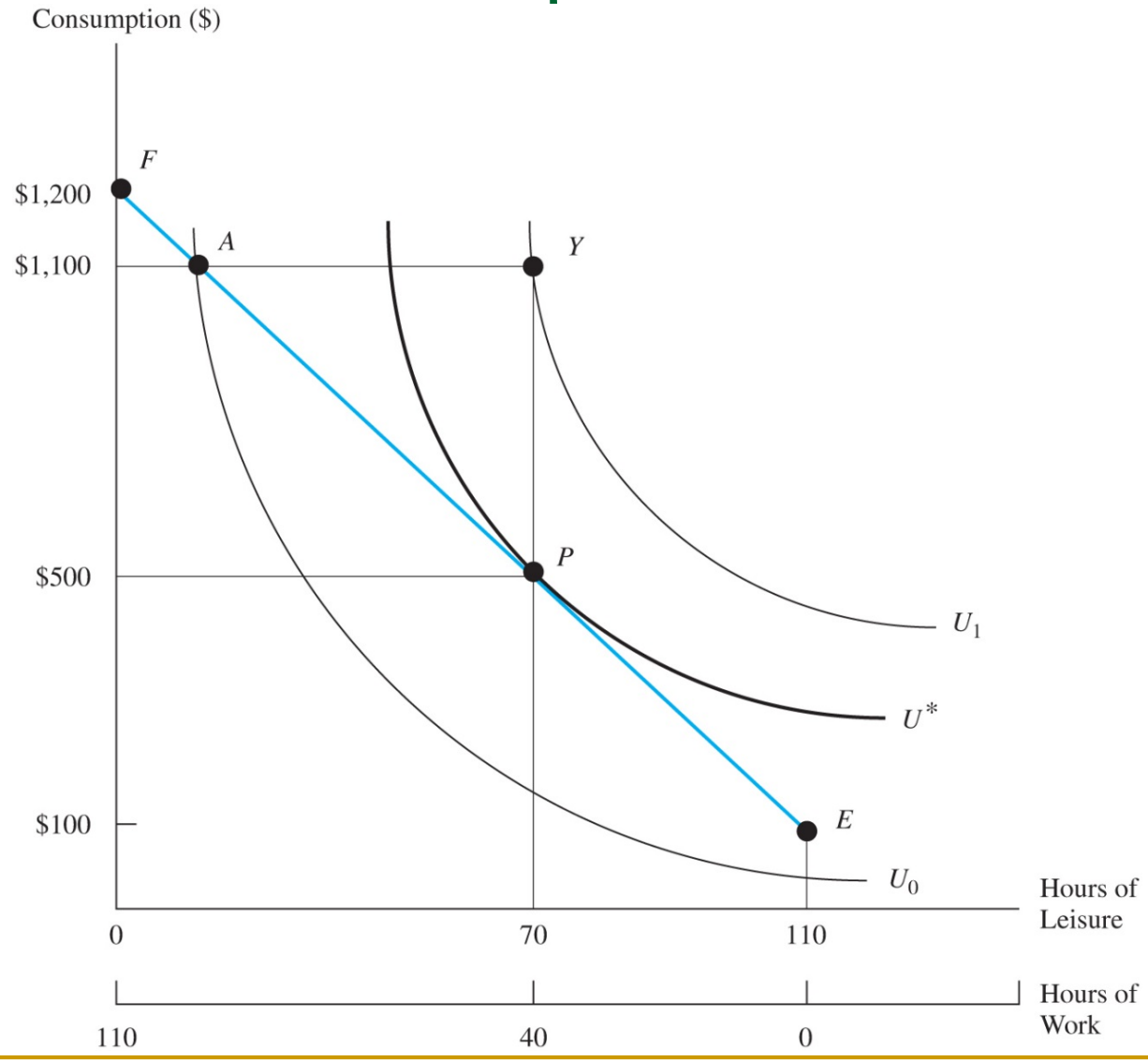
- Individuals choose consumption and leisure to maximize utility.

- Optimal consumption is given by the point where the budget line is tangent to the indifference curve.

  - At this point the marginal rate of substitution (MRS) between consumption and leisure equals the wage.

  - Any other consumption – leisure bundle on the budget constraint would give the individual less utility.

Optimal Consumption and Leisure

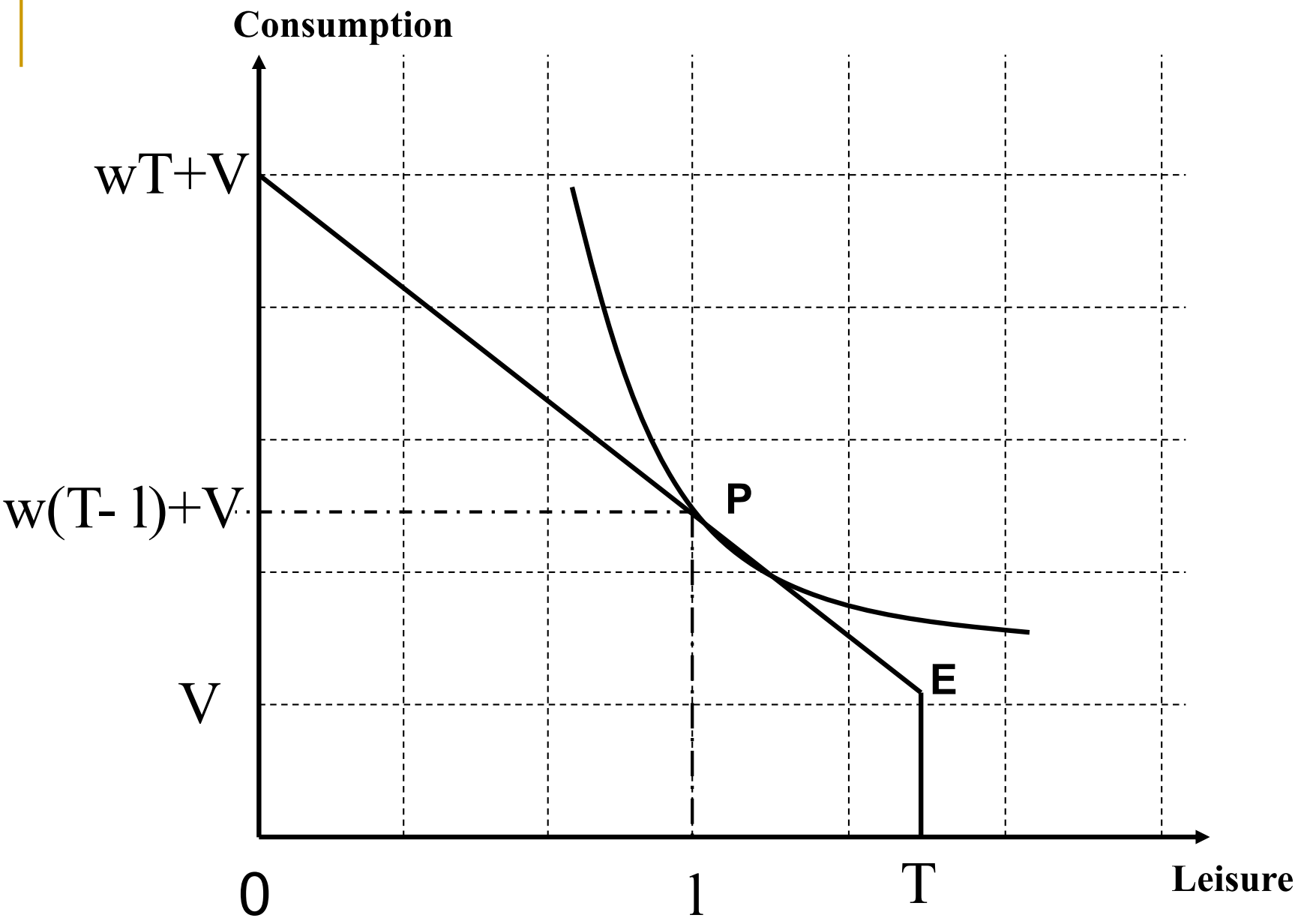


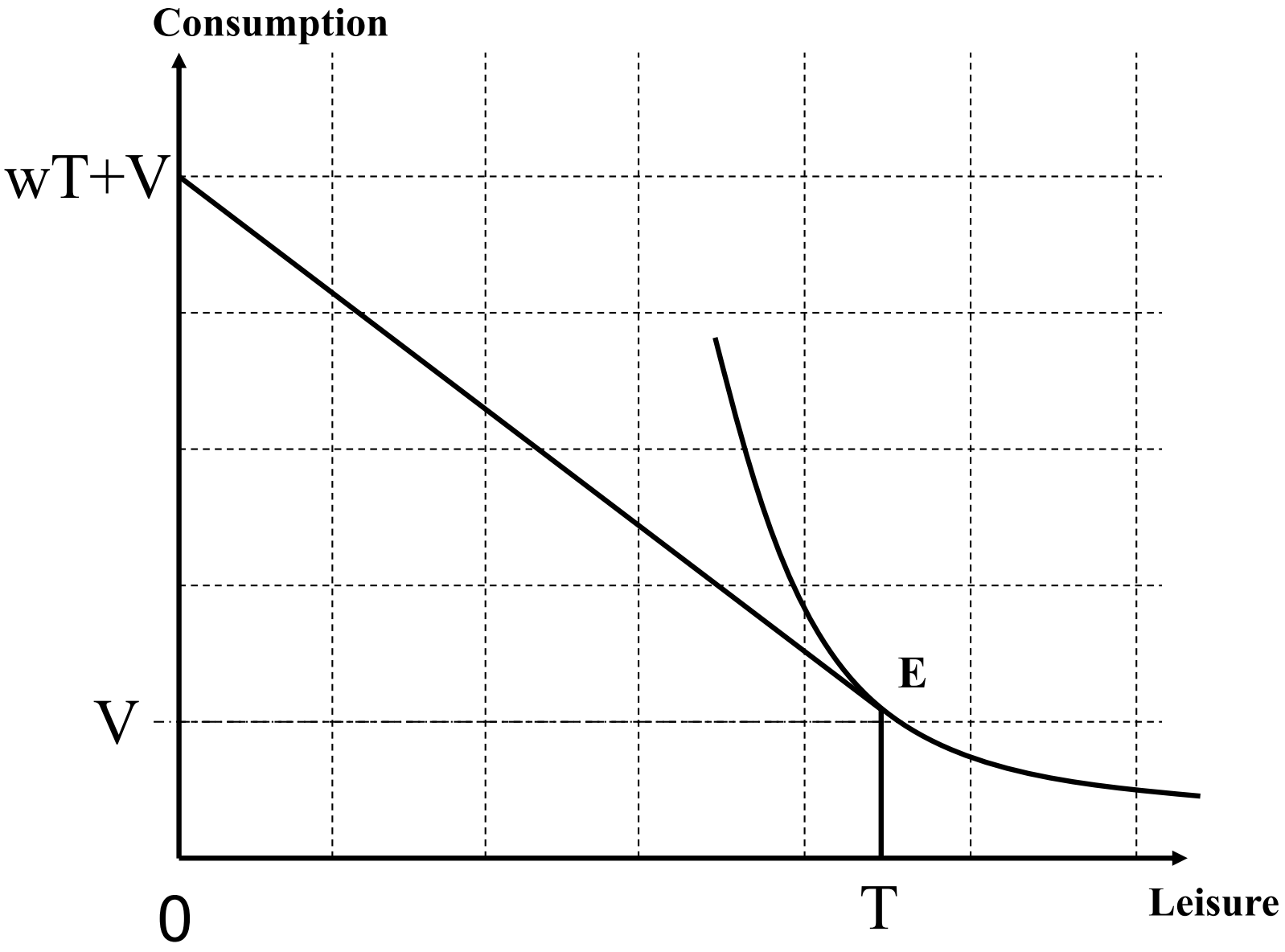
Type of Solution

- **Interior solution** – decision between consumption and leisure are neither zero unit
- **Corner solution** – either consumption or leisure are zero unit

Explanation for zero working hour

- High Reservation wage rate
- Very high non-labor income
- Preference


Consumption
wT+V
w(T- l)+V
V
P
E
0
l
T
Leisure


Consumption
wT+V
V
E
0
T
Leisure

Interpreting the Tangency Condition

- The slope of the indifference curve equals the slope of the budget line
- At the chosen level of consumption and leisure, the MRS equals the wage rate

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

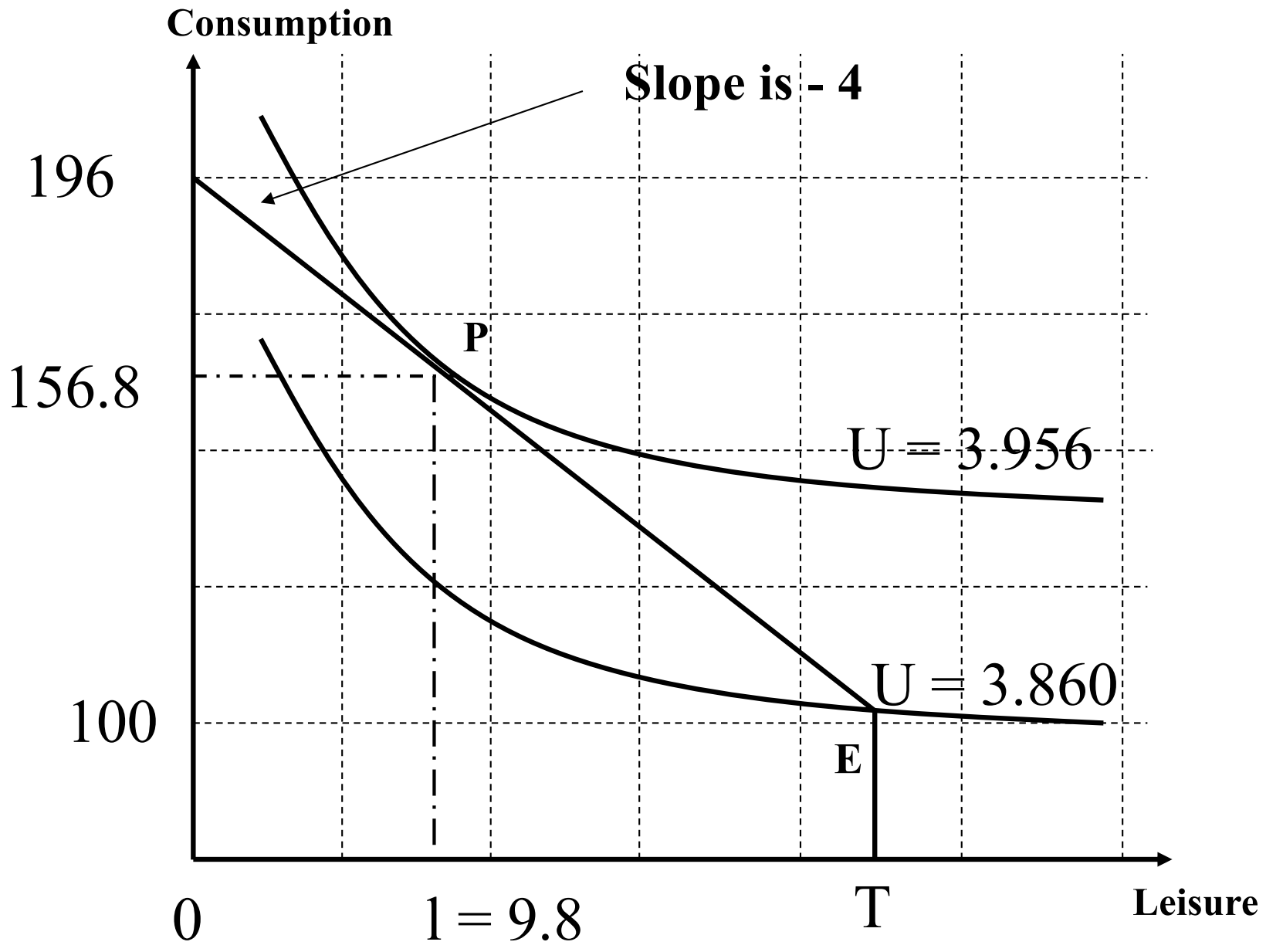
Example A.2.3.1 Let Utility function is $U(C,l)=(C^{0.5}+L^{0.5})^{0.5}$, the wage rate is 4 per hour, with 100 unit of non-labor income. Find the optimal solution of leisure and consumption in one day (one day = 24 hours).

First, Check the condition that slope of IC = Slope of Budget line

Slope of IC is $-\sqrt{\frac{C}{L}}$ and Slope of Budget line is -4 (as same as wage rate), so the condition for attachment (interior solution) is $-\sqrt{\frac{C}{L}}=-4$, means that $\frac{C}{L}=16$. Use this condition with budget constraint $C=4(24-l)+100$ to solve for optimal interior solution. The interior solution is $(l,C)=(\frac{196}{20},\frac{3,136}{20})=(9.8,156.8)$ that returns the utility 3.956 utils.

Second, Check that if individual do not work which is corner solution $(l,C)=(24,100)$, the utility will be 3.860 utils.

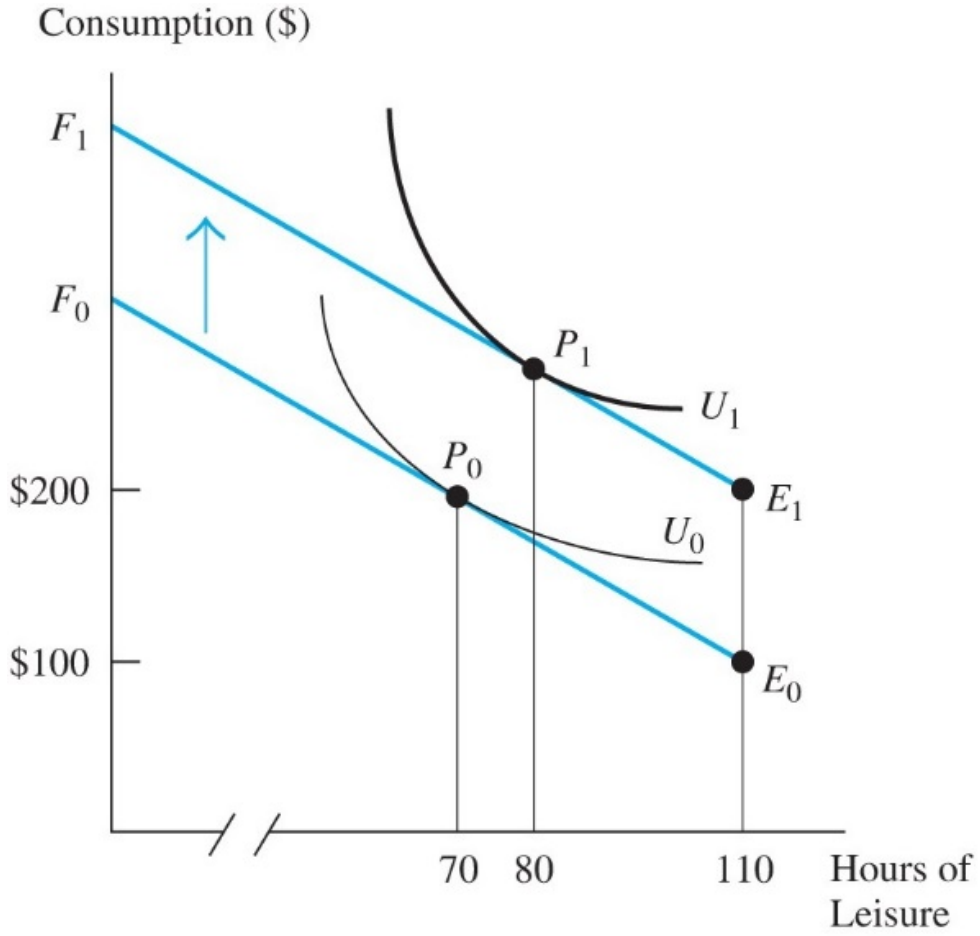
Compare both case, the working approximate 14 hours a day (leisure is 10) return higher utility than taking all leisure, this is the optimal for interior solution. This situation is shown by figure A.2.2.1


Consumption
Slope is - 4
196
156.8
100
P
U = 3.956
U = 3.860
E
0
l = 9.8
T
Leisure

What happens to hours of work when non-labor income changes?

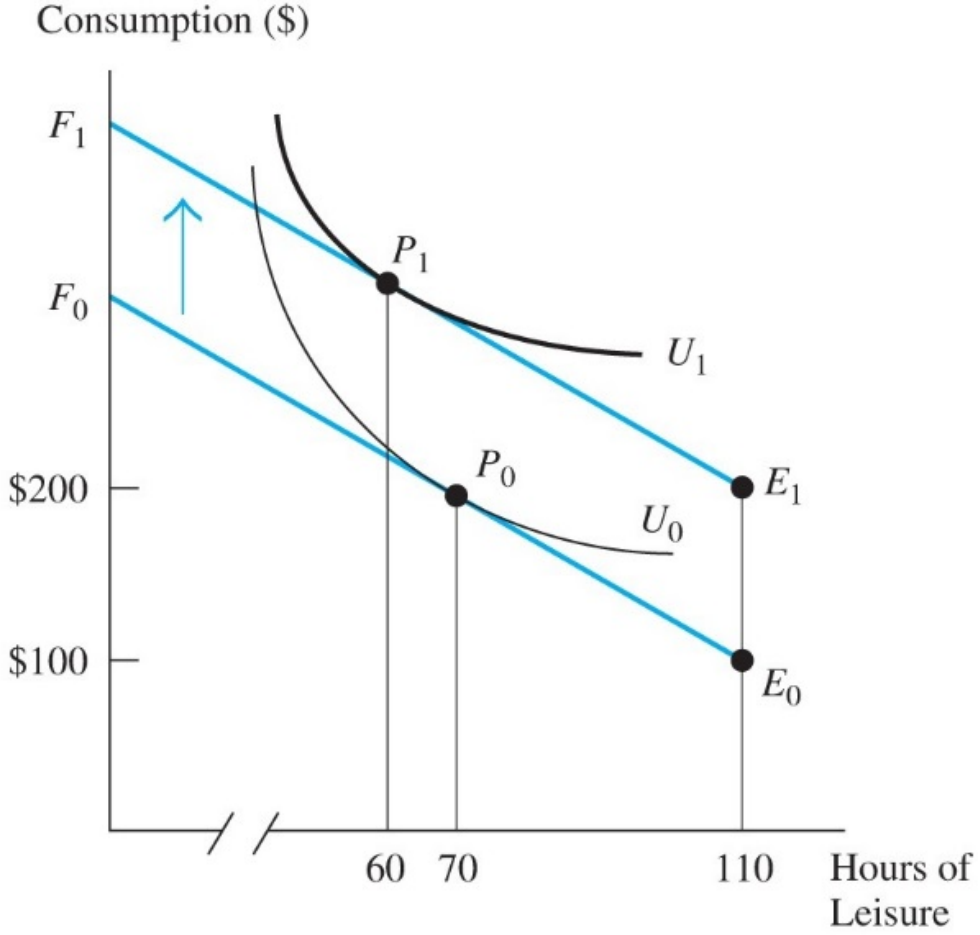
- The impact of the change in nonlabor income (holding wages constant) on the number of hours worked is called an **income effect**
- Shift the budget line (slope of budget line constant)
- Two possibilities
  - Leisure is normal good (increasing leisure hours, reduces hours of work)
  - Leisure is an inferior good (decreasing leisure hours, increases hours of work)

The Effect of a Change in Nonlabor Income on Hours of Work

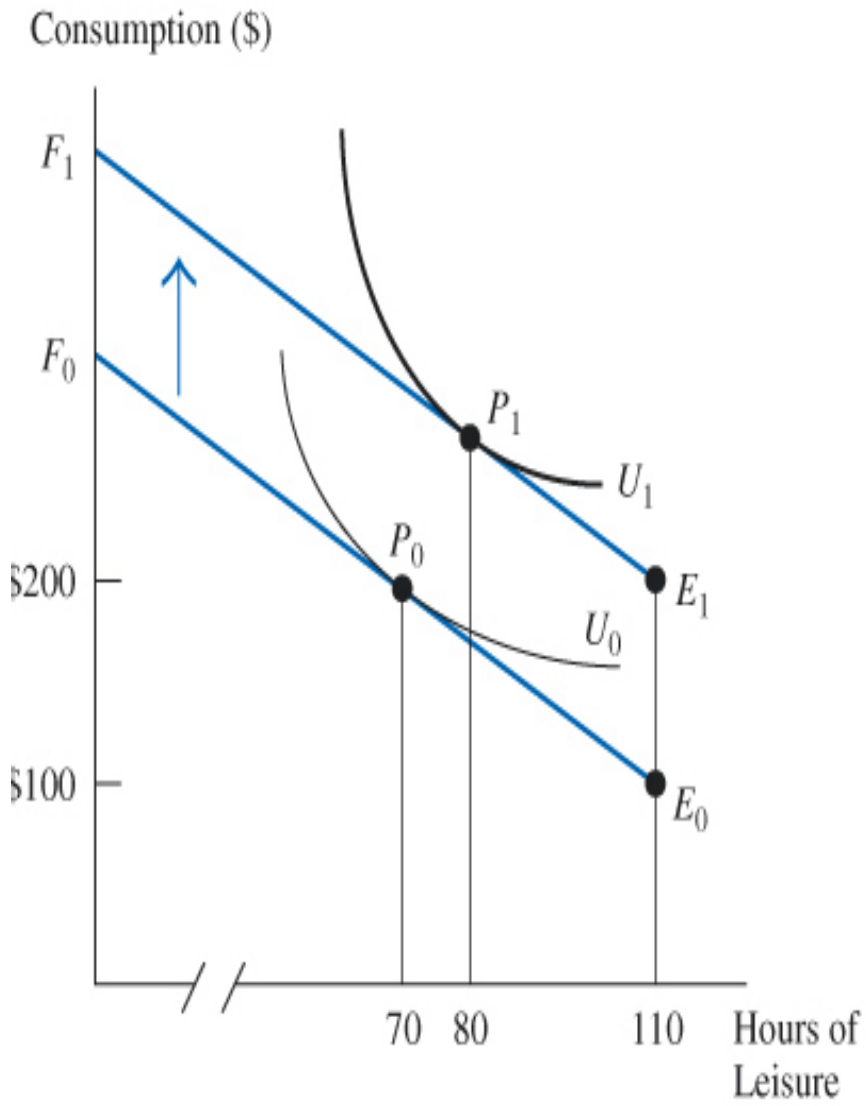


An increase in nonlabor income leads to a parallel, upward shift in the budget line, moving the worker from point P_0 to point P_1. If leisure is a normal good, hours of work fall.

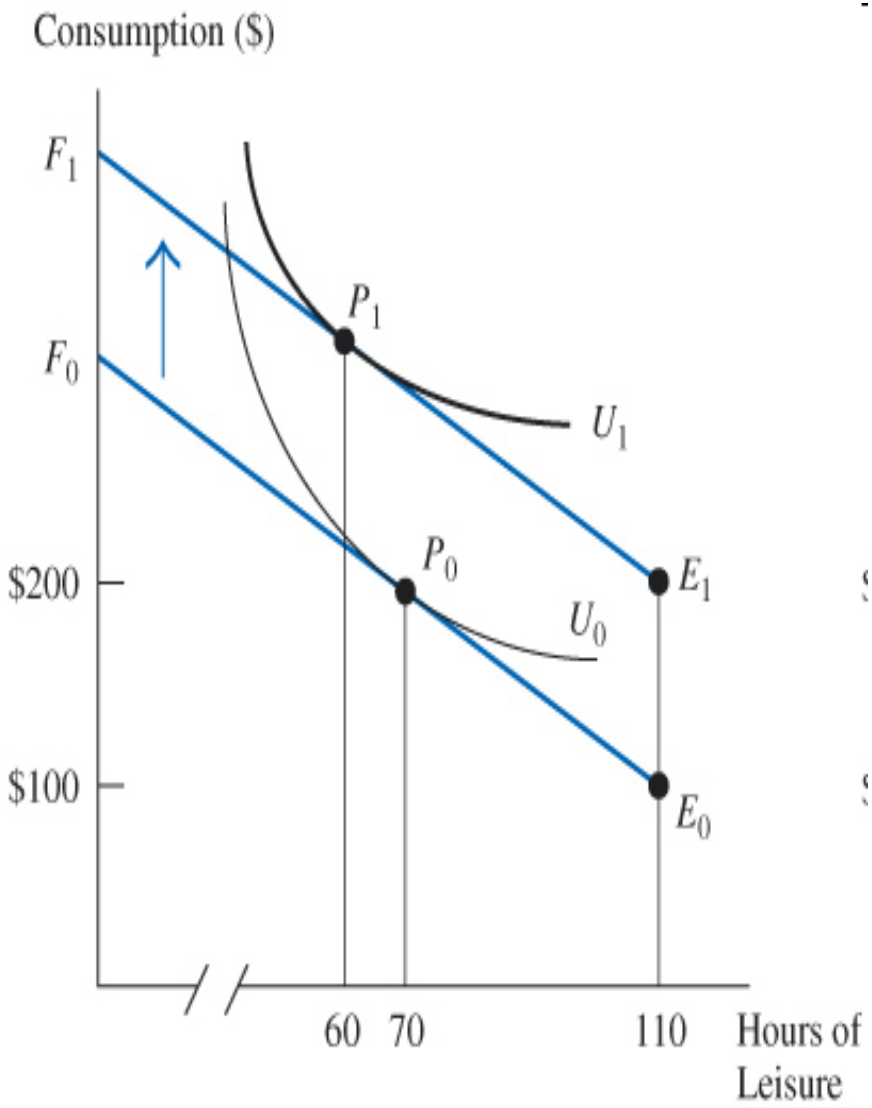
The Effect of a Change in Nonlabor Income on Hours of Work



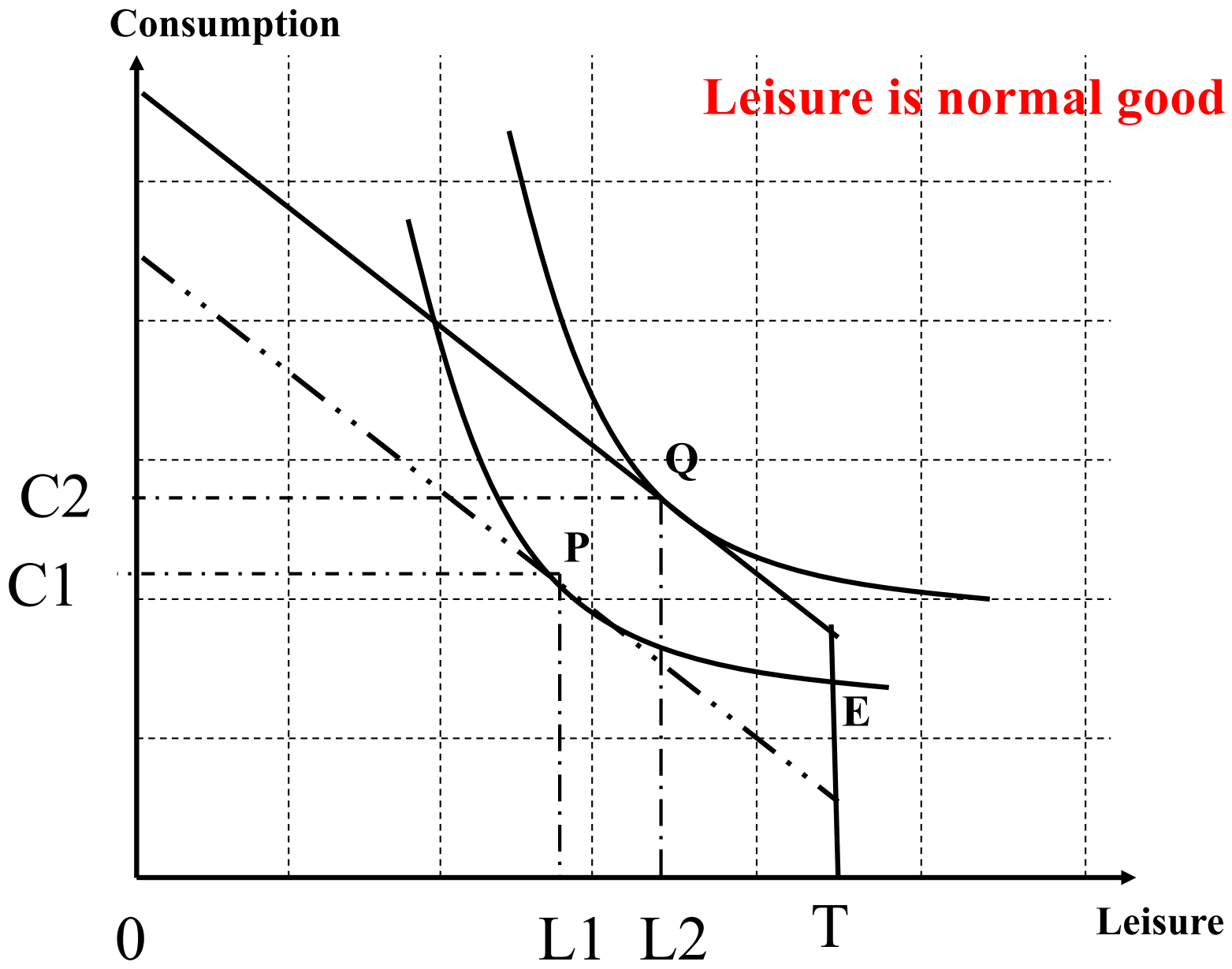
An increase in nonlabor income leads to a parallel, upward shift in the budget line, moving the worker from point P_0 to point P_1. If leisure is inferior, hours of work increase.

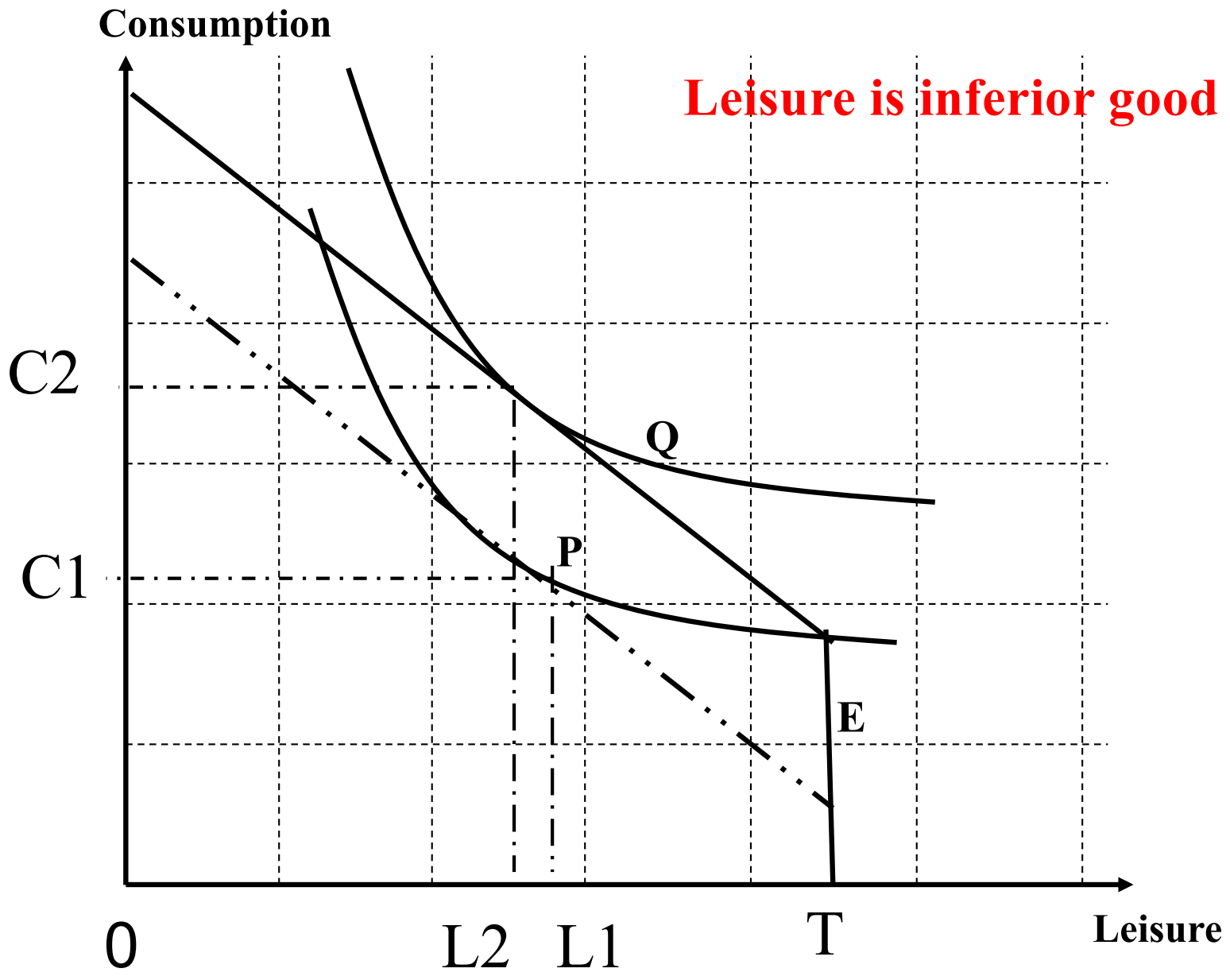


(*a*) Leisure Is a Normal Good



(*b*) Leisure Is an Inferior Good


Consumption
Leisure is normal good
C2
C1
Q
P
E
0
L1
L2
T
Leisure


Consumption
Leisure is inferior good
C2
C1
Q
P
E
0
L2
L1
T
Leisure

What happens to hours of work when the wage changes?

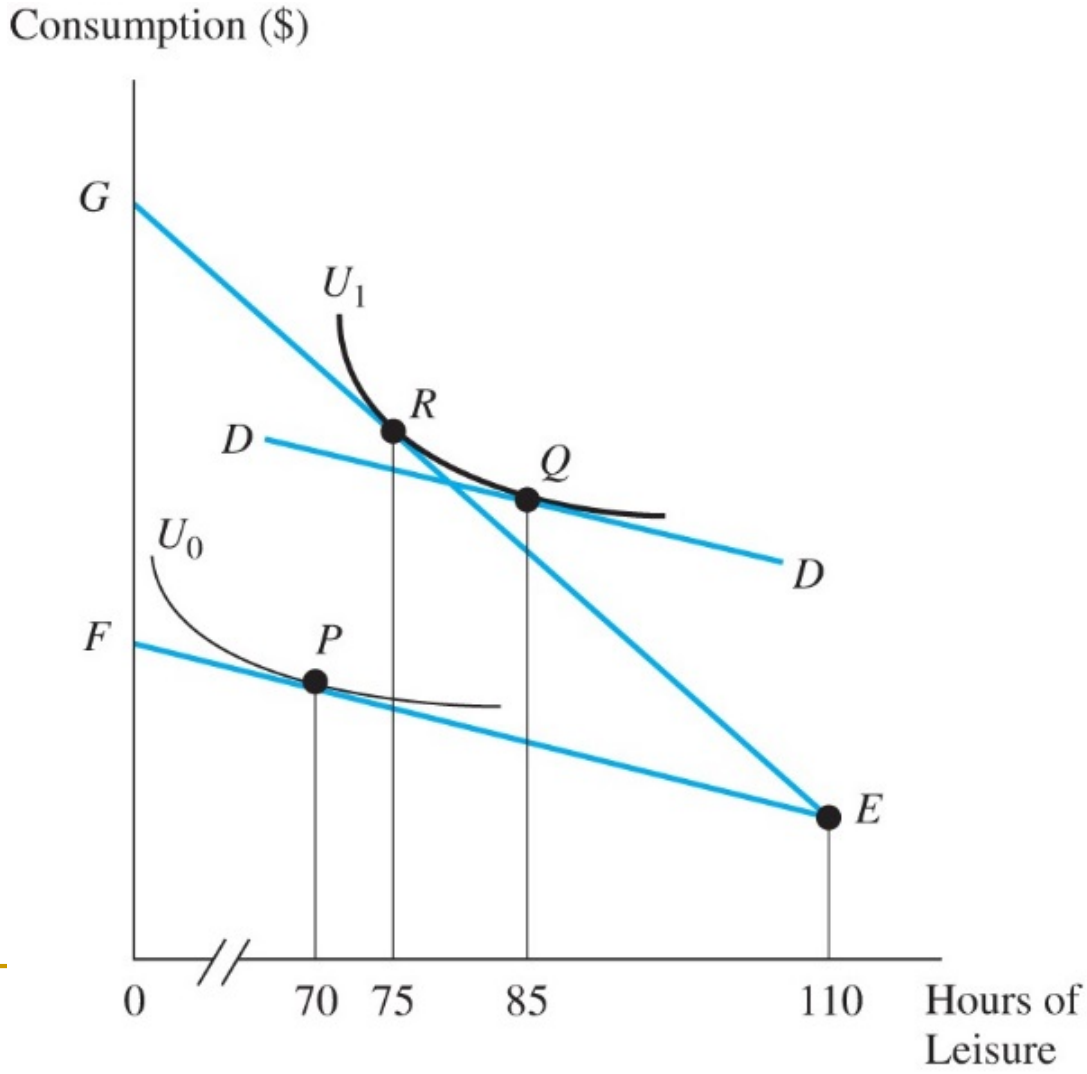
Consider a wage increase from \$10 to \$20 an hour, holding nonlabor income V constant

(a) The wage increase shifts the optimal consumption bundle from point P to point R ⟶ ↑Leisure ↓Work

(b) The wage increase shifts the optimal consumption bundle from point P to point R ⟶ ↓Leisure ↑Work

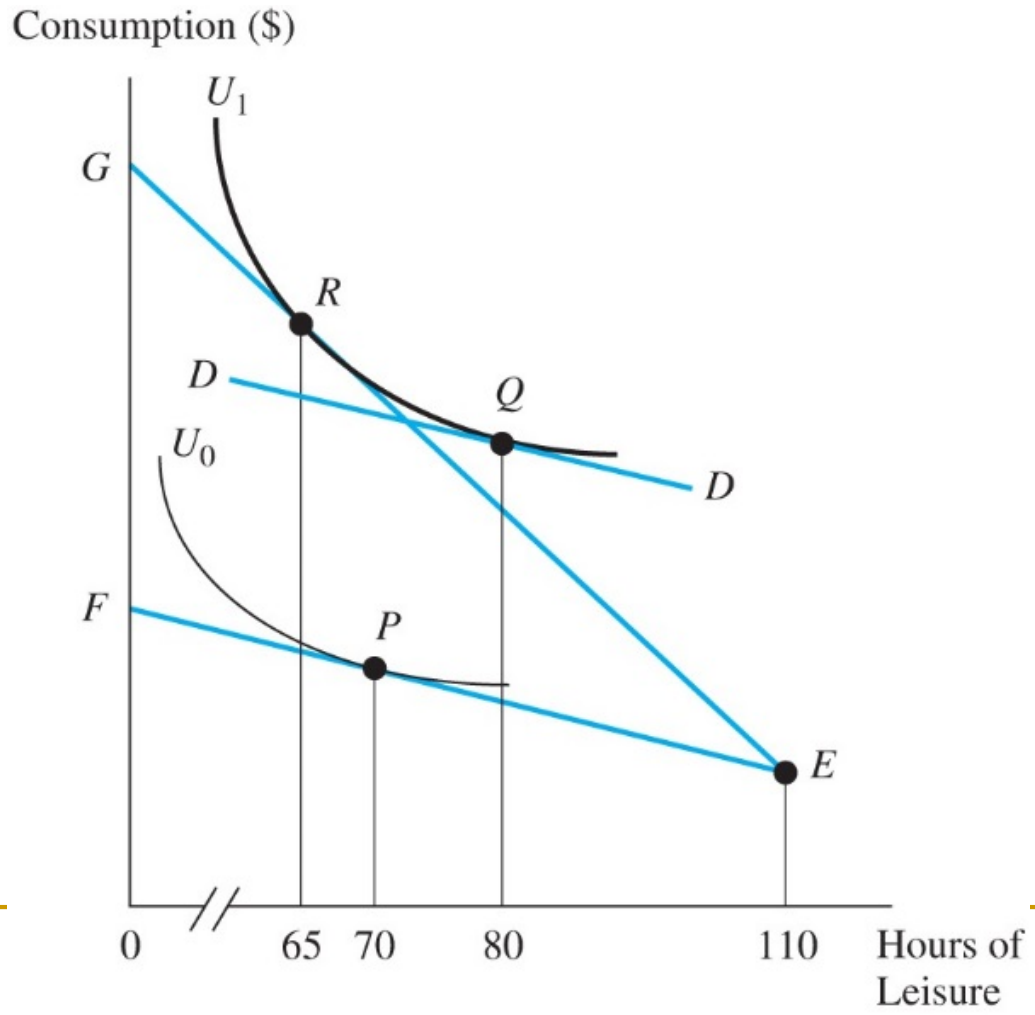
More Leisure at a Higher Wage

When the income effect dominates the substitution effect, the worker increases hours of leisure in response to an increase in the wage.

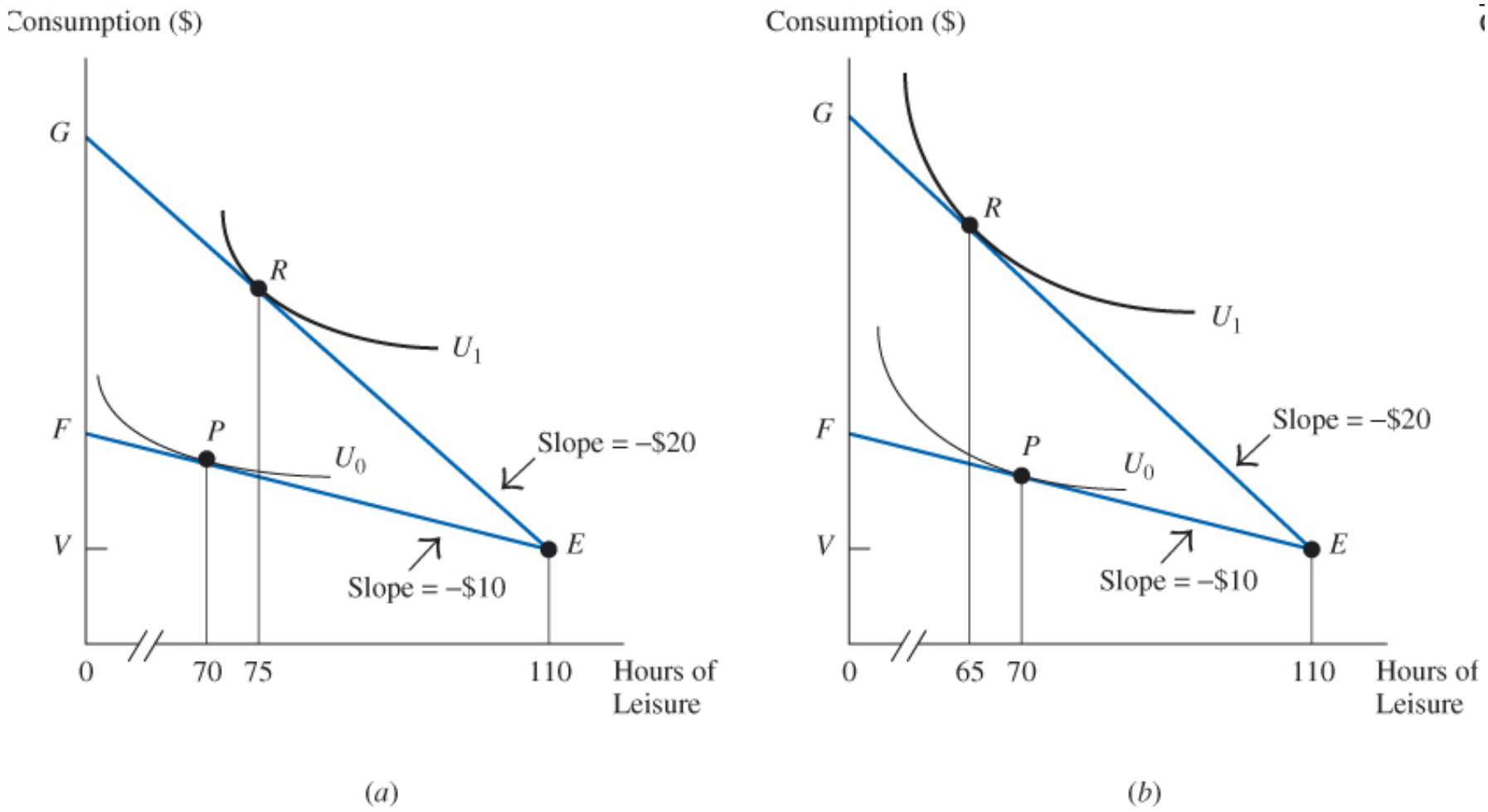


More Work at a Higher Wage

When the substitution effect dominates the income effect, the worker decreases hours of leisure in response to an increase in the wage.



The effect of a change in the wage rate on hours of work

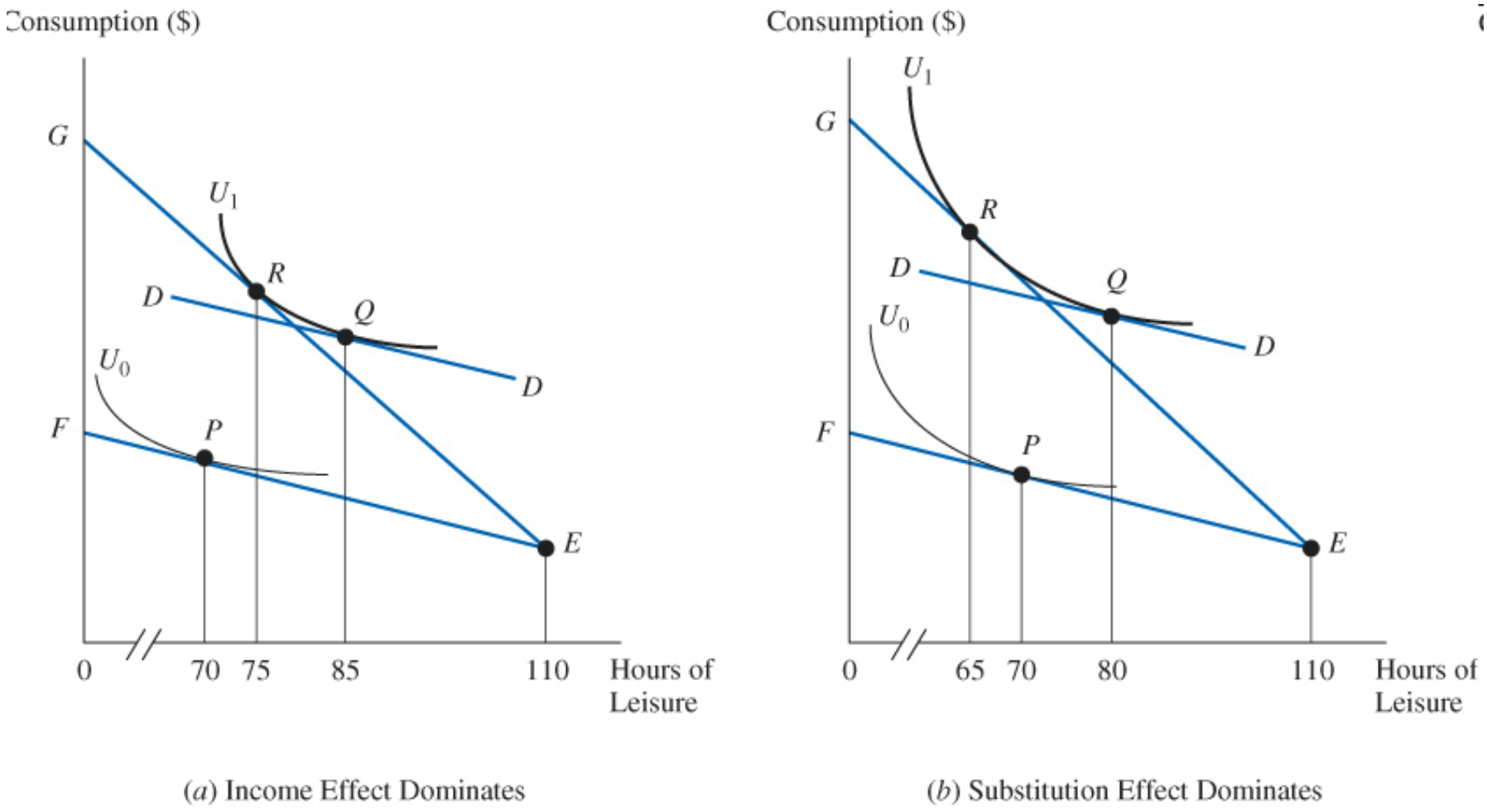


Decomposing the impact of a wage change into income and substitution effects

The wage increase generates two effects:

- **Income effect (move from P to Q)**
  - The wage increases the worker's income and it raises the price of leisure
- **Substitution effect (move from Q to R)**
  - It illustrates what happens to the worker's consumption bundle as the wage increases, holding utility constant.
  - As wages rises, the worker devotes less time to expensive leisure activities and increases her consumption of goods
  - Implies that an increase in the wage rate, holding real income constant, increases hours of work

Decomposing the impact of a wage change into income and substitution effects

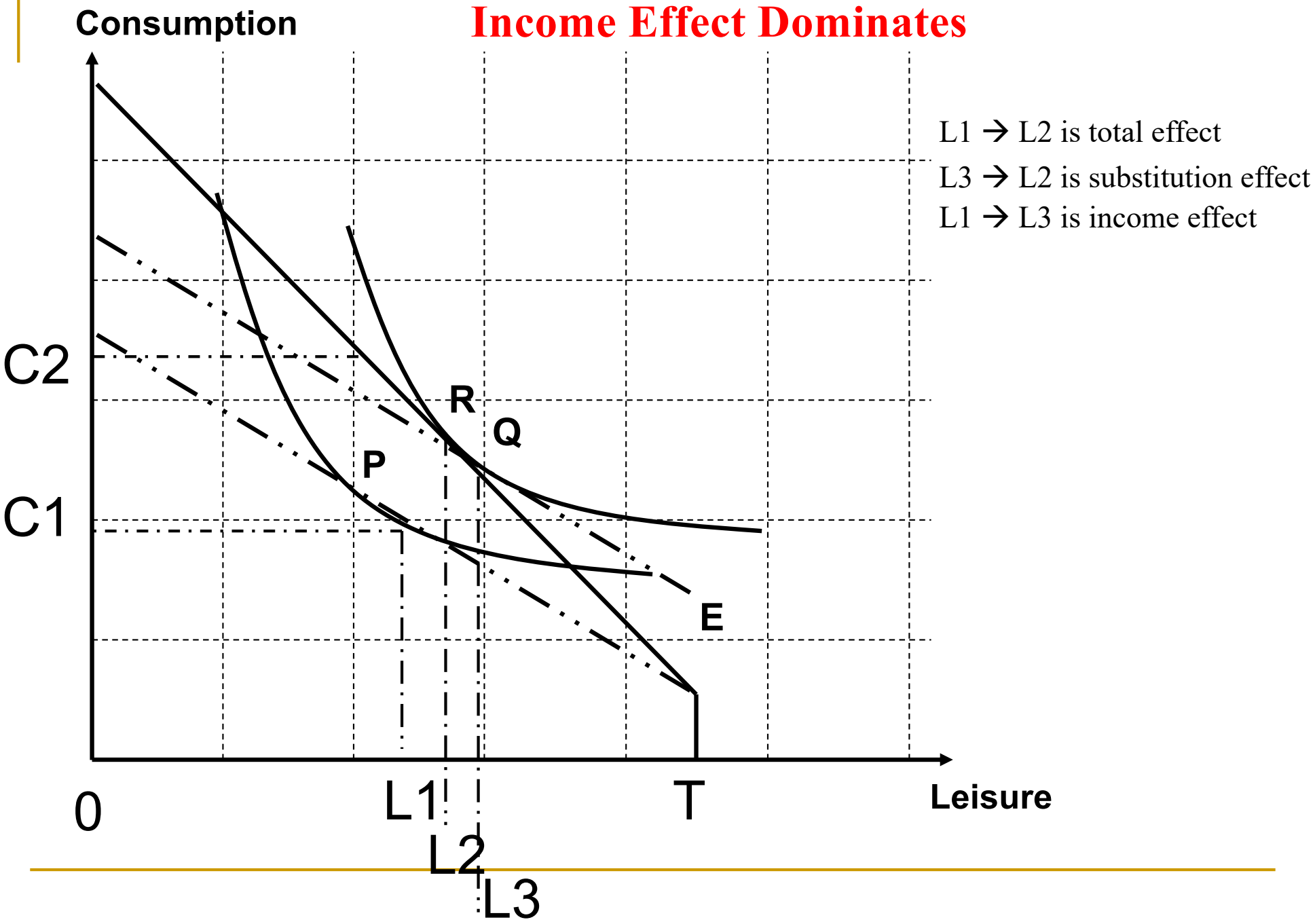


The relation between hours of work and the wage rate

(a) An increase in the wage rate **decreases hours of work** if the income effect dominates the substitution effect

(b) An increase in the wage rate **increases hours of work** if the substitution effect dominates the income effect

Income Effect Dominates

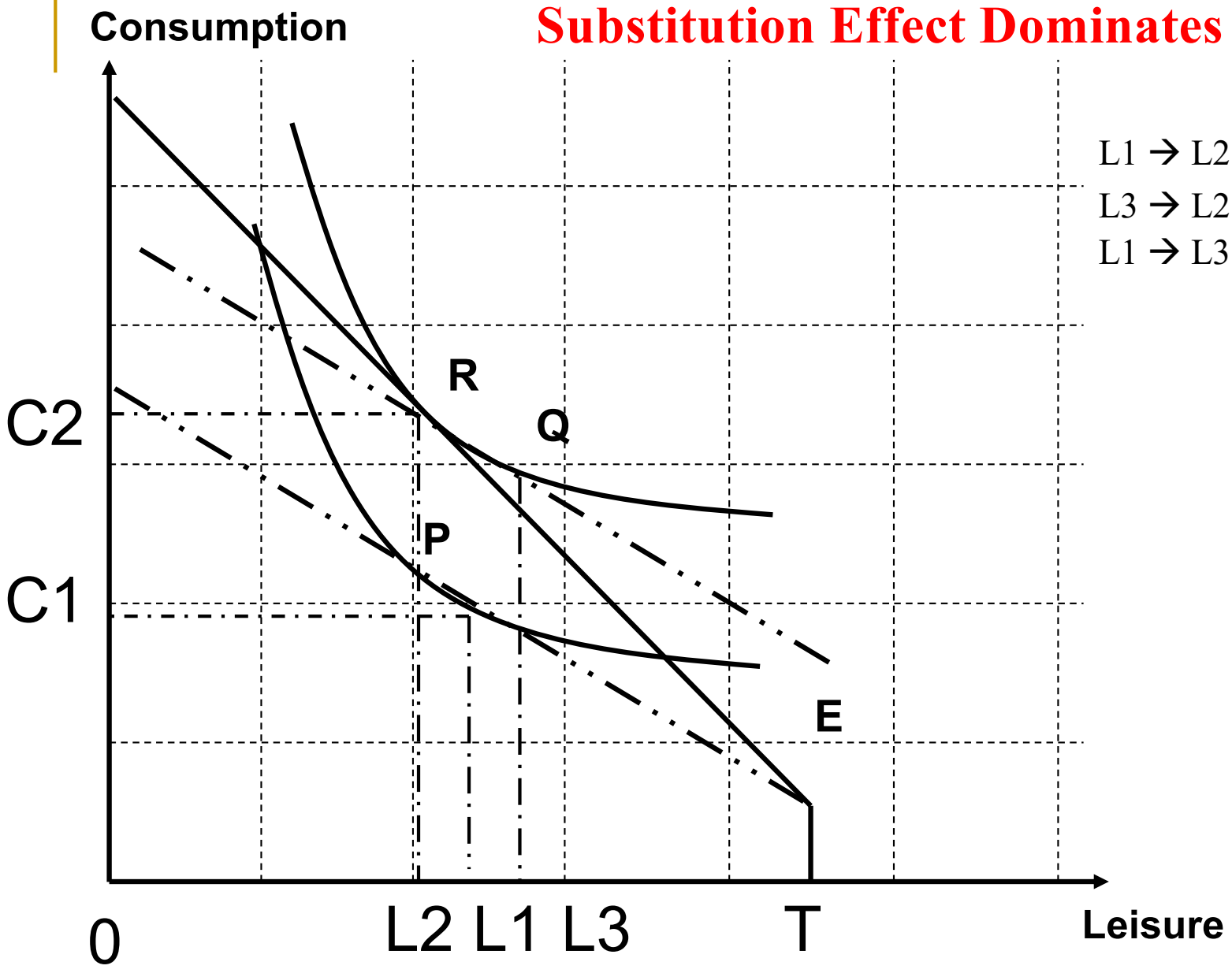


L1 → L2 is total effect

L3 → L2 is substitution effect

L1 → L3 is income effect

Substitution Effect Dominates

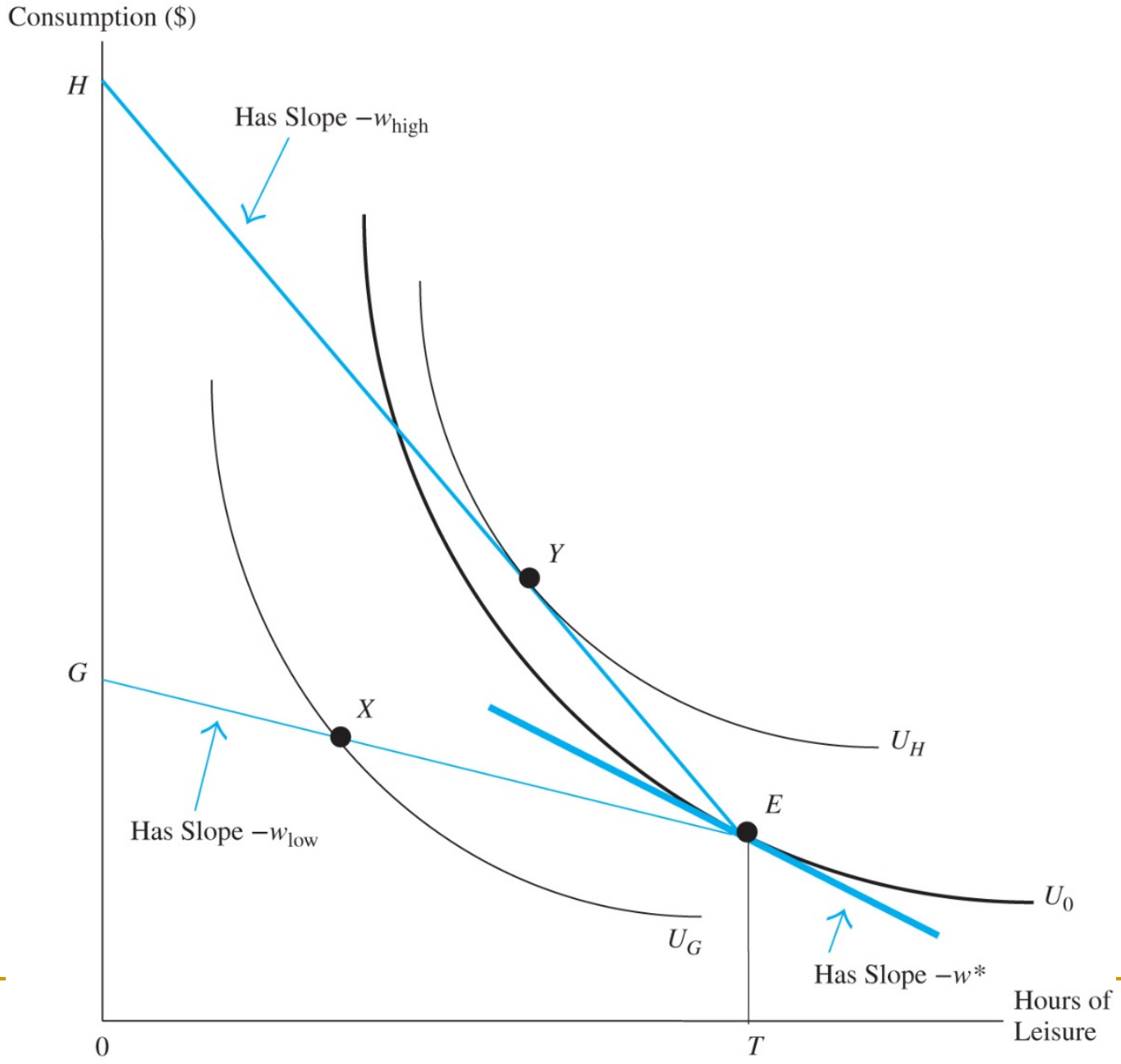


L1 → L2 is total effect

L3 → L2 is substitution effect

L1 → L3 is income effect

To Work or Not to Work?



To Work or Not to Work?

- Are the “terms of trade” sufficiently attractive to “bribe” a worker to enter the labor market?
- Reservation wage: the lowest wage rate that would make the person indifferent between working and not working.
  - Rule 1: if the market wage is less than the reservation wage, then the person will not work.
  - Rule 2: the reservation wage increases as nonlabor income increases

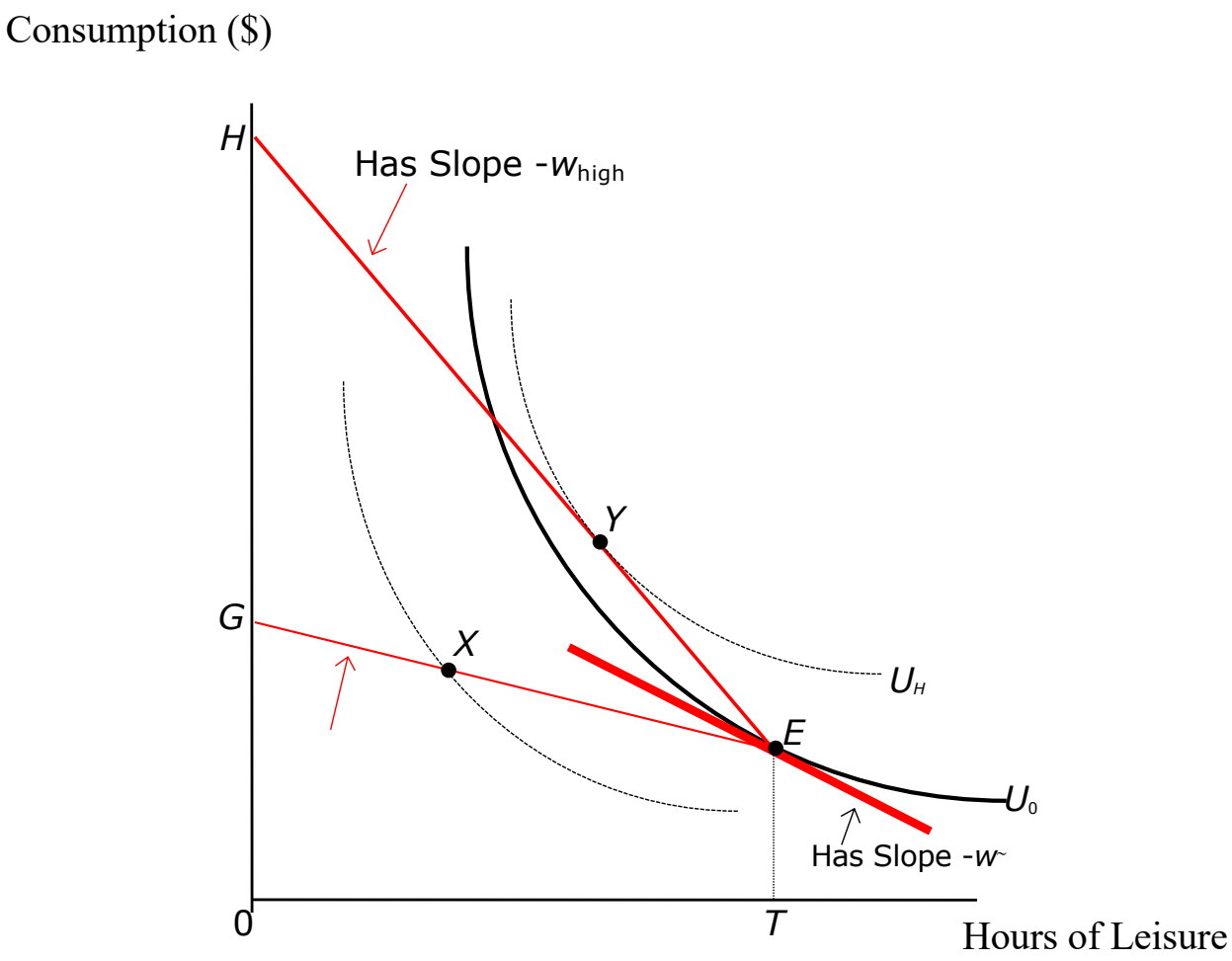
The Reservation wage

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

The Reservation Wage



Labor Supply Curve

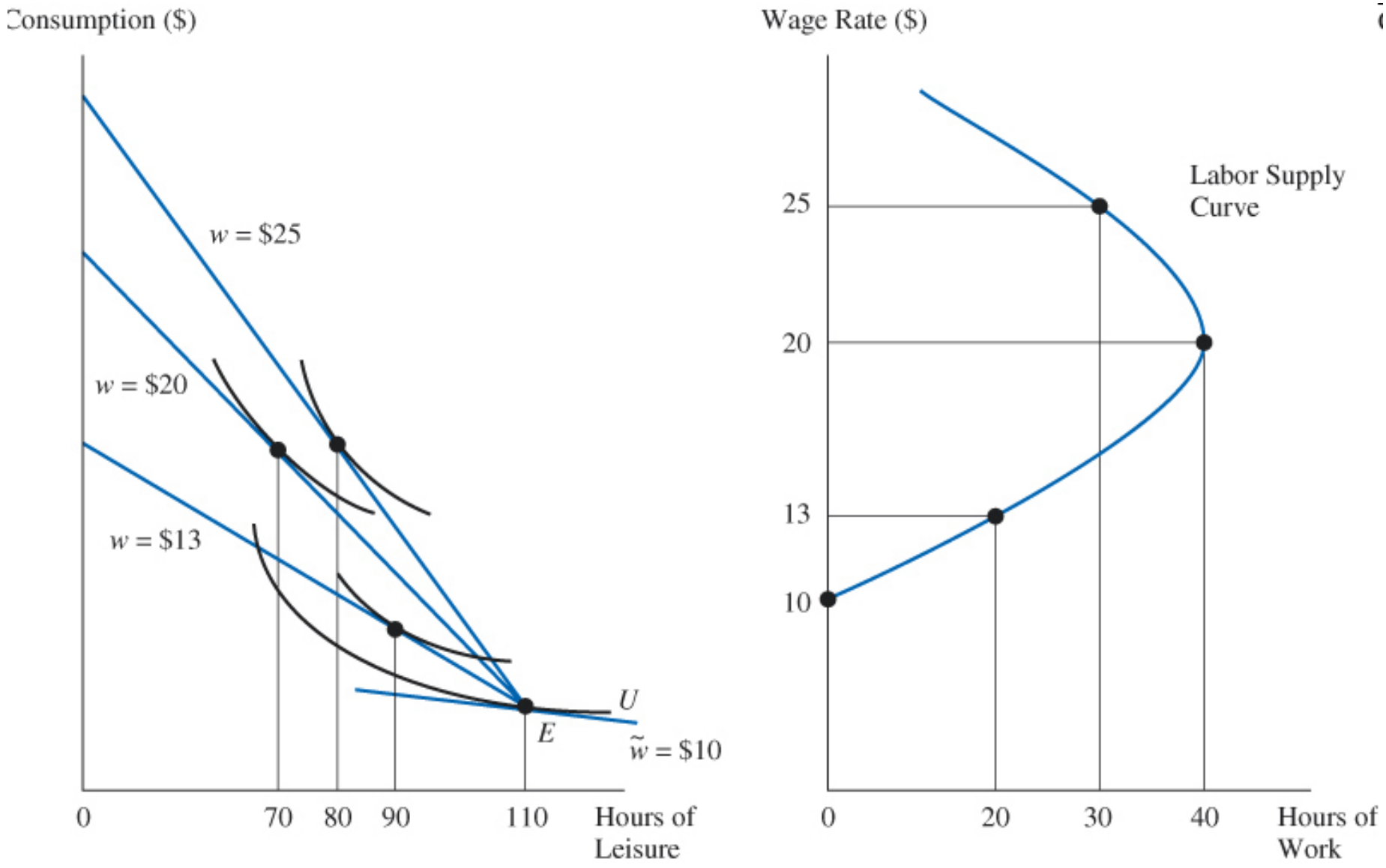
The predicted relation between hours of work and the wage rate is called the **labor supply curve**

- At wages slightly above the reservation wage, the labor supply curve is positively sloped (the substitution effect dominates the income effect).

- If the income effect begins to dominate the substitution, hours of work decline as the wage rate increases (a negatively sloped labor supply curve).

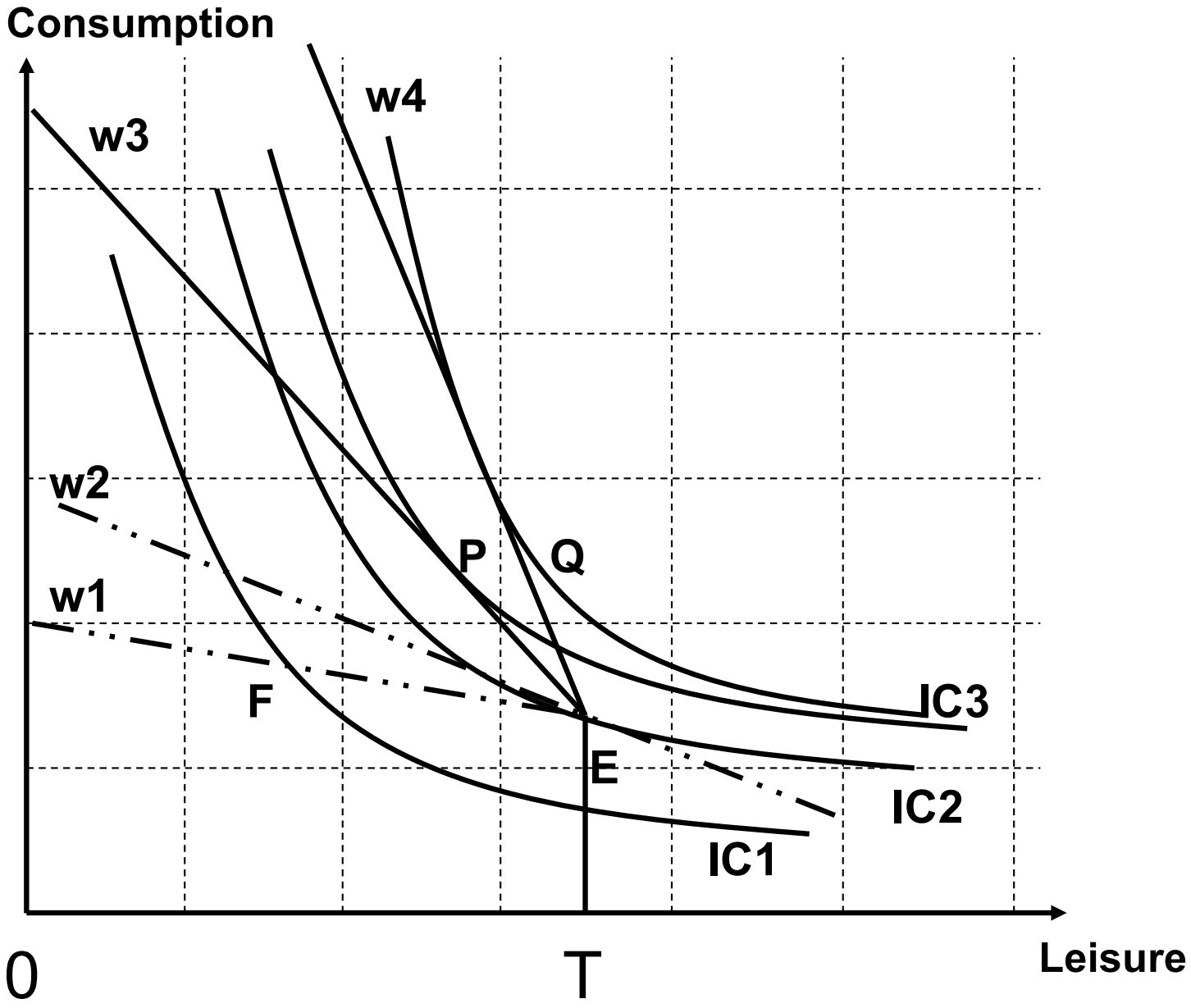
Backward-bending labor supply curve

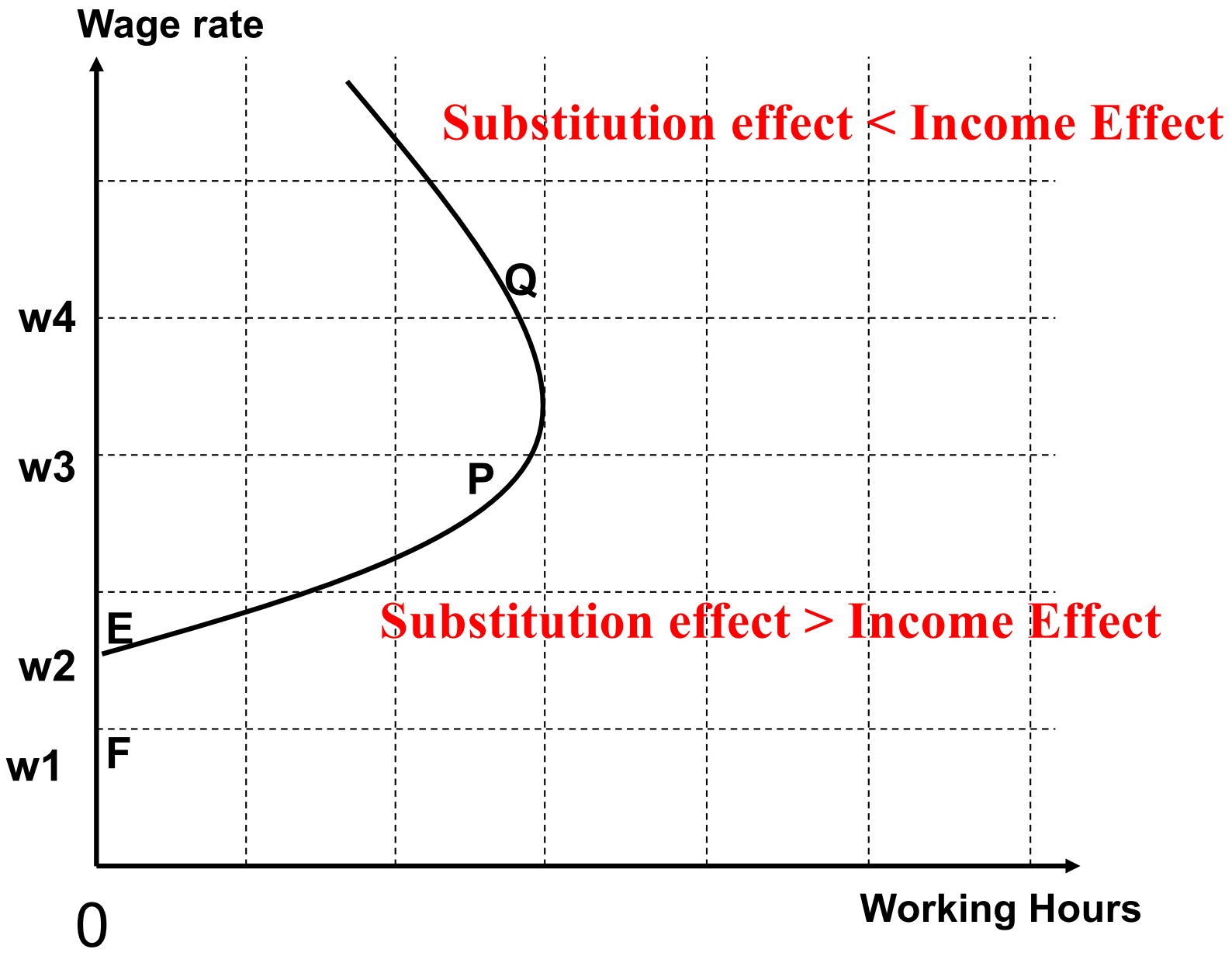
- The income effect dominates and hours of work decline as the wage rises, creating a segment of the labor supply curve that has a negative slope



(*a*) Optimal Consumption Bundles

(*b*) Relation between Optimal Hours of Work and the Wage Rate


Consumption
w4
w3
w2
w1
P
Q
F
E
IC3
IC2
IC1
0
T
Leisure


Wage rate
Substitution effect < Income Effect
Q
w4
w3
P
E
Substitution effect > Income Effect
w2
w1
F
0
Working Hours

Labor Supply Elasticity

- The labor supply elasticity (σ) measures responsiveness in hours worked to changes in the wage rate.
  - σ = Percent change in hours worked divided by the percent change in wage rate.
  - Labor supply elasticity less than 1 is inelastic as hours of work respond proportionally less than the change in wages.
  - Labor supply elasticity greater than 1 is elastic as hours of work respond proportionally more than the change in wages.

Labor supply elasticity

- Measure the responsiveness of hours of work to changes in the wage rate
- The labor supply elasticity gives the percentage change in hours of work associated with a 1 percent change in the wage rate

$$\sigma = \frac{Percent\ change\ in\ hours\ of\ work}{Percent\ change\ in\ wage\ rate} = \frac{\Delta h / h}{\Delta w / w} = \frac{\Delta h}{\Delta w} \cdot \frac{w}{h}$$

$$\frac{\Delta h}{\Delta w} > 0$$

The Labor supply curve is upward sloping

Substitution effects dominate

$$\frac{\Delta h}{\Delta w} < 0$$

The Labor supply curve is downward sloping

Income effects dominate

When labor supply elasticity is **less than one** in absolute value, the labor supply curve is said to be *inelastic*

If the labor supply elasticity is **greater than one** in absolute value – indicating that hours of work are greatly affected by the change in the wage

Estimation of Elasticity

- The estimation equation

$$h_i = \alpha + \beta w_i + \gamma V_i + Other\ Variables$$

$$h_i = the\ number\ of\ hours\ that\ person\ i\ works$$

$$w_i = wage\ rate$$

$$V_i = nonlabor\ income$$

Killingsworth (1983) found that the elasticity is

Gender	Wage		Income
	Uncompensated	Compensated	
Second generation			
Male	-0.23 to -0.05	0.13 to 0.23	-0.1 to -0.4
Female	0.6 to 1.1	0.7 to 1.2	-0.1 to -0.2
First Generation			
Male	0.00 to -0.4	0.00 to 0.36	0.00 to -0.16
Female	0.2 to 0.9	0.1 to 2.0	-0.1 to -0.2

Labor Supply of Women

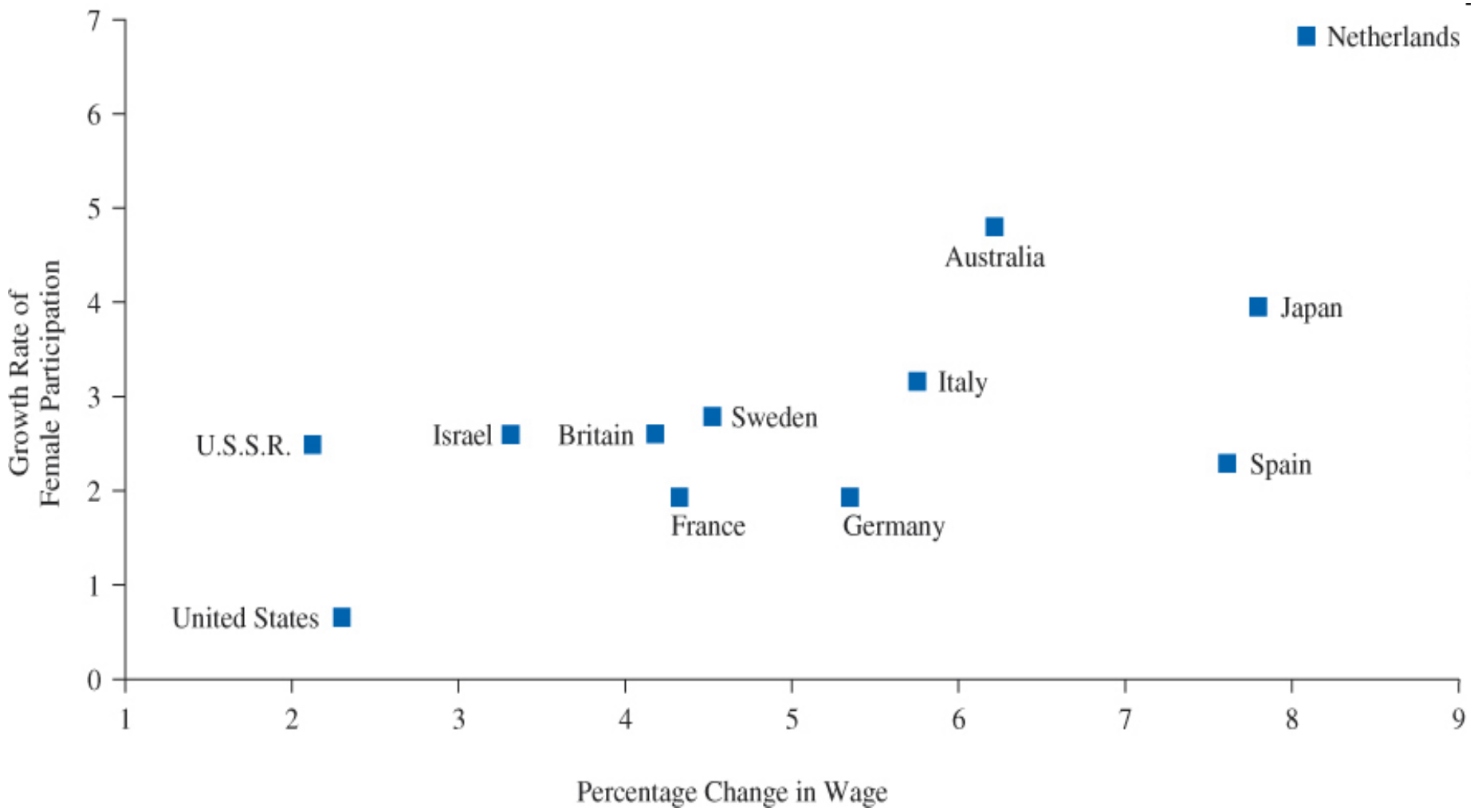
Country	1980	1990	2003
Australia	52.7	62.1	66.4
Canada	57.8	67.6	70.4
France	54.4	57.8	62.0
Germany	52.8	56.7	64.0
Greece	33.0	43.6	50.2
Ireland	36.3	43.8	56.2
Italy	39.6	45.9	46.8
Japan	54.8	60.3	64.2
Korea, South	—	51.2	54.3
Mexico	33.7	—	42.4
New Zealand	44.6	63.0	67.6
Portugal	54.3	62.9	67.2
Spain	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

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

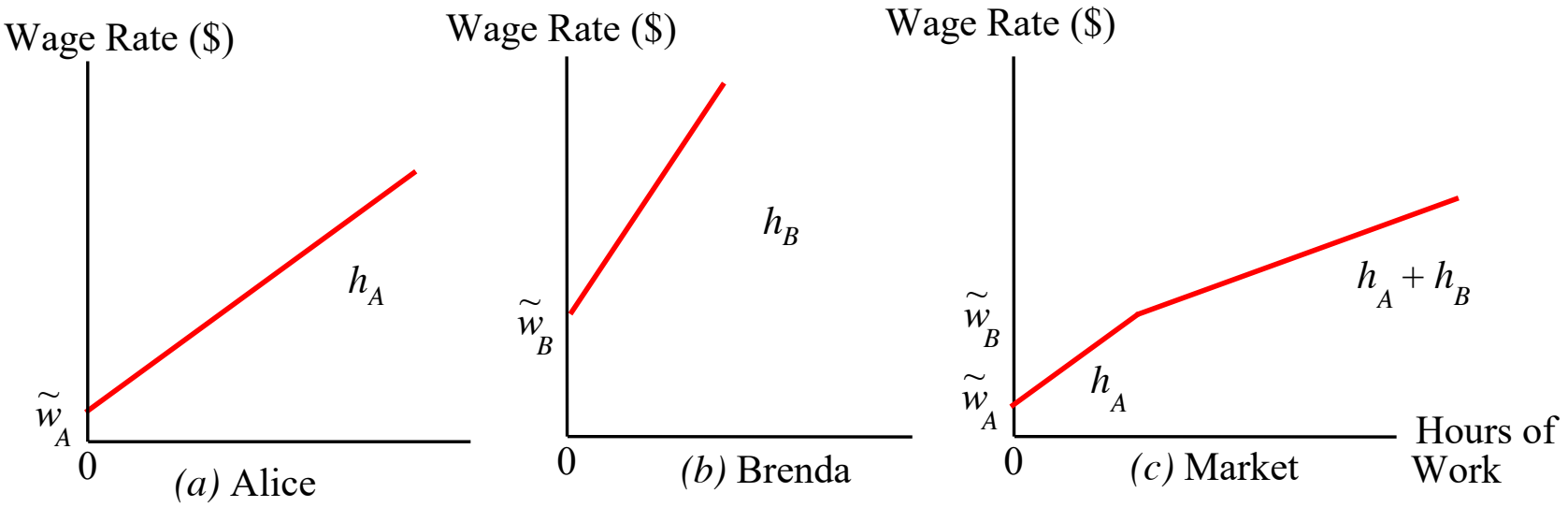
Labor Supply of Women

- Substantial cross-country differences in women's labor force participation rates.
- Over time, women's participation rates have increased.
- In most studies on women, substitution effects dominate income effects (upward sloped labor supply curve).

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



Derivation of the Market Labor Supply Curve from the Supply Curves of Individual Workers

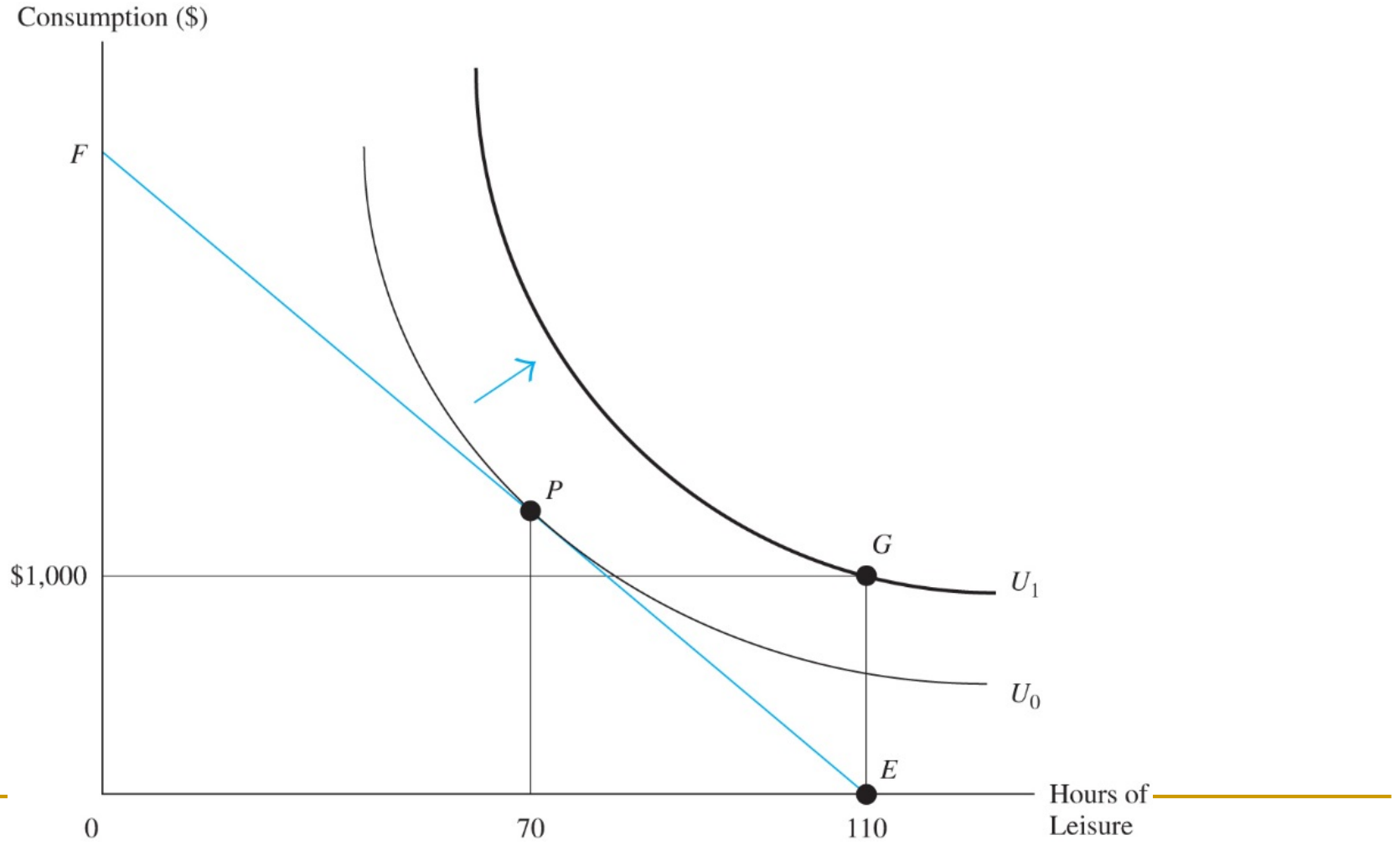


Policy Application: Welfare Programs and Work Incentives

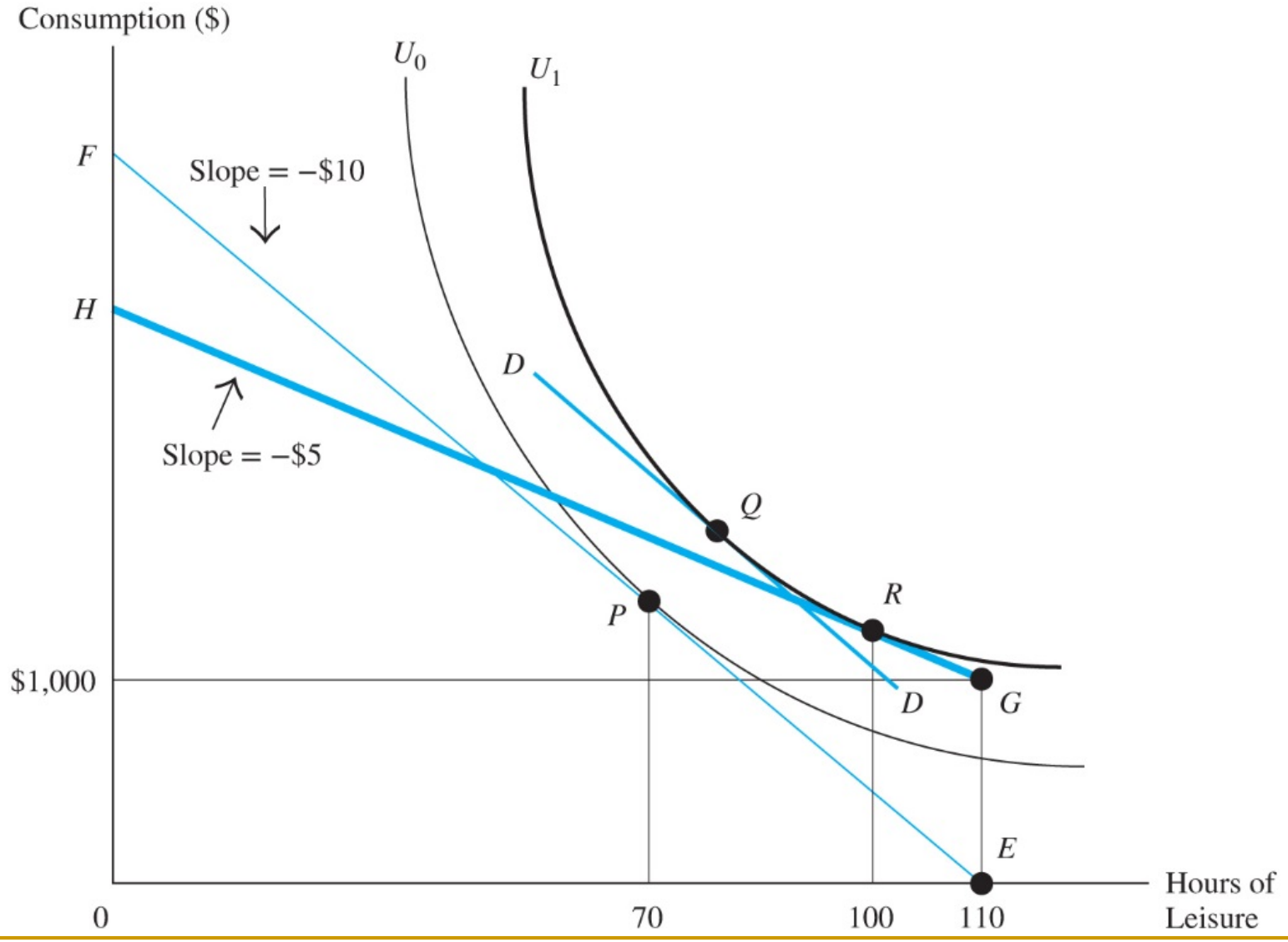
- Cash grants reduce wage incentives.
- Welfare programs create work disincentives.
- Welfare reduces supply of labor by increasing nonlabor income, which raises the reservation wage.

Effect of a Cash Grant on Work Incentives

- A take-it-or-leave-it cash grant of $1,000 per week moves the worker from point P to point G, and encourages the worker to leave the labor force.



Effect of a Welfare Program on Hours of Work



Policy Application: The Earned-Income Tax Credit

- The EITC should increase labor force participation of nonworkers of targeted groups.
  - The EITC encourages some non-workers to start working and never encourages a worker to quit working.
- The EITC produces an income effect.
  - Hours worked should change.

Policy Application: The Earned-Income Tax Credit

- In the absence of the tax credit, the budget line is FE
- The EITC grants the worker a credit of 40 % on labor earnings as long as she earns less than $14,040.
- The credit is capped at $5,616.
- The worker receives this amount as long as she earns between $14,040 and $18,340.
- The credit is then phased out gradually.
- The worker's net wage is 21.06 % below her actual wage whenever she earns between $18,340 and $45,007

The EITC and the Budget Line

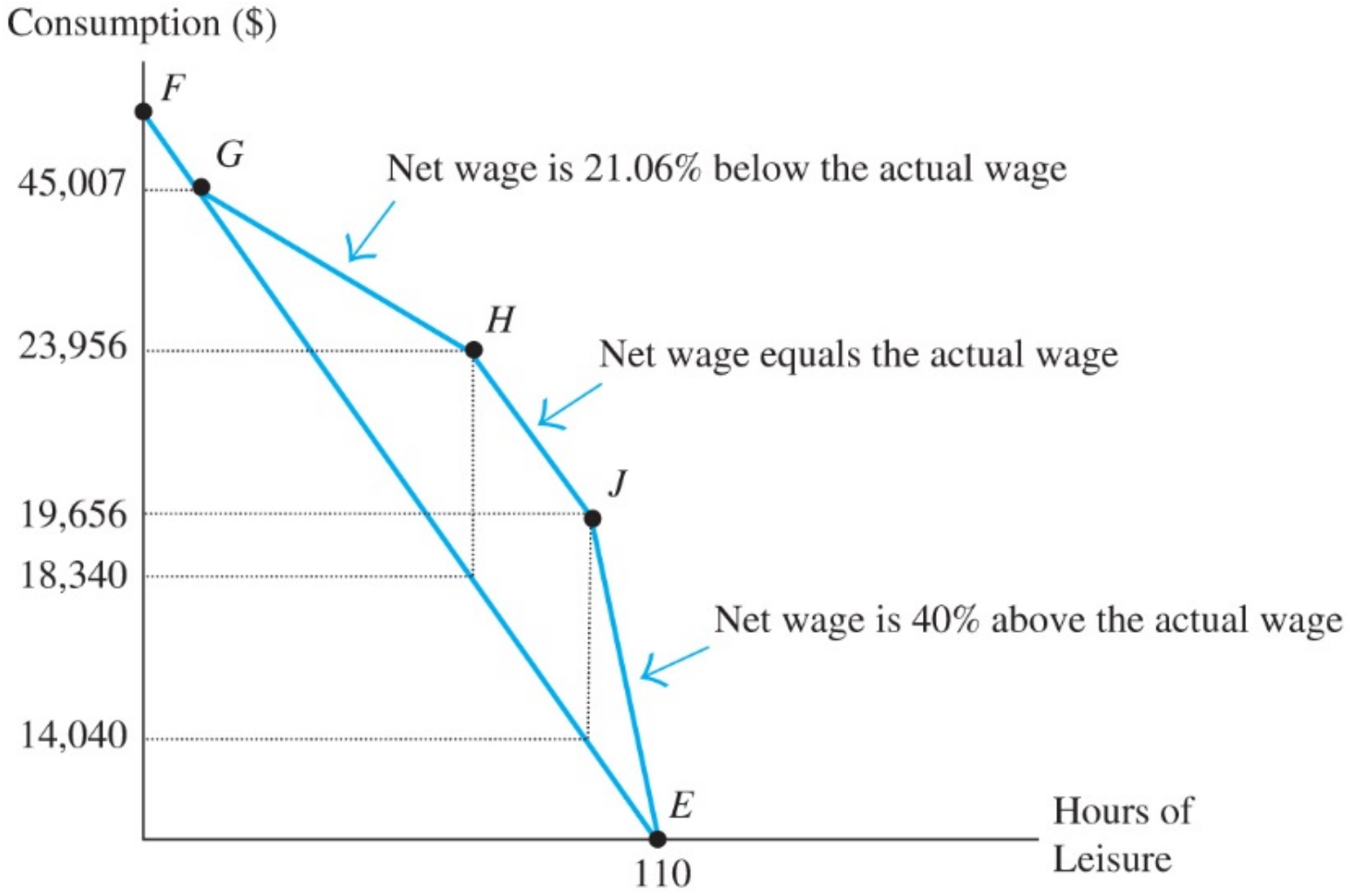
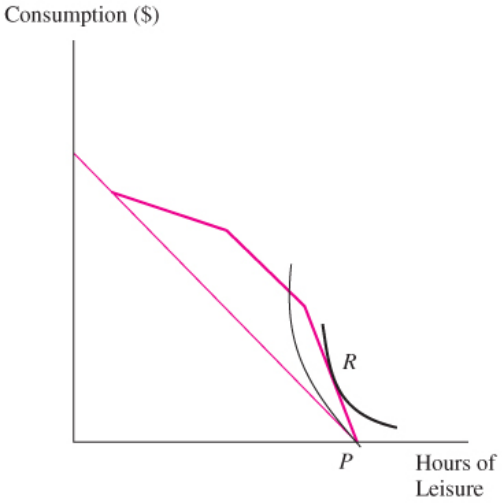
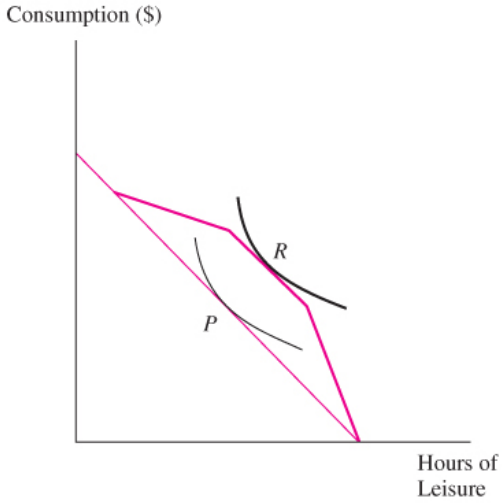


FIGURE 2-17 **The Impact of the EITC on Labor Supply**

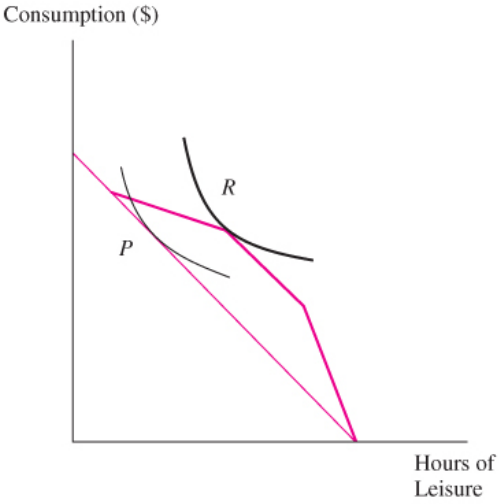
The EITC shifts the budget line, and will draw new workers into the labor market. In (*a*), the person enters the labor market by moving from point *P* to point *R*. The impact of the EITC on the labor supply of persons already in the labor market is less clear. In the shifts illustrated in (*b*) and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

The impact of the EITC on labor force participation

	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	2.4
Control group – not eligible for the EITC: Unmarried women with children	95.2	95.2	0	

Labor Supply over the Life Cycle

- Wage rates change over the worker's life (over the life cycle).
  - Wages are low when young.
  - Wages rise with time and peak around age 50.
  - Wages decline or remain stable after age 50.

- The changes in wages over the life cycle are "**evolutionary**" wage changes that alter the price of leisure.

Theoretical Issues of Evolutionary Wages

- A person will work more hours when wages are higher (i.e., **the substitution effect tends to dominate the income effect**).
- The profile of hours of work over the life cycle will have the same shape as the age-earnings profile.
- Intertemporal substitution hypothesis: **people substitute their time over the life cycle to take advantages of changes in the price of leisure.**

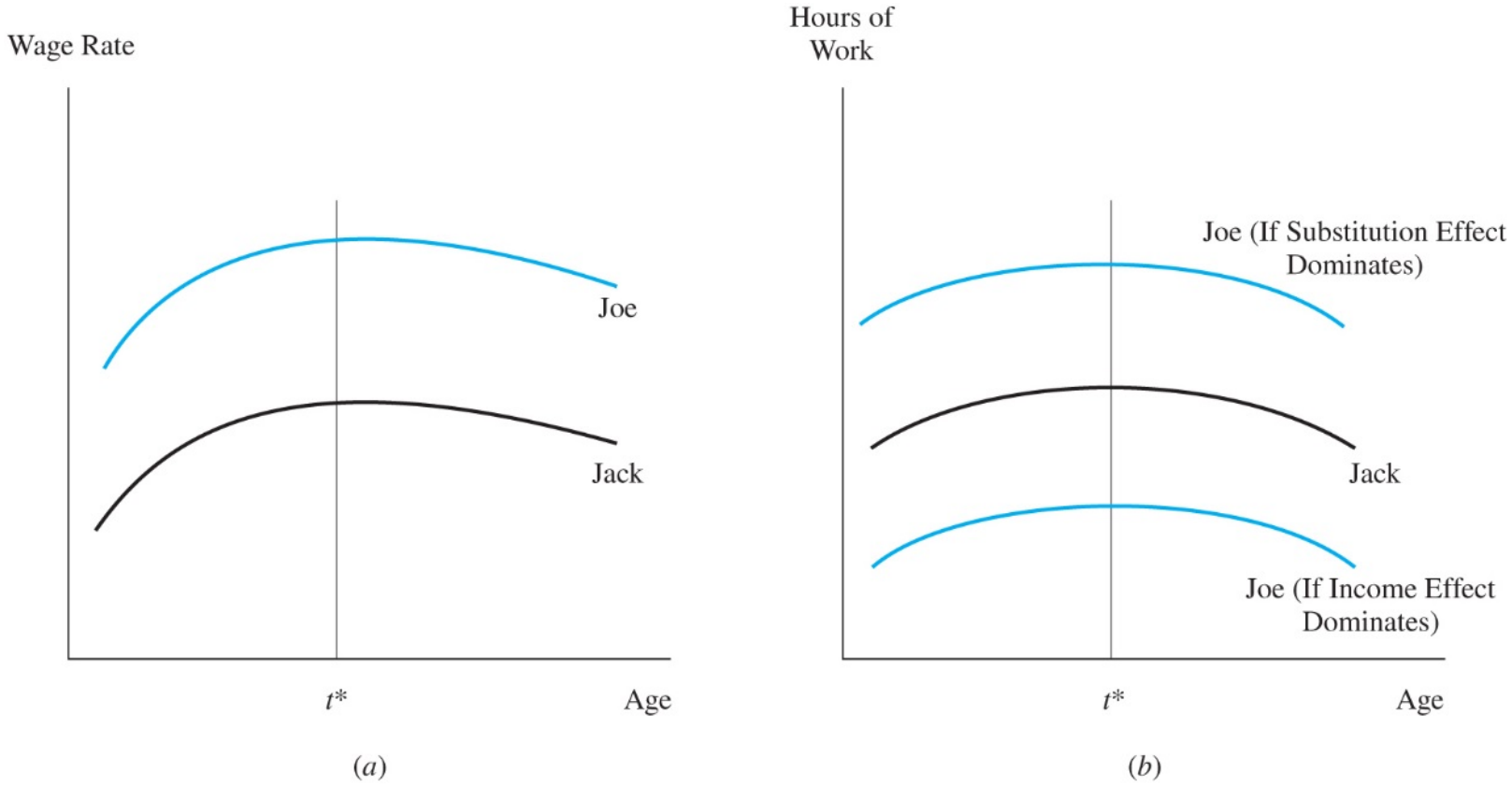
Labor Supply over the Life Cycle

- 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

- 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

The Life Cycle Path of Wages and Hours for a Typical Worker

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 if the substitution effect dominates. If the income effect dominates, Joe works fewer hours than Jack.

Labor Force Participation Rates over the Life Cycle in 2013

Hours of Work over the Life Cycle in 2013

Labor Supply over the Business Cycle

Added worker effect

- So-called "secondary" workers currently out of the labor market are affected by a recession because the main breadwinner becomes unemployed or faces a wage cut.
- A secondary worker may choose to enter the labor force during these bad times
- The labor force participation rate of secondary workers (i.e., the added worker effect) is counter-cyclical.

Discourage worker effect

- Unemployed workers find it very difficult to find jobs during a recession, so they give up searching.
- Discouraged workers exit the labor force during bad times.
- The labor force participation rate of discouraged workers is pro-cyclical.

- The discouraged worker effect dominates the added-worker effect, especially during recessions.

Household Production

Household production function

- Two-person household of Jack and Jill
- Married couple would like to maximize their utility, which depends on the dollar value of the goods they can buy in the marketplace, C, and the dollar value of the commodities they produce in the household, Z.

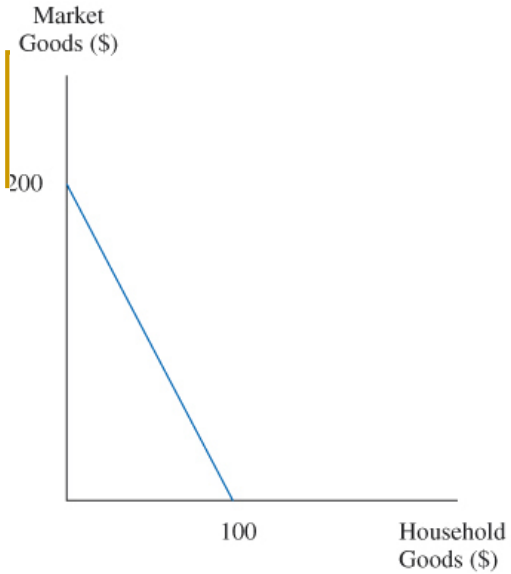
Example

Suppose that Jack produces $10 worth of the output for each hour that he devotes to the household sector and Jill produces $25 of output for each hour that she devotes to that sector

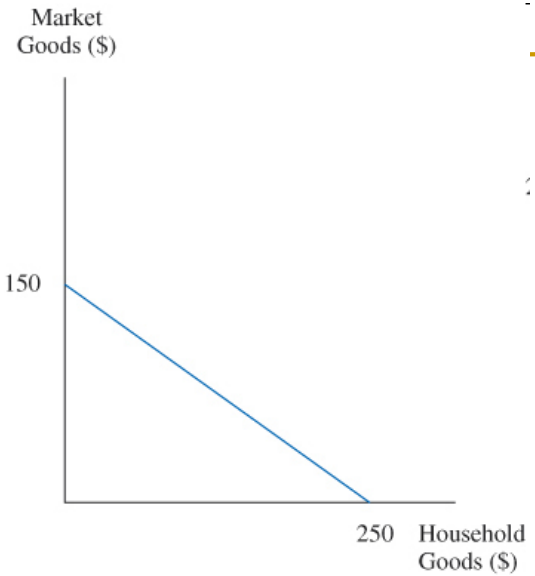
Jack's wage rate is $20 per hour

Jill's wage rate is $15 per hour

10 available hours

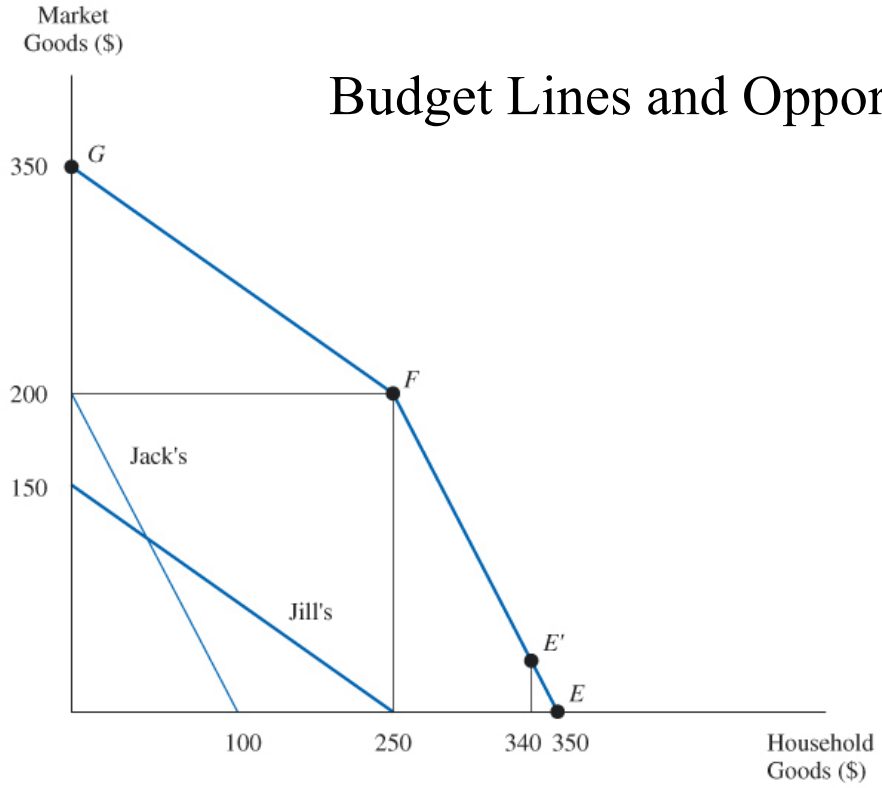


(*a*) Jack's Budget Line



(*b*) Jill's Budget Line

Budget Lines and Opportunity Frontier on Married Couple



(*c*) Jack and Jill's Opportunity Frontier

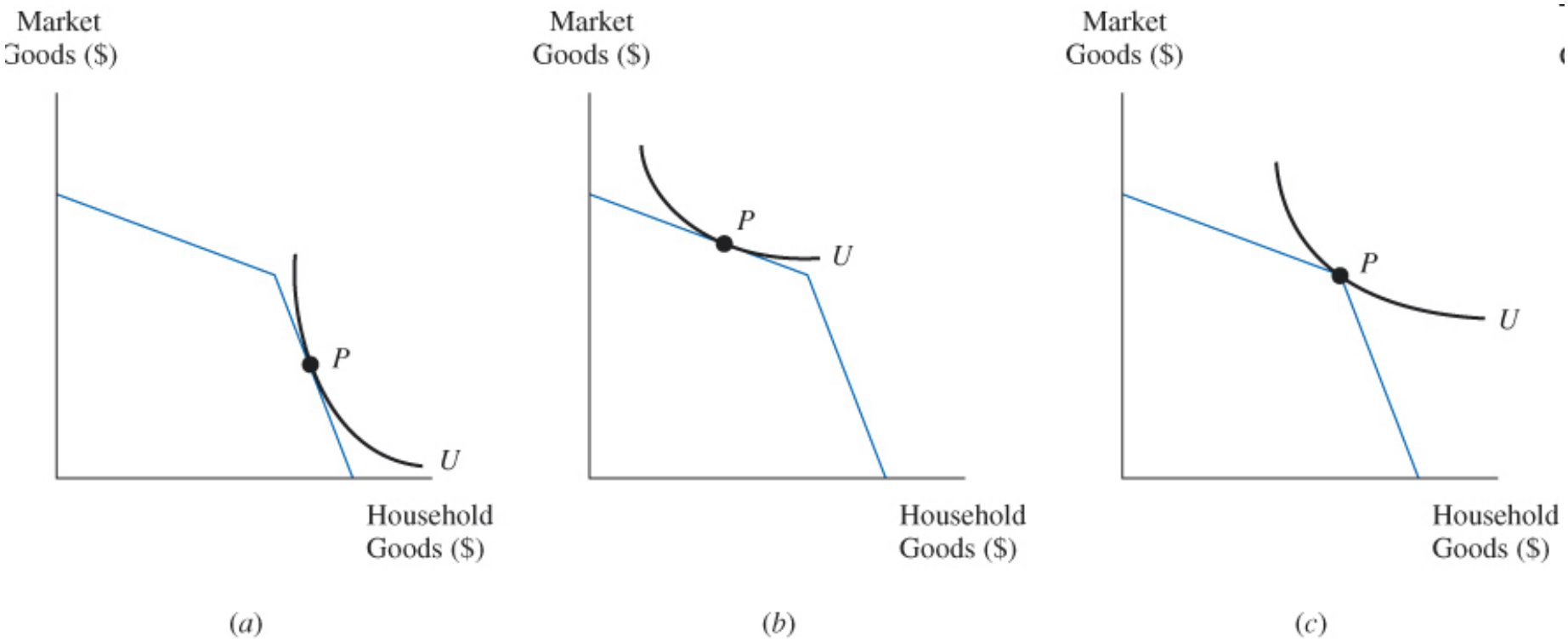
- It makes economic sense for Jack and Jill to decide that it should be Jack who enters the labor market and works that first hour.
- For every dollar's worth of household commodities they give up, Jack gains $2 worth of market goods (20÷10)
- If Jill were to enter the labor market, for every dollar's worth of household commodities the household gives up, Jill can get only 60 cents worth of market goods (15÷25)

The household's opportunity set

- A relatively steep segment (FE) where Jill devotes all her time to the household and Jack shares his time between the market and household sectors

- A flatten segment (GF) where Jack devotes all his time to the market sector and Jill is sharing her time between the market and the household

The Division of Labor in the Household



Who works where?

- Figure A
  - the household chooses a point along the steeper segment of the opportunity frontier
  - Jack and Jill decide that Jill devotes all her time to household production and Jack divides his time between the market and household sectors

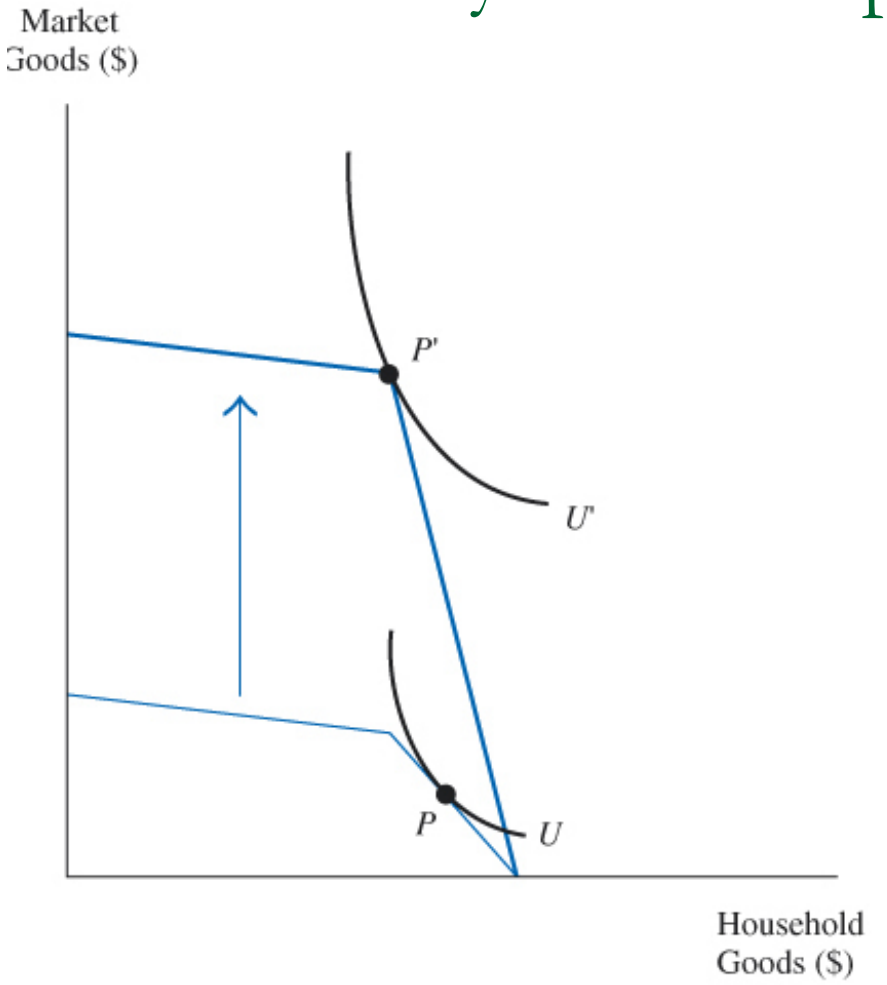
Who works where?

- Figure B
  - the household chooses a point along the flatter segment of the opportunity frontier
  - Jack allocates all his time to the market sector, and Jill divides her time between the market and household sectors

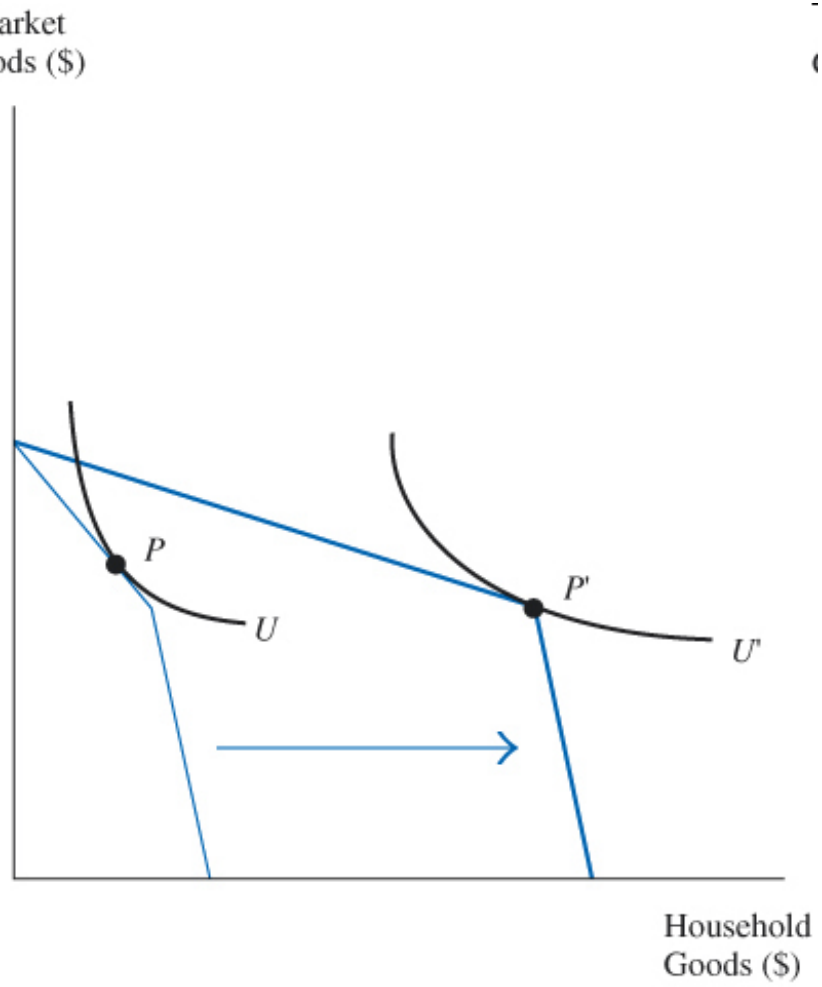
Who works where?

- Figure C
  - point P is located at the kink
  - Jack and Jill completely specialize. He devotes all his time to the market sector; she devotes her time to the household sectors

Increasing in the Wage Rate or Household Productivity Lead to Specialization



(*a*) Increase in Jack's Wage



(*b*) Increase in Jill's Marginal Product of Household Time

Figure A Increase in Jack's wage

- A large wage differential between husband and wife creates incentives for specialization
- At the initial point P, Jack divides his time between the market and nonmarket sectors
- Suppose that Jack's wage increased substantially – the steeper segment of the opportunity frontier would now become much steeper
- The wage increase encourages Jack to withdraw entirely from the household sector and to specialize in the market sector

Figure B Increase in Jill's Marginal Product in the Household

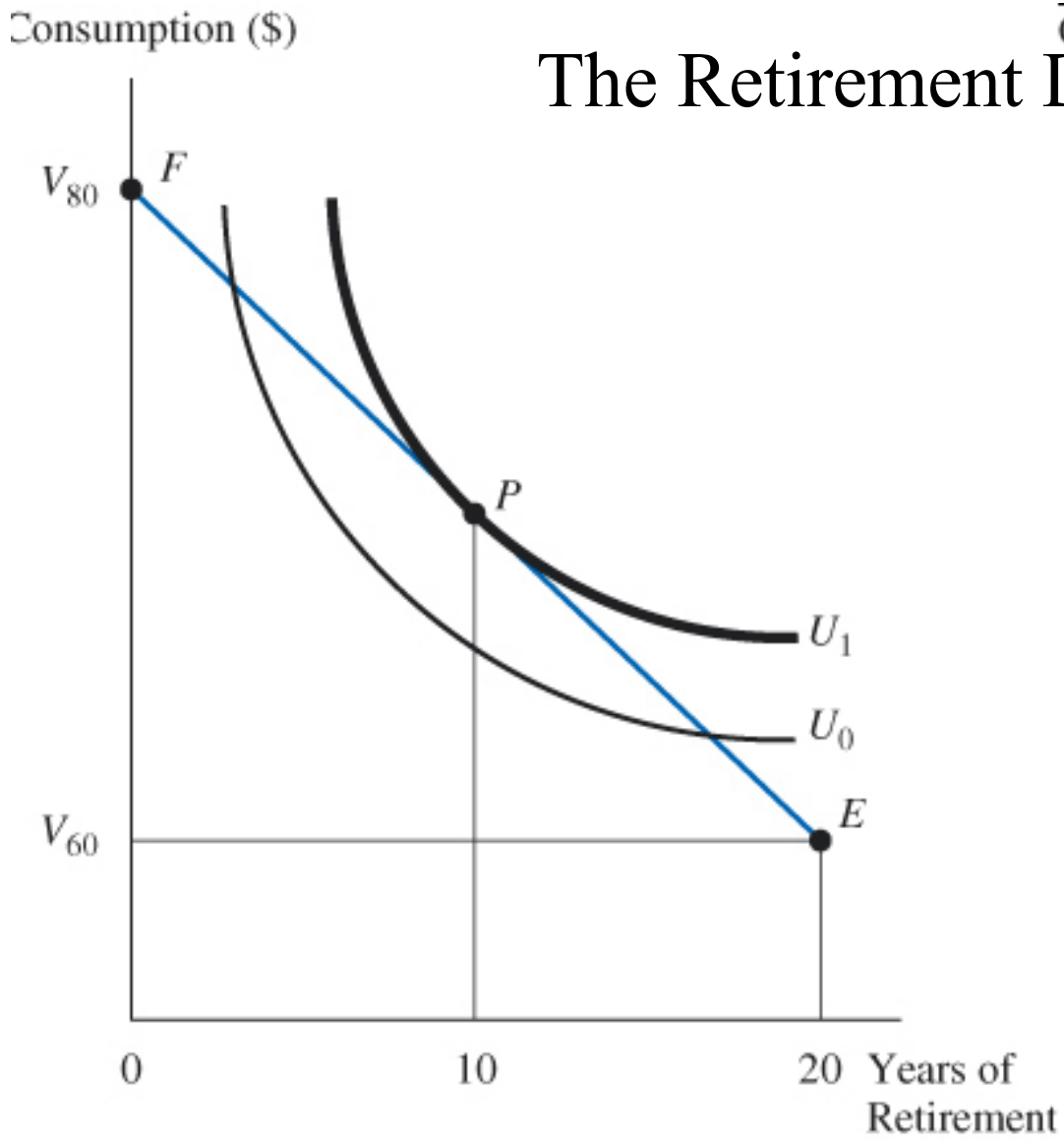
- The opportunity frontier shifts out, moving the household to the new kink point P' on the higher opportunity frontier

- Jill now allocates all her time to household production

Retirement

- Lifetime income is higher the longer a worker puts off retirement.
- If pension benefits are constant, wage increases have a substitution and income effect, so lifetime income might not be altered.
- An increase in pension benefits reduces the price of retirement, increasing the demand for leisure and encouraging the worker to retire earlier.

Retirement



The Retirement Decision

Determinants of the Retirement Age

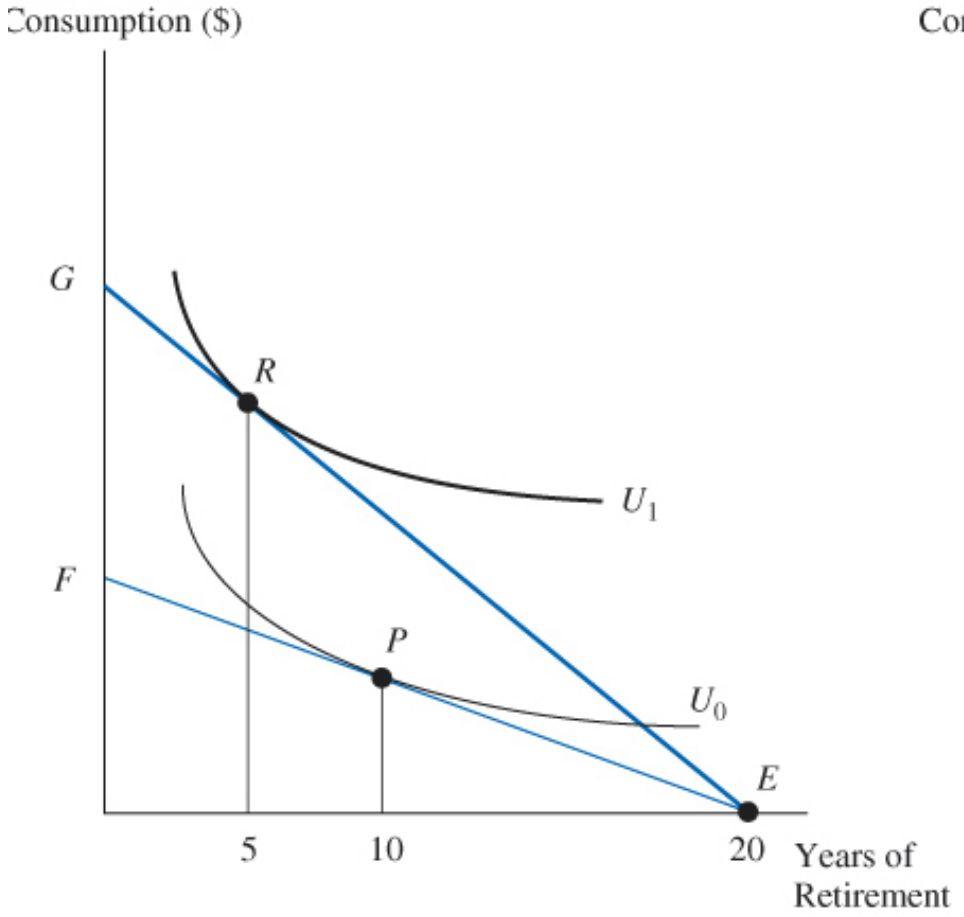
The worker's retirement age depend on his wage and pension benefits

- A wage increase generates both income and substitution effects
  - The high wage worker has a larger opportunity set and would like to consume more leisure, so he will want to retire earlier **(income effect dominates)**
  - The wage increases raises the price of retirement, so the worker will want to delay retirement **(substitution effect dominates)**

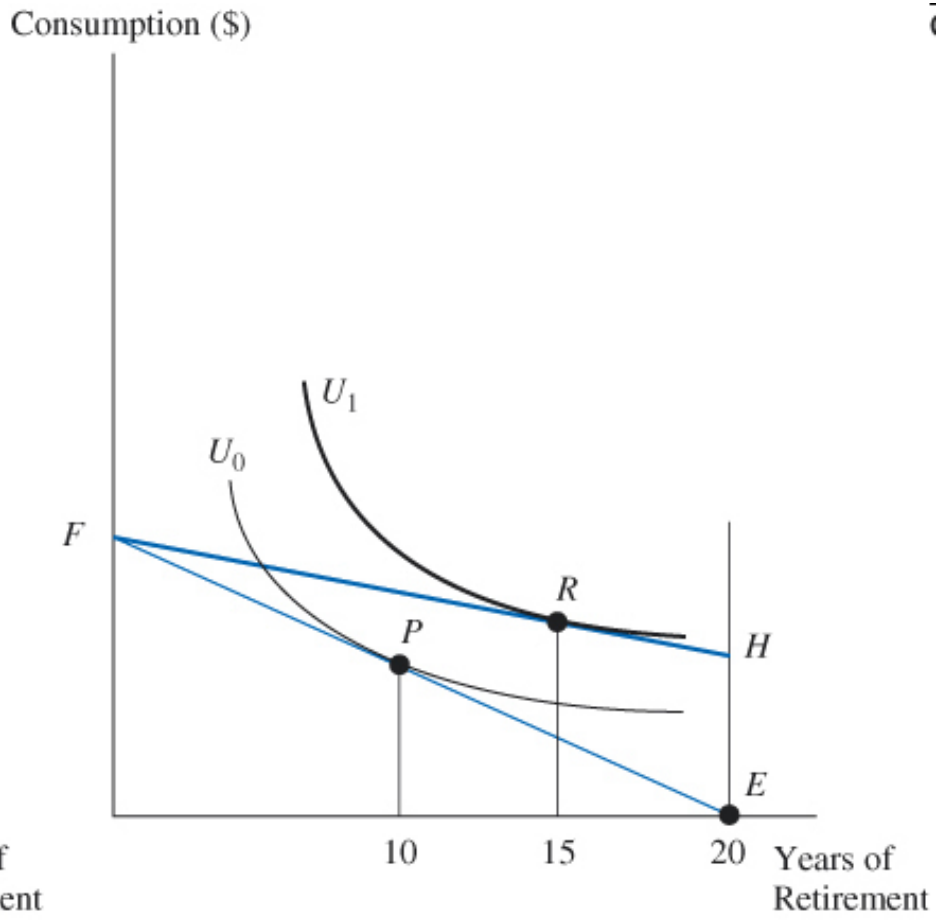
The increase in pension benefits generate both income and substitution effects

- Both of these effects, work in the same direction
- The increase in pension benefits expands the worker's opportunity set, increases the demand for leisure, and induces him to retire earlier
- The increase in pension benefits reduces the price of retirement, increasing the demand for leisure and further encouraging the worker to retire earlier

The Effects of an Increase in the Wage and Pension Benefits on the Retirement Age



(*a*) Wage Increase



(*b*) Increase in Pension Benefits