Intermediate macroeconomics

Part III

Micro-founded macroeconomics

*The material in this part is mostly based on the lecture slide prepared by Dr. Pichit. I've received his permission to use his slide in my teaching. His permission is gratefully acknowledged here.

Historical development of macroeconomics framework

- 1930s: the emergence of traditional macroeconomics.
- 1940s: Become increasingly popularized since Timbergen, Frisch, Klien, Havelmo (and many others) have combined the framework with statistical analysis.
- 1950s/1960s: The golden era of traditional macroeconometrics and central-planning policy
- 1970s: Loosing its ground since the oil shocks.

Historical development of macroeconomics framework

- What's wrong with the traditional framework?
- Overly relying on data-driven reasoning; empirical fitness of statistical model with a "loosely-grounded theoretical foundation".
  - Phillips curve is a good example; this had lured economist to believe that permanent trade-off exists.
  - Structural analysis with deep economic reasoning by Friedman et.al. has suggested otherwise; trade-off works only when inflation is near zero.

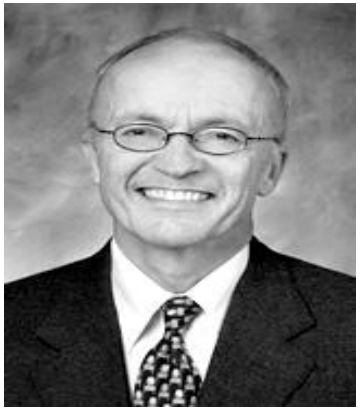
Historical development of macroeconomics framework

Robert Lucas
Nobel 1995

- To guard against the temptation, macroeconomics should be based on "micro-foundation".
- Lucas doubted that policy analysis under traditional framework can be helpful - The famous Lucas's critique in 1976.
- Agent's behaviors normally change with "environment" and "rule of the game".
  - All these combined is call "regime".
  - Example: Ricardian equivalence

Historical development of macroeconomics framework

Edward Prescott
Nobel 2004



Finn Kydland
Nobel 2004

- Lucas's critique has inspired thoughts to many economists whose interest is about studying business cycles.
- A new framework for business cycles has been created, and known as the real business cycles theory - Kydland and Prescott (1981)
- The framework has been subsequently developed into a unified framework called the Dynamic Stochastic General Equilibrium model (DSGE model).

Micro-foundation of modern macroeconomics

- An alternative approach in macroeconomics studies.
- Macro behavior is the sum of microeconomic decisions by consumers and firms.
- Model building from the micro behavior to the aggregate levels.
- Giving details about environment and rule of the game at the very primitive level.

Basic structure of a micro-foundation macroeconomic model.

- **Actors**: consumers, firms, government, the rest of the world.
- The set of goods that consumers consume.
- Consumer's preference over goods.
- Firms' production technology.
- Resources available.

- Model structure:
  - Consumer preferences: **Consumer optimization**.
  - Production technology: **Firm optimization**.
  - Government taxes and spending.
  - The current account.

- The above decisions determine the outcomes: income, employment, productivity, etc.

Where we are headed from now

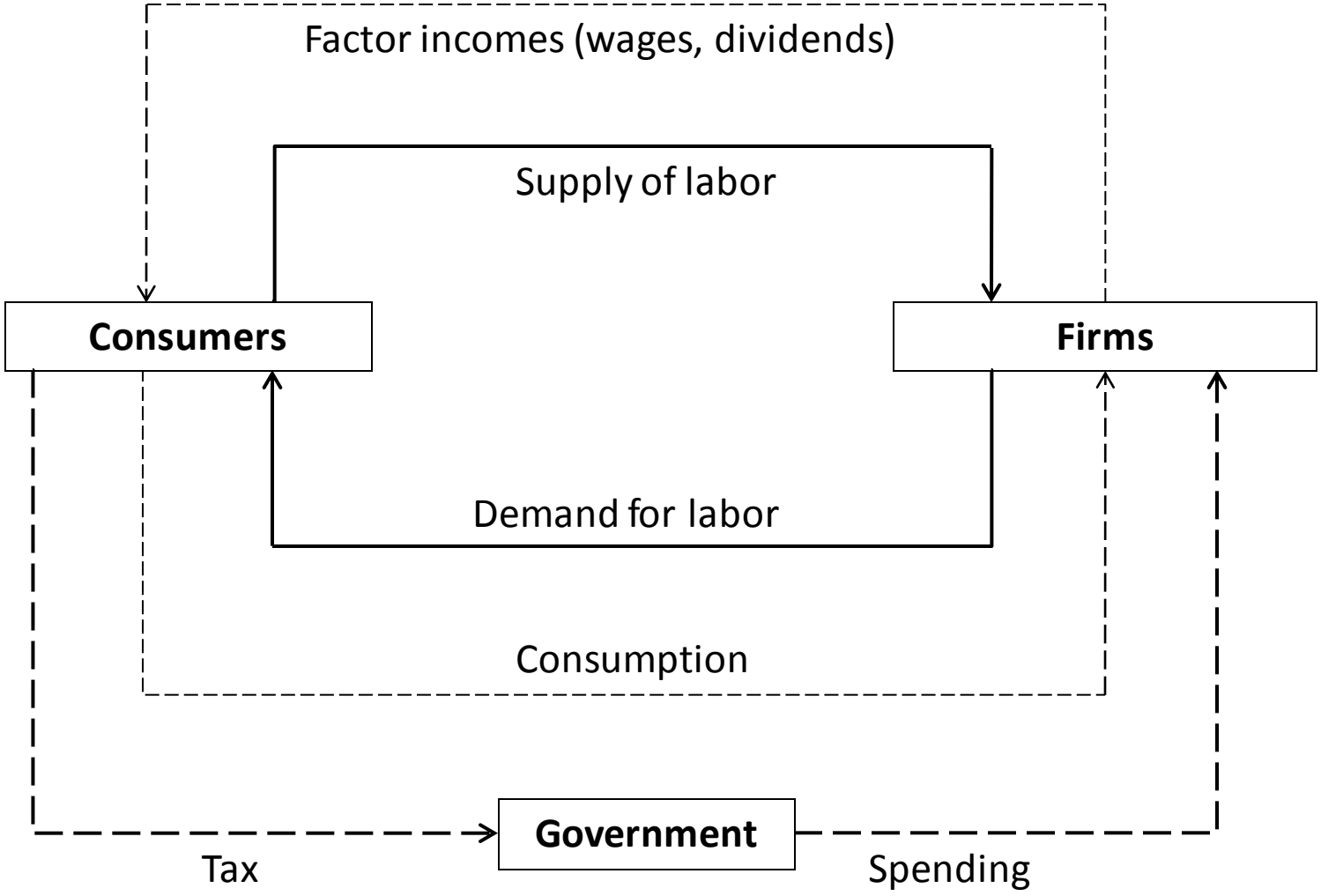
- Start from a simple one-period model
- Extend into multi-period model
- Using the model understand the propagation of shocks.

Readings: Chapters in Williamson (check your outline.)

One-period decisions

- Optimization by consumers and firms.
- One period decisions; static analysis:
  - **Consumers**: consumption demand and labor supply.
  - **Firms**: supply of goods and demand for labor.
  - No investment, no savings.
- Government collects taxes and spends (G = T).
- No foreign trade; a barter economy.
- The foundation of all macro analysis.

The Circular Flow



Representative Consumer

- **Preference** over consumption goods and leisure represented by indifference curves.
- **A budget constraint** of wage and non-wage incomes.
- Combination of **consumption goods and leisure** which maximizes utility, given the budget constraint.
- Effects of an increase in non-wage income and the real wage rate.

The utility function

- U = U(C, L),
  - where U = the utility function;
  - C = amount of consumption goods;
  - L = amount of leisure
- U(C1,L1) = level of utility derived from the **consumption bundle** of C1 and L1.

Properties of consumer preference

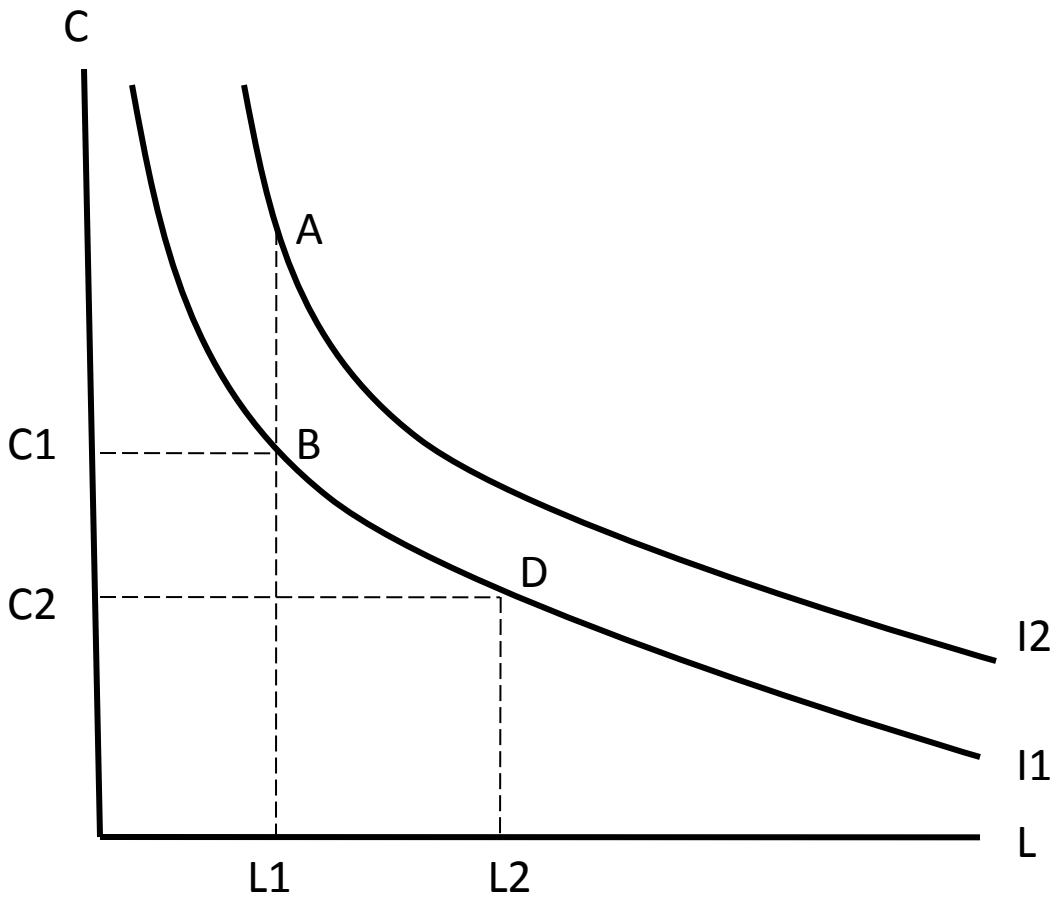
- **More is preferred to less.**
  - If U(C2,L2) > U(C1,L1), then U(C2,L2) is strictly preferred to U(C1,L1).
- **The consumer has preference for diversity in his/her consumption bundle.**
  - U (C2,L1) is preferred to U (C3,0).
- **Consumption goods and leisure are normal goods.**
  - The consumer demands more as income rises.

The indifference curves

- **The indifference curve** (IC) gives different bundles of the two goods which the consumer is indifferent (equal utility).
  - '**More is preferred to less**.': ICs slope downwards.
  - '**Preference for diversity**': ICs are convex towards the origin.
- **The indifference map**: a set of ICs for the representative consumer.

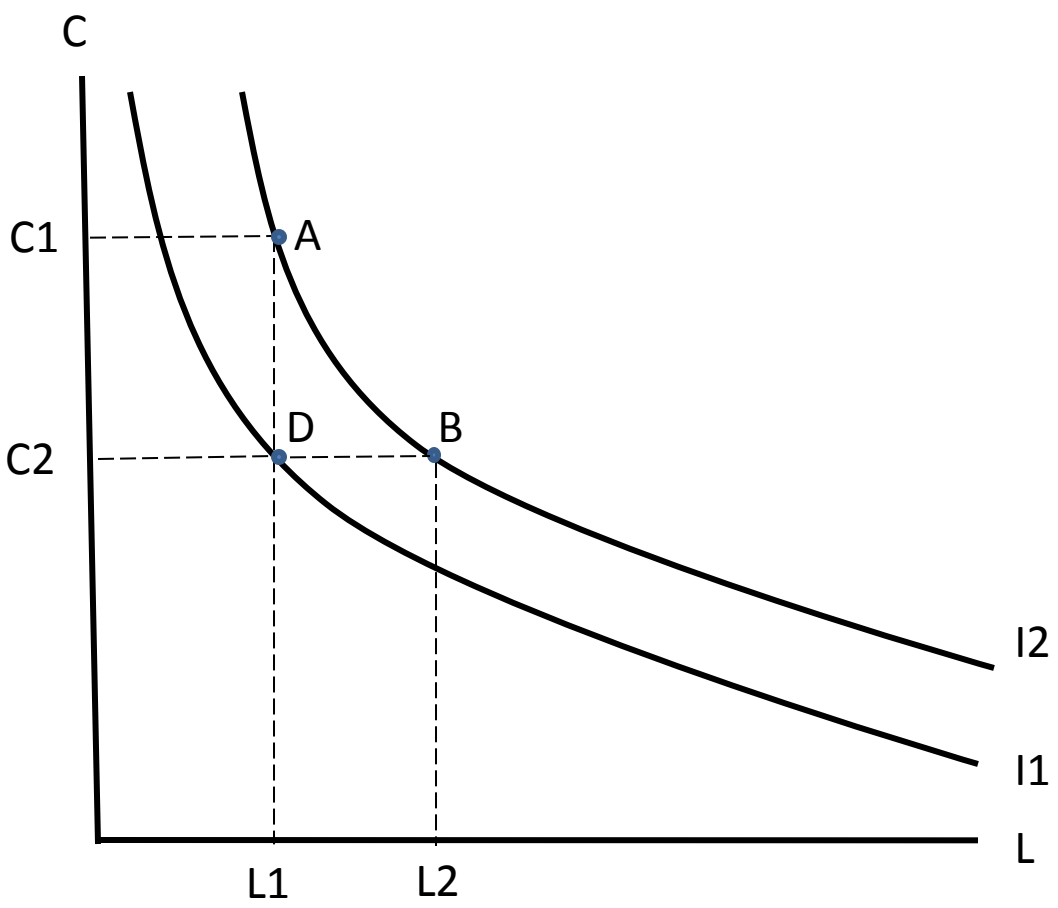
Indifference Curves

- A is strictly preferred to B.
- The consumer is indifferent between B and D.



More is preferred to less.

- If C1 (at A) drops to C2 with the same L1, the consumer is on a lower I1.
- To get the initial I2 (with the same C2, raise L1 toL2 (at B).

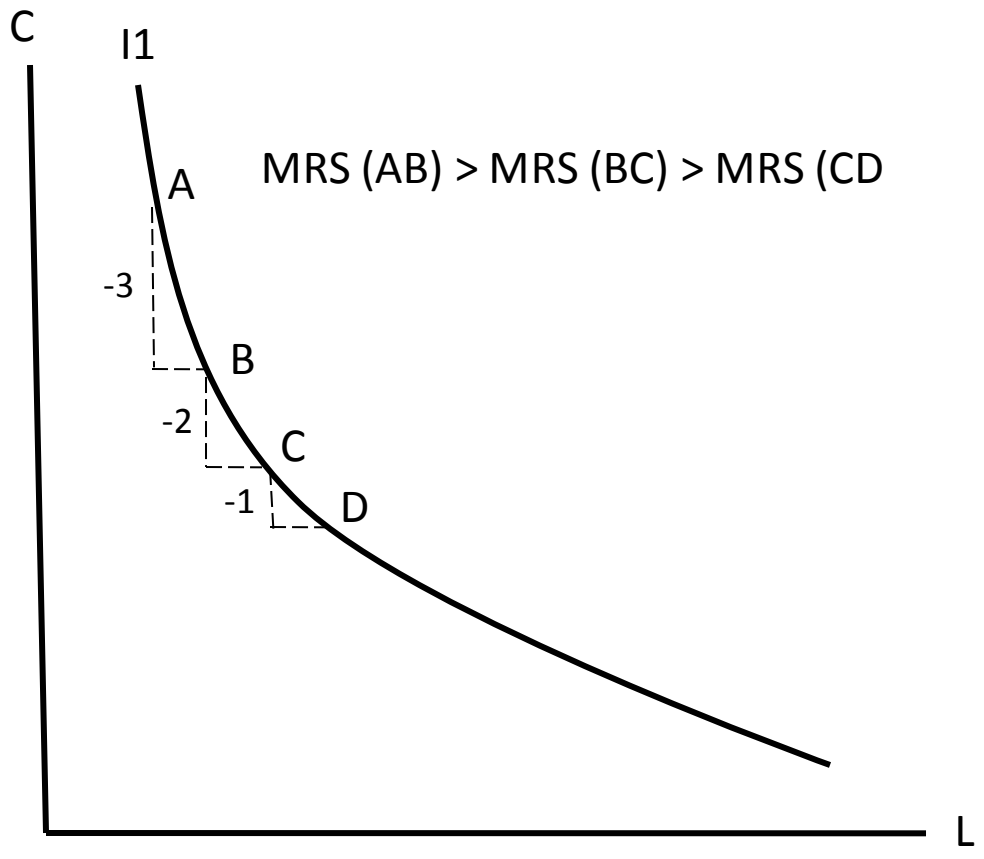


Marginal rate of substitution (MRS)

- **The marginal rate of substitution of leisure for consumption goods ($MRS_{L,C}$)** is the rate at which the consumer is willing to substitute leisure for consumption goods.
  - The slope of the IC passing through a given (C, L).
  - Willingness to sacrifice given consumption for more leisure.
  - **$MRS_{L,C}$ is decreasing** as the consumer moves from consumption goods to more leisure.

Preference for diversity

- **From A to B**, the agent is willing to sacrifice 3 units of C for one unit of L.
- **From B to C**, 2 units of C is sacrificed for one unit of L.
- **From C to D**, one unit of C is sacrificed for one unit of L.



Consumer's budget constraint

- The consumer is subject to competition.
  - The consumer is **a price-taker**.
  - The market prices are given.
  - Individual action has no influence on the market price.
- The consumer allocates time between leisure and work.
  - He/She receives wages from work and non-wage incomes from non-labor services.

The consumer's time constraint

- h = hours of time available;
- L = time allotted to leisure;
- N^s = time spent working (labor supply)

$$l + N^s = h$$

Real disposable income

$$Y^d \quad = \quad wN^s + \pi - T$$

- **The real disposable income** is the sum of wage and dividend incomes minus taxes.
  - w = the real wage in the units of consumption goods;
  - π = real dividend income (profits) in the unit of consumption goods received from the firm;
  - T = a lump-sum tax.

The consumer's budget constraint

- The consumer's disposable income is spent on consumption goods.
- Disposable income (Y^d) = consumption expenditure (C);

$$C = wN^s + \pi - T$$

$$C = w(h - l) + \pi - T$$

$$C = w(h-l)+\pi-T$$

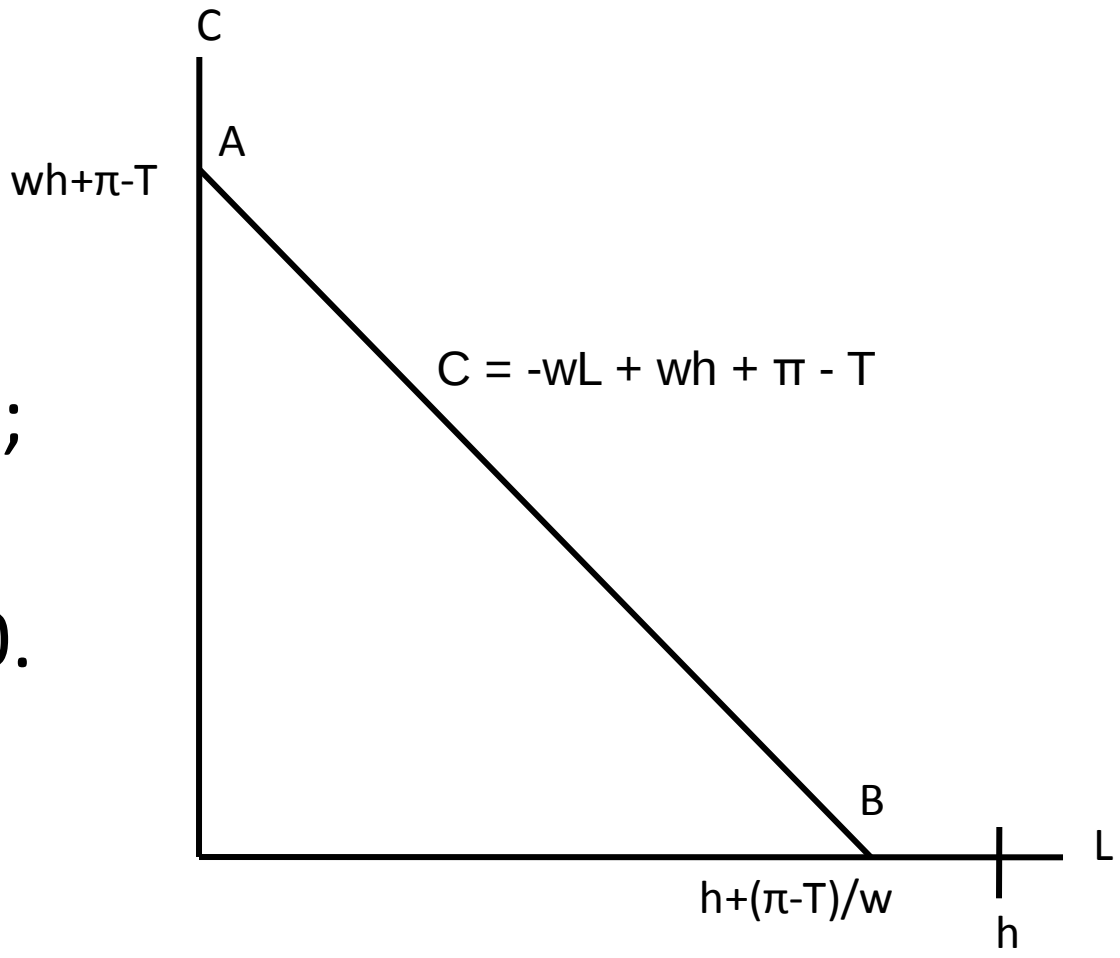
$$C+wl = wh+\pi-T$$

$$C = -wl+wh+\pi-T$$

- The implicit real disposable income (wh+π-T) is split into expenditures on consumption goods and leisure (C+wL).
  - w = the market price of leisure.
- The slope = –w; the intercept = wh+π-T

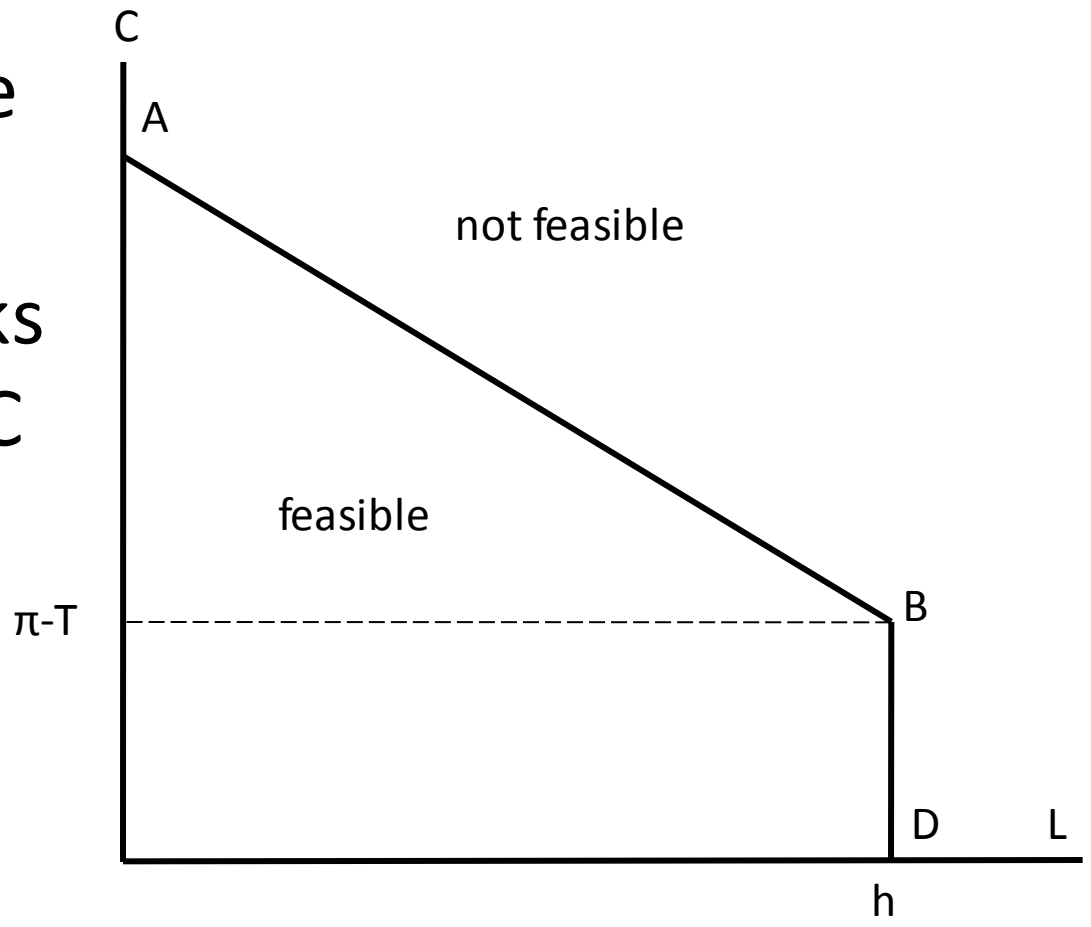
The budget constraint (T>π)

- AB = the budget line.
- The vertical intercept is L = 0;
- The horizontal intercept is C = 0.
- Slope = -w



The budget constraint (T<π)

- The budget line is kinked at B.
- Along BD, works = 0; L = h, and C ≤ π – T > 0.

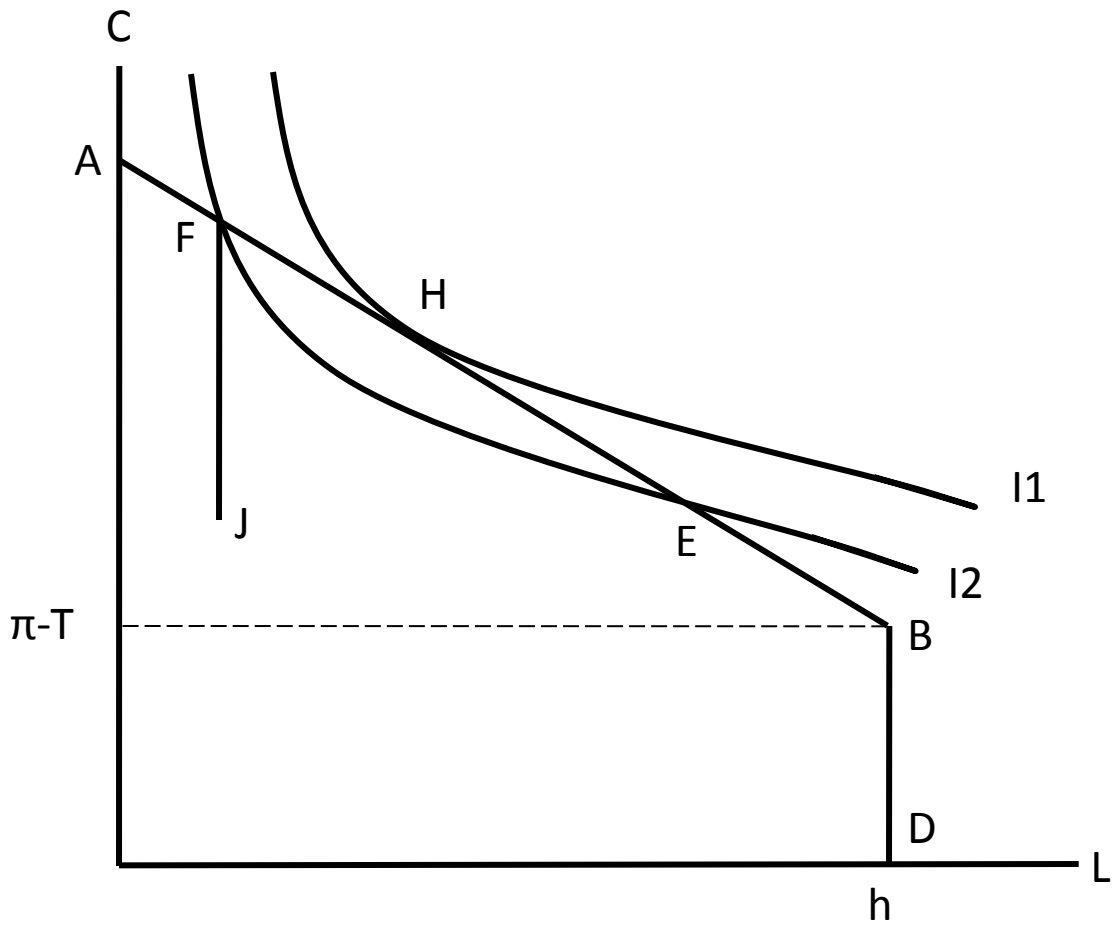


Consumer optimization

- The consumer is rational.
  - Knowledge of his/her own preferences and budget constraint.
  - Combination of consumption goods and leisure (the consumption bundle) which maximizes utility.
- The consumer chooses the consumption bundle that is on his/her highest indifference curve subject to the budget constraint.

The optimal consumption bundle

- H = optimal consumption bundle.
- E and F are feasible but not optimal.



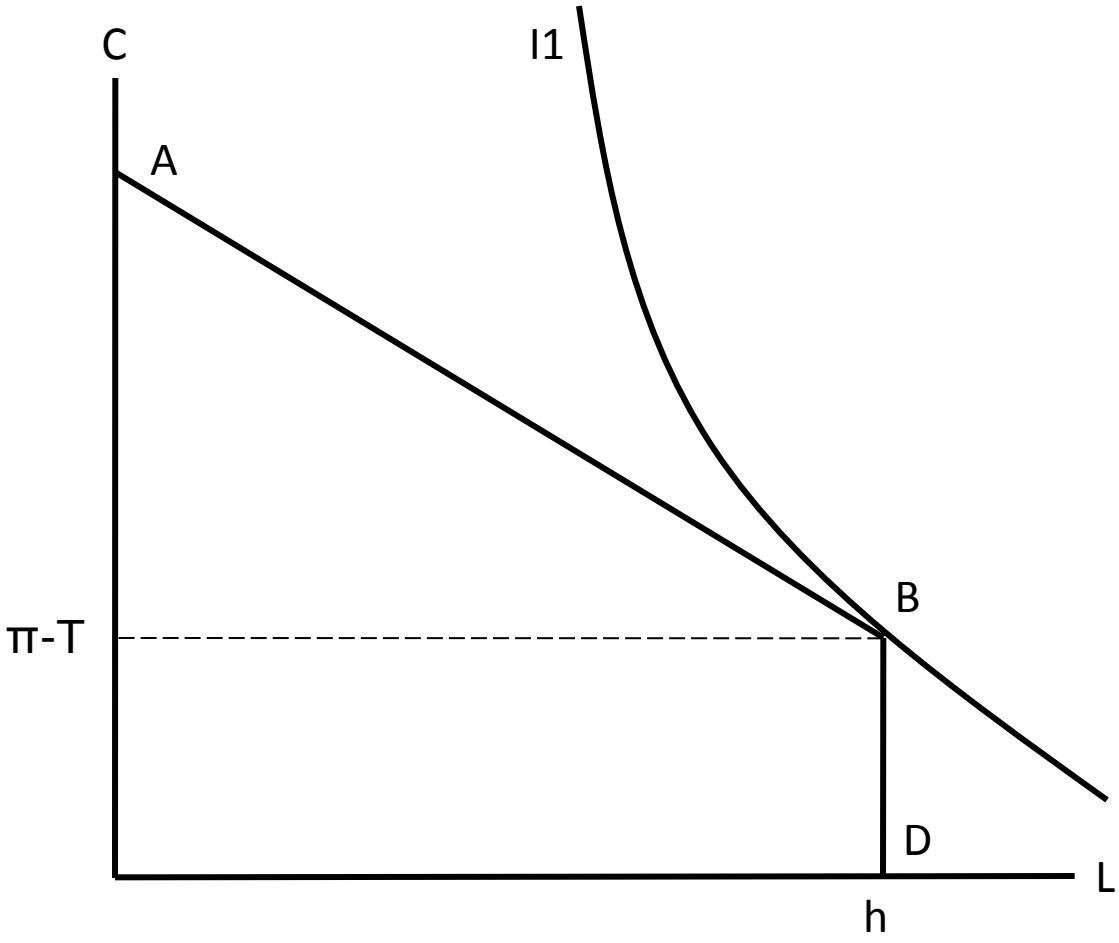
Optimization condition

- The rate of marginal substitution of leisure for consumption goods is equal to the real wage.
- **The real wage** is the relative price of leisure in terms of consumption goods.

$$MRS_{l,C} = w$$

Corner solution

- The consumer chooses not to work at B.



Corner solution: impossible

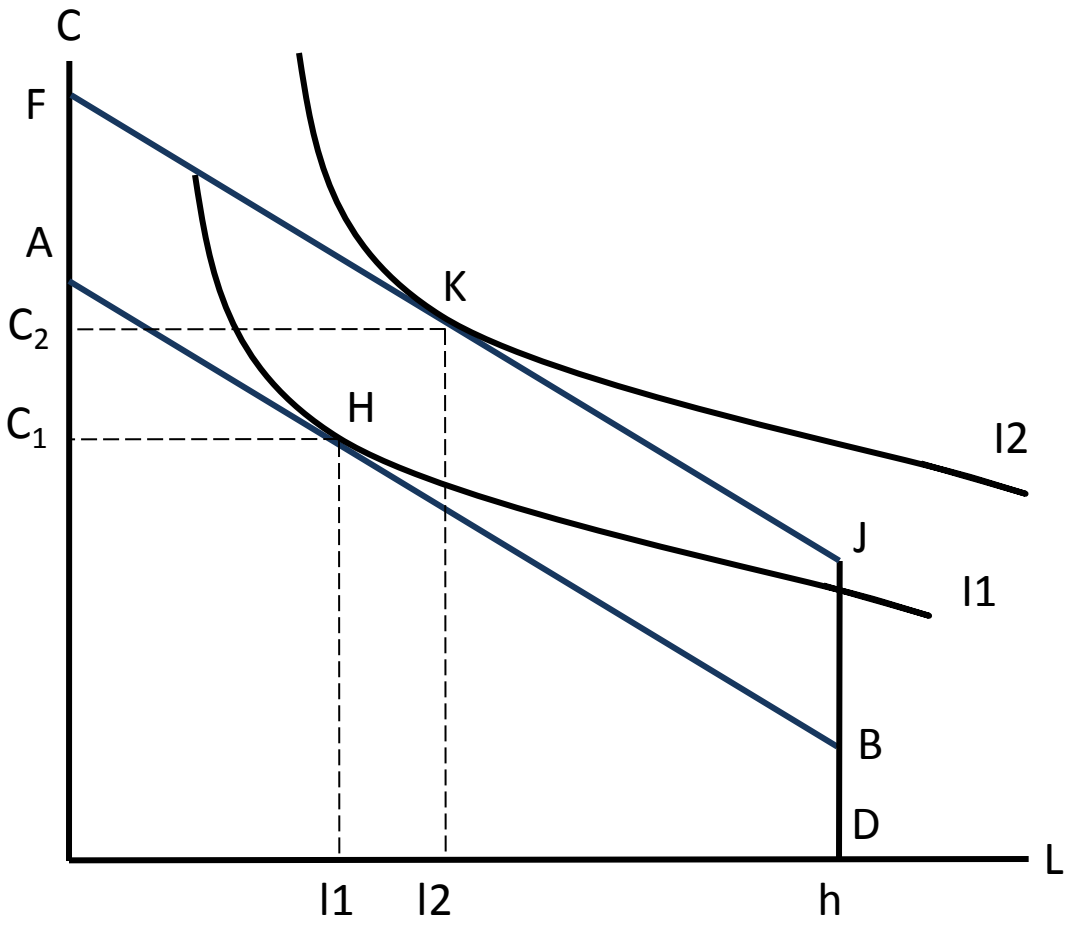
- The consumer may choose not to work and consume only leisure.
- Impossible solution:
  - No labor service to the firm, no incomes.
  - No production by the firm, no consumption goods.
  - The consumer's preference for diversity.
- Real life?
  - Consumers do not repeat their mistakes.

Changes in dividends or taxes

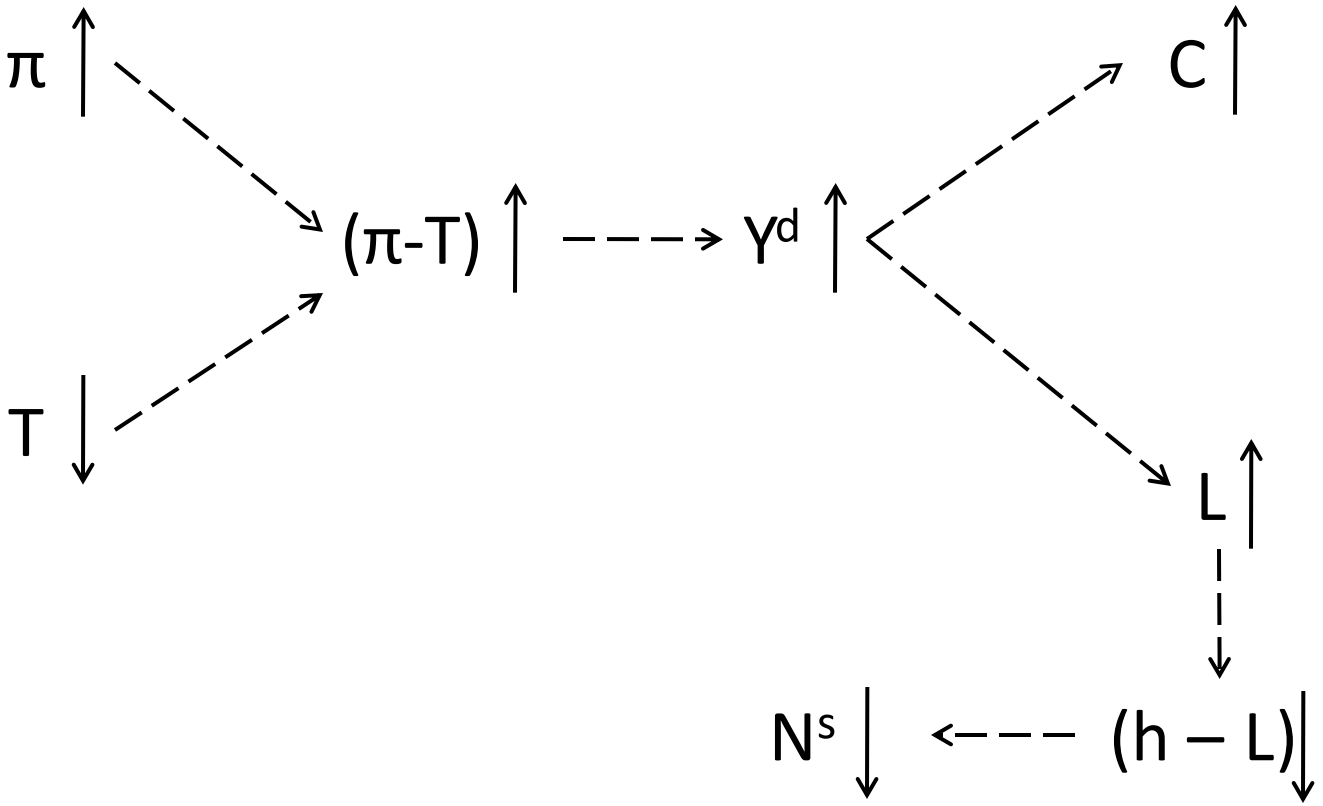
- Assuming consumption goods and leisure are both **normal goods**.
- An increase in dividends or a decrease in taxes (π-T) causes the consumer to increase both consumption goods and leisure (and to reduce the quantity of labor supply).
  - The pure income effect.

An increase in π-T

- An increase in π-T (by JB) causes the consumer to increase both C and L.



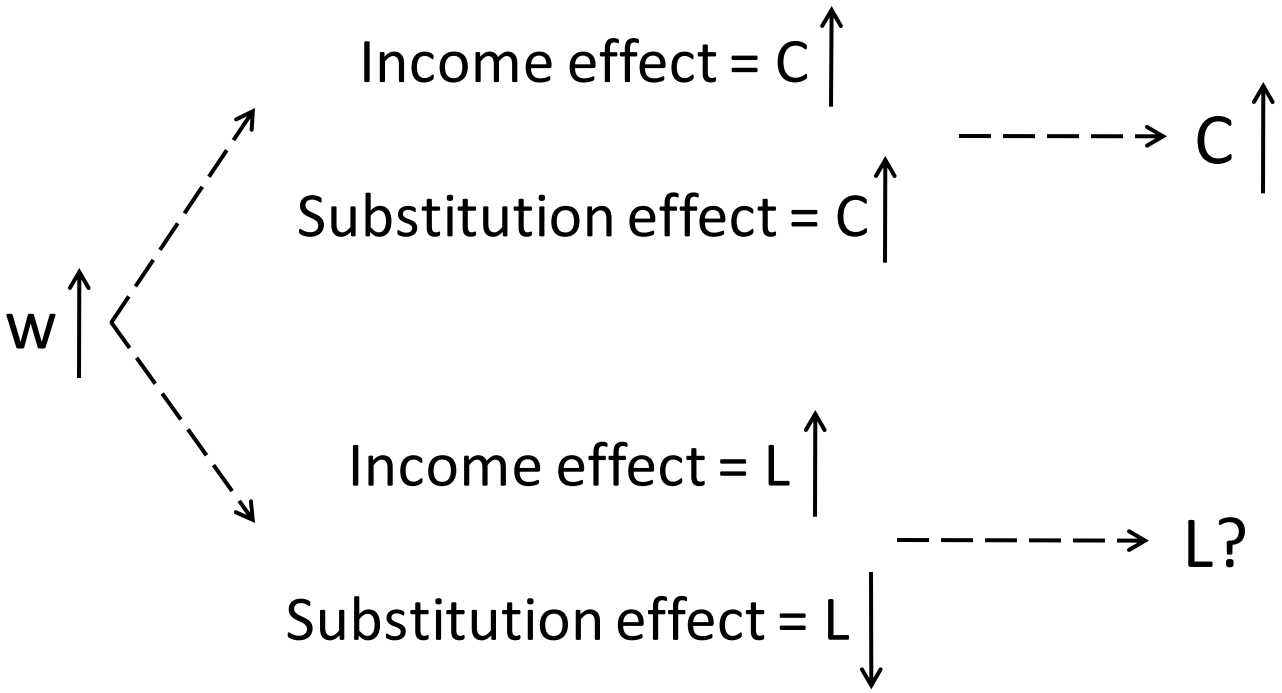
A higher π-T raises C and L



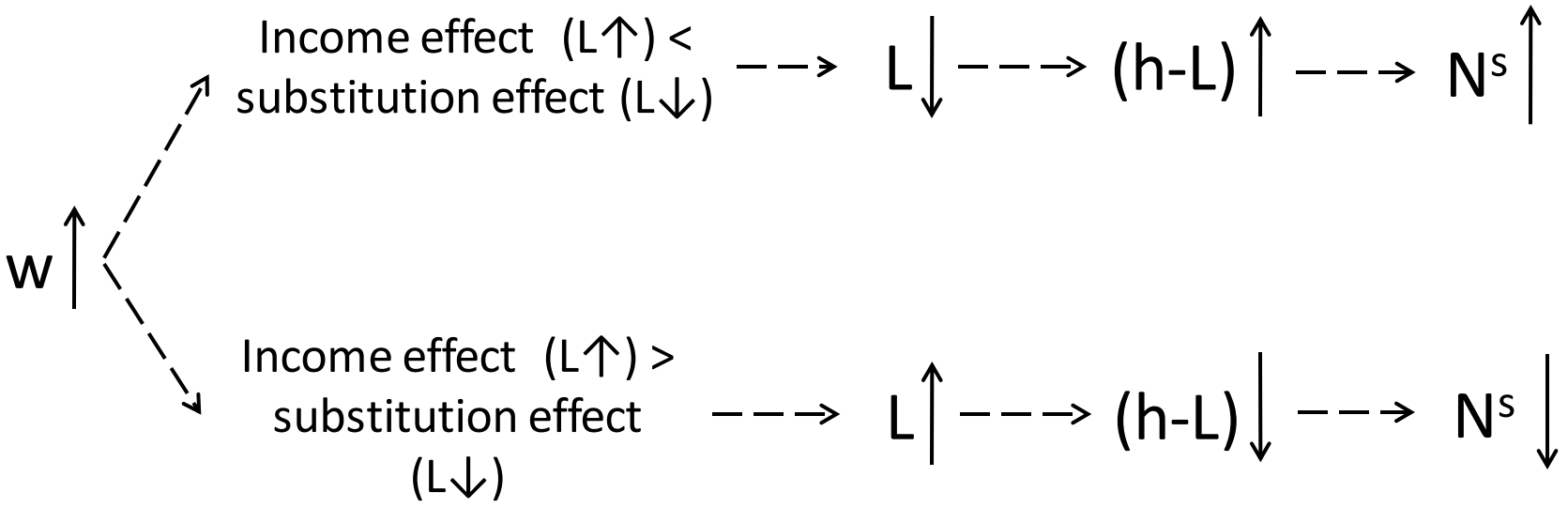
An increase in the market real wage

- **Substitution effect**: an increase in the real wage (the price of leisure) causes the consumer to substitute consumption goods for leisure.
- **Income effect**: the consumer's income increases, causing both consumption goods and leisure to increase.
- Consumption increases, but leisure may rise or fall.

A higher wage raises C

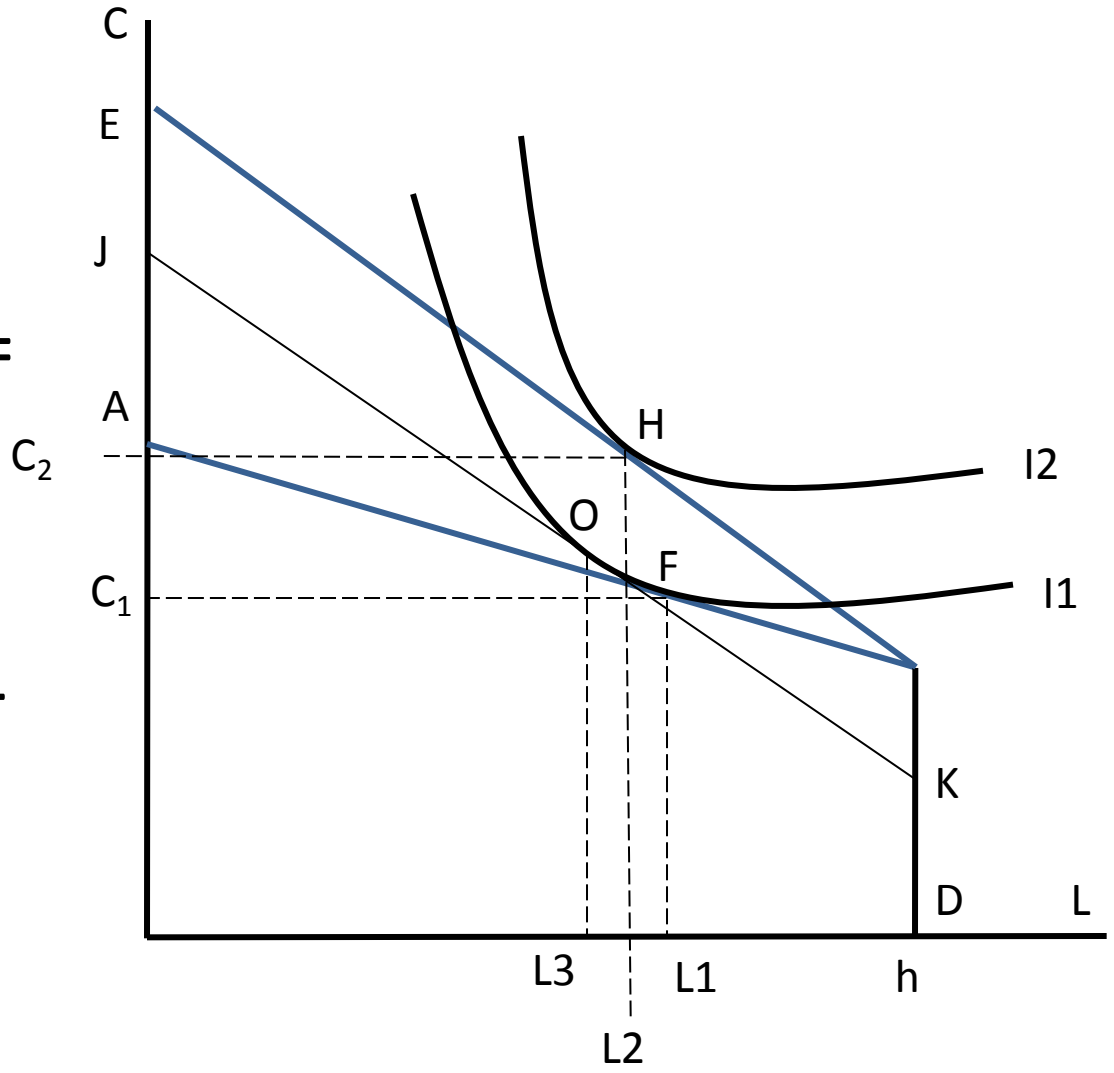


Effects of a higher w on L



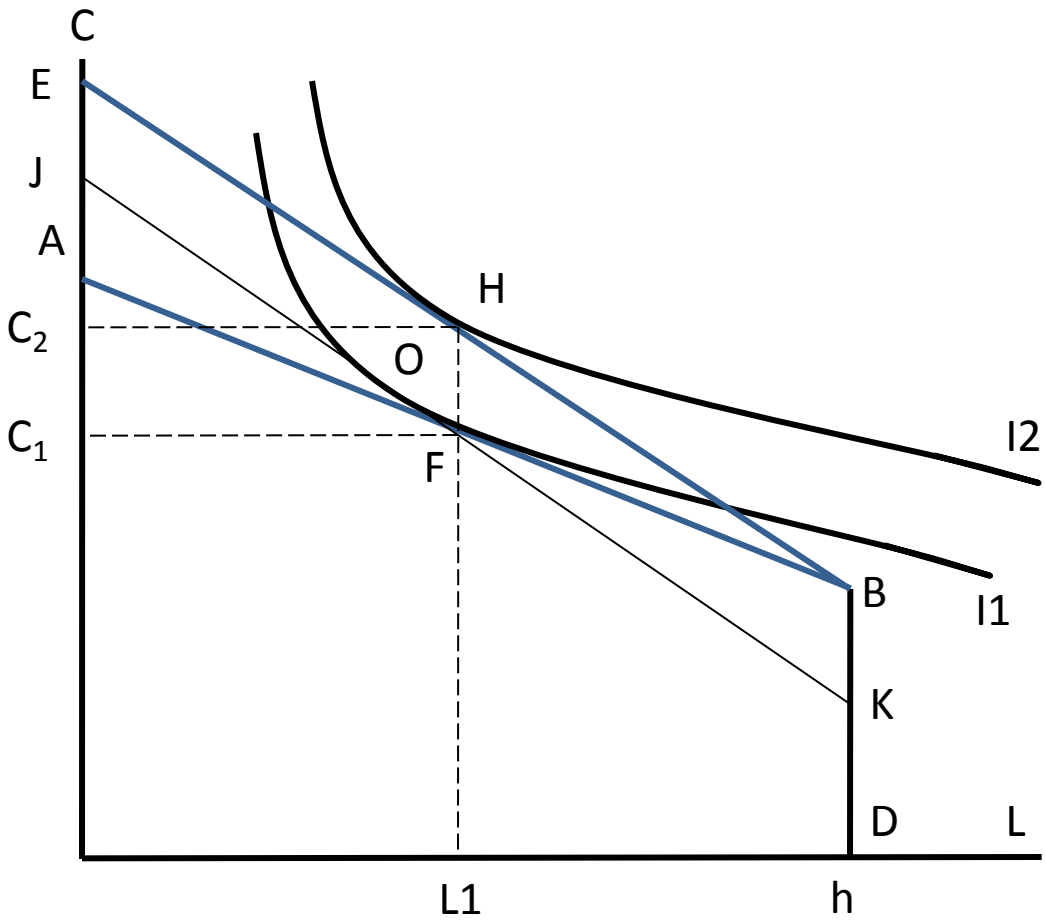
Stronger substitution effect

- Substitution effect = FO.
- Income effect = OH.
- FO > OH, C increases and L decreases
- So N increases.



Equal effects (Williamson)

- Substitution effect = FO.
- Income effect = OH.
- FO = OH, C increases; but L (and N) is the same.



The labor supply function

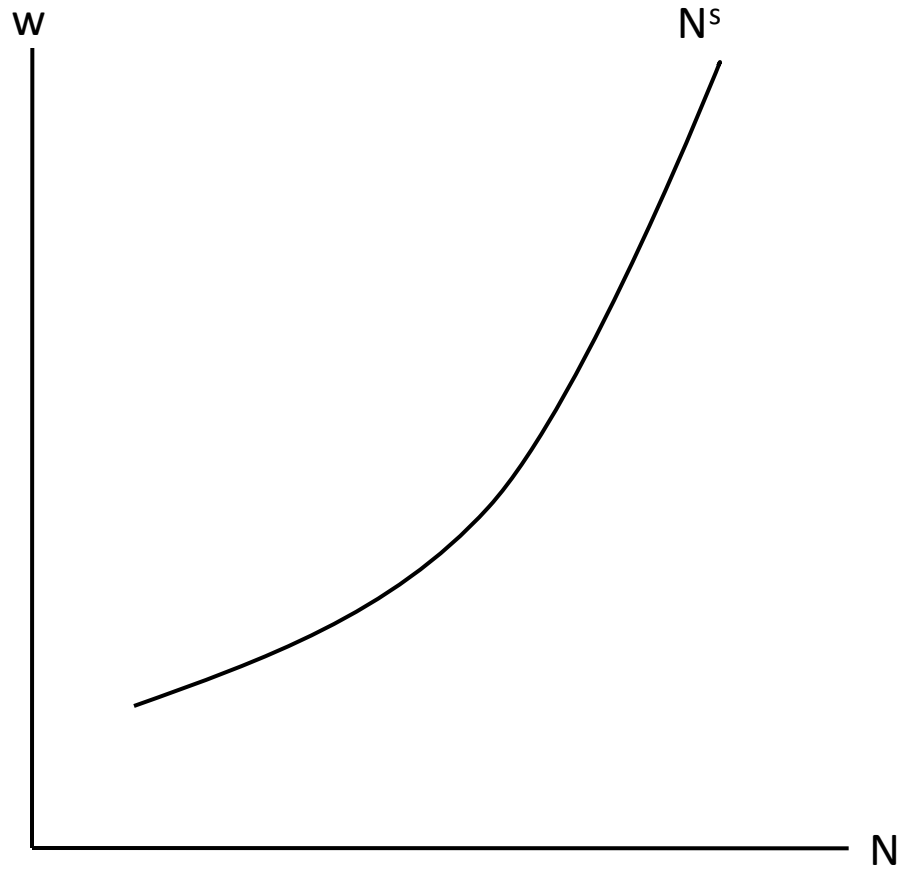
$$N^s(w) = h - l(w)$$

$$\frac{\partial N^s}{\partial w} \succ 0$$

- N^s = the labor supply function;
- h = the maximum hours available;
- L(w) = the leisure function, given the real wage.
  - Assuming the **stronger substitution effect**.

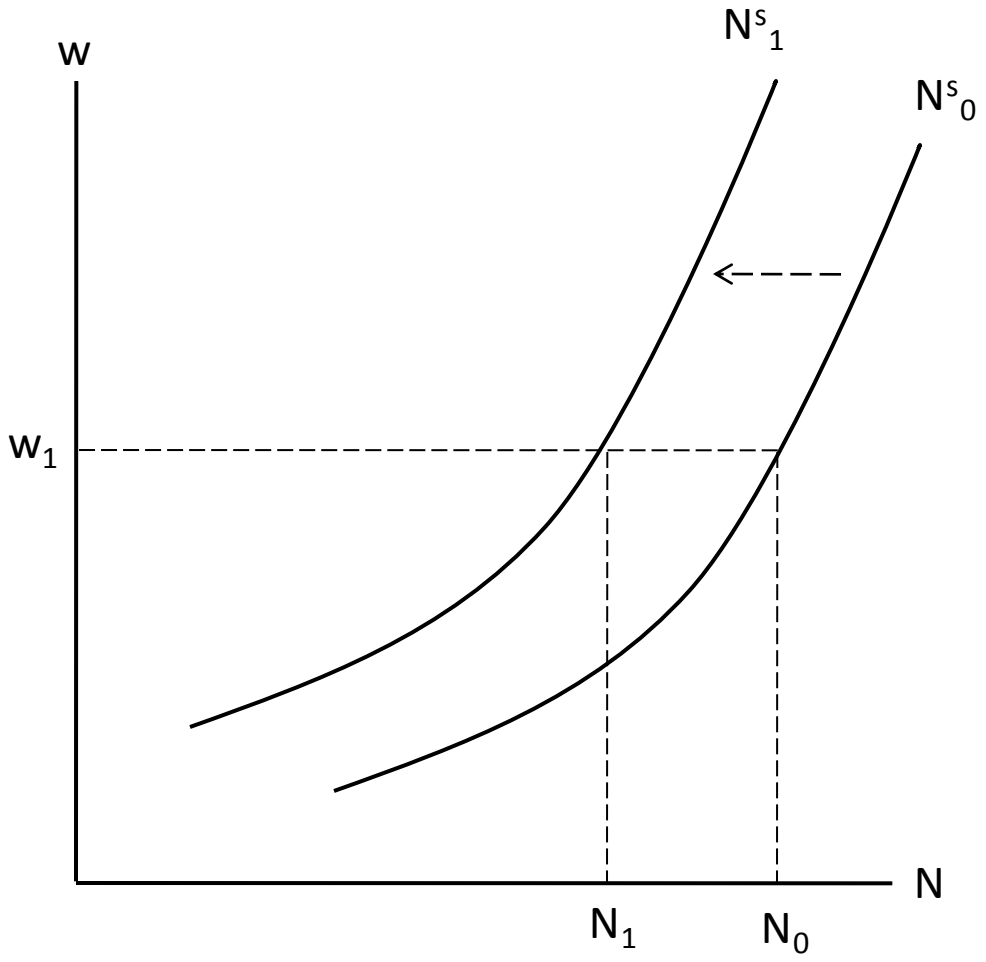
The labor supply curve

- The quantity of labor supply is a positive function of the real wage.
  - Assuming the **stronger substitution effect**.



Effect of an increase in π-T

- A rise in π-T causes the consumer to reduce labor supply, given the real wage (positive income effect).



Representative firm

- The firm demands labor and supplies consumption goods.
  - Source of wage and dividend incomes for the consumer.
  - The production function combines labor service to produce consumption goods.
- Profit maximization and labor demand function.

The firm's production function

$$Y = zF(K, N^d)$$

- where:
- Y = output of consumption goods;
- K = capital input;
- N^d= labor input (hours);
- z = total factor productivity.

Total factor productivity

- **z = the degree of sophistication of the production process**.
- A production function with the same K and N^d as another but with **a larger z** will produce more output.
  - Production organization;
  - Managerial input;
  - Social and physical infrastructures.

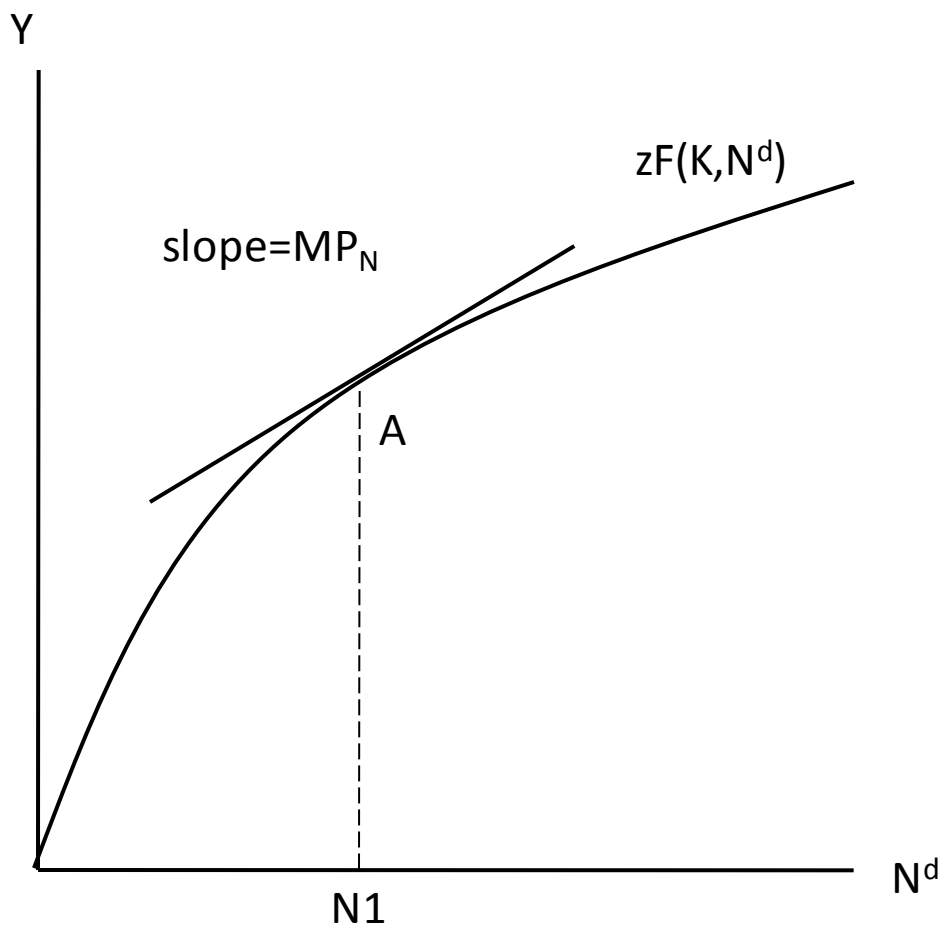
Properties of the production function

- Constant returns to scale:
  - $zF(xK, xN^d) = xY = xzF(K, N^d)$
  - Increase each input by x times will raise the total output by x times.
- Output increases if either labor or capital increases.
  - $MP_N = \partial Y/\partial N^d > 0$; $MP_K = \partial Y/\partial K > 0$.
  - Upward slope of the production function.

- **The marginal product of labor (MP_N)** decreases as the labor input increases, given the capital input.
  - The production function is concave; the slope is decreasing as output increases.
- **The marginal product of capital (MP_K)** decreases as the capital input increases, given the labor input.
- **The marginal product of labor** increases as the quantity of **the capital input** increases.

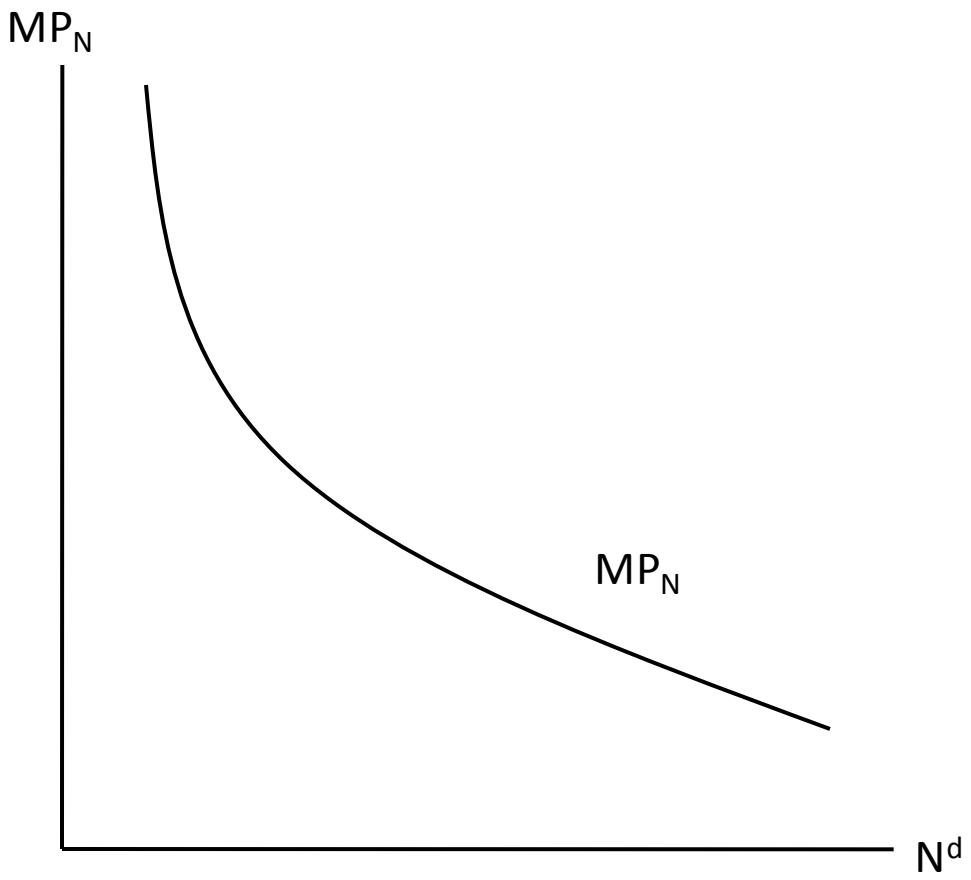
Production function, fixed capital

- The slope at A is MP_N when N = N1.
- MP_N is falling as the labor input increases, given the capital input.



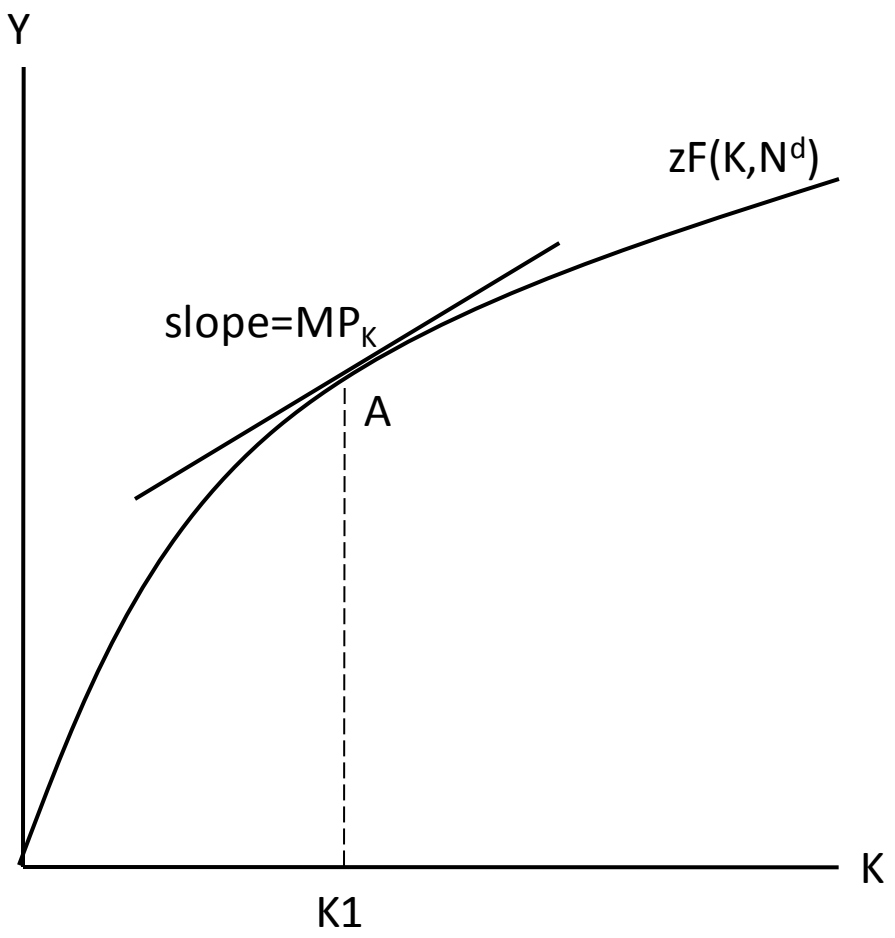
Marginal product of labor

- The marginal product of labor decreases as the labor input increases.
- Downward slope MP_N.



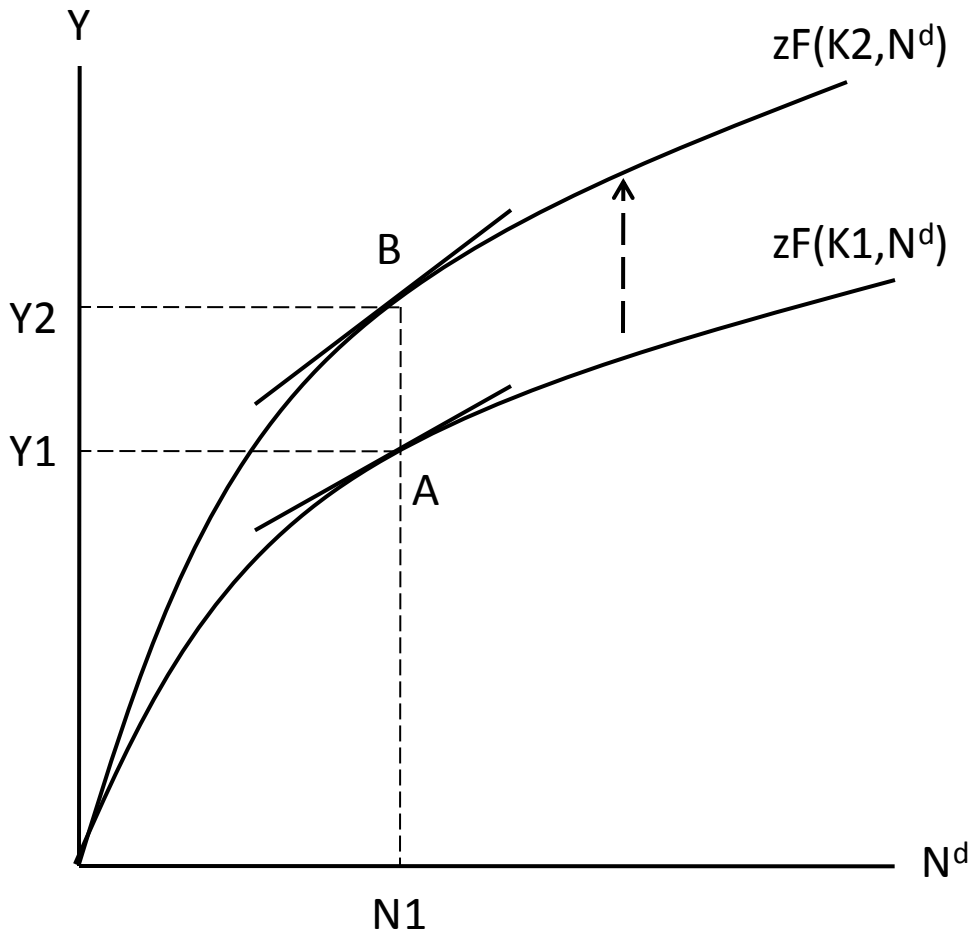
Production function, fixed labor

- The slope at A is MP_K when K = K1.
- MP_K is falling as the capital input increases, given the labor input.



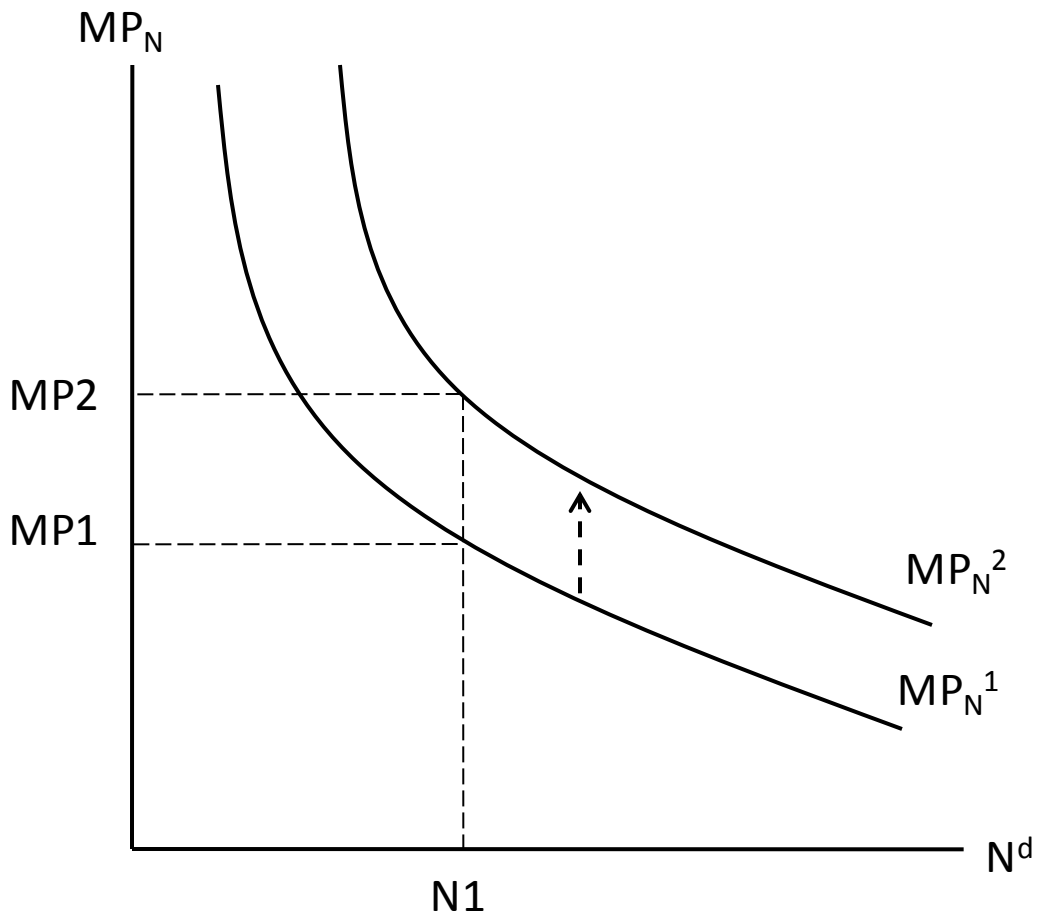
Increases in the capital input (K)

- An increase in K causes MP_N and output (Y) to rise at N1.



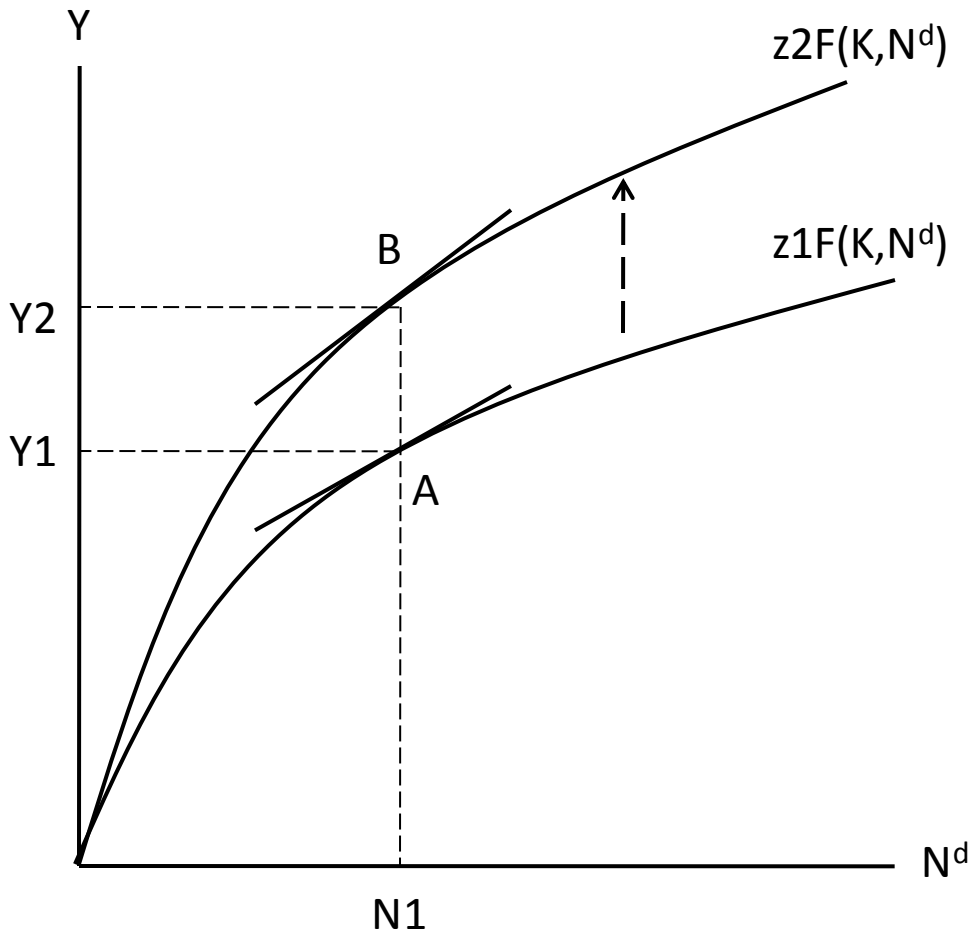
MP_N increases as K increases.

- The marginal product of labor increases as the capital input increases.



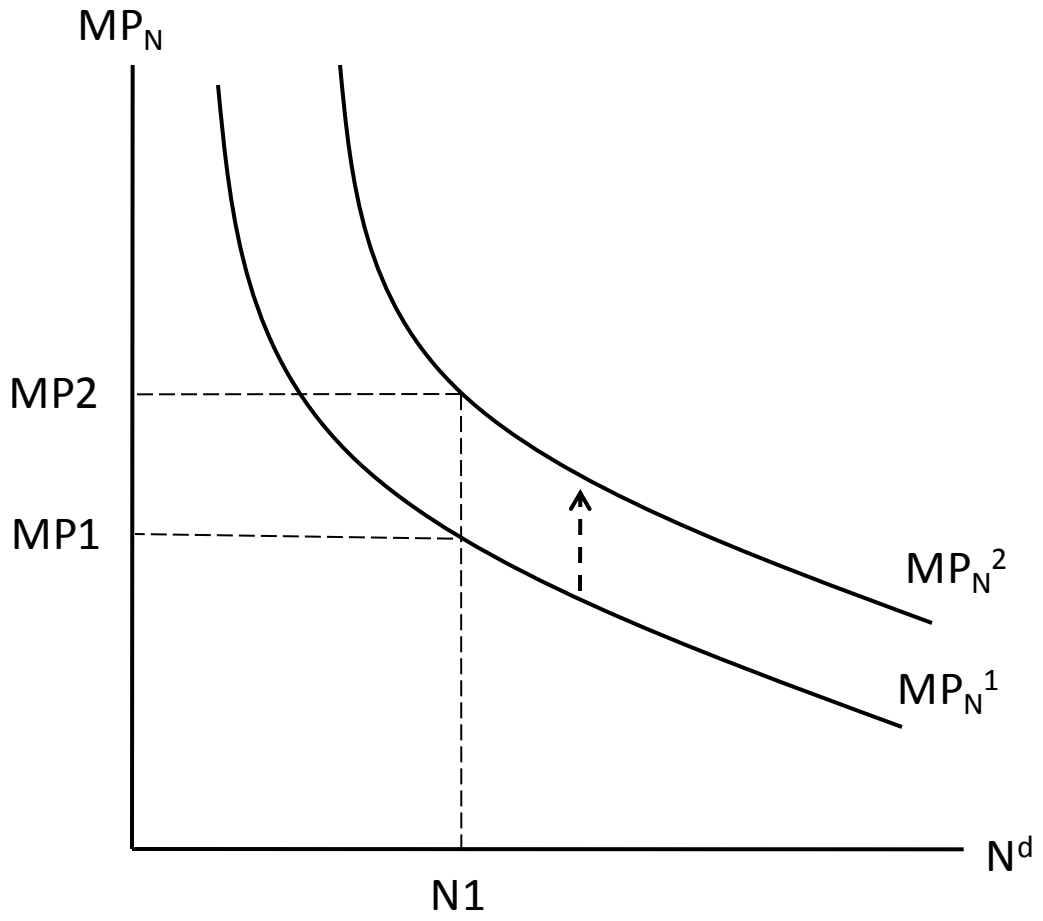
Increases in total factor productivity (z)

- An increase in z causes MP_N and output (Y) to rise at N1.



Effect of rising z on MP_N

- An increase in z causes MP_N at N1 to rise.

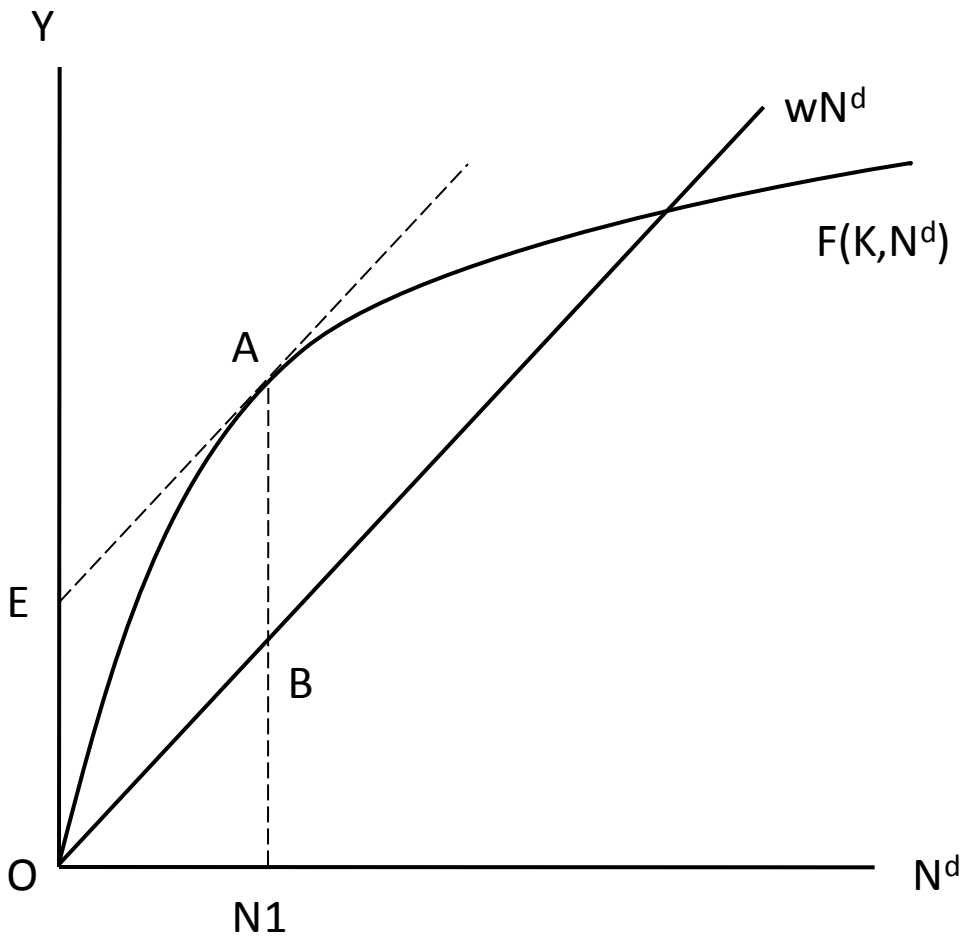


The firm's profit maximization

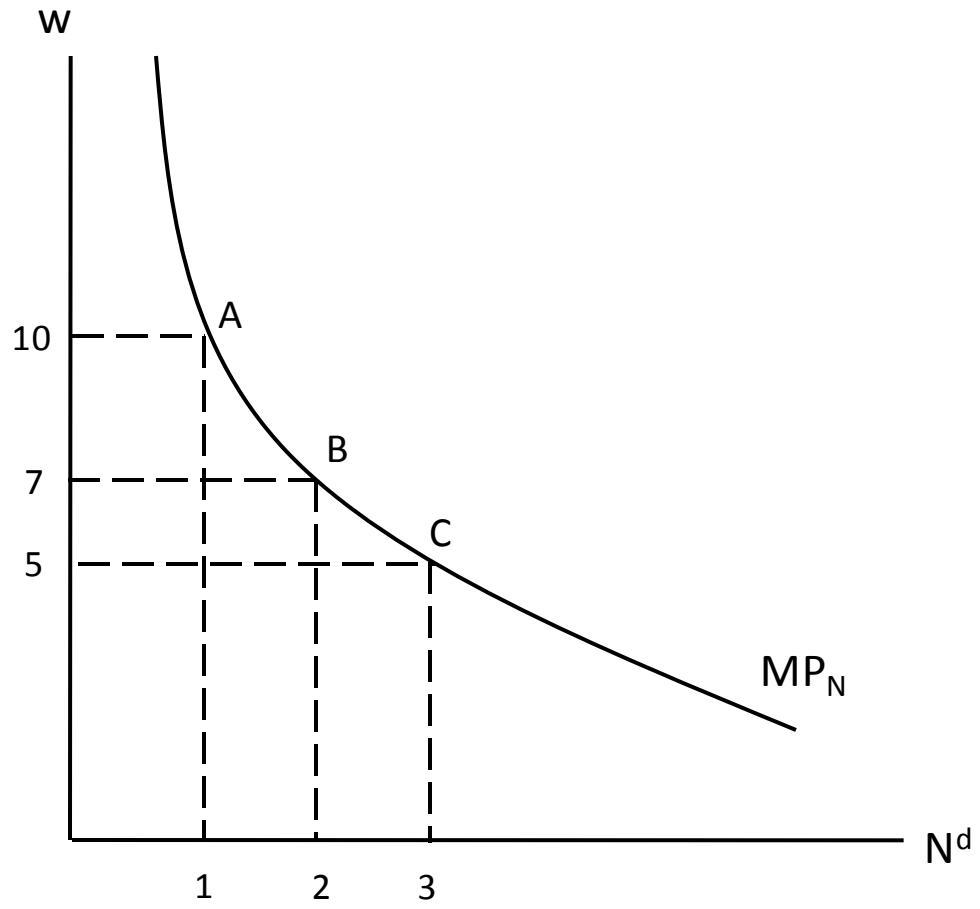
- Y = total revenue = $zF(K, N^d)$;
- wN^d = total variable cost;
- $\pi = zF(K, N^d) - wN^d$
- **Maximized profit** where
  - Slope of Y = slope of wN^d;
  - MR = MC
  - MP_N = w or the firm's labor demand function.
- The MP_N is the firm's labor demand curve.

Profit maximization

- Y = revenue; MP_N = marginal revenue;
- wN^d = variable cost; w = marginal cost;
- Profit = Y – wN^d;
- Max profit = AB where MP_N = w.



- If $MP_N > w$, hire more workers.
- If $MP_N < w$, hire less workers.
- Profit-max at $MP_N = w$
- If w = 5, the firm hires 3 units of labor.



The firm's labor demand curve

- Profit-max: the firm hires labor up to the point where $MP_N = w$.
- As w changes, the firm moves along MP_N curve.