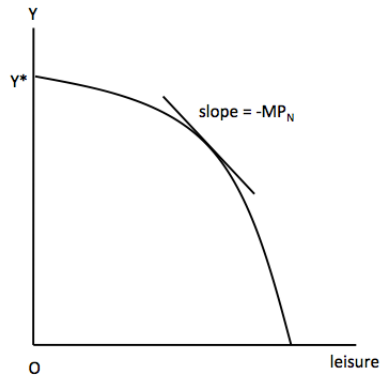
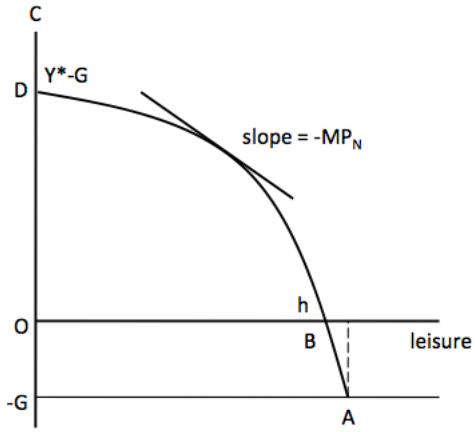
EE312 Macroeconomics, 2/2013 (Sec. 046402)
Chapter 3 (Part 2)

1. PPF (Y, ℓ) : output as a function of leisure



- Y = zF(K, h-ℓ), which is a relationship between output and leisure.
- Y* is the level when $\ell = 0$, and it is the maximum output level.
- Y* = zF(K , h)
- The relation between Y and ℓ is a mirror image of the production function with slope = - MP_N.

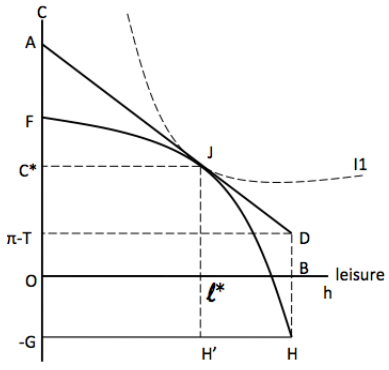
2. PPF$(C, \ell\ )$



- PPF gives the trade-off between consumption and leisure, given technology.
- DB is feasible ($C \geq 0$); AB is not feasible (C is negative).
- The slope of PPF is **the marginal rate of transformation (MRT)** of ℓ to C, the rate at which leisure is converted to consumption through work, given technology.

$$MRT_{\ell,C} = MP_N = -\text{slope of PPF}$$

3. Put the PPF $(C, \ell\ )$ together with the consumer's indifference curve.

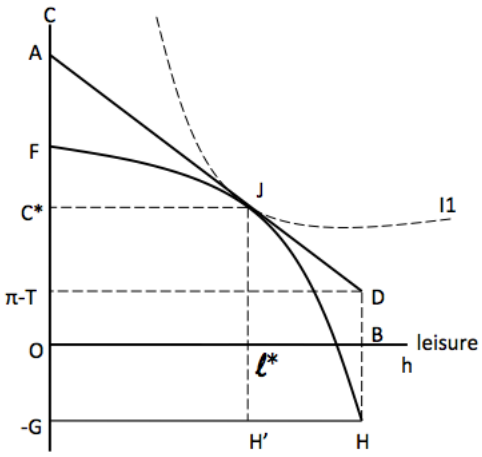


- J is the equilibrium consumption bundle (C*, ℓ*) where $MRS_{\ell,C} = w$
- In equilibrium, $\begin{array}{rcl} MP_N & = & w = MRT_{\ell,C} \\ & = & MRS_{\ell,C} \end{array}$
- The firm and the consumer both optimize at J.
- The firm demands labor equal to $h - \ell^*$ and produces $Y* = zF(K, h-\ell)$.
- Max. profit: $\pi^* = zF(K,\ h-\ell) - w(h-\ell^*) = DH$.
- DB $= \pi^* - G = \pi^* - T$.

- ADB is the budget constraint; the slope = –w.
- DB = the consumer's dividend income minus taxes $= \pi^* - T = \pi^* - G =$ the firm's max. profit minus G.
- C* = consumption goods demanded by the consumer = quantity of consumption goods produced by the firm.
- h-ℓ* = quantity of labor supplied by the consumer = quantity of labor demanded by the firm;
- ℓ*= leisure desired by the consumer.

4. Competitive Equilibrium VS. Social Planner Problem

Competitive Equilibrium

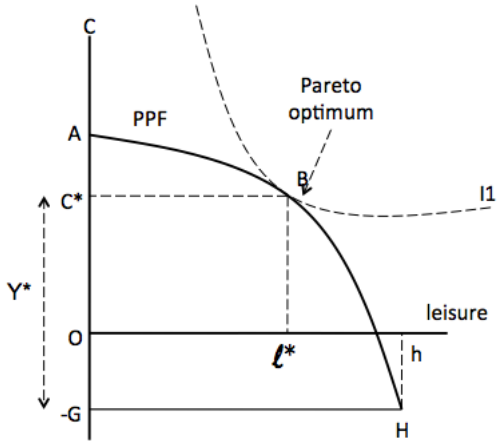


- In equilibrium,

  $MP_N = w = MRT_{\ell,C} = MRS_{\ell,C}$

- The firm demands labor equal to $h - \ell^*$ and produces $Y^* = zF(K, h-\ell) = JH'$.
- Max. profit: $\pi^* = zF(K,\, h-\ell) - w(h-\ell^*) = DH$.
- DB $= = \pi^* - T = \pi^* - G =$ the firm's max. profit minus G.

Social Planner



- The Pareto optimum is at B where the equality holds

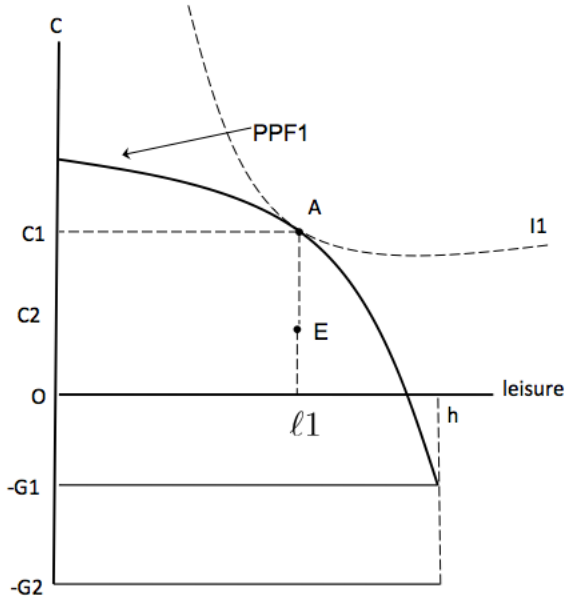
  $$MRS_{\ell,C} = MRT_{\ell,C} = MP_N$$

  the same condition for a competitive equilibrium.

- The social planner simply maximizes the agents' utility subject to what is feasible.
- Comparison:
  - Representative consumer faces a linear or kinked budget constraint.
  - Social planner faces a concave PPF.

- **The first fundamental theorem of welfare economics** :
  - Under certain conditions, a competitive equilibrium is Pareto optimal.
  - Adam Smith's "Indivisible hand": an unrestricted, free market economy can produce socially optimal outcome.
- **The second fundamental theorem of welfare economics**
  - Under certain conditions, a Pareto optimum is a competitive equilibrium.
- Remark: Pareto optimality ignores the distribution issue among individuals and is thus a narrow concept of social optimality.
- One result of the model is **the equivalence between competitive equilibrium and the Pareto optimum.**
- In the real-world social inefficiencies may arise from many possible sources; for example, externalities, distorting taxes, imperfect competition, imperfect information, etc.

5. Application : (1) Effects of an increase in G



- Consider an ↑ in G from G_1 to G_2 .
- Since G = T, G ↑ must be followed by T ↑ of the same amount.
- G ↑, the PPF shifts from PPF_1 to PPF_2.
- This shift leaves the slope of the PPF constant for each ℓ.

- The new Pareto optimum is at point .....
- Thus, G ↑ leads to a negative ..... effect on C and ℓ.
- Two effects

$$G\uparrow \Rightarrow \begin{cases} (1)Y_d..... \rightarrow C..... \\ \quad\quad\quad\quad\quad\quad (\text{the distance .....}) \\ (2)\ell..... \rightarrow (h-\ell)..... \\ \quad\quad\quad\quad\quad\quad \downarrow \\ \quad\quad\quad\quad\quad\quad Y.....\text{and } Y_d = (Y-T)..... \\ \quad\quad\quad\quad\quad\quad \downarrow \\ \quad\quad\quad\quad\quad\quad C..... \\ \quad\quad\quad\quad\quad\quad (\text{the distance .....}) \end{cases}$$

- There are two effects from an increase in government spending.

1. Consumption drops. $C\downarrow$. (keeping ℓ constant, C drops by the distance AD = $\Delta G = \Delta T$)
2. Leisure drops. $\ell\downarrow$.

Less leisure is equivalent to **an increase in working time** $(h-\ell)$. The consumer **supplies more labour services** (N^s).

The real wage(w) drops to induce more labor demand by the firm.

The real wage decreases because the slope of PPF2 at point B is less steep than the slope of PPF1 at point A.

Employment rises.

More labour input in production results in **larger total output** (Y). The original Y can be represented by the distance $H1A$. The new Y can berepresented by the distance $H2H3$. $(\Delta Y = ED)$

Consumption increases by the distance ED.

*The first effect (the distance AD= ΔG) is larger than the second effect (ED).

- Total effect is shown by the distance ..... . $G\uparrow \Rightarrow C.....$:

Private consumption is **crowded out** by government purchases.

The decrease in C is smaller than the increase in G.

$\Delta C = C1C2 =$ .....
$\Delta G = G1G2 =$ .....
$\Delta Y = Y1Y2 =$ .....

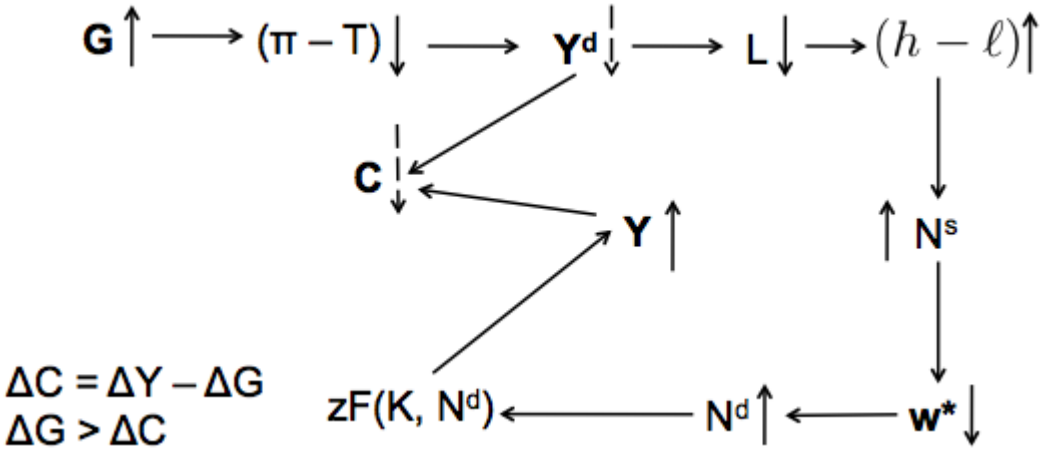
- What happens to the real wage?
  - The slope of PPF_2 at B is ..... steep than PPF_1 at A.
  - So the real wage fall. The consumer supplies more labor (N=h-ℓ increases).
  - Given K, more labor input causes MP_N to fall.
  - The firm optimizes by paying lower $w = MP_N$.
  - The lower real wage (w) induces the firm to raise employment (N).

ℓ..... $\Rightarrow$ N..... $\Rightarrow$ MP_N..... $\left(\text{Since } \bar{K}.\right) \Rightarrow w$.....
: w_{new} = slope of $PPF_{....}$at....
: $w_{original}$ = slope of $PPF_{....}$at....

- The consumer works more, receives a lower real wage and consume less.
- Y..... but C..... This means that when government increases its spending, the firm produces more. The government takes a ..... share of total output while the consumer takes a ..... share of total output.
- In sum, The consumer's utility ..... as the governmet expenditure increases.

  As the representative consumers pay higher taxes, his or her disposable income falls, and in equilibrium he or she spends less on consumption goods, and work harder to support a larger government.

- Chained effect : an increase in G



- Note on business cycle :
  - Model prediction

$G \uparrow \Rightarrow Y^*$.....

N^*..... procyclical
w^*..... countercyclical
C^*..... countercyclical

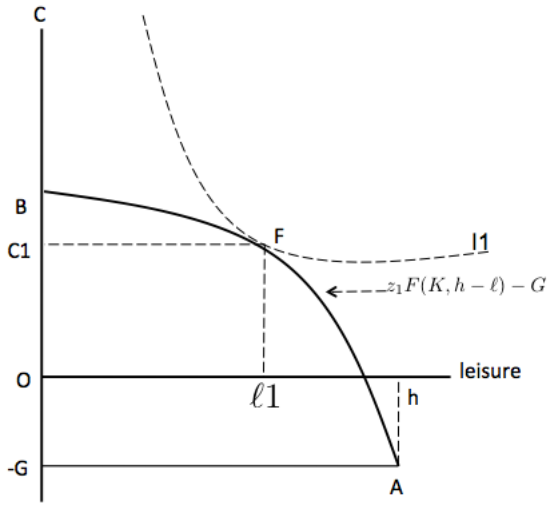
– facts

$Y^* \uparrow$

$N^* \uparrow$ procyclical
$w^* \uparrow$ procyclical
$C^* \uparrow$ procyclical

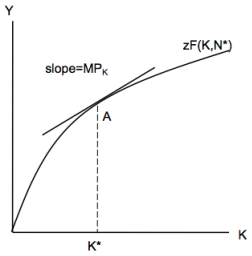
– Therefore, it is unlikely that governement spending is the primary cause of business cycle fluctuation.

6. Application : (2) Effects of an increase in z (or K)

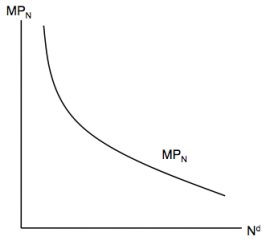


- The PPF rotates upwards.
- The new PPF is steeper than the original one.
- The PPF rotates upwards.
- MP_N..... for all N , ℓ

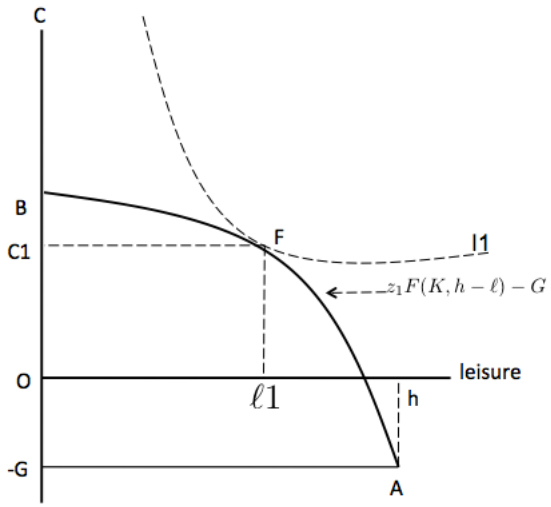
- Increases in z = better technology or organization.
- The production function rotates upwards with higher MP_N, given N.



- Not only more Y can be produced given N, but the MP_N i.e. the slope of the production function also increases for each N.



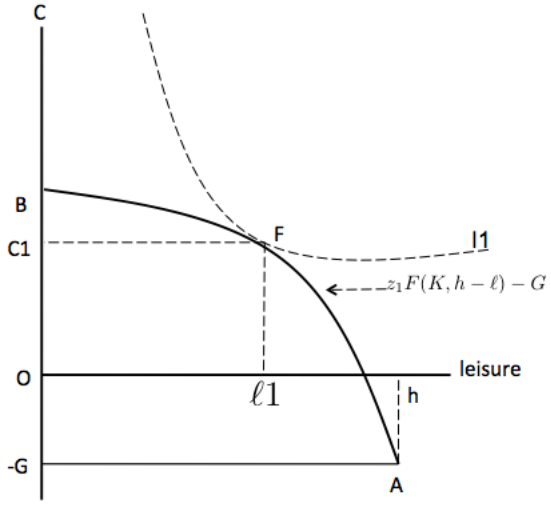
- Production function is steeper for all N , $\ell \rightarrow MP_N$ ..... for all N , ℓ
  This means that wage ..... for all N , ℓ
- **substitution effect and income effect**
  substitution effect : ℓ ..... and C.....
  leisure is ..... costly.
  income effect : ℓ ..... and C.....
  higher wage implies higher income.
- **Total Effect**
  C..... (for sure)
  ℓ depends
  - substitution effect is equal to income effect, ℓ .....
  - substitution effect is greater than income effect, ℓ .....
  - substitution effect is less than income effect, ℓ .....



Equal Effect

- ..... = substitution effect (rising C and N, falling ℓ).
- ..... = income effect (rising C and ℓ).
- Equal effects:ℓ^* ..... and N^*.....
- Wage .....

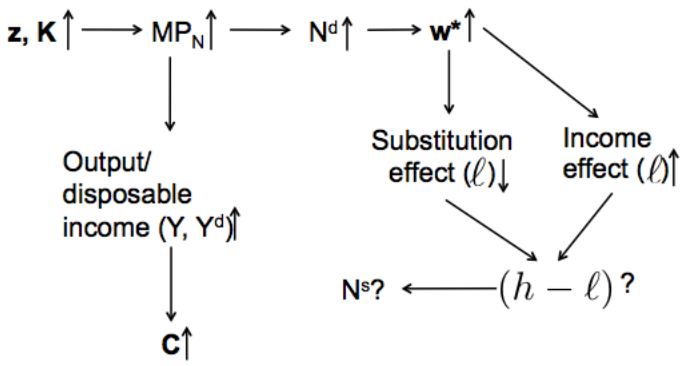
"tells a story about the long-term economic effects of long-run improvement in technology, such as that have occured in the United States since WWII. ... some keys observations from post-WWII US data are that aggregate output has increased steadily, consumption has increased, the real wage has increaed, and the hours worked per employed person has remained roughly constant."



Stronger Substitution Effect

- ..... = substitution effect (rising C and N, falling ℓ).
- ..... = income effect (rising C and ℓ).
- Stronger substitution effects: ℓ^* ..... and N^*.....
- Wage .....

- **Chain Effect : an increase in total factor productivity**



If SE = IE, N^s ..... .
If SE > IE, N^s ..... .
If SE < IE, N^s ..... .

- Note on business cycle :
  - Model prediction : assuming a stronger substitution effect or equal effect

$G\uparrow \Rightarrow Y^*$.....

N^*..... procyclical(SE....IE) ,uncertain (SE....IE)
w^*..... procyclical
C^*..... procyclical

  - facts

$Y^*\uparrow$

$N^*\uparrow$ procyclical
$w^*\uparrow$ procyclical
$C^*\uparrow$ procyclical

  - Therefore, fluctuations in total factor productivity could be the primary cause of business cycle.