ECON3102-005
Chapter 5: A Closed-Economy One-Period Macroeconomic Model (Part 1)

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Competitive Equilibrium

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3. All markets clear (supply=demand for each market).
4. The government satisfies its budget constraint:

$$G = T$$

Exogenous and Endogenous Variables

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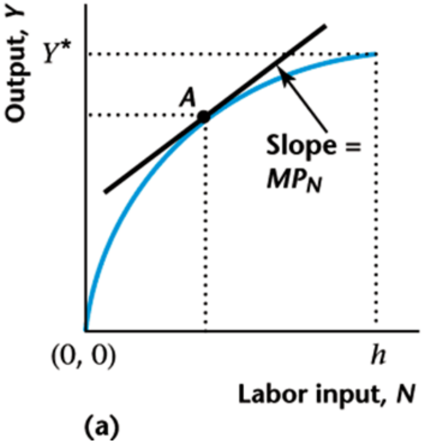
- In this closed-economy one-period model, the exogenous variables are G, z, K, and the endogenous variables are c, N^d, N^s, T, Y, w.
- Making use of the model is running experiments to see how changes in the exogenous variables change the endogenous variables.

Production Function



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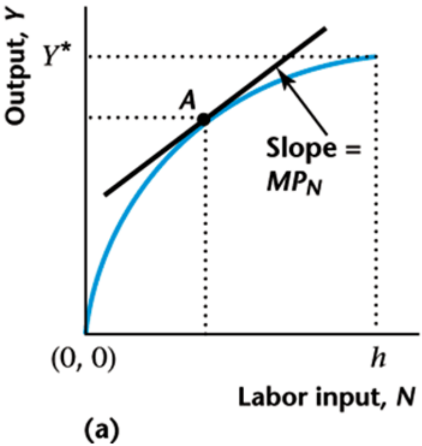

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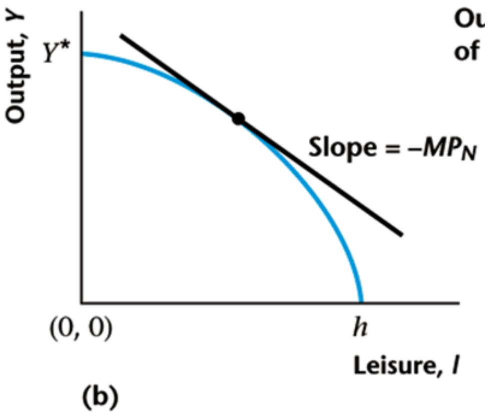
- Note that the maximum output that can be produced is Y^*, where

$$Y^* = zF(K, h)$$

Output as a Function of Leisure



- Recall that $N = h - l$. Then it makes sense to put $Y = zF(K, h - l)$, so we can express output as a function of leisure.

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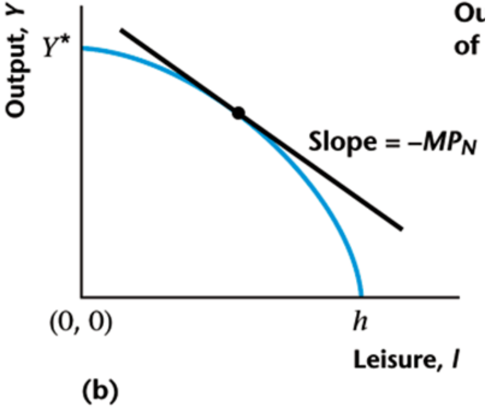

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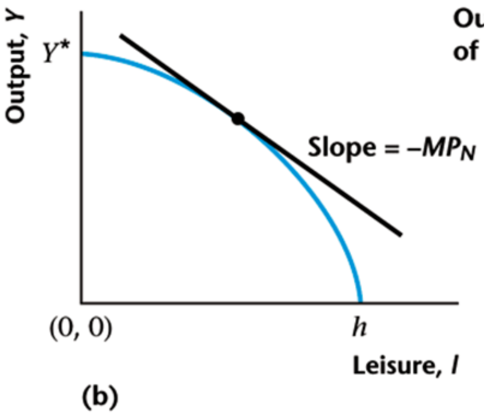

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- If $l = 0$, then $N = h$ and Y^* is produced.
- If $l = h$, then the consumer takes all his time as leisure, and nothing is produced.

Production Possibilities Frontier (PPF)

We now want to express the previous graph not as an output-leisure relationship, but rather as a consumption-leisure relationship (the two goods which the consumer cares about).

- Since in equilibrium $Y = C + G$ (because of the income-expenditure identity (aka the market clearing condition for consumption goods), then

$$C = Y - G$$

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- This means that we can take the previous graph, shift it down by some amount G, and then get the production possibilities frontier (PPF).

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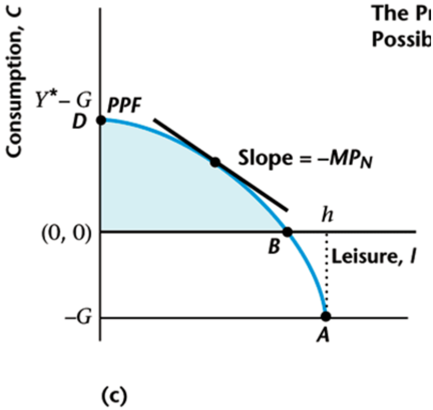

- The PPF describes the technological possibilities in terms of consumption goods and leisure.

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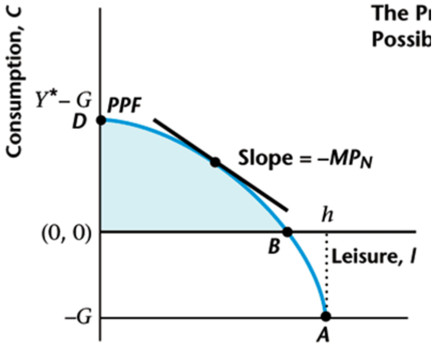

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- Points inside the PPF (blue area) are feasible but not efficient.

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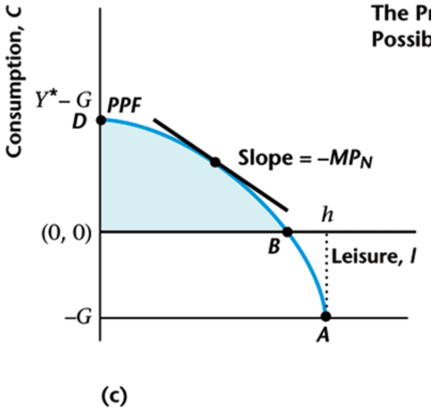

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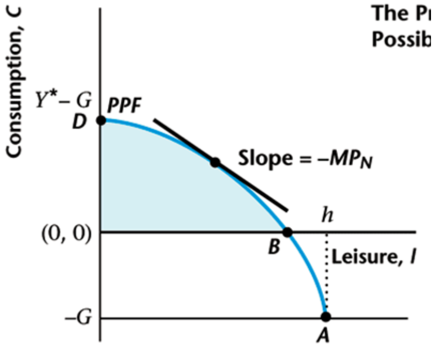

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- Points on segment BD are feasible.

Marginal Rate of Transformation

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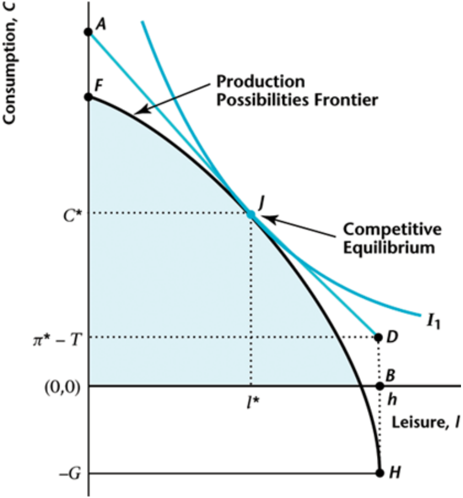
- Call this rate the $MRT_{l,c}$. In particular, note that

$$MRT_{l,c} = MP_N = \text{-(slope of PPF)}$$

Competitive Equilibrium on Graph



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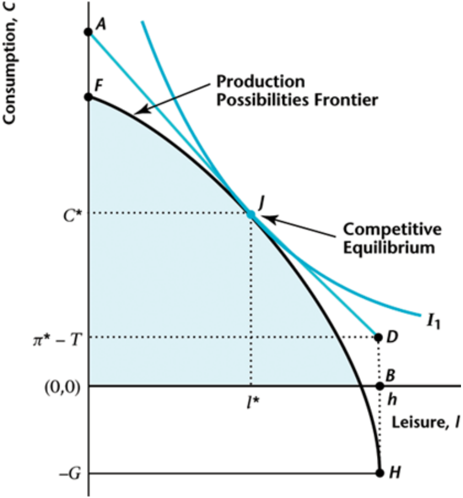

- The PPF is curve FH.
- Given w, the firm chooses N to maximize π by setting $MP_N = w$. Hence,

$$N^* = h - l^*,$$

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

$$\pi^* = zF(K, N^*) - wN^*,$$

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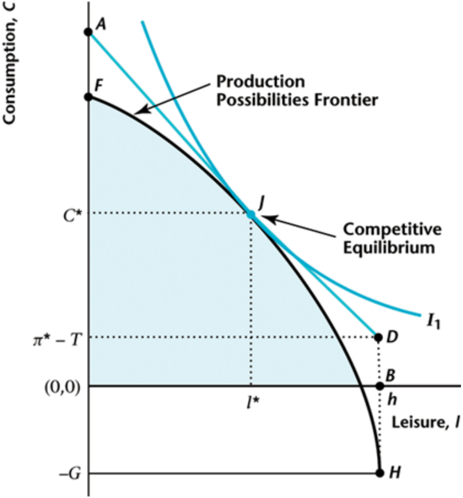

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- In equilibrium, minus the slope of the PPF equals w; line AD is tangent to the PPF at J; here $MP_N = w$.

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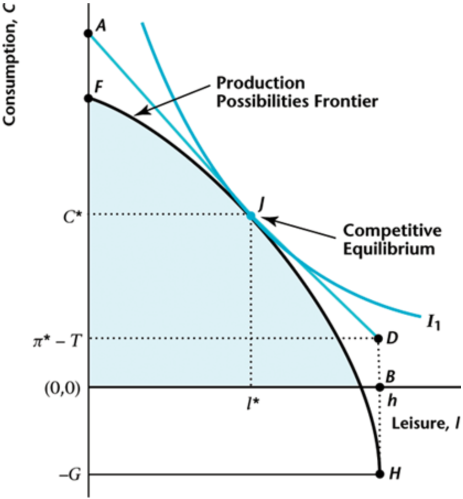

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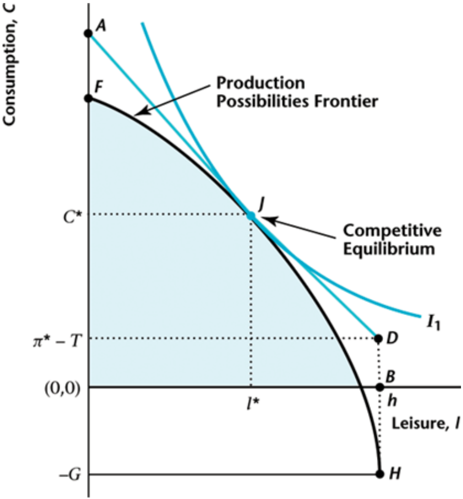

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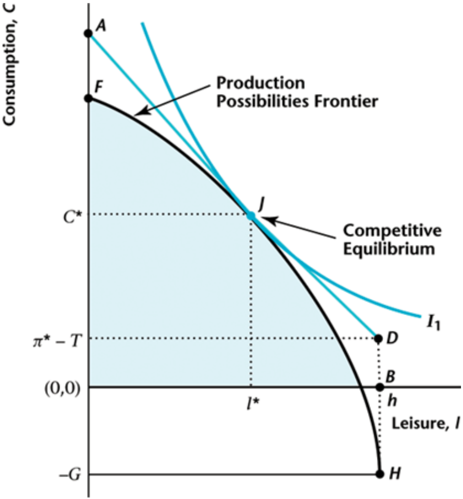

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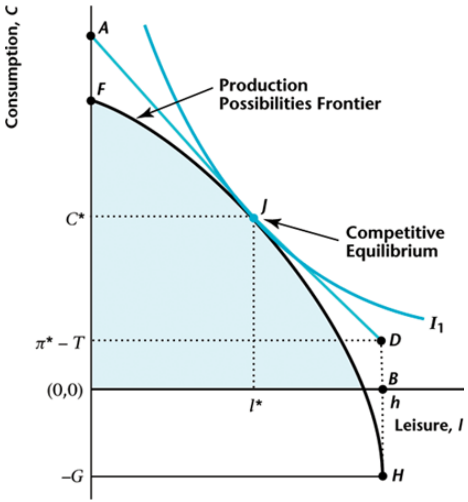

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- Distance DB is $\pi - G$, which equals $\pi - T$ by equilibrium properties.
- Then ADB is the consumers budget constraint.
- Point J is the competitive equilibrium. By consistency, c^* is the desired consumption and hl^* is the desired labor supply.

A Necessary Condition for Competitive Equilibrium

$$MRS_{l,c} = MRT_{l,c} = MP_N$$

Pareto Optimal and Social Planner's Problem

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- To answer this, the (almost) universal benchmark is that of **Pareto optimality**:

  Definition A competitive equilibrium is Pareto optimal if there is no way to rearrange production or reallocate goods so that someone is better off without making someone else worse off.

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    2. Order the consumer to work $N^s = N$ hours.
    3. Take an amount G of output and give the remainder to the consumer.

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Hence the planners problem is to choose c and l that, given technological constraints, maximize the utility of the consumer.

- Formally, he solves:

$$\max_{c,l} U(c,l)$$

$$\text{subject to} \quad c = zF(K, h-l) - G$$

$$c \geq 0$$

$$0 \leq l \leq h$$

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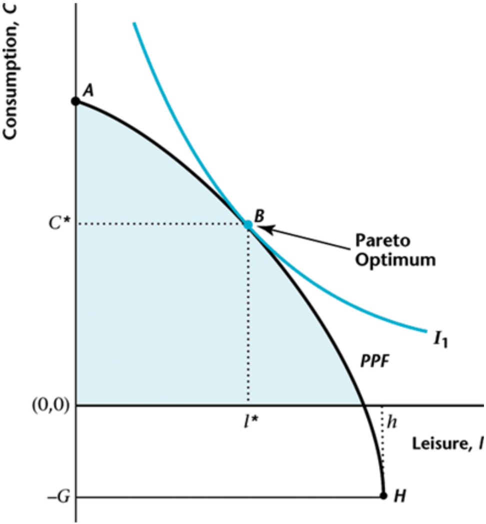

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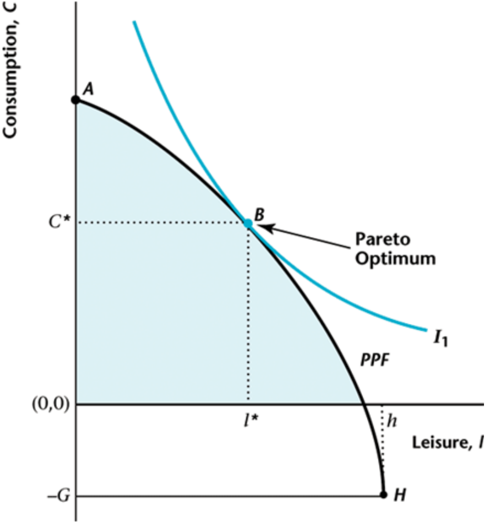

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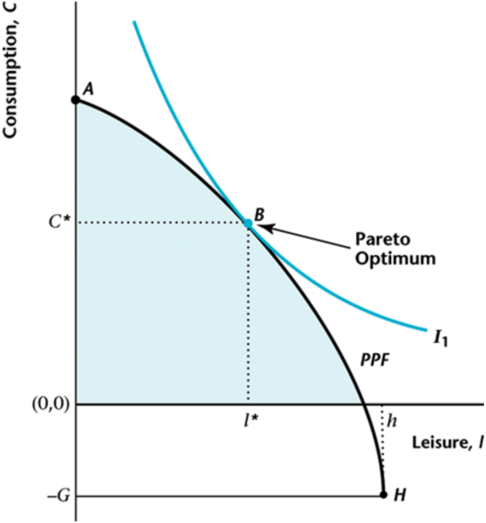

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- This is similar to our previous problem, but we don't get to worry about the budget constraint.

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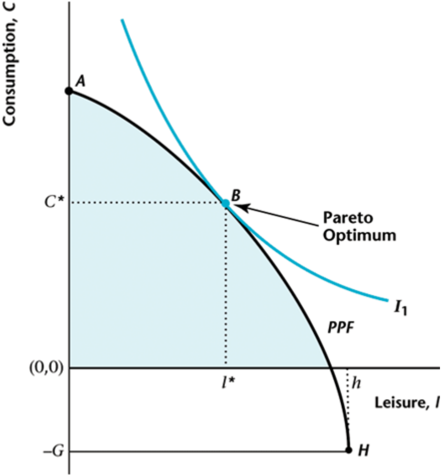

From the figure note that

- The slope of the indifference curve is $MRS_{l,c}$

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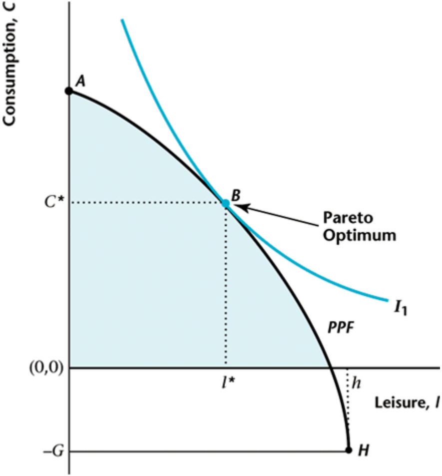

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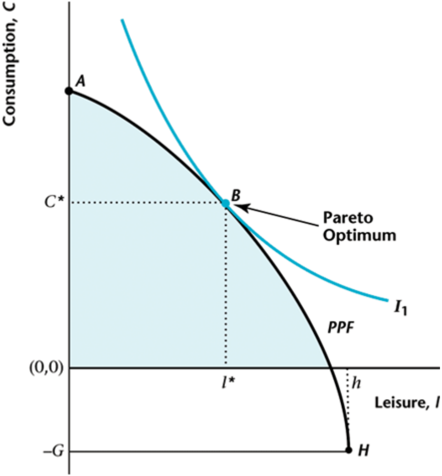

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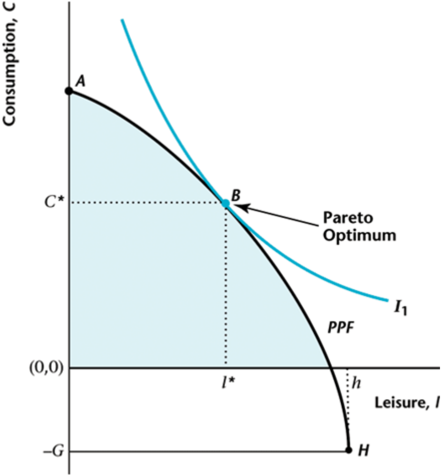

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- **Pareto optimality satisfies** $MRS_{l,c} = MRT_{l,c} = MP_N$**.**

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    - **Theorem (The Second Fundamental Theorem of Welfare Economics)** Under certain conditions, a Pareto optimal allocation can be established as a competitive equilibrium.
- *Free market economies tend to produce socially efficient economic outcomes.*

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  3. Distorting taxes

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- Positive externalities cause underproduction of the good.
- Hence, the socially efficient outcome is not reached. A competitive equilibrium is not Pareto optimal.

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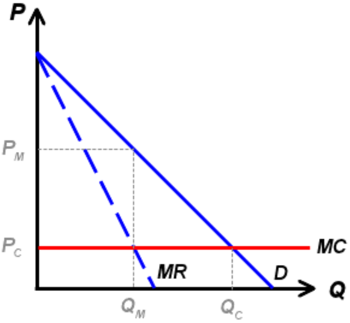
- As you remember from 1101, monopoly power leads to underproduction relative to the social optimum:



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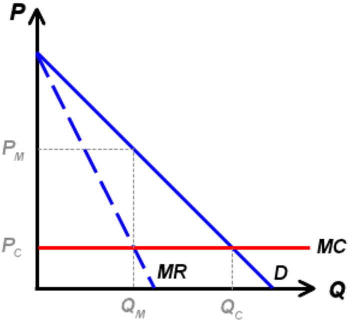

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- And the equivalence condition breaks down.

Solving the CE

- To avoid dealing with prices we will use the equivalence between competitive equilibrium and Pareto optimal allocations. Thus, the solution to the planners problem is our competitive equilibrium.