Labor Supply

I. Basic Tools - How to count

A. Definitions

1. Labor Force - number of people who work for pay or profit or wish to at current wages but cannot during the reference week.

L = E + U

2. Employed - those individuals that work 1 or more hours for wages or salary in a week or persons who work 15 or more hours in a week on a family business or farm

Problem: "does not consider the underemployed"

3. Unemployed - those workers who are 16 years or older that are:

a. on layoff
b. looking for work in the 4 weeks prior to the reference week (discourage worker).

4. civilian vs. total labor force - most labor force stats exclude military

a. P = E + U + O example: 100=60+10+30

b. LFPR = (L/P) * 100 example: (70/100)*100=70%

c. UR = (U/L) * 100 example: (10/70)*100=14.28%

B. Determinants of Labor Supply

1. Manpower: $M_t = L_t * H_t$
M_t - manpower in the economy at a particular point in time
L_t - number of people in labor force at a particular point in time
H_t - average hours worked per person in time period t

2. Reexpression - divide and multiply by P_t (Population)

$$M_t = P_t * (L_t / P_t) * H_t$$

labor supply depends on:

a. population - changes slowly
b. labor force participation rate - can be changed quickly
c. hours worked - change be changed quickly

WWII analogy

3. Human capital - the quality of the workforce

$$M_t = Q_t \{P_t * (L_t / P_t) * H_t\}$$

II. Labor Supply of the Individual: Individual's demand for leisure.

A. Zen and the Art of Economics

The Question: How does one achieve happiness?

The Problem: "how does an individual choose leisure (and thereby the amount of labor) to be happy?"

The Approach: Economics is a constraint based study: start with the things that limit our happiness that are easier to observe

B. The Constraint: Nontechnical approach

1. w - hourly wage
2. C - consumption
3. V - nonlabor income (i.e., bond, parent subsidy)
4. T - total hours in the day: h - labor or L-leisure

Graph: budget constraint

5. How much consumption if you leisured all day (i.e., L=T=16): V=10 then C=10.

6. How much consumption if you worked all day: (i.e., L=0); wT+V: If w=5 then: 5*16+10=90.

7. The Slope:

$$\frac{RISE}{RUN} = -\frac{(wT+V) - V}{T} = -\frac{wT}{T} = w$$

C. The Constraint: Technical Approach:

1. Limited amount of money:

$C = wh + V$

2. Limited amount of time:

$T = h + L$

3. Substitute (2) into (1): $h = T - L$

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

note: price of C is normalized to 1.

b. $C = wT - wL + V$

c. $wT+V = C + wL$ (full income = expenditures on consumption + expenditures on leisure)

"the wage is the opportunity cost of time"

4. Draw the graph -

1. write (3) in slope intercept form

$C = (wT+V) - wL$

2. pick some numbers: $T=16$, $V=100$ $w=10$

$C = (10(16) + 100) - 10L = 260 - 10L$

3. Question: suppose $L=8$, What is h - show on graph.

D. Measuring Happiness: Utility

1. Utility function: depends on consumption and leisure (i.e., no work)

U = U(C,L) = number of utils

2. Example: Preference and Indifference

U(3,10) = 15

U(3,11) = 20

U(3,11) > U(3,10) preference

or

U(3,10) = 15 = U(5,7) indifference

3. Indifference curve:

4. MRS - marginal rate of substitution -

$$MRS = \left| \frac{\Delta C}{\Delta L} \right|$$

5. Aside: MU_c and MU_L

$$MU_C = \frac{\Delta U}{\Delta C}\Big|_{\bar{L}}$$

$$MU_L = \frac{\Delta U}{\Delta L}\Big|_{\bar{C}}$$

6. The slope of the indifference curve

$$SLOPE = -\frac{MU_L}{MU_C} =$$

graph: slope of indifference curve

7. Other properties

a. downward sloping - tradeoff

b. indifference curves cannot intersect

c. convex w.r.t. the origin -
diminishing marginal rate of substitution

d. indifference curves increase to the north east

E. Utility maximization - interior solution

1. 1st of 2 conditions: spend all your money

2. 2nd of 2 conditions: at a tangency

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

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

recall that P=1

3. graphical representation

graph: utility maximization

F. Utility maximization: corner solution -

1. "people choose not to work: L=T"

graph 1: slope of indifference curve exceeds slope of constraint

$MU_L/MU_C > w$ or $MU_L/w > MUc$

2. The reservation wage - the wage such that any wage above it induces the individual to work.

graph 2: slope of indifference curve equals slope of constraint

slope of indifference curve when L=T

$$w_{RESERVATION} = \frac{MU_L}{MU_C}\Big|_{L=T}$$

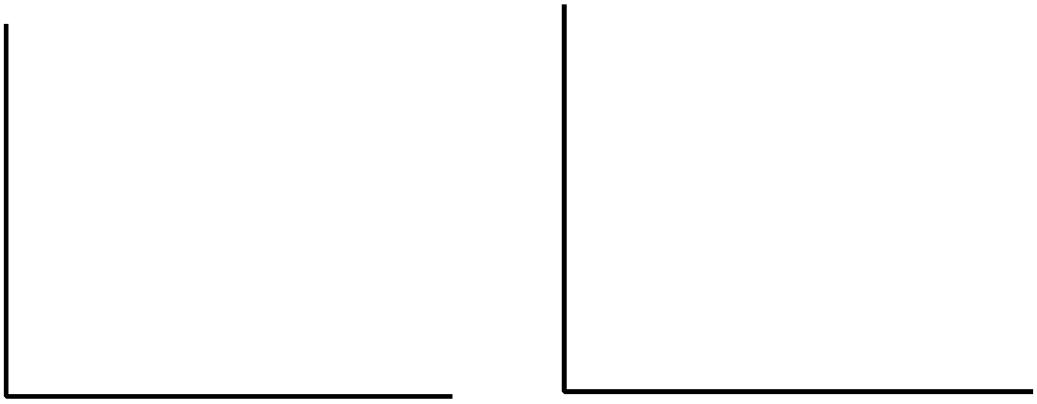
example: previous example: reservation wage = (10/16)

G. Income and Wage effects

1. Income effect - budget constraint shifts parallel

2. Wage effects

G.Backward-Bending Labor Supply Curve



III. Income and Substitution Effects

A. Intuitive approach

1. substitution effect - substitute towards good that has become relatively cheaper

$\Uparrow w \rightarrow \downarrow L \rightarrow \Uparrow h$ (positively sloped labor supply)

2. income effect - wage change changes real income

Two parts
i. if leisure is normal

⇑w → ⇑I→ ⇑ L → ↓ h (negatively sloped labor supply)

ii. leisure is inferior (macaroni and cheese)

⇑w → ⇑I → ↓L → ⇑ h (positively sloped labor supply)

B. Implication for labor supply:

C. Technical Approach

1. graph of sub and inc effect for normal good.

four rules -

i. draw artificial b.c. tangent to new level of utility at old prices

ii. income effect is always a movement between indifference curves

iii. substitution effect is always a movement along the new level of utility.

iv. substitution and income effect move in opposite directions if leisure is normal - move in same direction if inferior

2. leisure is an inferior good

3. trick of the trade

i. draw both budget constraints
ii. draw artificial b.c. - this defines substitution effect
iii. defines 3 regions

D. Empirical Application:

1. Labor Supply Elasticity - measure of responsiveness of hours of work to changes in the wage rate

$$\Theta = \frac{\%\Delta h}{\%\Delta w} = \frac{\Delta h}{\Delta w} * \frac{w}{h}$$

a. $\Theta>0$ if sub>inc

b. $\Theta<0$ if inc>sub

2. Estimates of Labor Supply Elasticity: Our theoretical model implies

$h_i = \alpha + \beta w_i + \gamma V_i$ + other variables

a. $\beta = \Delta h/\Delta w$:
   i. see you can calculate elasticity for given w and h
   ii. $\beta<0$ if inc>sub or labor supply has negative slope
   iii. $\beta>0$ if sub>inc or labor supply has positive slope

b. $\gamma <0$ implies L is normal

c. "consensus" estimates for men $\Theta<0$ (-.1)
   i. inc>sub
   ii. much variation in estimates
   iii. value of "good" studies is small responsiveness (i.e., labor supply is inelastic)

d. Sample Selection: one (of many) problems with estimates:

i. do not observe wages of those people who do not work

ii. those people that do not work have higher reservation wages or lower wages than those that do - in other words they are not selected randomly

iii. estimates of hours work equation with only those workers that work will give biased estimates of the parameters

IV. Welfare: An Application of Substitution Effects

A. Two key attributes

1. an upfront payment.
2. a tax on earned income.

B. Two distinct periods

1. prior to 1967: 100 percent tax
2. after 1967: less than a 100 percent tax (67%)
3. may be entering a third period

C. Welfare prior to 1967:

1. suppose w=3: T=16; V=0

graph of participant and non-participant in welfare

2. calculate amount have to work to pay off upfront payment

t*w*h=16

1*3*h=16 → h=5.333

3. tax revenue = 0 under 100% tax because person does not work

4. creates 2 disincentives to work

i. income effect - upfront payment is like a gift of nonlabor income: if leisure is normal ⇑V →⇑L→ ↓h

ii. substitution effect - tax rate lowers the real wage to 0: substitute away from good that has become relatively more expensive ↓w→ ⇑L→ ↓h

E. Welfare after 1967:

1. reduce disincentive to work - hoped to lower cost of program
   i. keep upfront payment
   ii. lower tax rate to 2/3's
   graph of welfare program under lower tax

2.
calcul
ate number of hours worked before payoff upfront payment

$t*w*h=16$

$(2/3)*3*h=16 \rightarrow h=8$

3. calculate cost of program:

tax revenue: $(2/3)*3*h = (2/3)*3*5=10$

cost: $16 - t*w*h = 16 - 10 = 6$

F. Welfare cost under an even lower tax rate.

1. hoped to lower cost of program still further

i. keep upfront payment
ii. lower tax rate to 1/3's

graph of welfare program under lower tax

2. calculate number of hours worked before payoff upfront payment

t*w*h=16

(1/3)*3*h=16 → h=16

3. calculate cost of program:

tax revenue: (1/3)*3*h = (1/3)*3*6=6

cost: 16 -t*w*h = 16 -6 = 10

V. Supply to an Occupation

graph of short-run and long-run labor supply for computer programmers

A. Short-run labor supply - upward sloping because persons with the skills to enter occupation (but are not in occupation) enter occupation

B. Long-run labor supply - upward sloping because persons who do not have the skills to enter the occupation can acquire the skills in the long run

C. Long run supply is more elastic - more responsive