

A woman's silhouette is shown from the back, looking at a display of various sunglasses on shelves. The sunglasses are arranged in rows on a white background. The woman's hair is dark and shoulder-length. The sunglasses come in various colors and styles, including yellow, orange, green, and blue lenses.

INTERMEDIATE

MICROECONOMICS

NINTH EDITION

HAL R. VARIAN

Chapter 33

Production

Exchange Economies (revisited)

- ◆ **No production, only endowments, so no description of how resources are converted to consumables.**
- ◆ **General equilibrium: all markets clear simultaneously.**
- ◆ **1st and 2nd Fundamental Theorems of Welfare Economics.**

Now Add Production ...

- ◆ **Add input markets, output markets, describe firms' technologies, the distributions of firms' outputs and profits ...**

Now Add Production ...

- ◆ **Add input markets, output markets, describe firms' technologies, the distributions of firms' outputs and profits ... *That's not easy!***

Robinson Crusoe's Economy

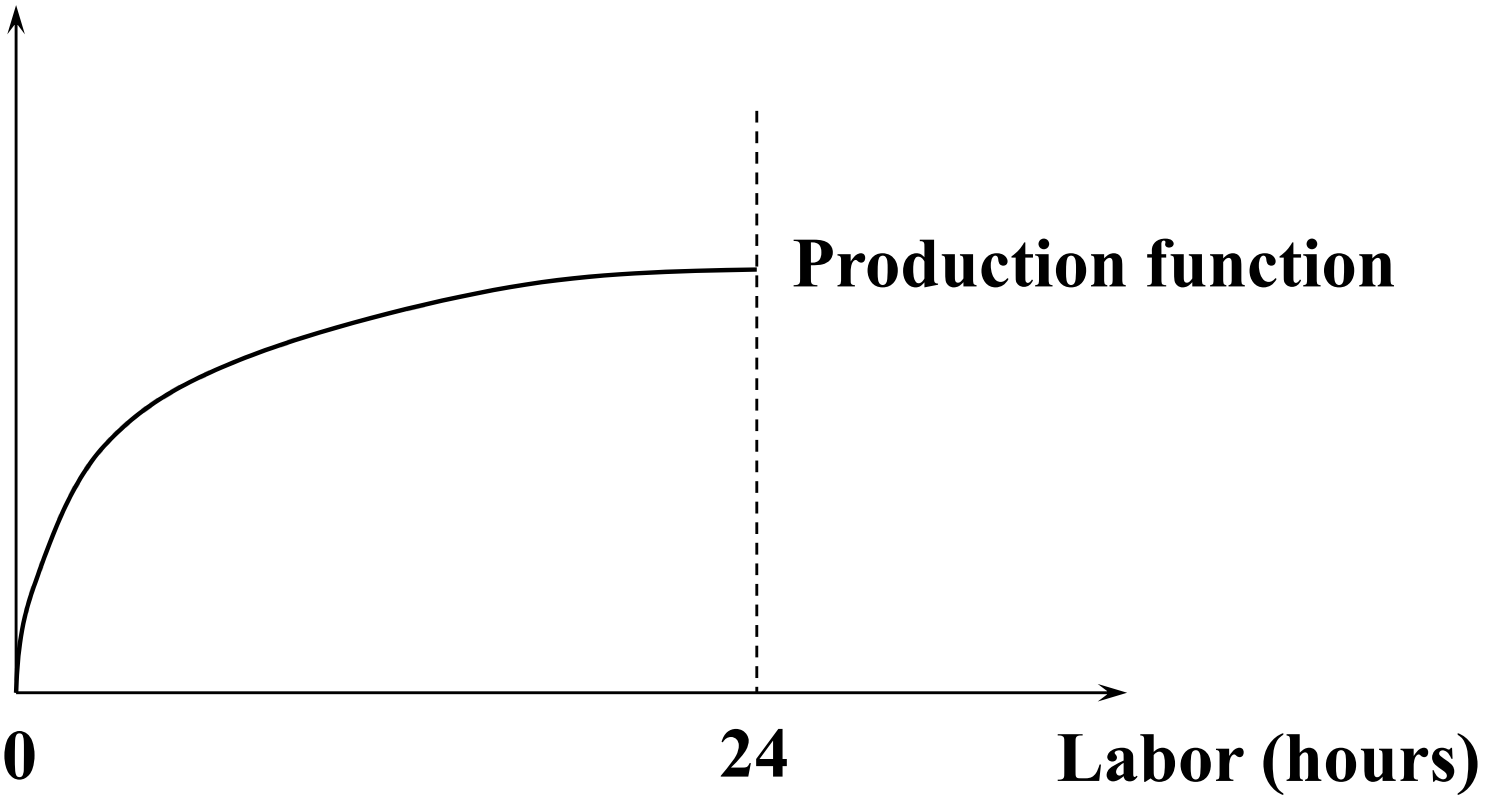
- ◆ **One agent, RC.**
- ◆ **Endowed with a fixed quantity of one resource -- 24 hours.**
- ◆ **Use time for labor (production) or leisure (consumption).**
- ◆ **Labor time = L . Leisure time = $24 - L$.**
- ◆ **What will RC choose?**

Robinson Crusoe's Technology

- ◆ **Technology: Labor produces output (coconuts) according to a concave production function.**

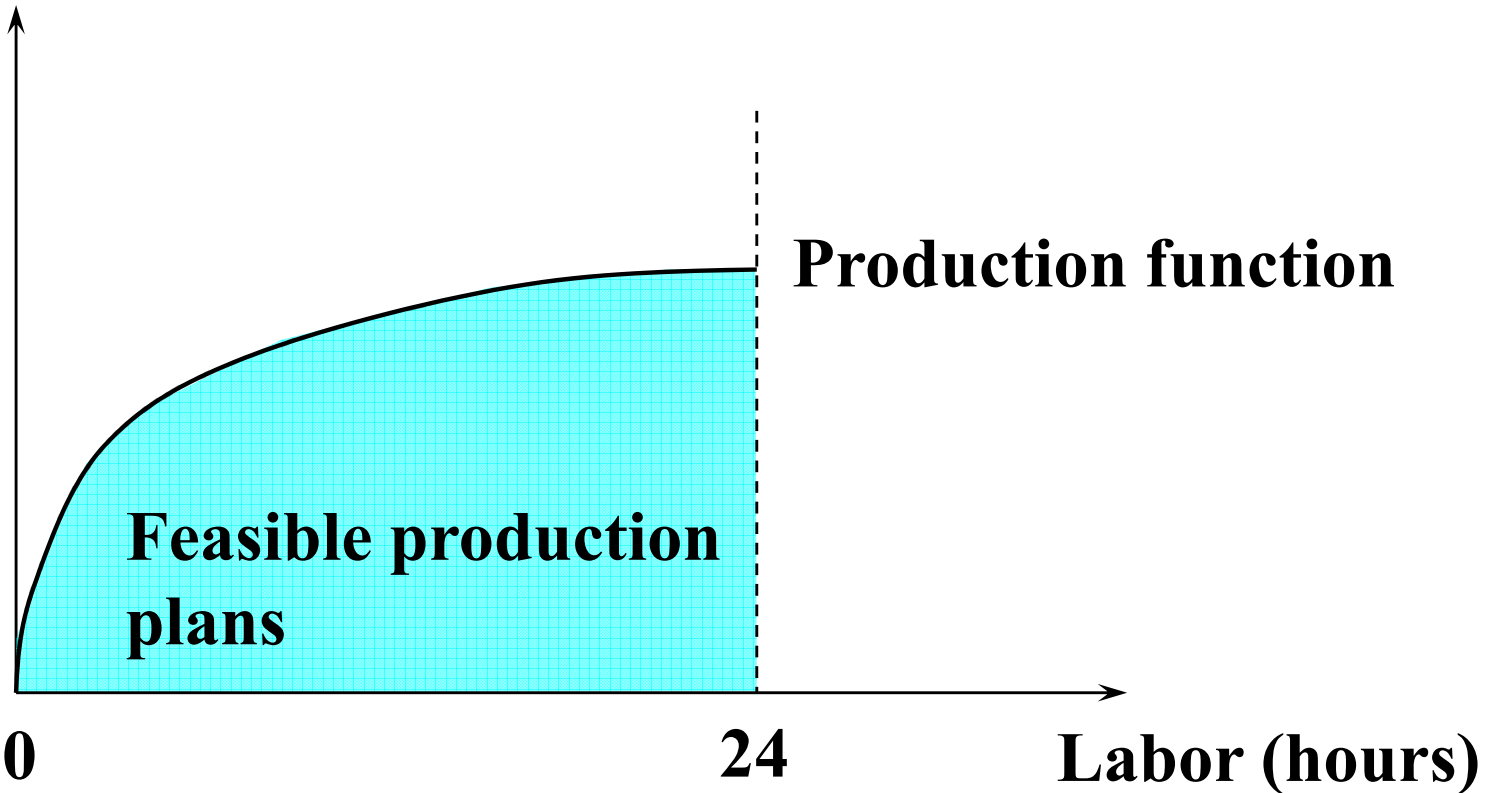
Robinson Crusoe's Technology

Coconuts



Robinson Crusoe's Technology

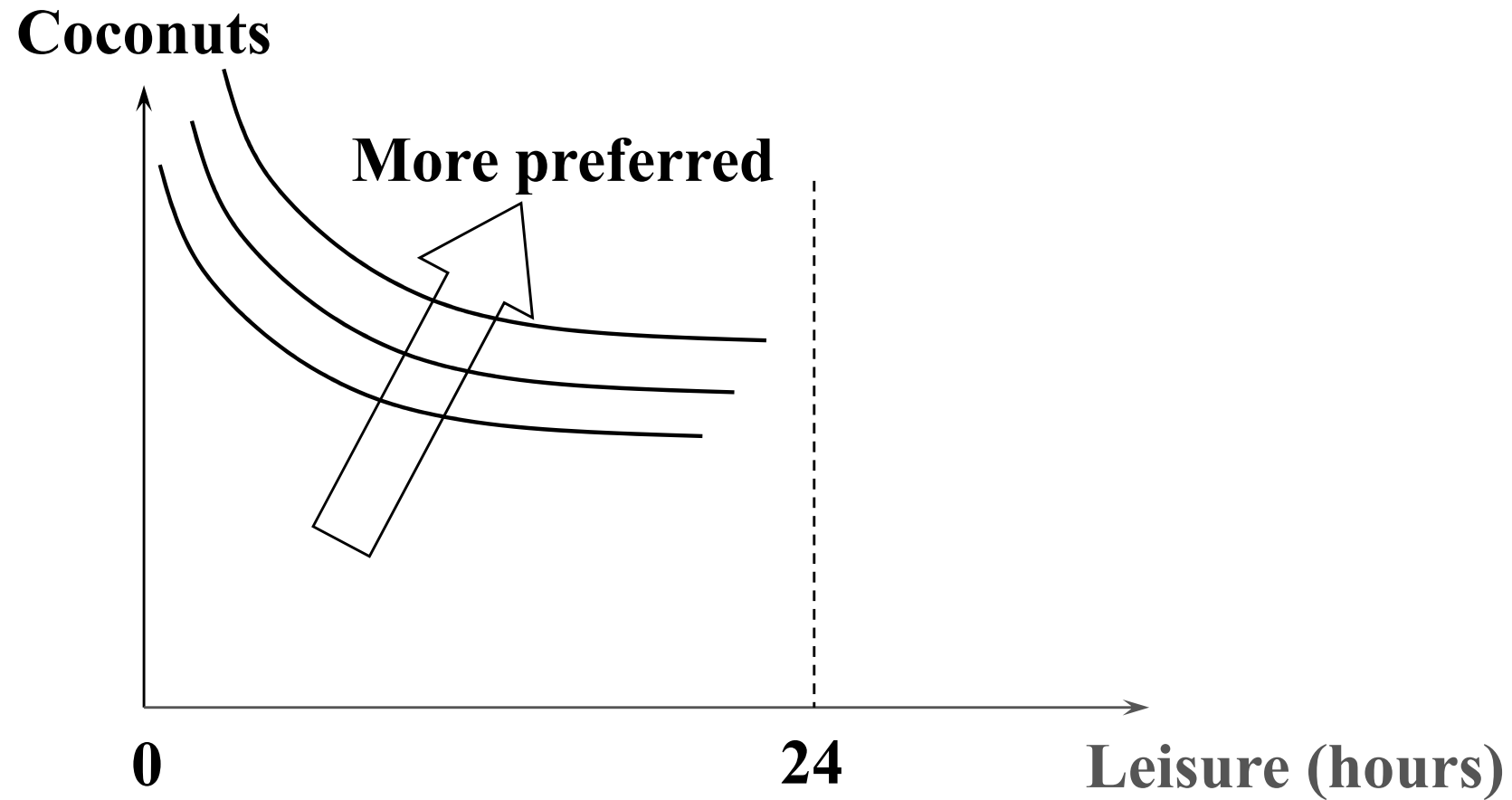
Coconuts



Robinson Crusoe's Preferences

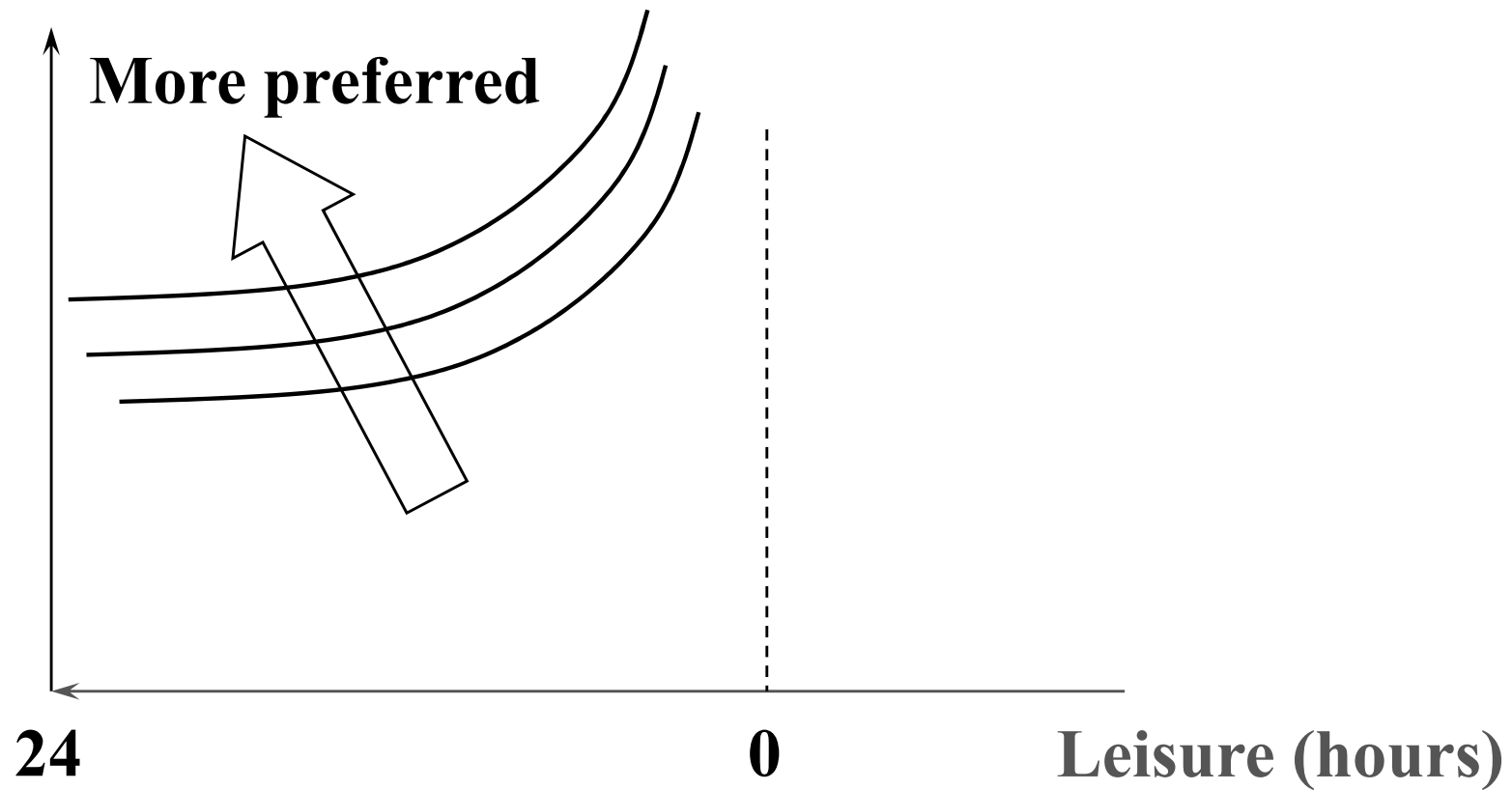
- ◆ **RC's preferences:**
 - **coconut is a good**
 - **leisure is a good**

Robinson Crusoe's Preferences



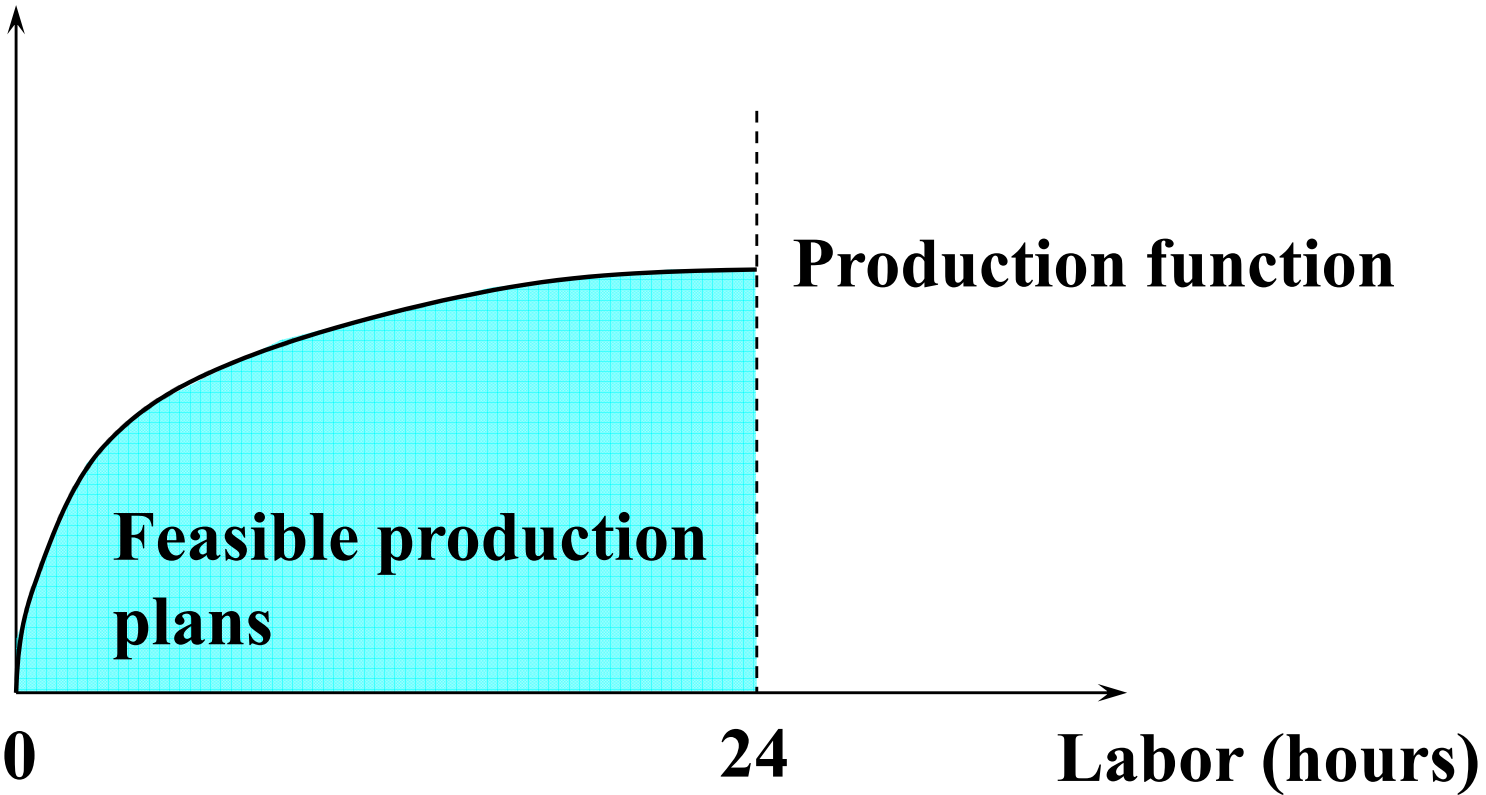
Robinson Crusoe's Preferences

Coconuts



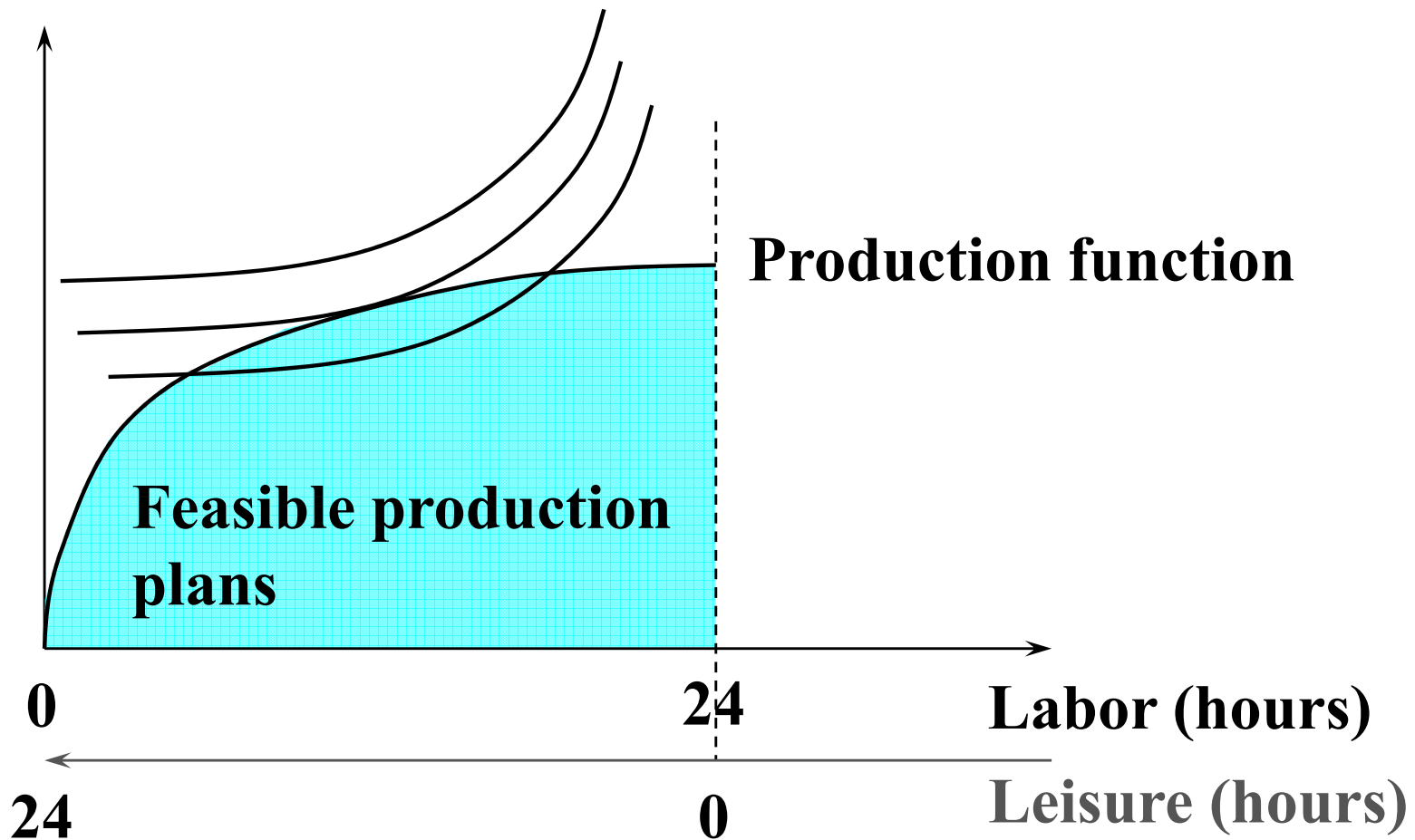
Robinson Crusoe's Choice

Coconuts



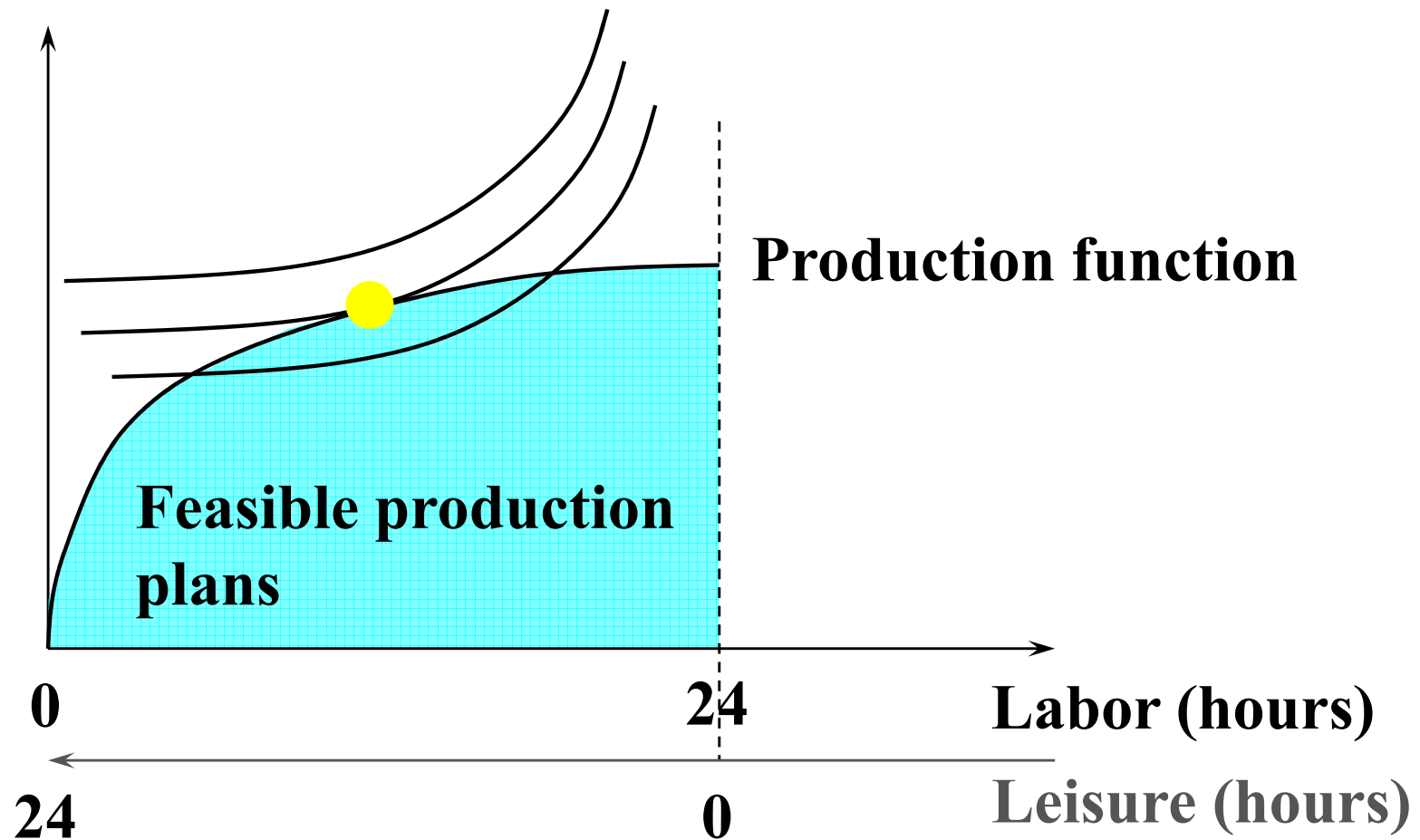
Robinson Crusoe's Choice

Coconuts



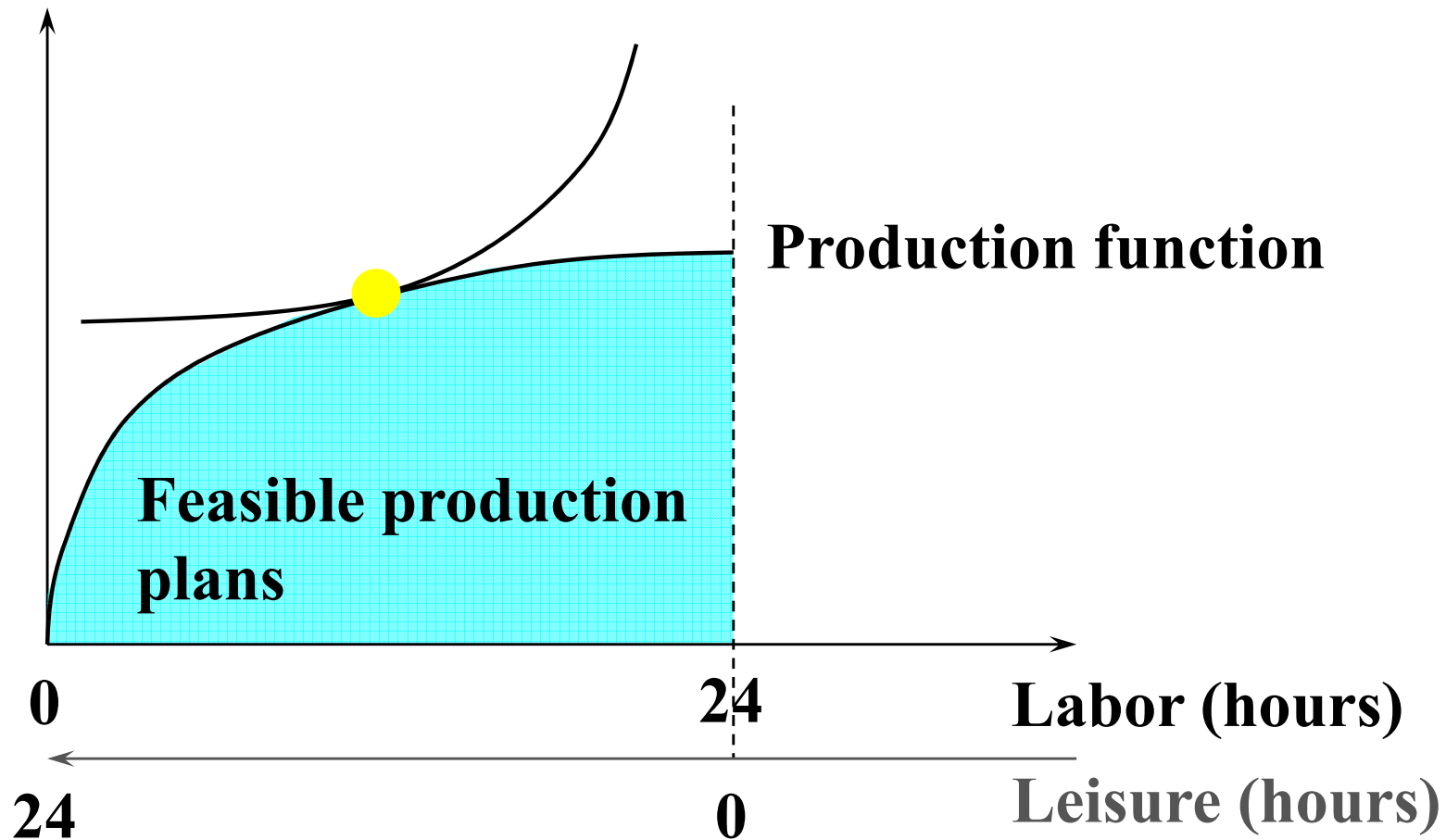
Robinson Crusoe's Choice

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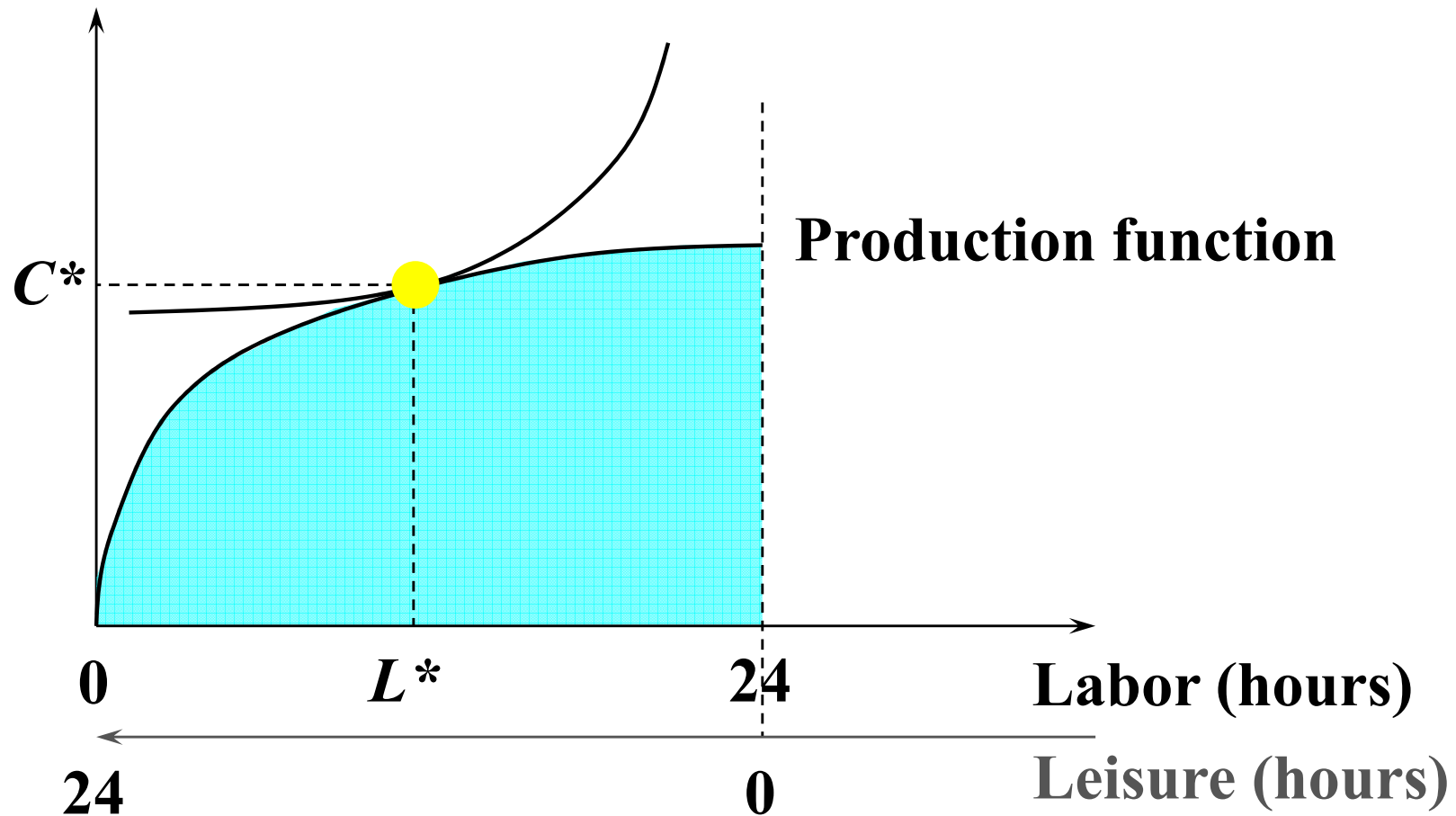
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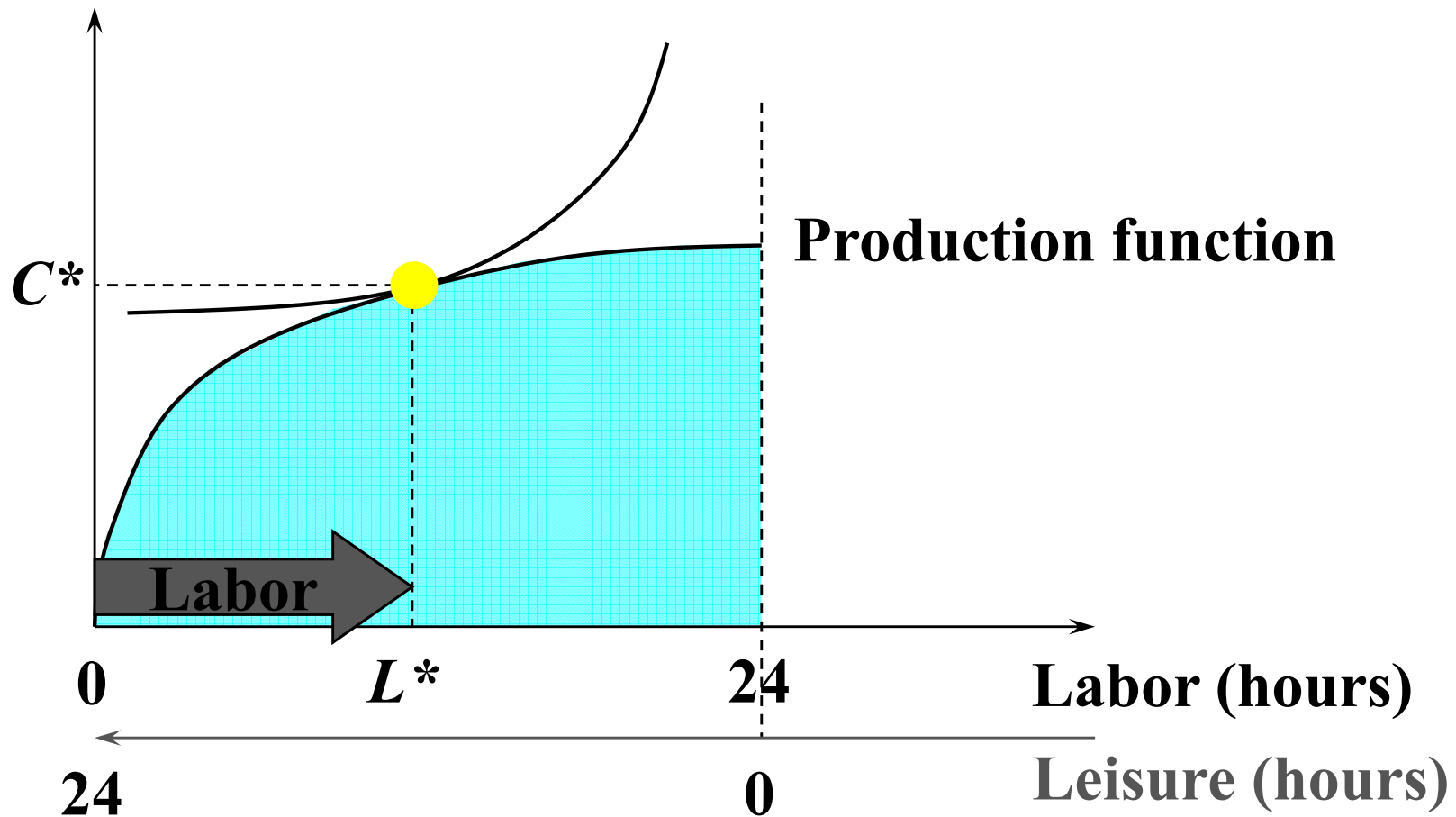
Robinson Crusoe's Choice

Coconuts



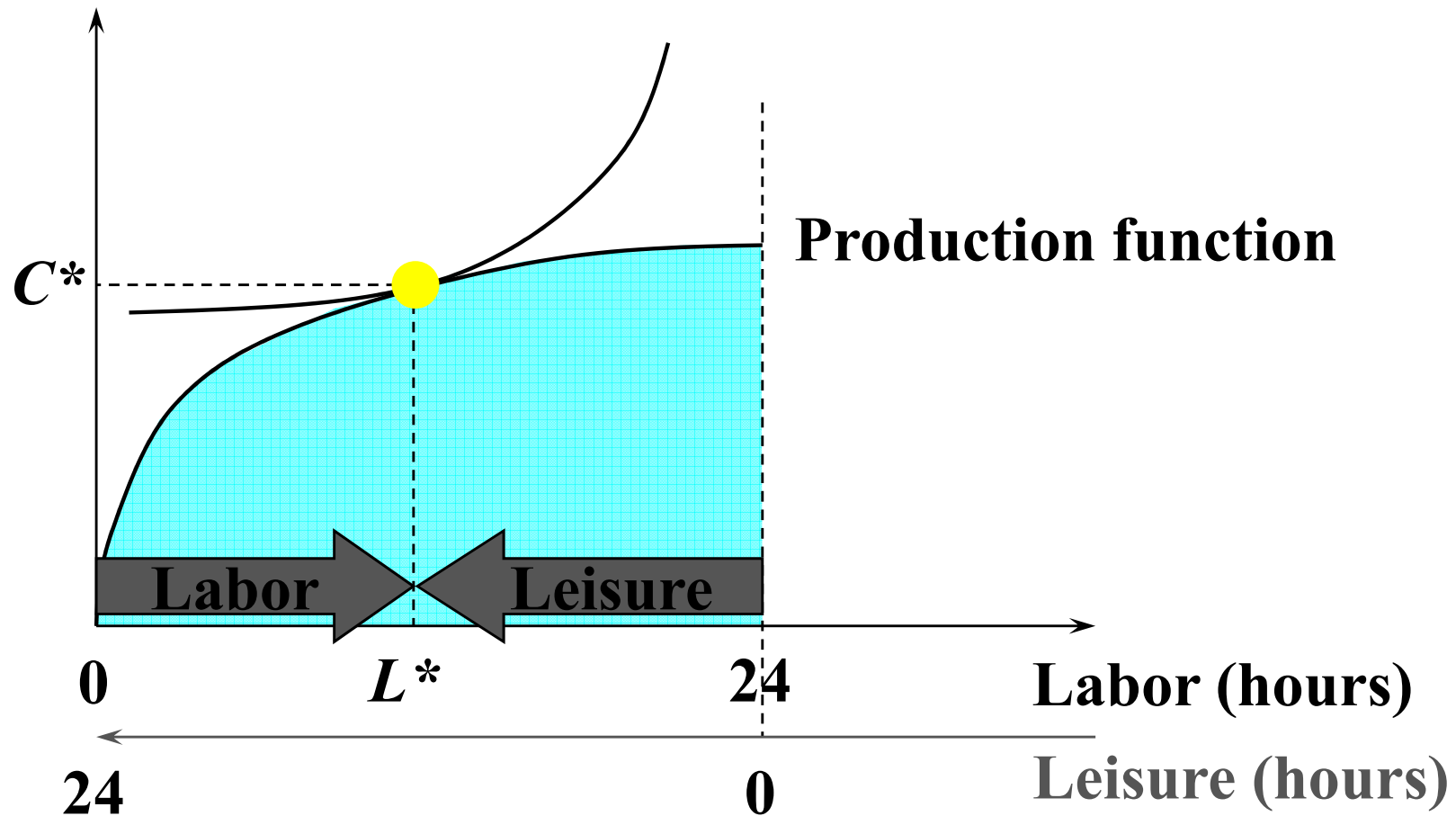
Robinson Crusoe's Choice

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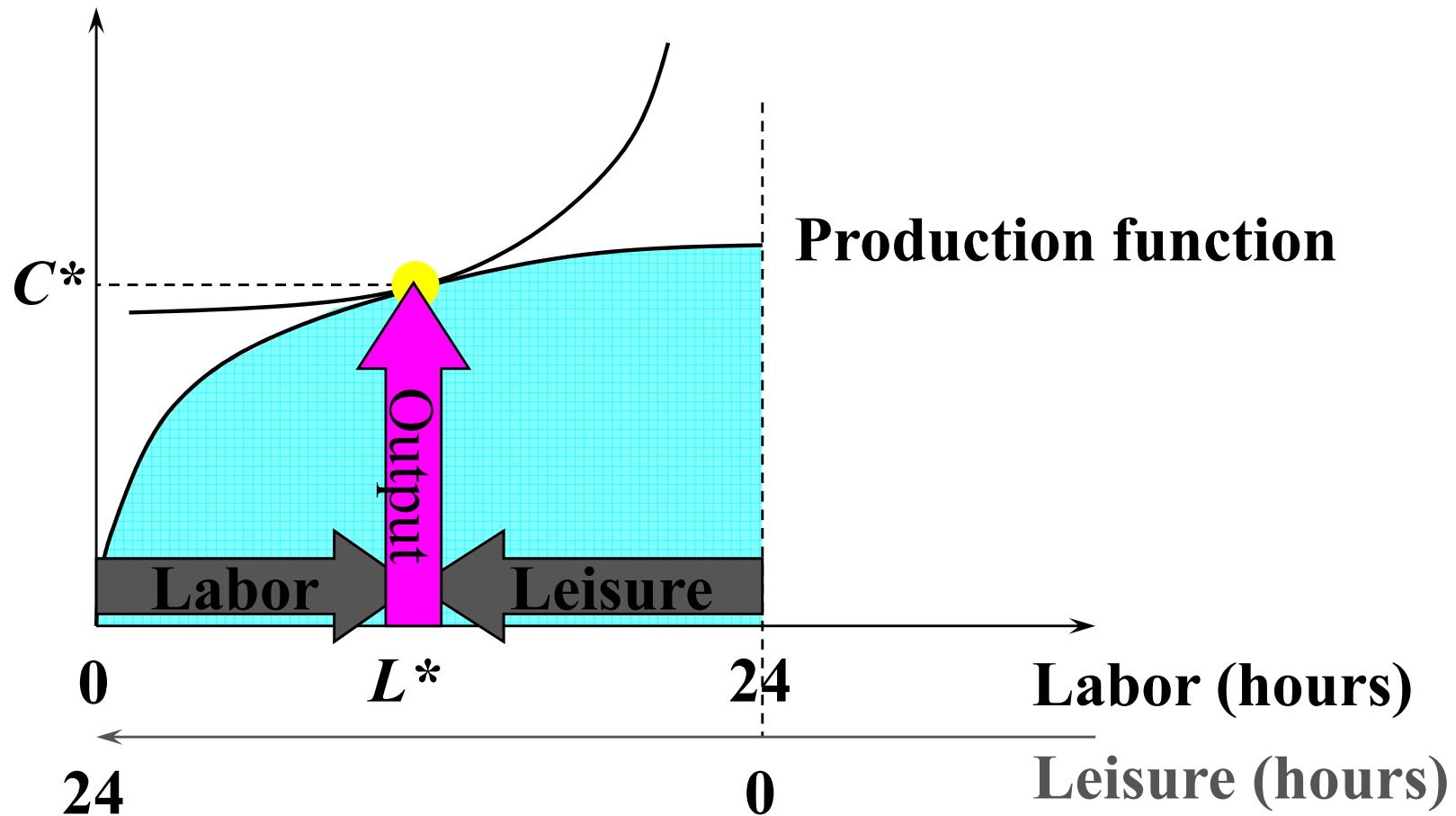
Robinson Crusoe's Choice

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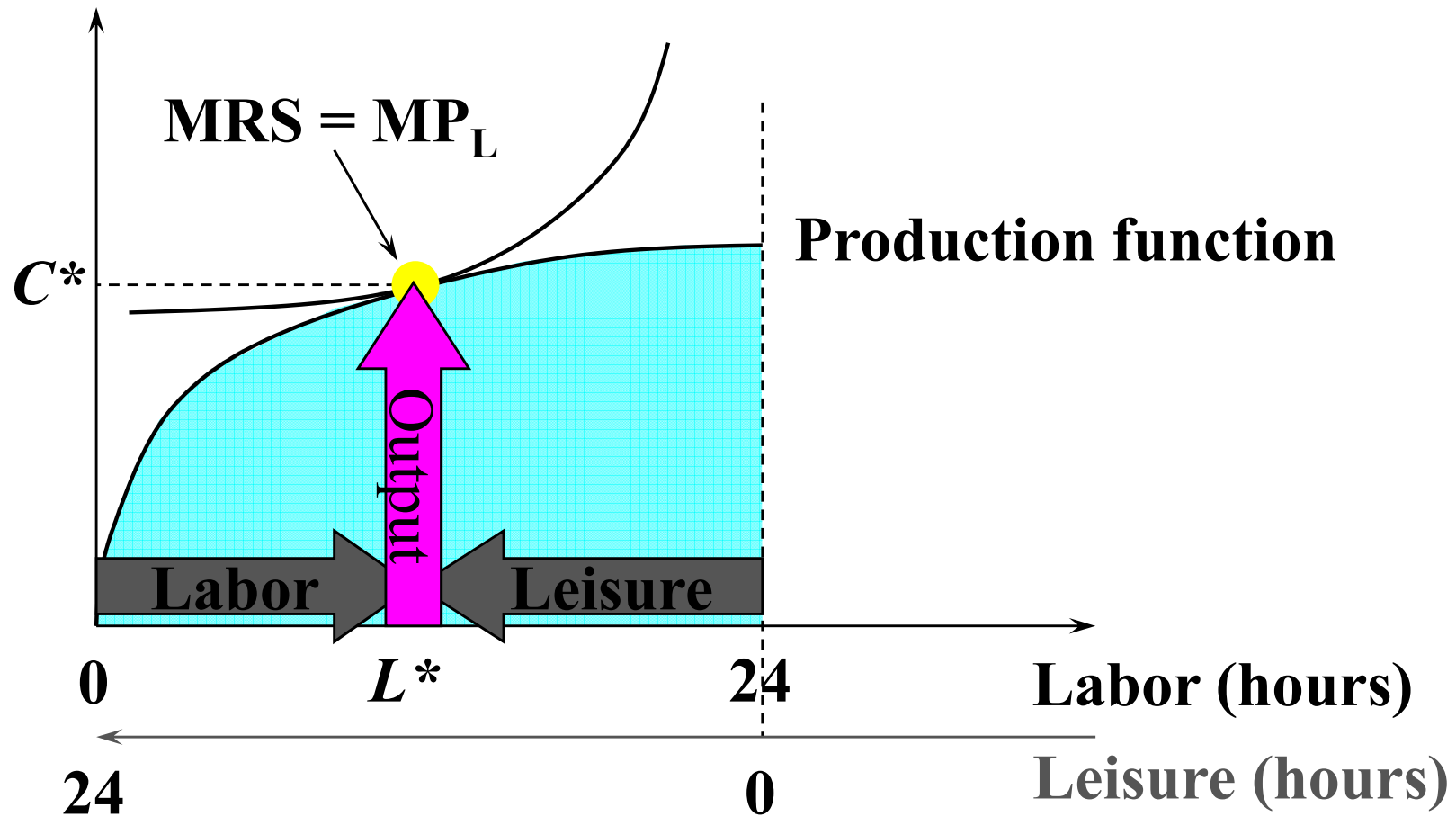
Robinson Crusoe's Choice

Coconuts



Robinson Crusoe's Choice

Coconuts



Robinson Crusoe as a Firm

- ◆ **Now suppose RC is both a utility-maximizing consumer and a profit-maximizing firm.**
- ◆ **Use coconuts as the numeraire good; i.e. price of a coconut = \$1.**
- ◆ **RC's wage rate is w .**
- ◆ **Coconut output level is C .**

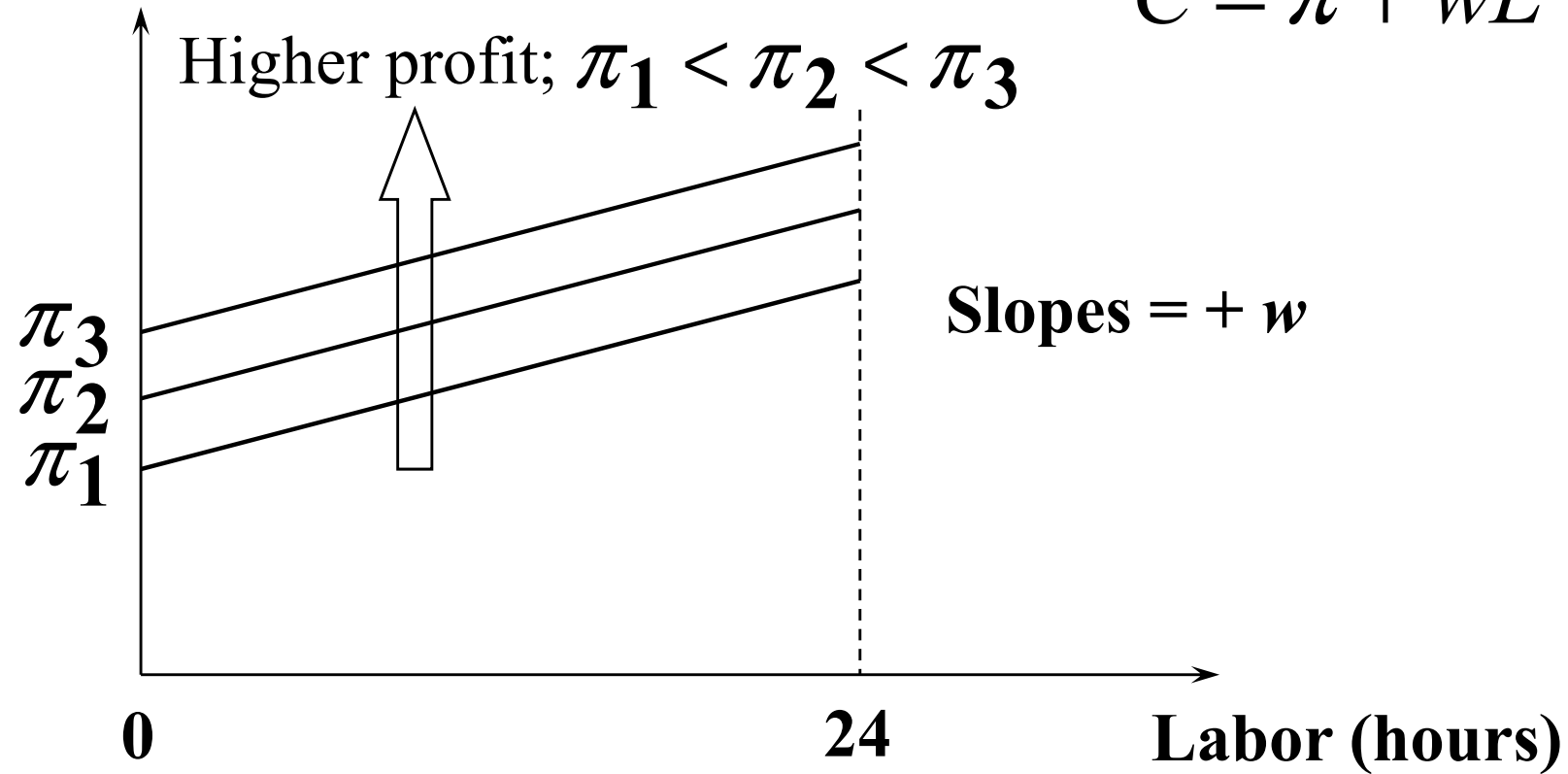
Robinson Crusoe as a Firm

- ◆ RC's firm's profit is $\pi = C - wL$.
- ◆ $\pi = C - wL \Leftrightarrow C = \pi + wL$, the equation of an isoprofit line.
- ◆ Slope = $+ w$.
- ◆ Intercept = π .

Isoprofit Lines

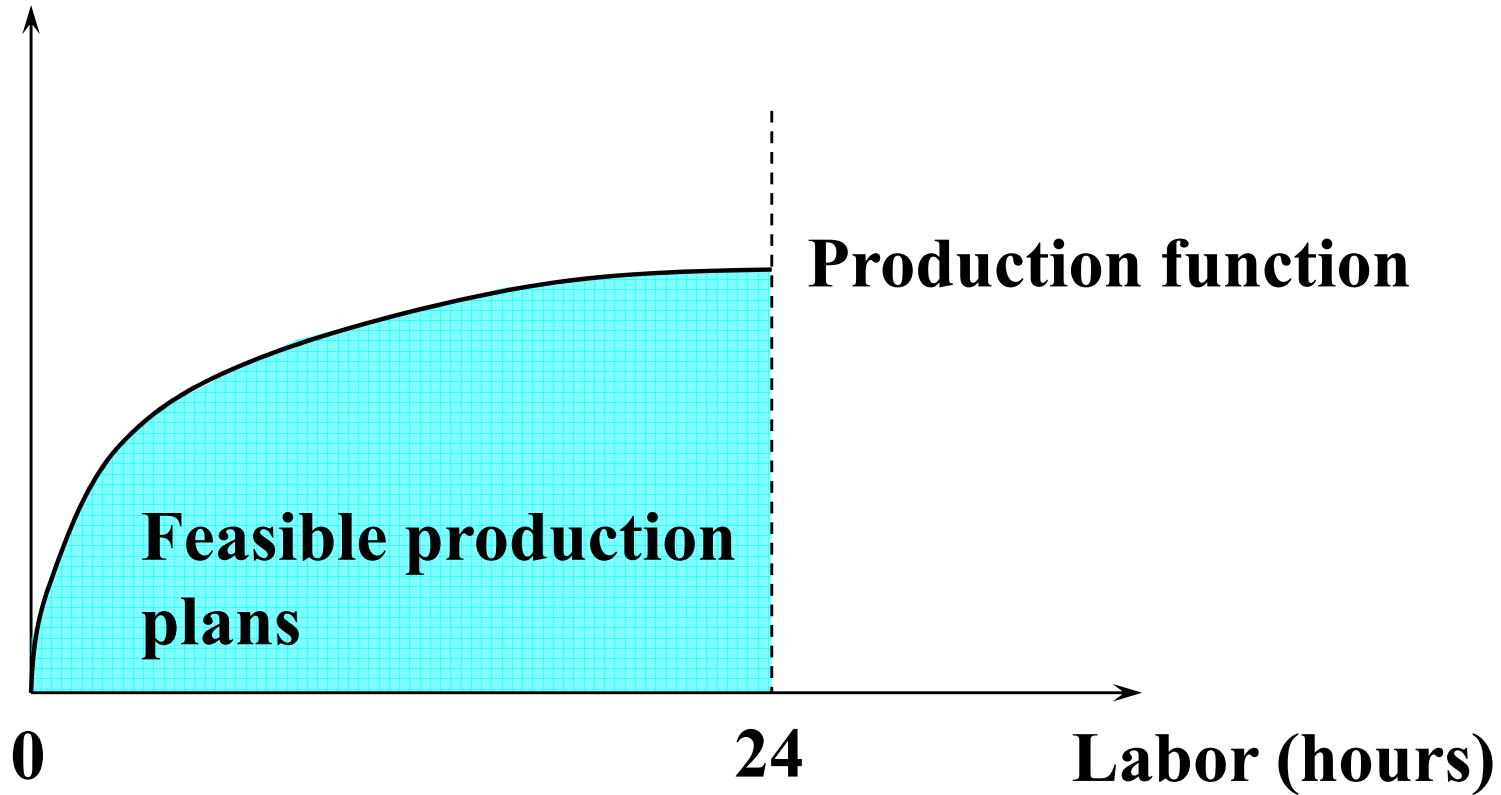
Coconuts

$$C = \pi + wL$$



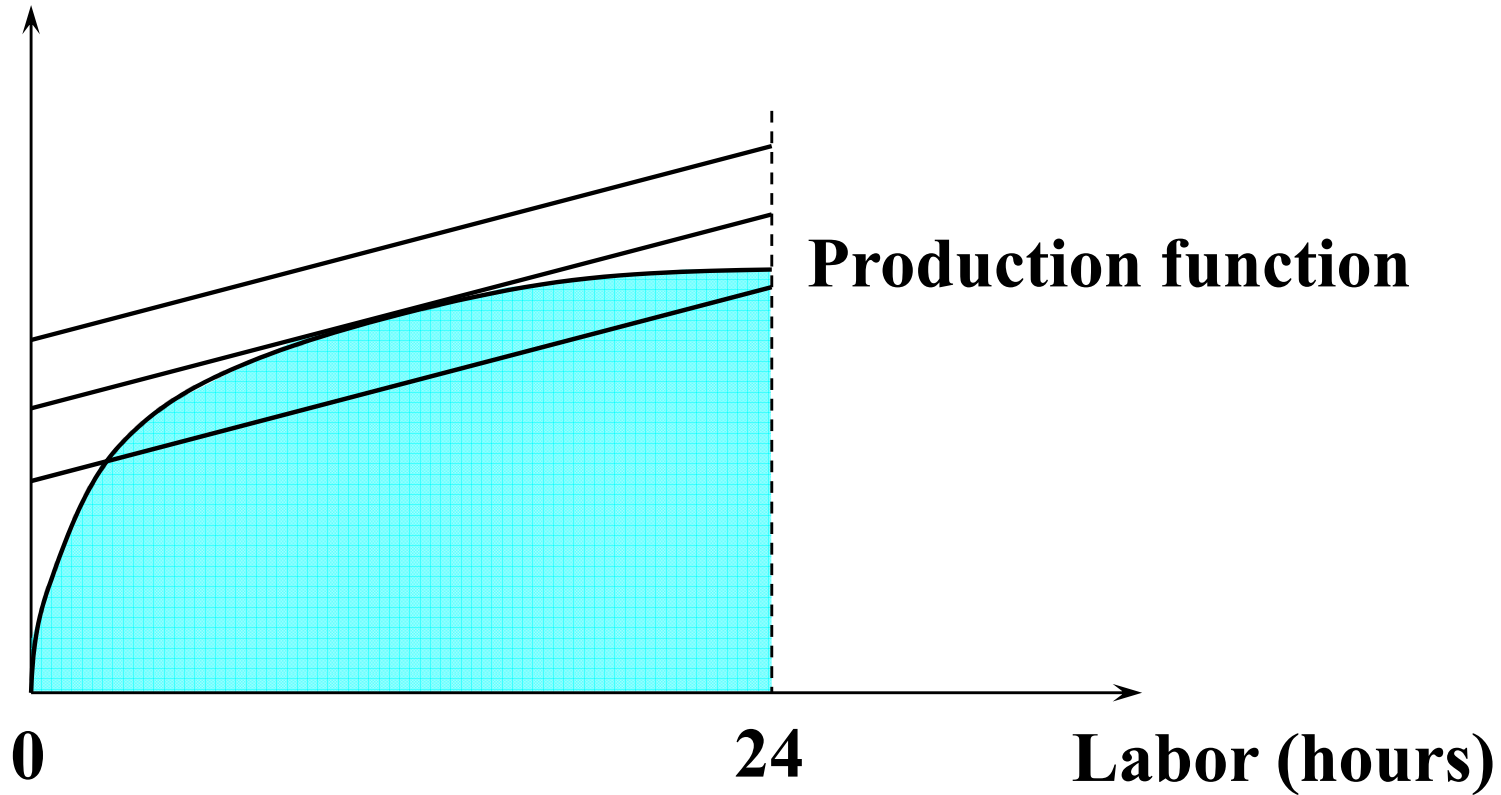
Profit-Maximization

Coconuts



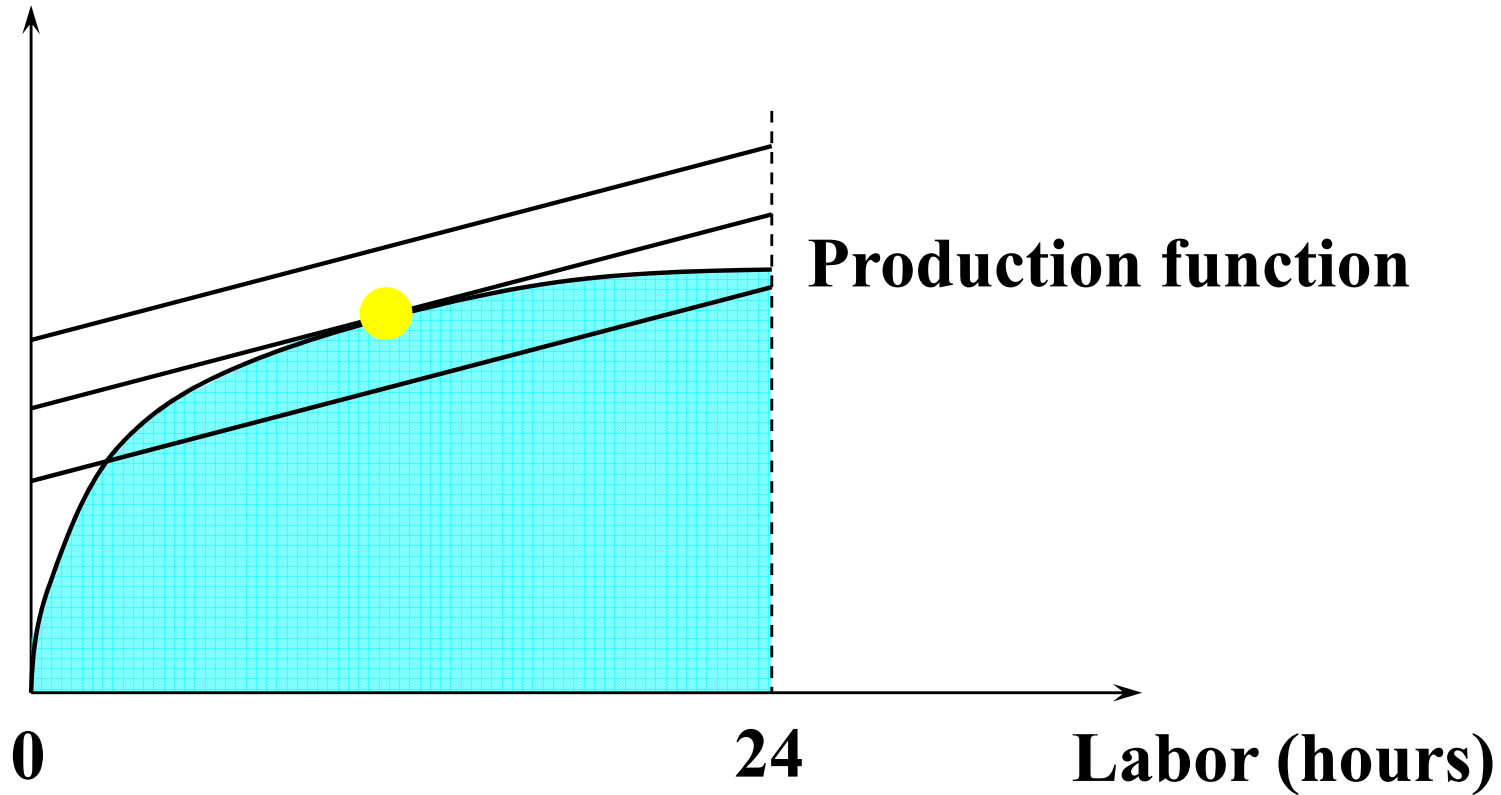
Profit-Maximization

Coconuts



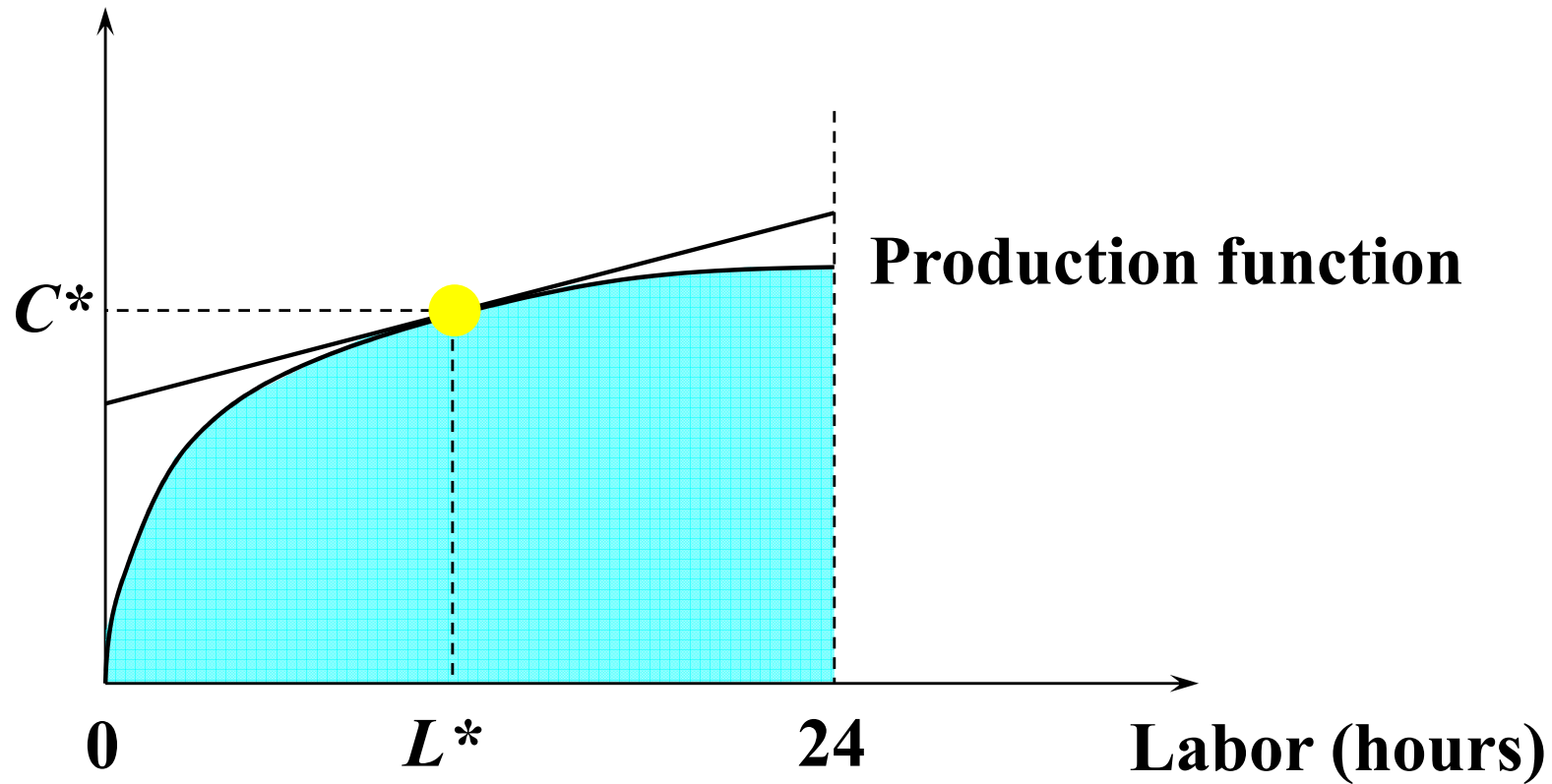
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Profit-Maximization

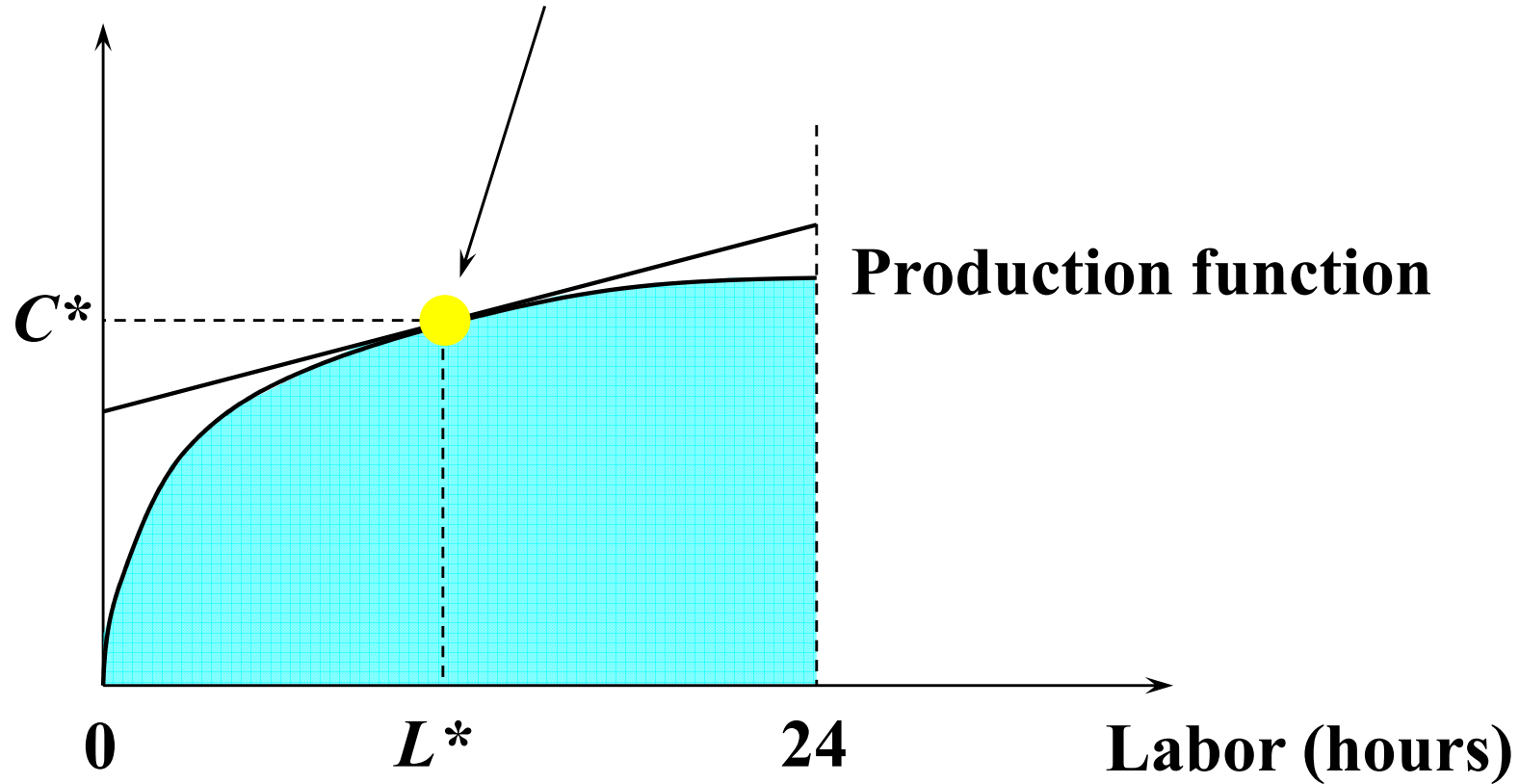
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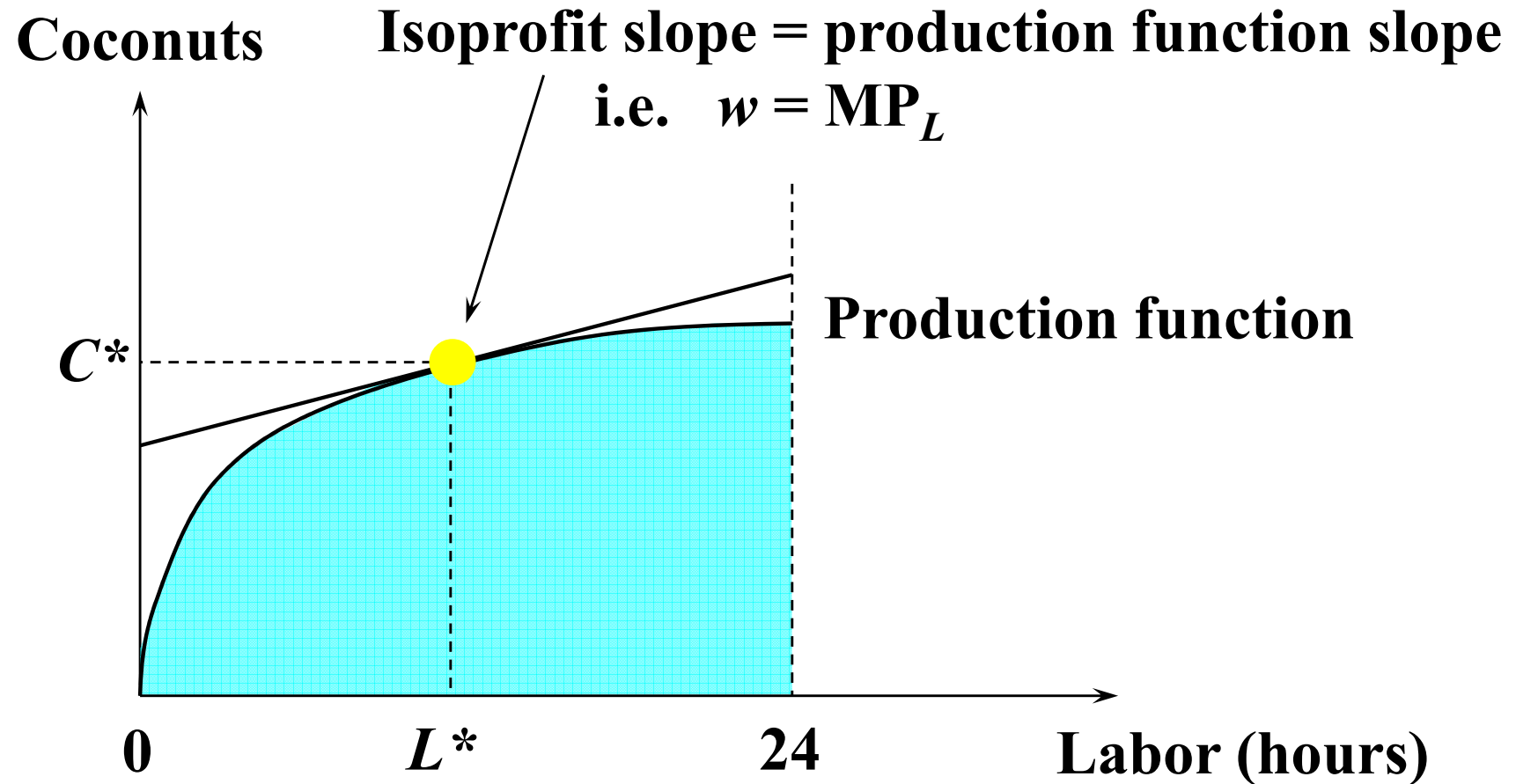
Profit-Maximization

Coconuts

Isoprofit slope = production function slope



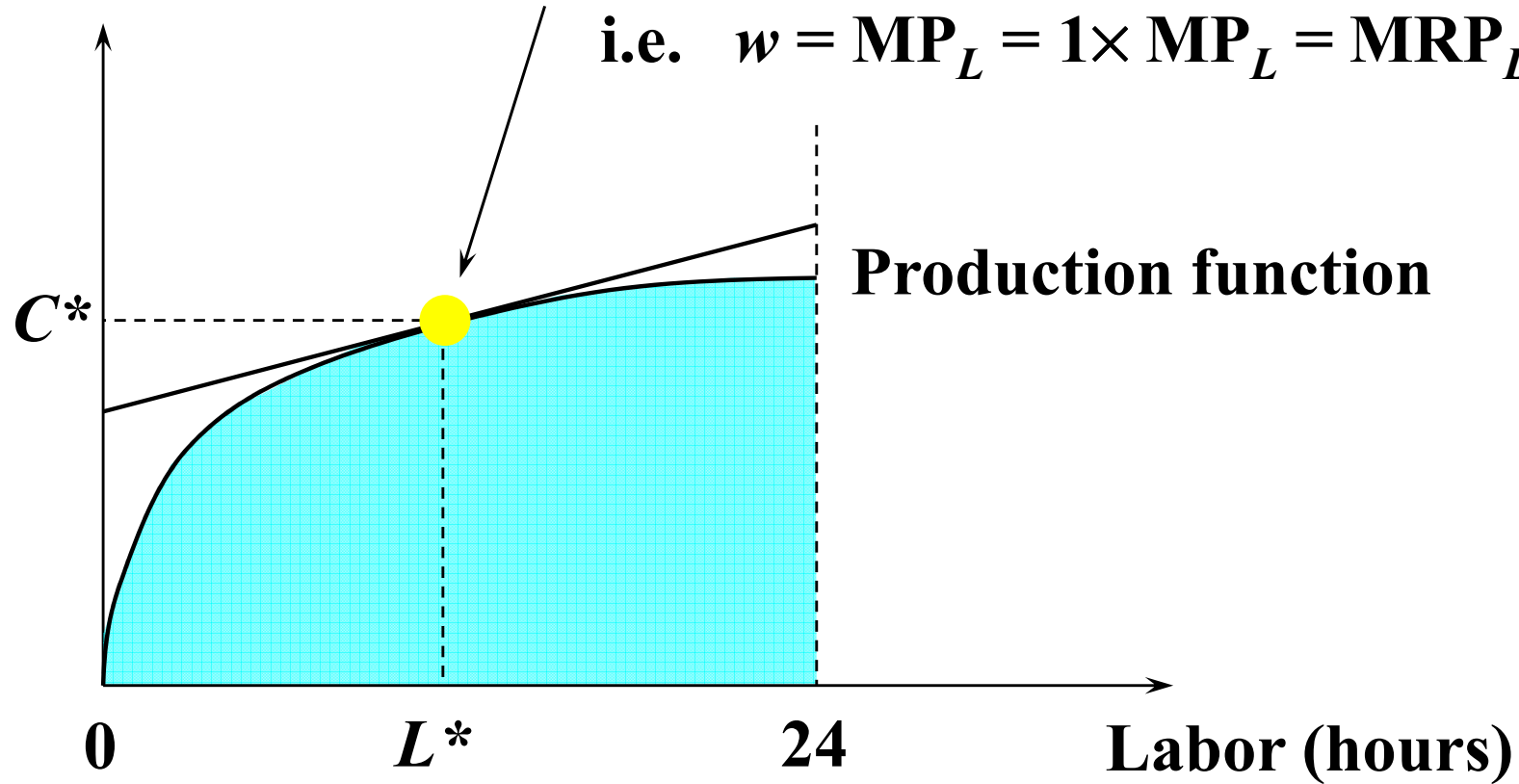
Profit-Maximization



Profit-Maximization

Coconuts

Isoprofit slope = production function slope
i.e. $w = MP_L = 1 \times MP_L = MRP_L$.

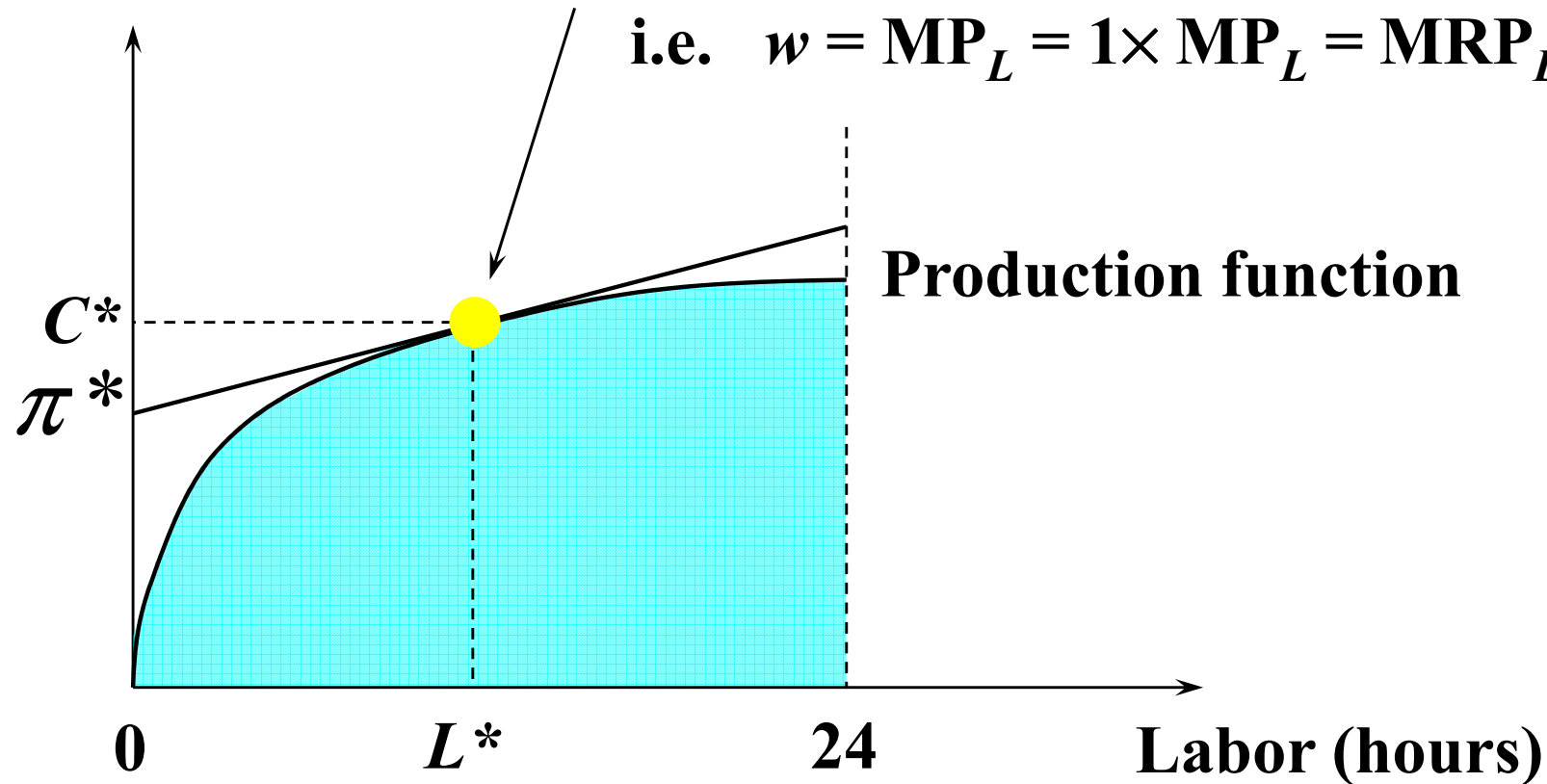


Profit-Maximization

Coconuts

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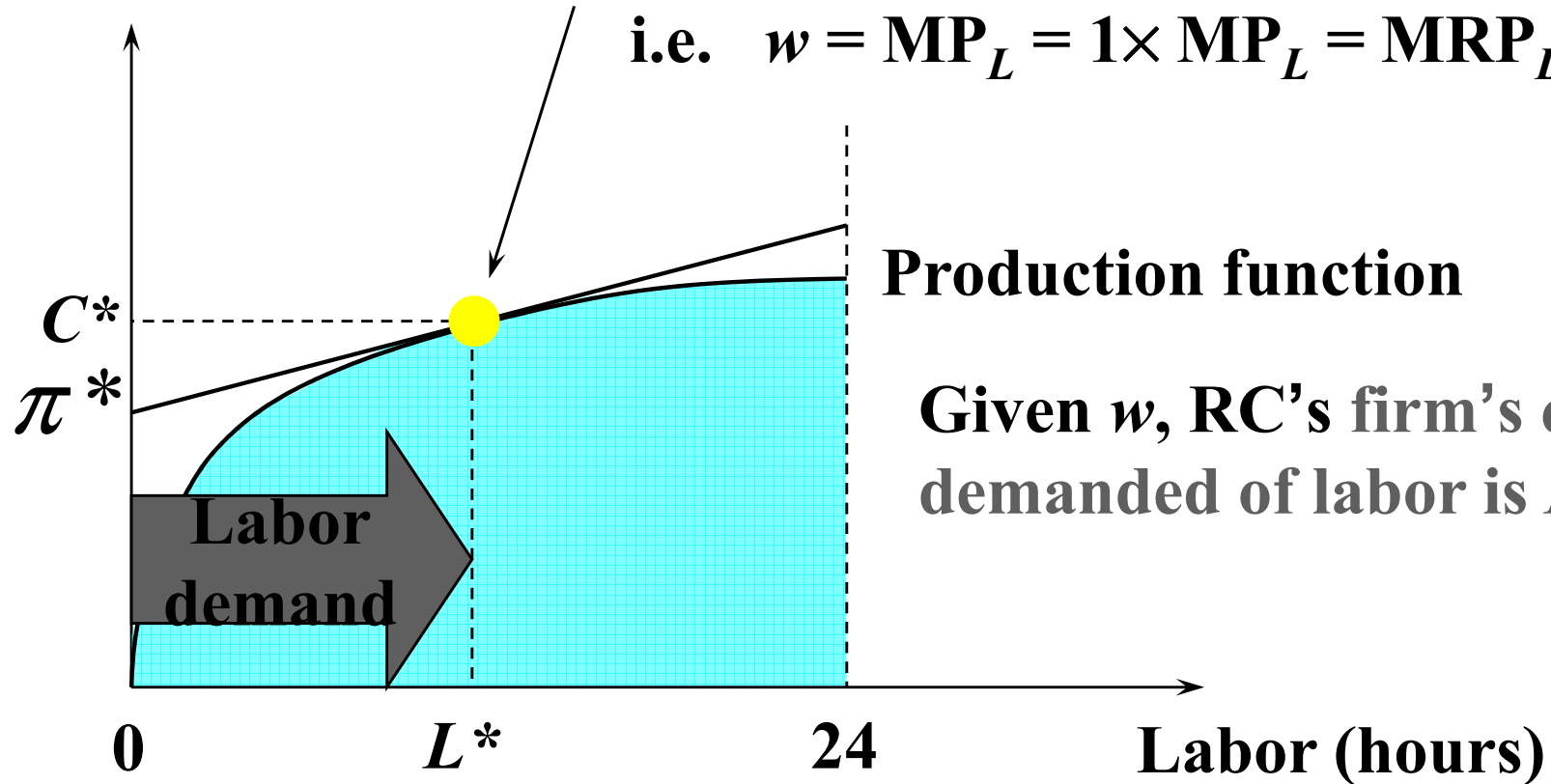
RC gets $\pi^* = C^* - wL^*$

Profit-Maximization

Coconuts

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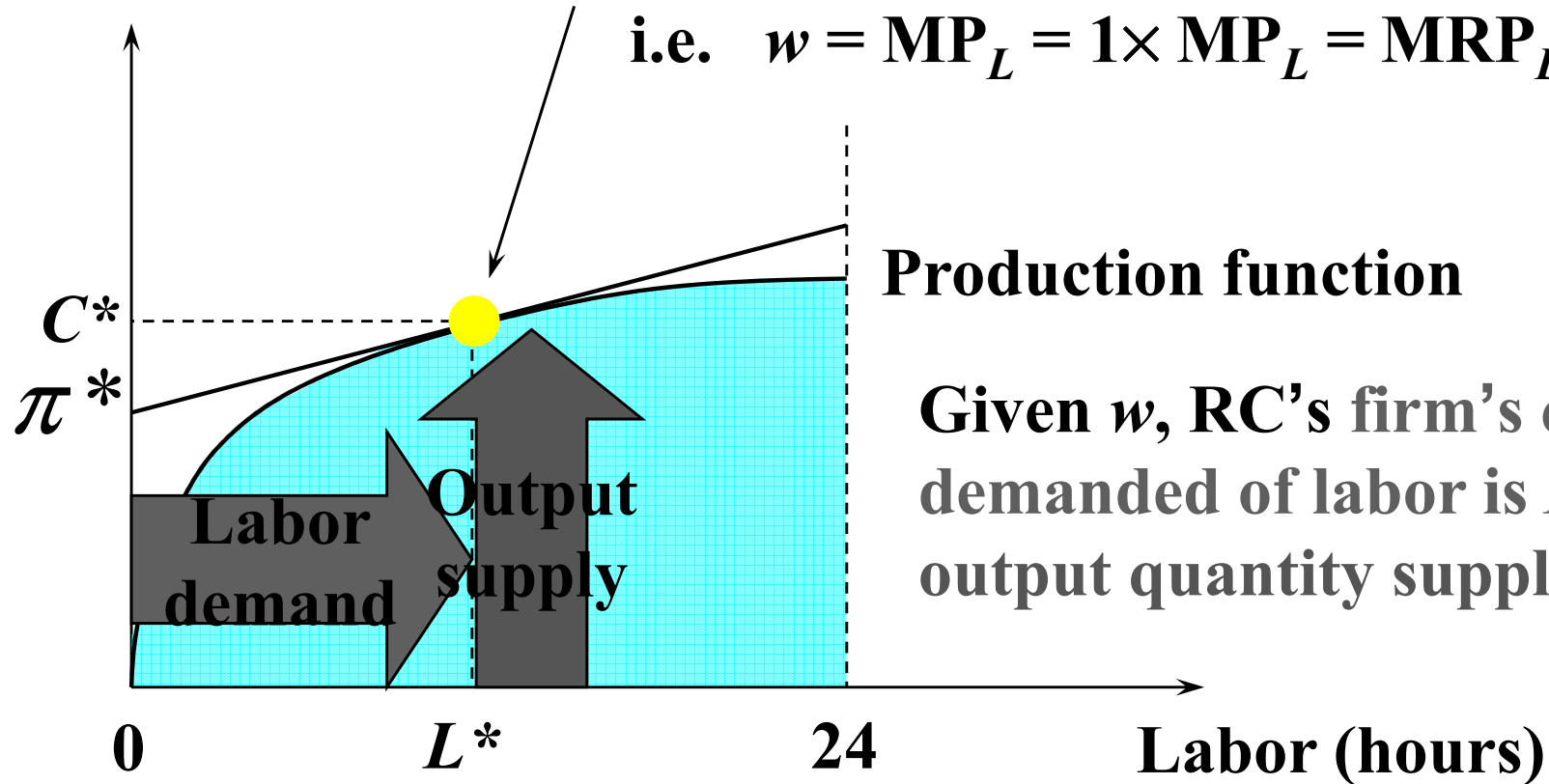
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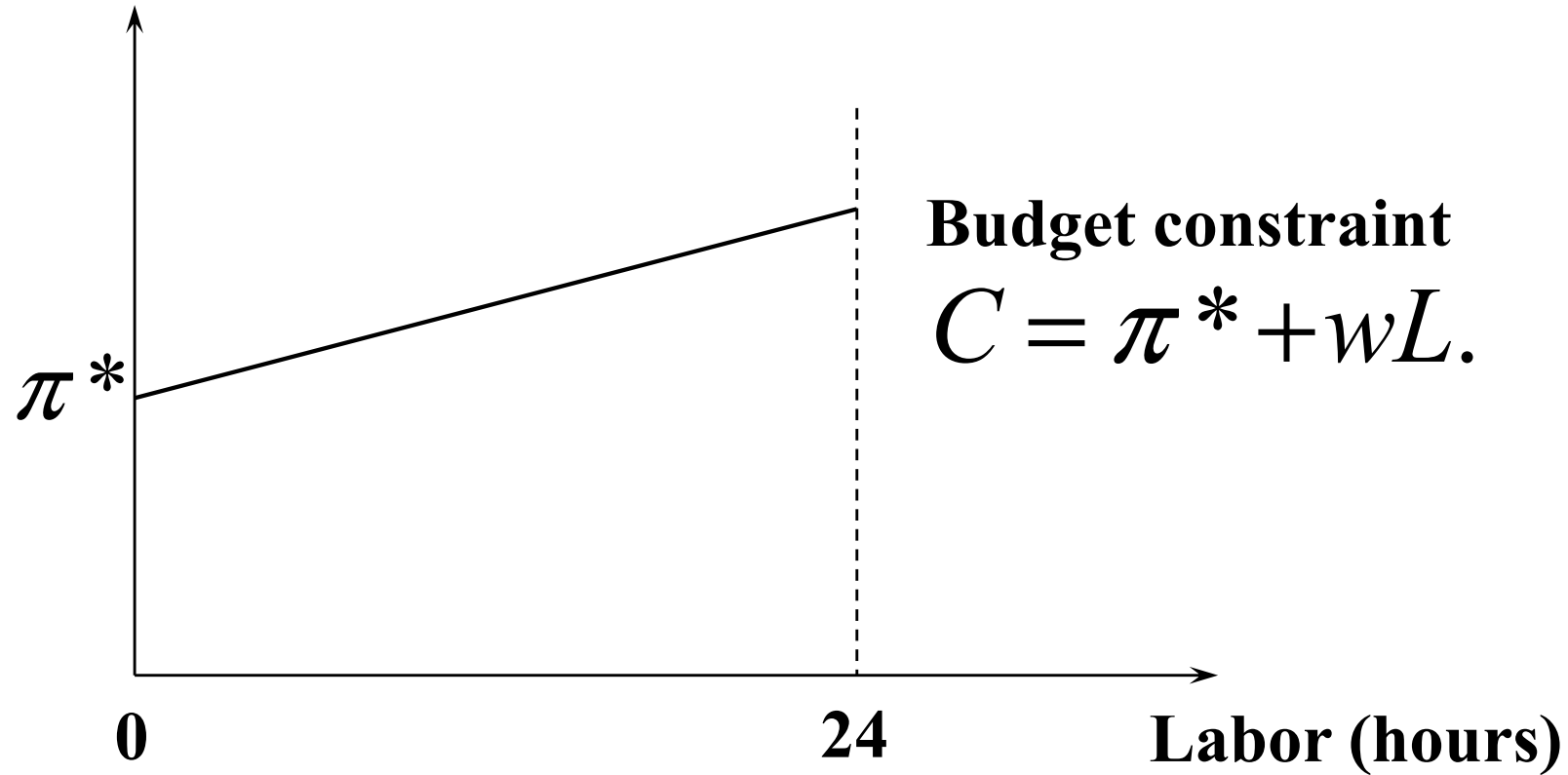
RC gets $\pi^* = C^* - wL^*$

Utility-Maximization

- ◆ **Now consider RC as a consumer endowed with π^* who can work for w per hour.**
- ◆ **What is RC's most preferred consumption bundle?**
- ◆ **Budget constraint is $C = \pi^* + wL$.**

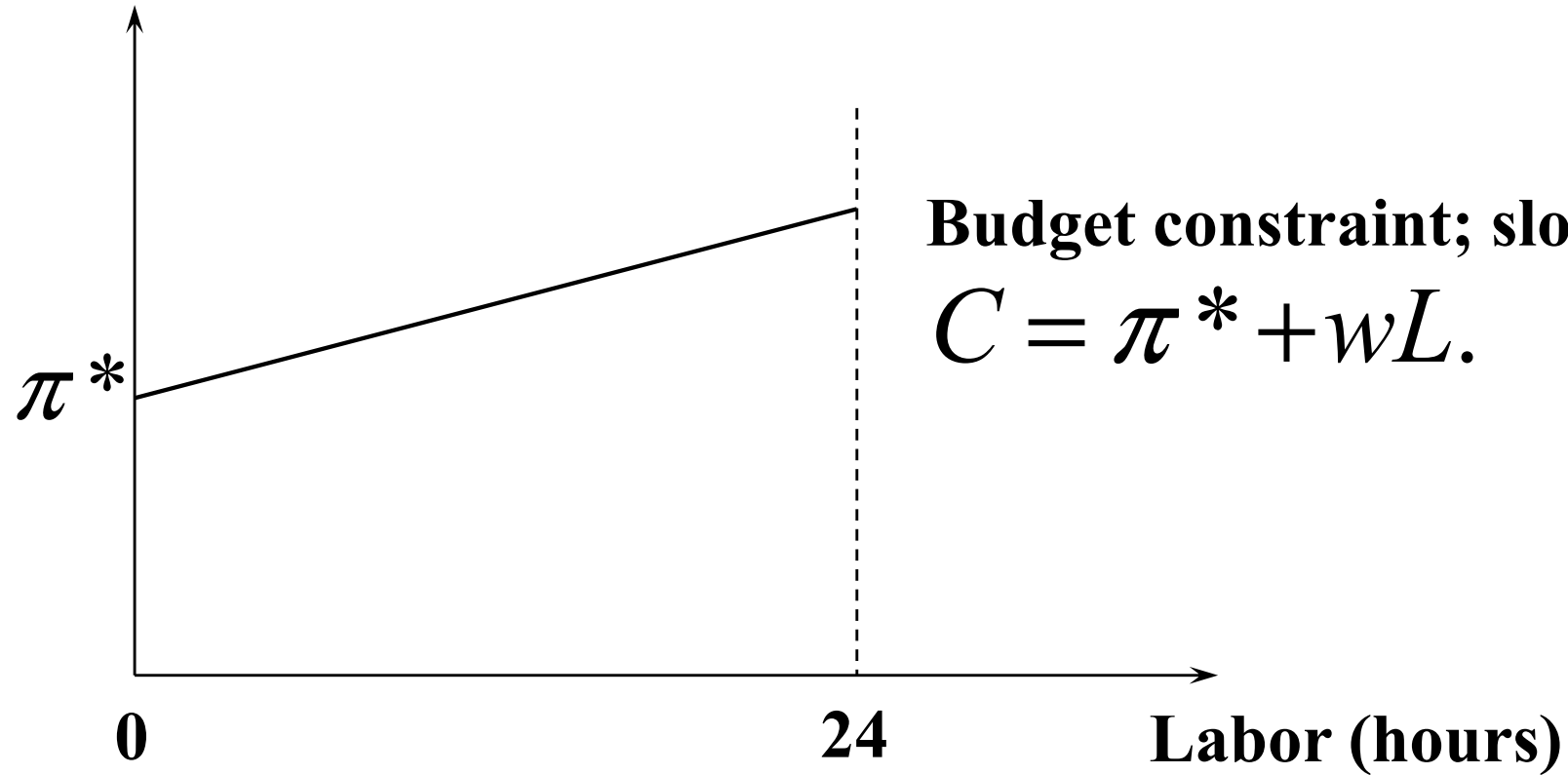
Utility-Maximization

Coconuts



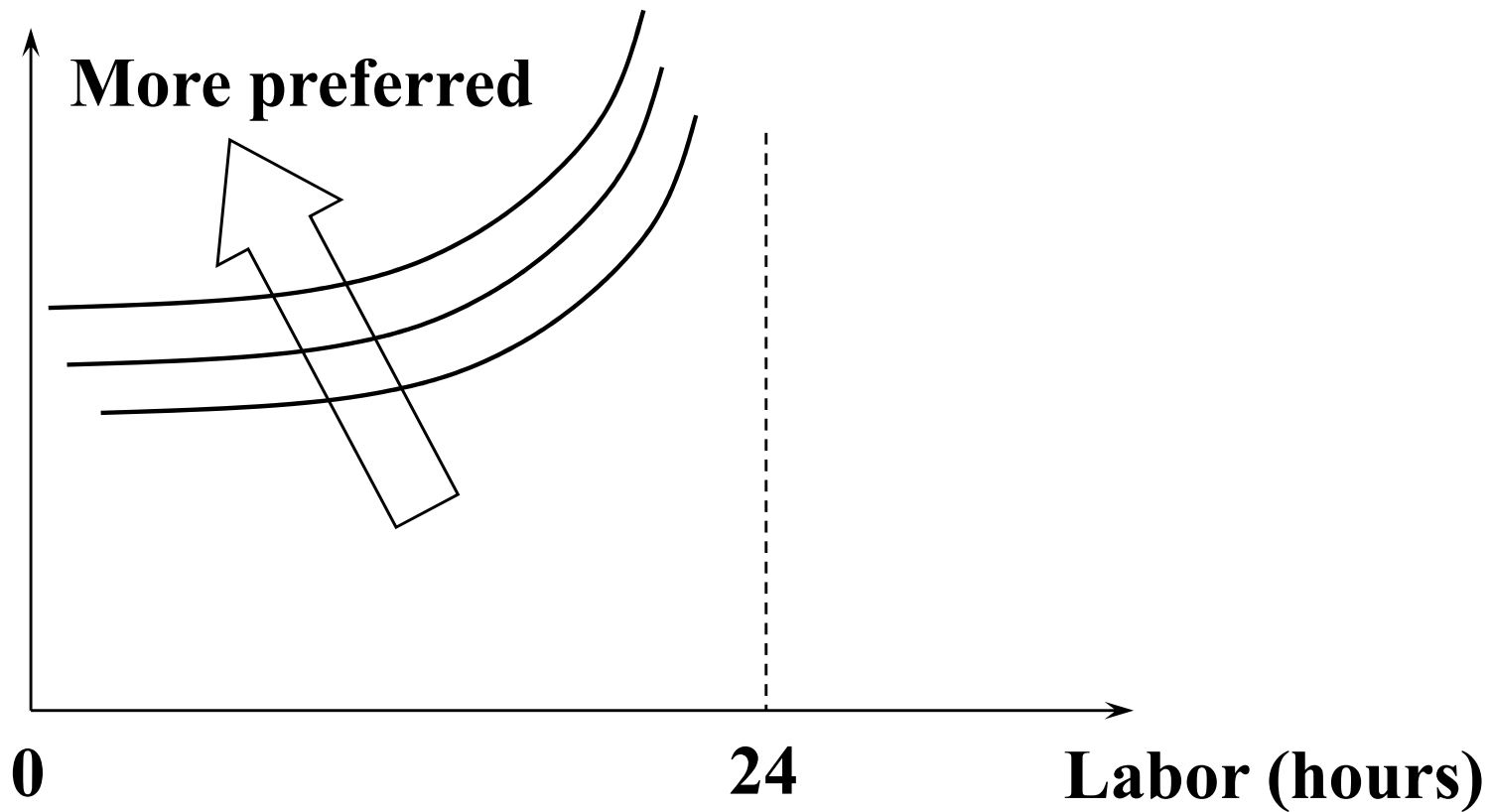
Utility-Maximization

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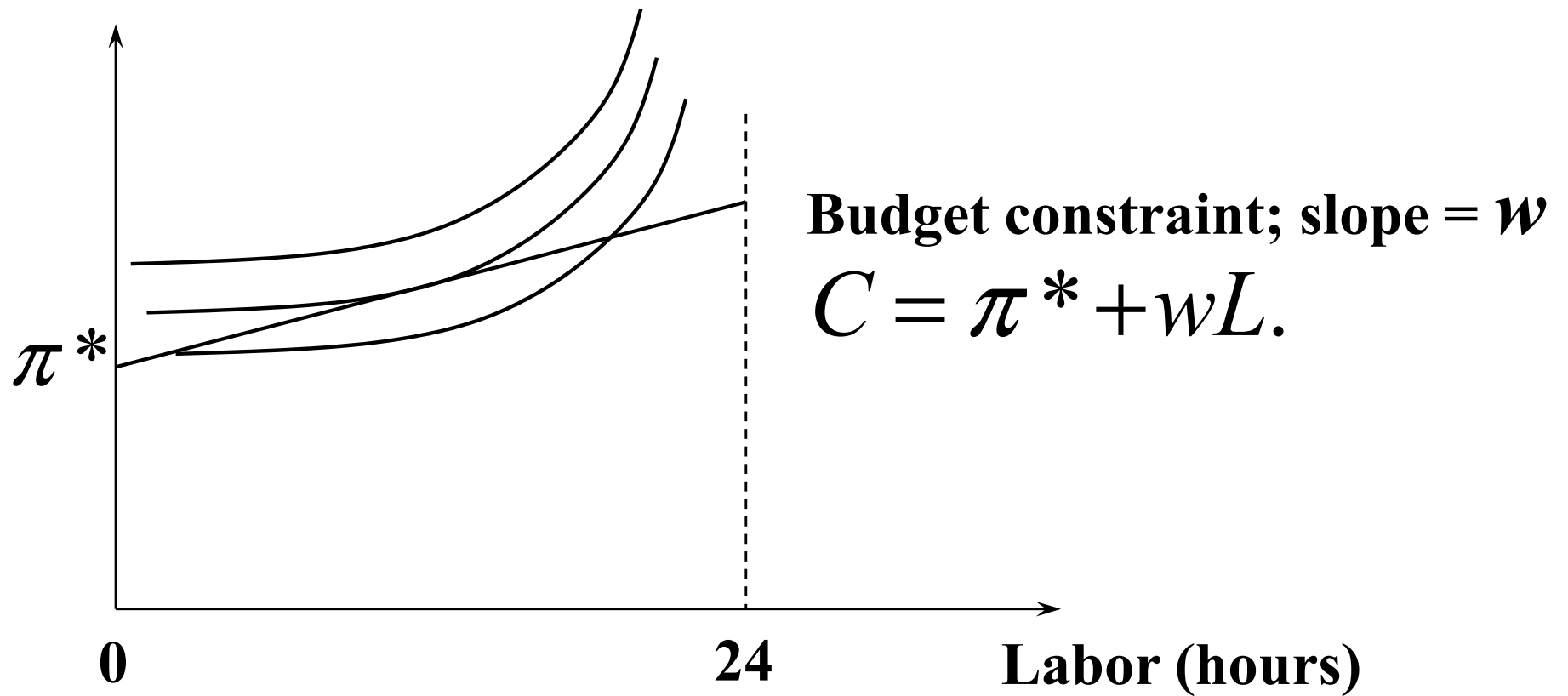
Utility-Maximization

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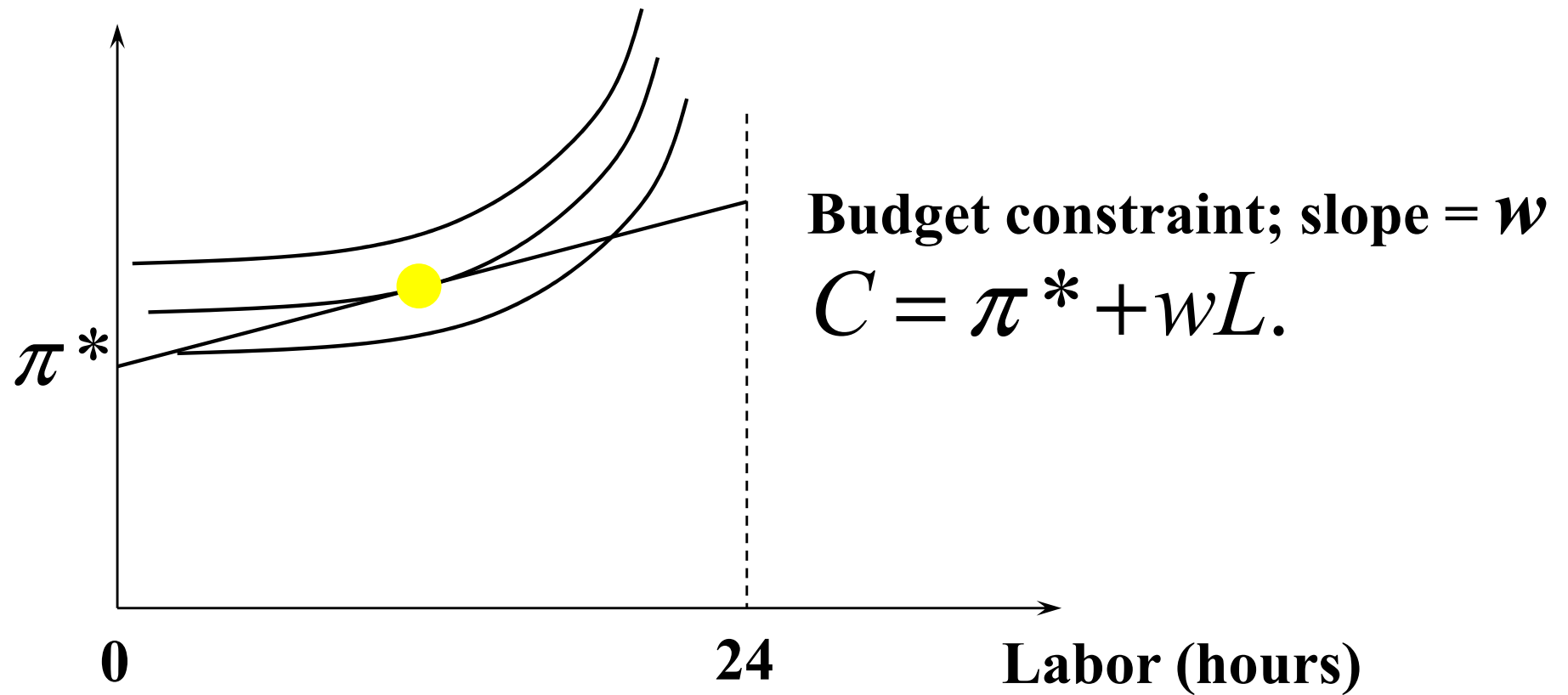
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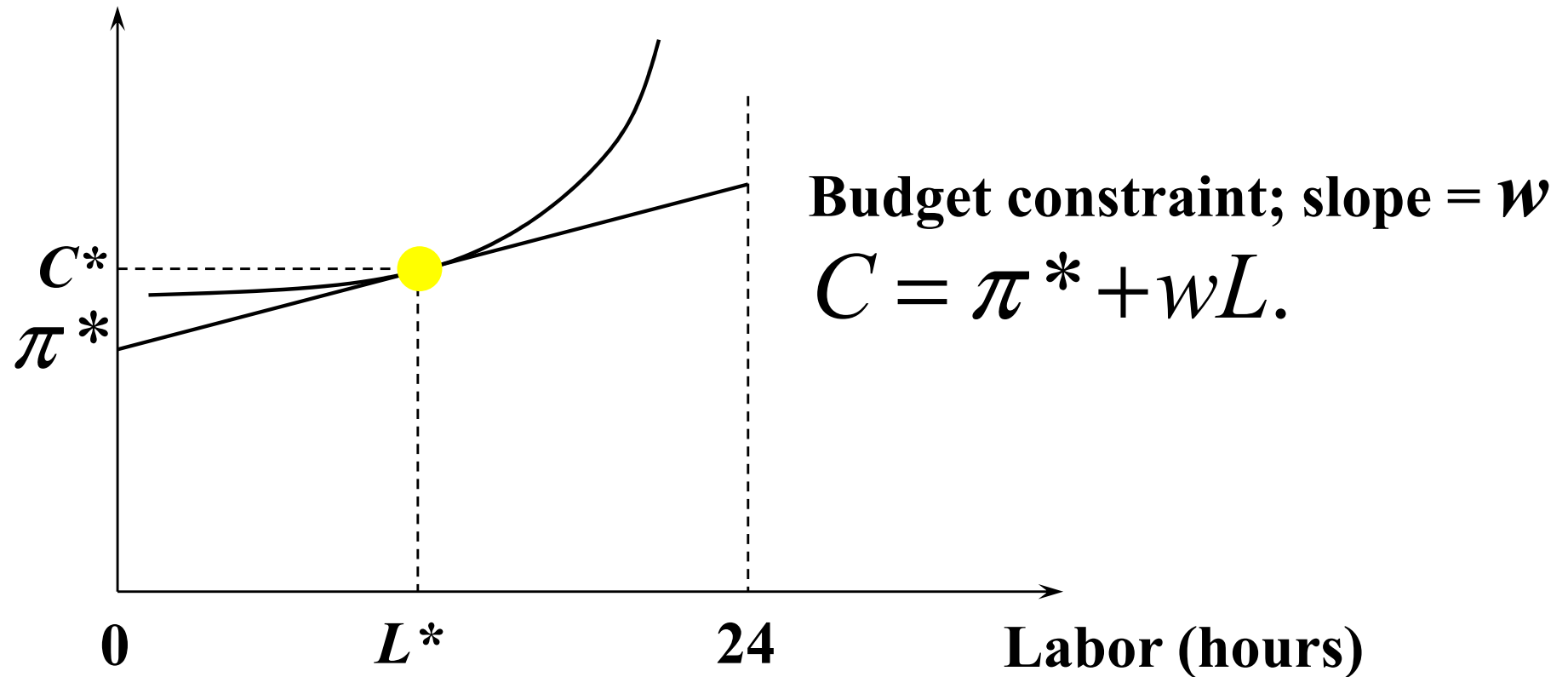
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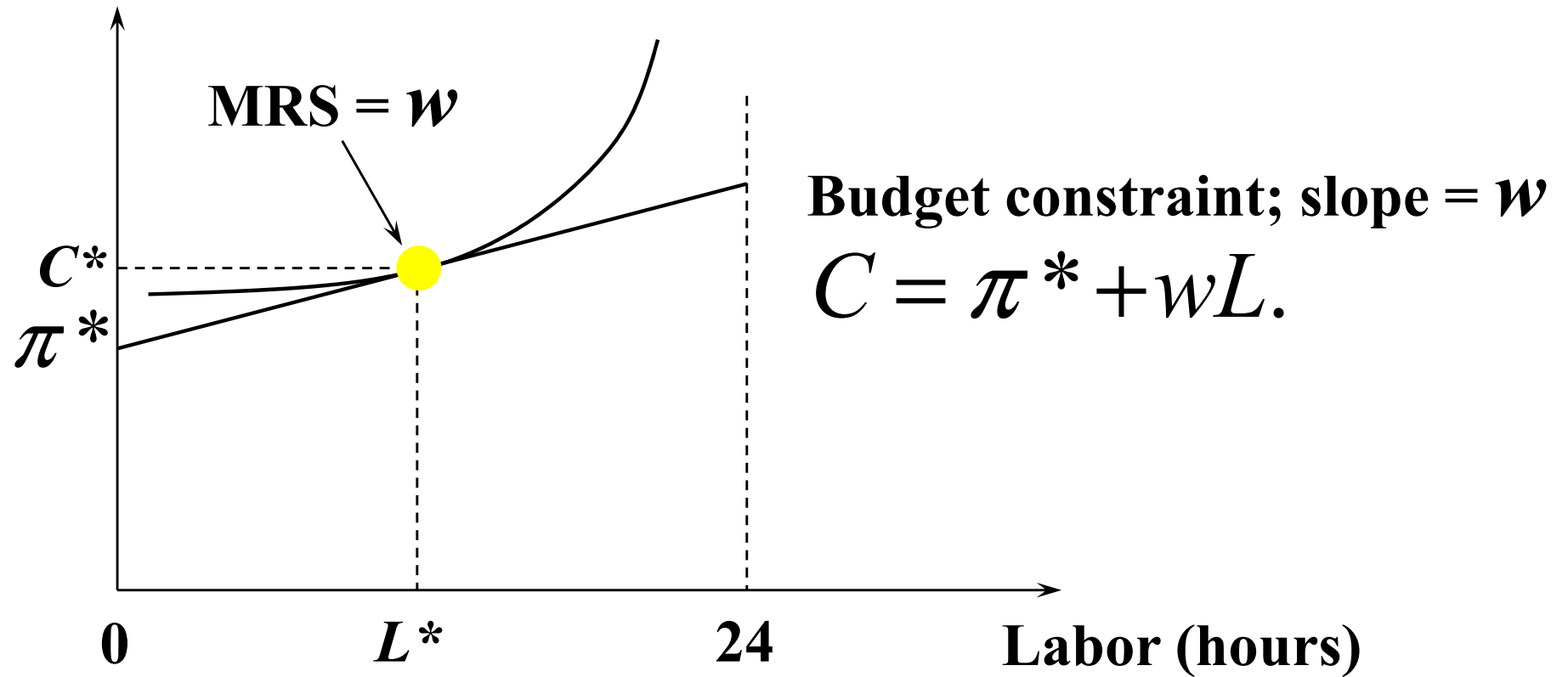
Utility-Maximization

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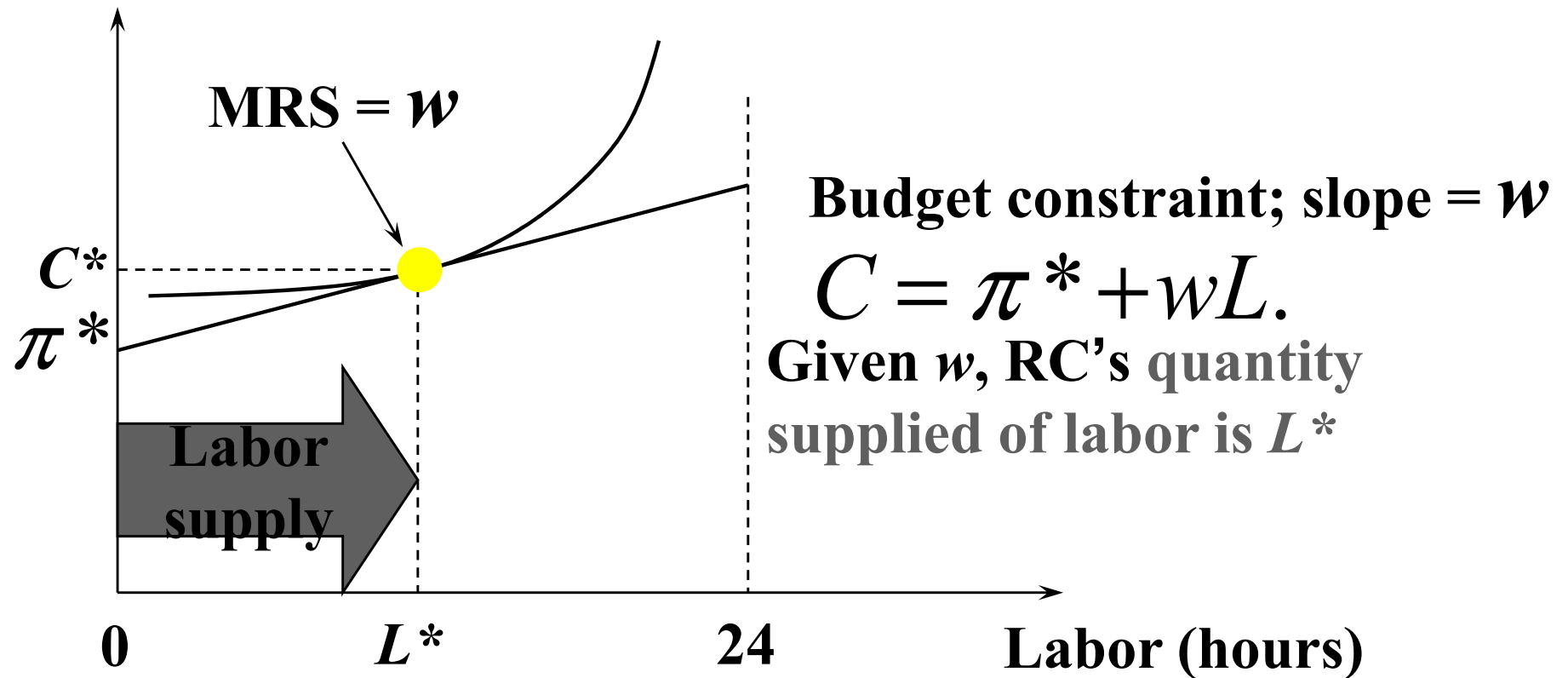
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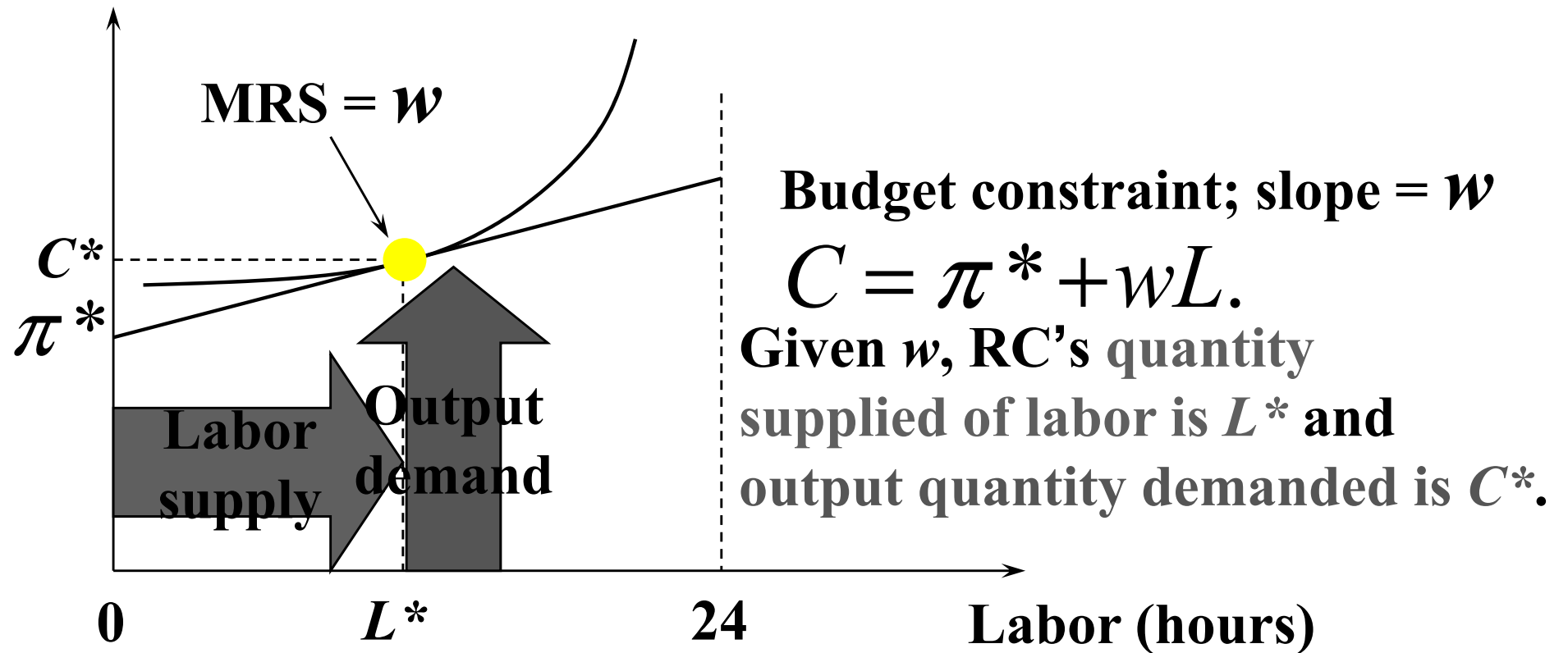
Utility-Maximization

Coconuts



Utility-Maximization

Coconuts



Utility-Maximization & Profit-Maximization

◆ Profit-maximization:

– $w = MP_L$

– quantity of output supplied = C^*

– quantity of labor demanded = L^*

Utility-Maximization & Profit-Maximization

◆ Profit-maximization:

– $w = MP_L$

– quantity of output supplied = C^*

– quantity of labor demanded = L^*

◆ Utility-maximization:

– $w = MRS$

– quantity of output demanded = C^*

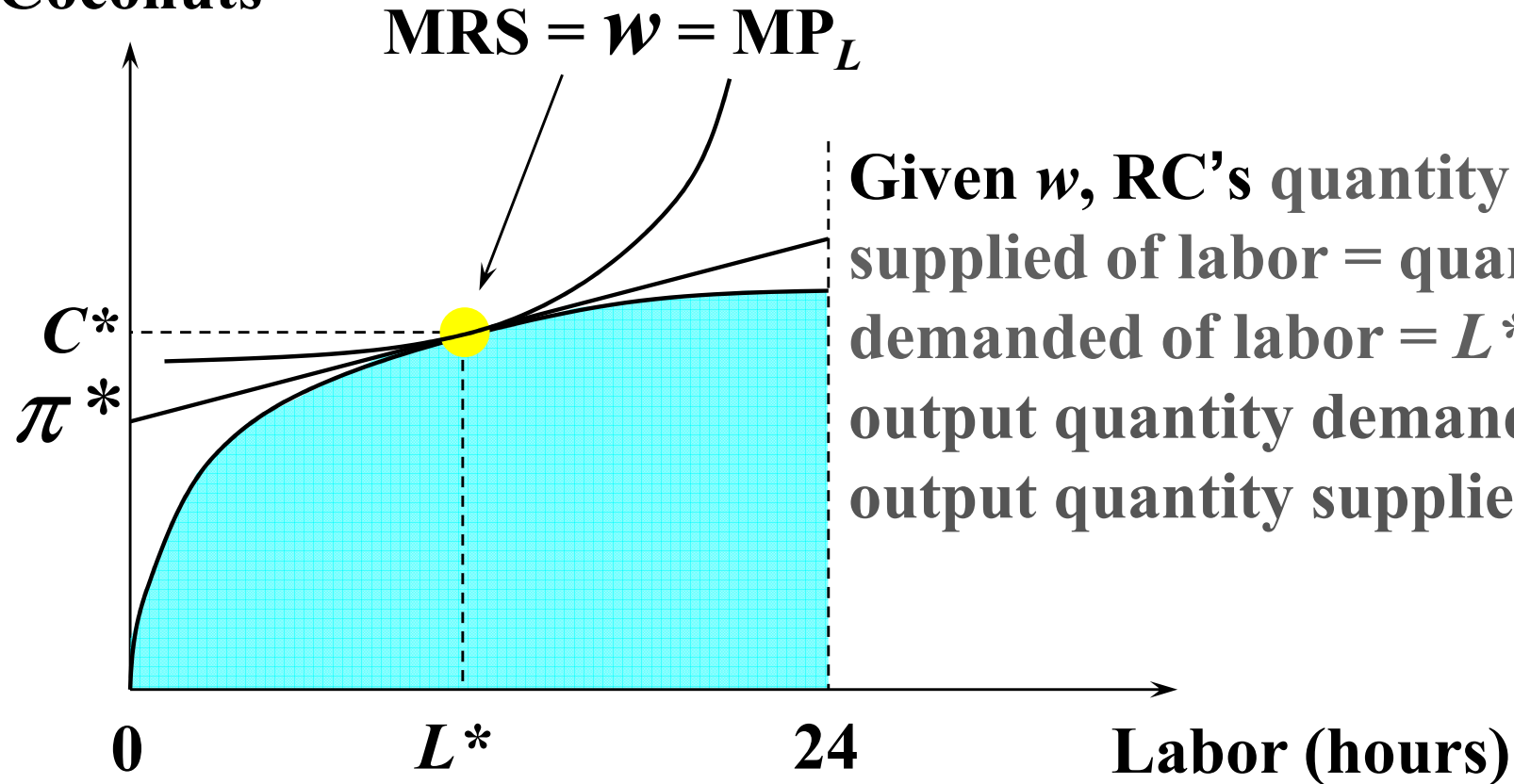
– quantity of labor supplied = L^*

Utility-Maximization & Profit-Maximization

- ◆ **Profit-maximization:** Coconut and labor markets both clear.
 - $w = MP_L$
 - quantity of output supplied = C^*
 - quantity of labor demanded = L^*
- ◆ **Utility-maximization:**
 - $w = MRS$
 - quantity of output demanded = C^*
 - quantity of labor supplied = L^*

Utility-Maximization & Profit-Maximization

Coconuts

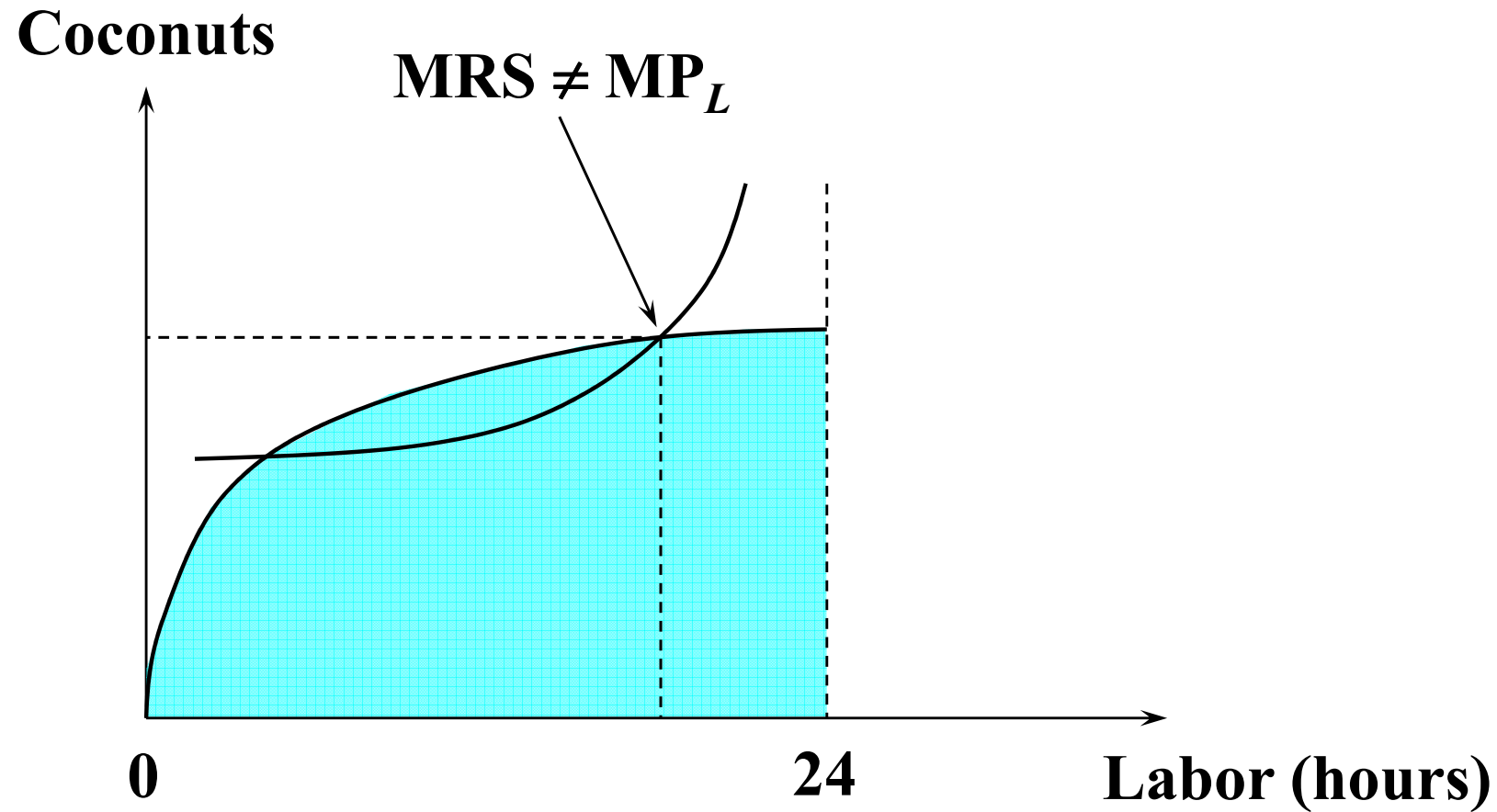


Given w , RC's quantity supplied of labor = quantity demanded of labor = L^* and output quantity demanded = output quantity supplied = C^* .

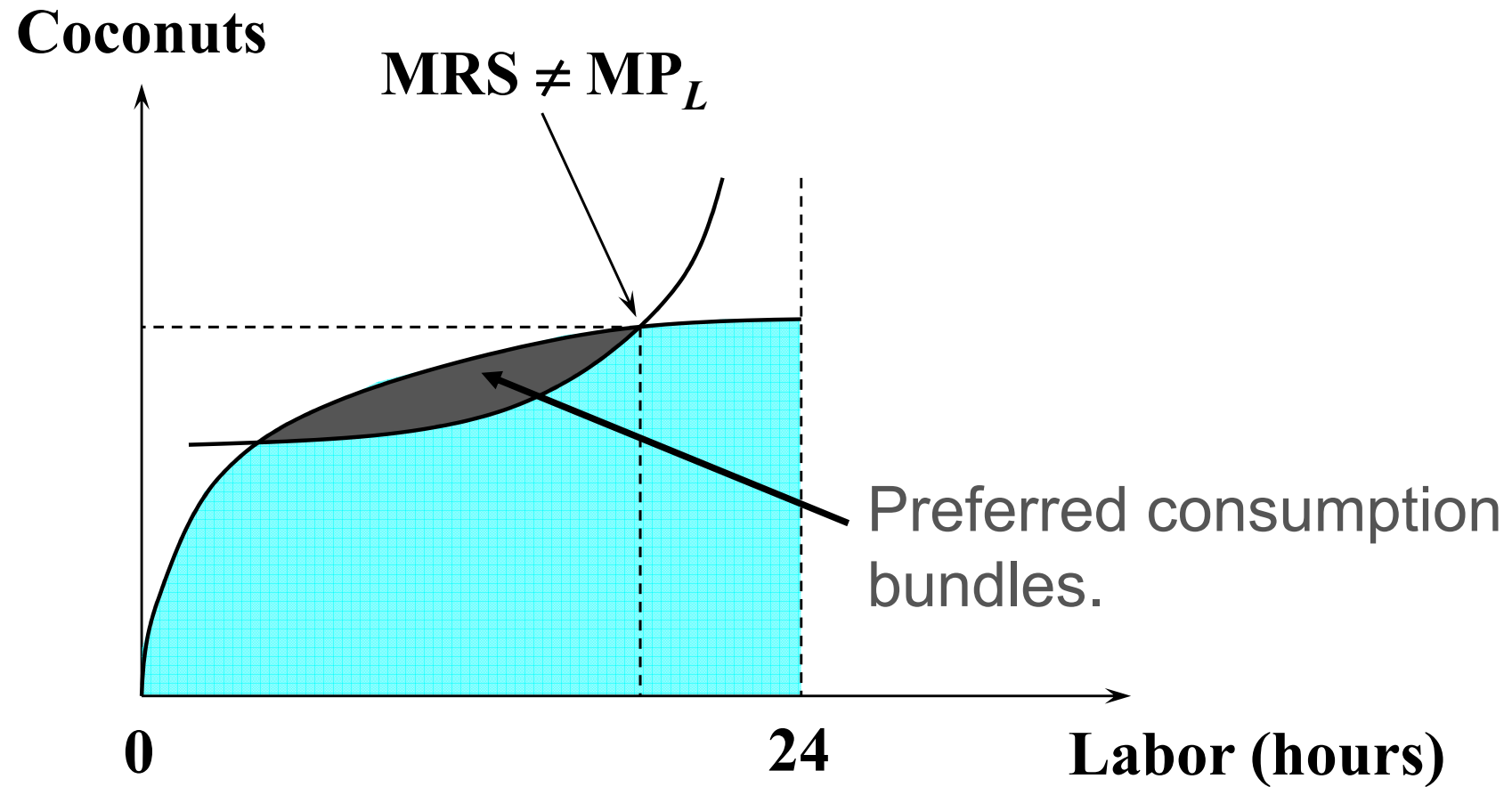
Pareto Efficiency

◆ **Must have $MRS = MP_L$.**

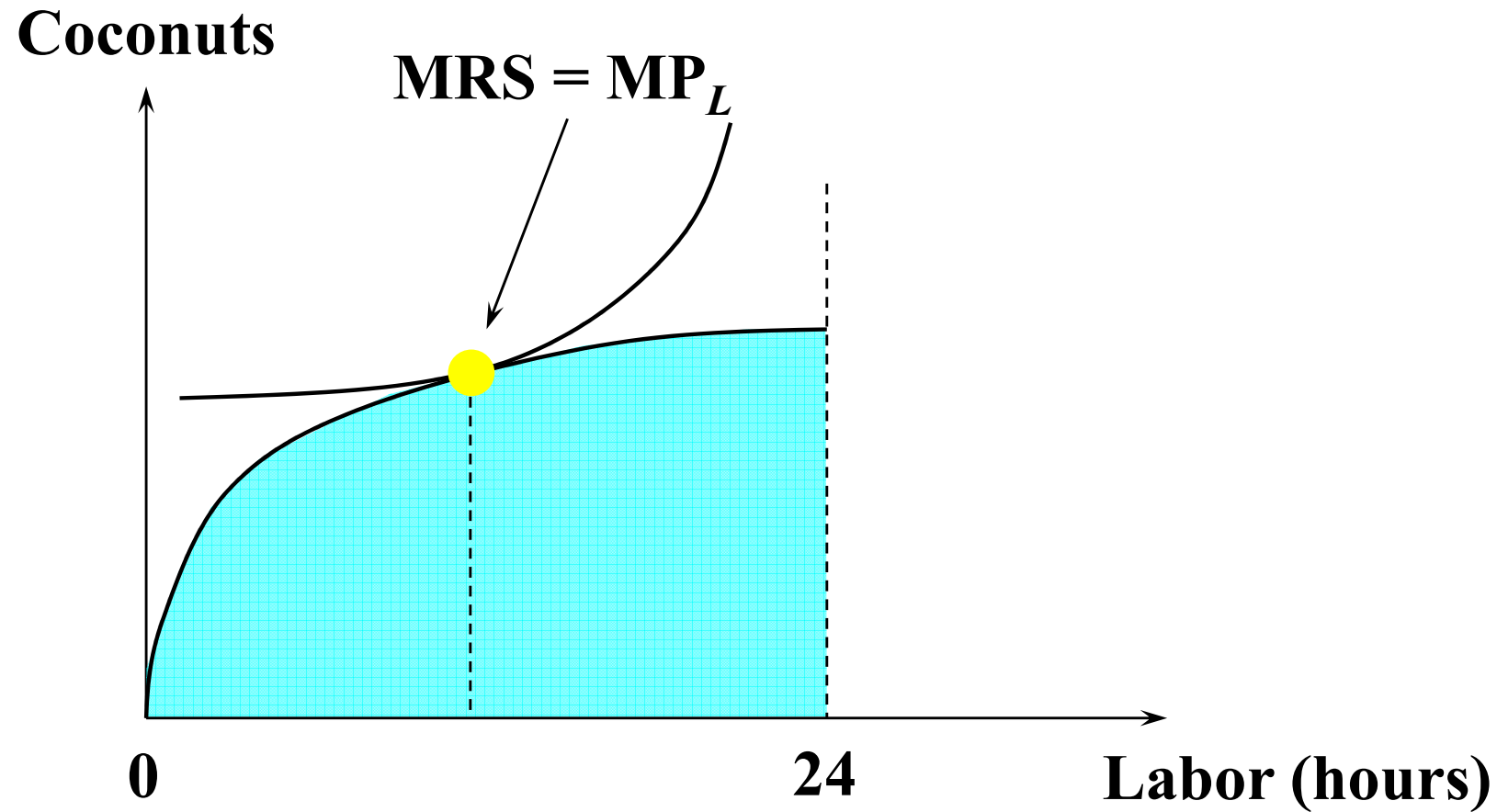
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Pareto Efficiency

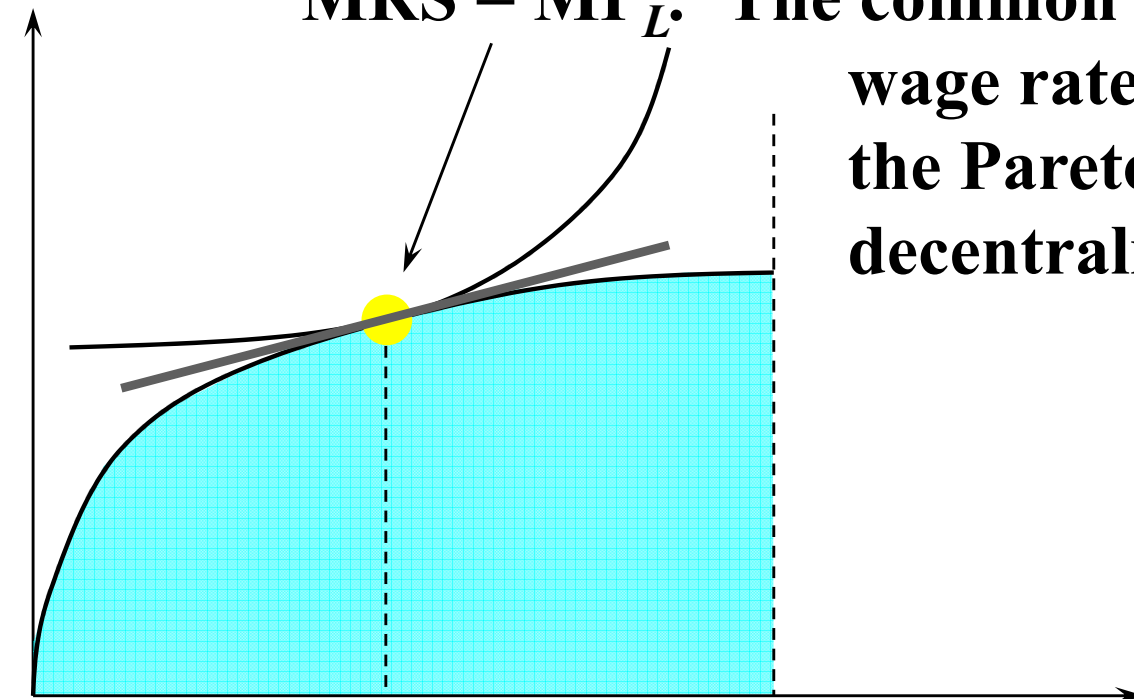


Pareto Efficiency



Pareto Efficiency

Coconuts



$MRS = MP_L$. The common slope \Rightarrow relative wage rate w that implements the Pareto efficient plan by decentralized pricing.

0

24

Labor (hours)

First Fundamental Theorem of Welfare Economics

- ◆ **A competitive market equilibrium is Pareto efficient if**
 - **consumers' preferences are convex**
 - **there are no externalities in consumption or production.**

Second Fundamental Theorem of Welfare Economics

- ◆ **Any Pareto efficient economic state can be achieved as a competitive market equilibrium if**
 - **consumers' preferences are convex**
 - **firms' technologies are convex**
 - **there are no externalities in consumption or production.**

Non-Convex Technologies

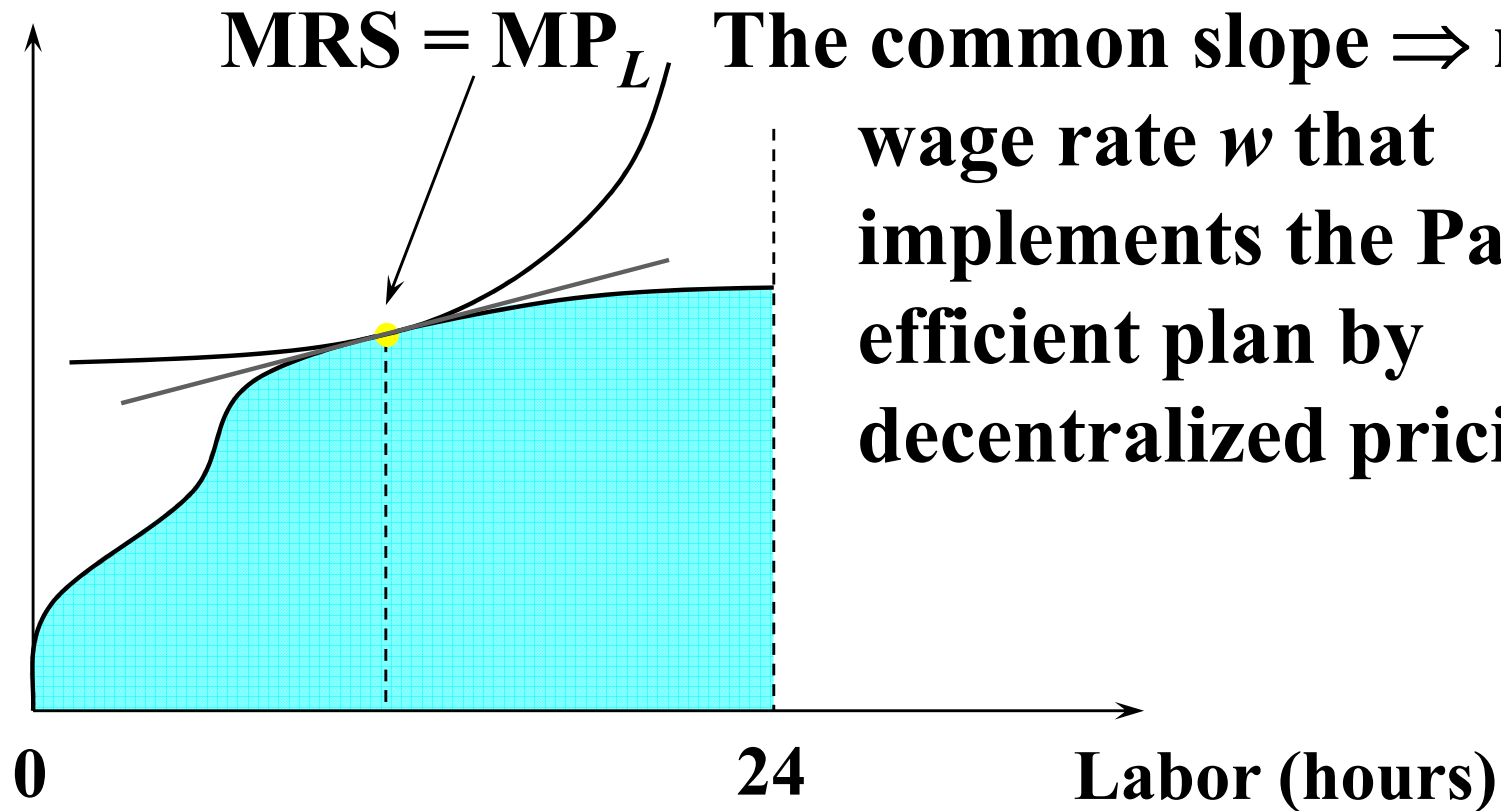
- ◆ **Do the Welfare Theorems hold if firms have non-convex technologies?**

Non-Convex Technologies

- ◆ **Do the Welfare Theorems hold if firms have non-convex technologies?**
- ◆ **The 1st Theorem does not rely upon firms' technologies being convex.**

Non-Convex Technologies

Coconuts

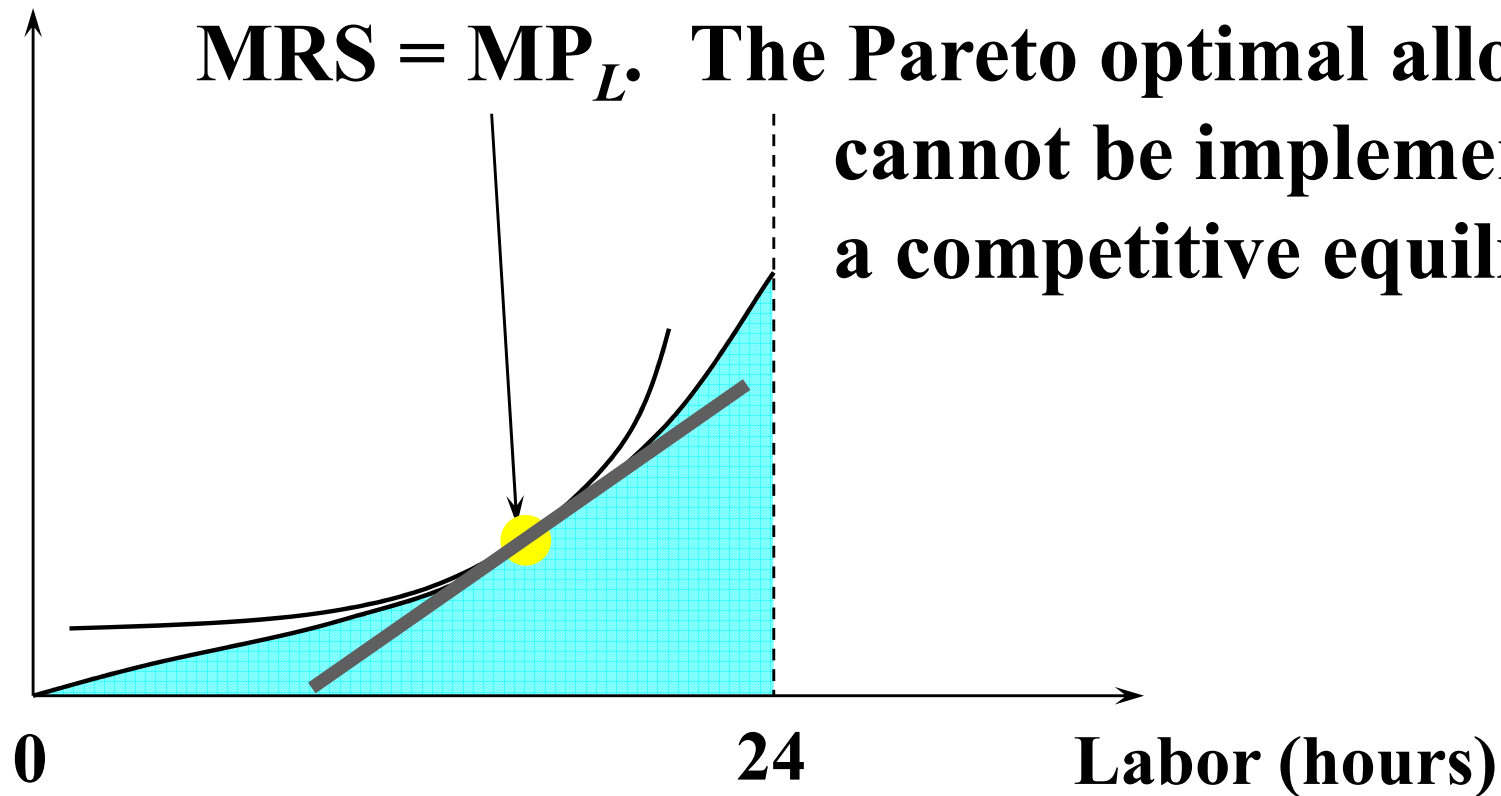


Non-Convex Technologies

- ◆ **Do the Welfare Theorems hold if firms have non-convex technologies?**
- ◆ **The 2nd Theorem does require that firms' technologies be convex.**

Non-Convex Technologies

Coconuts

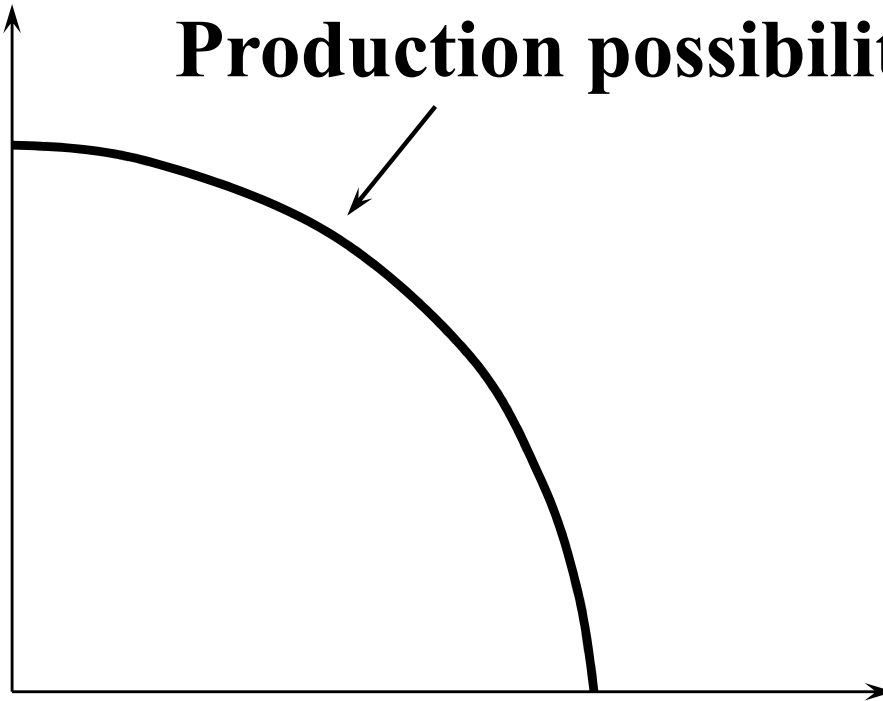


Production Possibilities

- ◆ **Resource and technological limitations restrict what an economy can produce.**
- ◆ **The set of all feasible output bundles is the economy's production possibility set.**
- ◆ **The set's outer boundary is the production possibility frontier.**

Production Possibilities

Coconuts

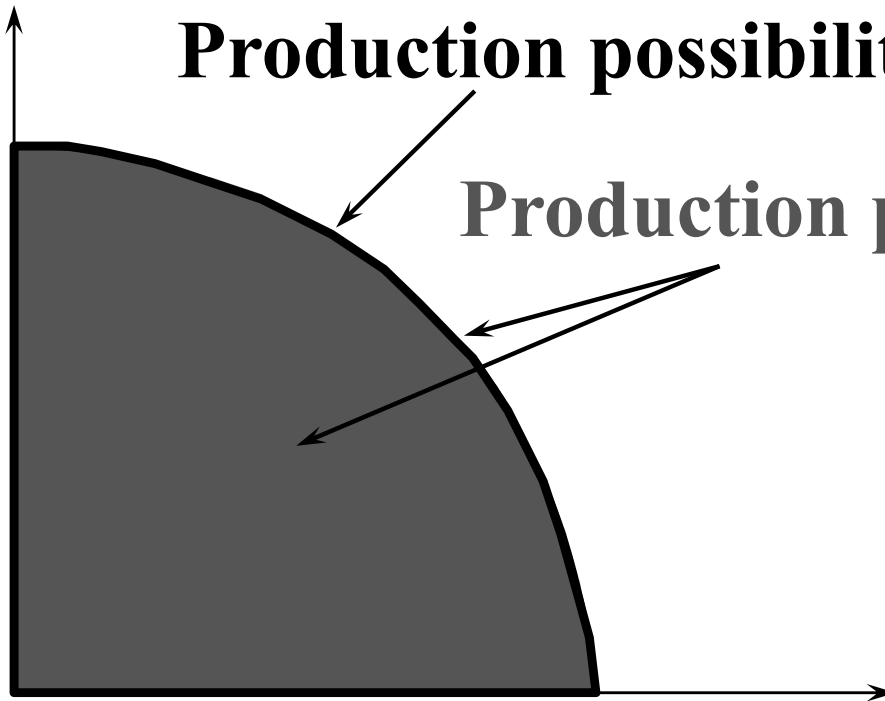


Production possibility frontier (ppf)

Fish

Production Possibilities

Coconuts



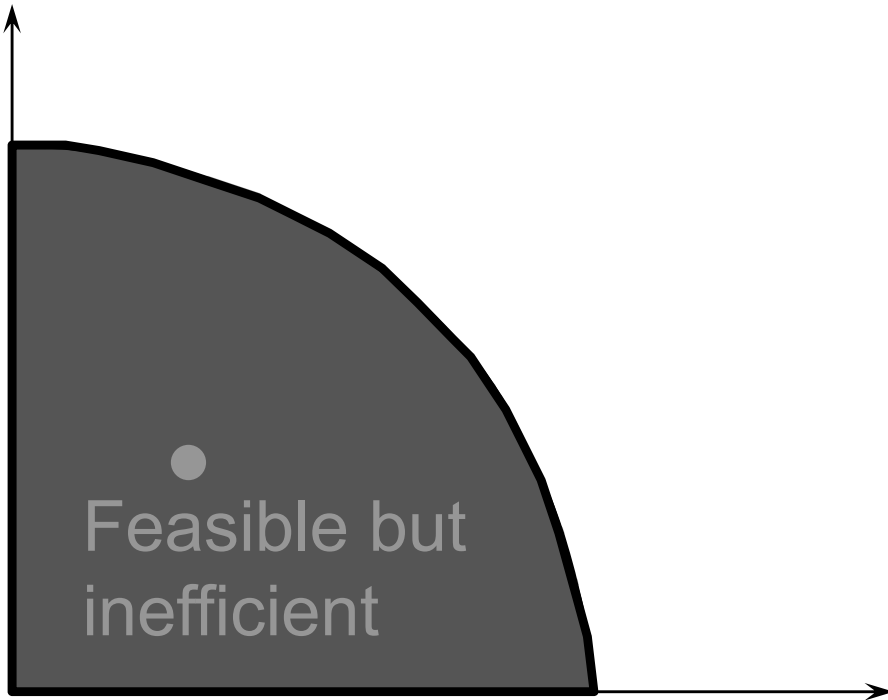
Production possibility frontier (ppf)

Production possibility set

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Production Possibilities

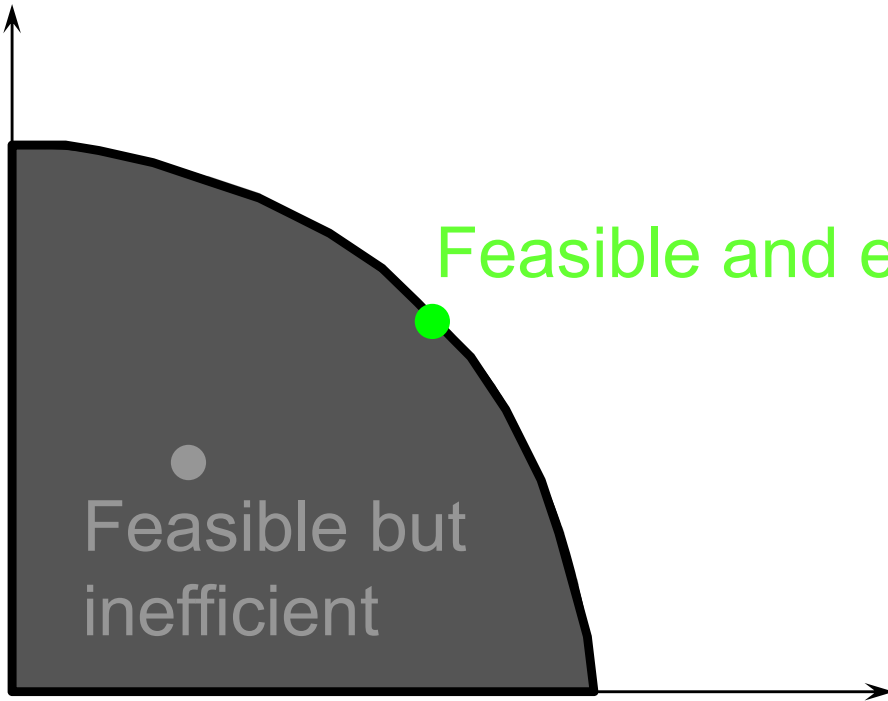
Coconuts



Fish

Production Possibilities

Coconuts



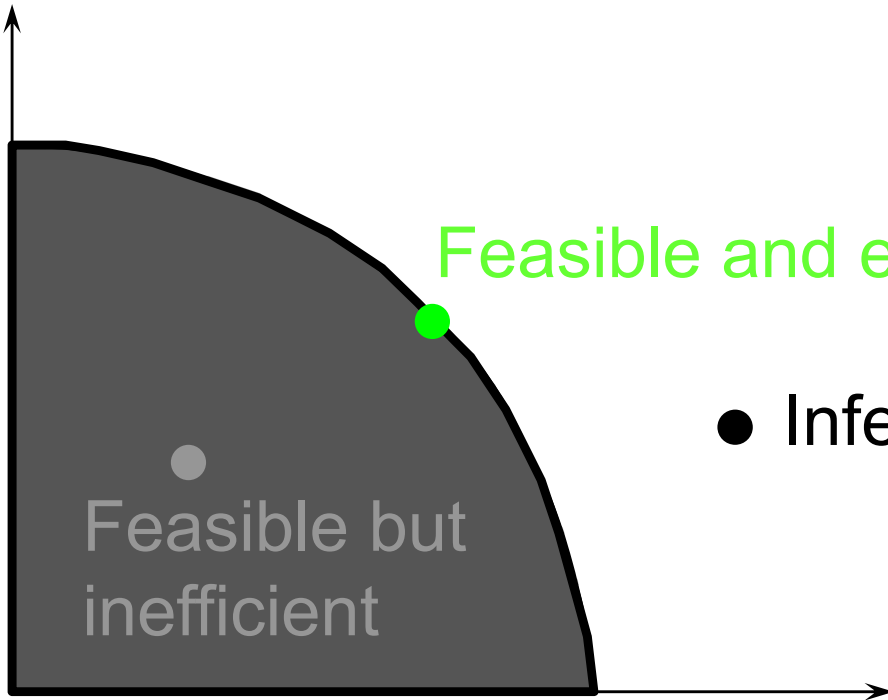
Feasible and efficient

Feasible but
inefficient

Fish

Production Possibilities

Coconuts



Feasible and efficient

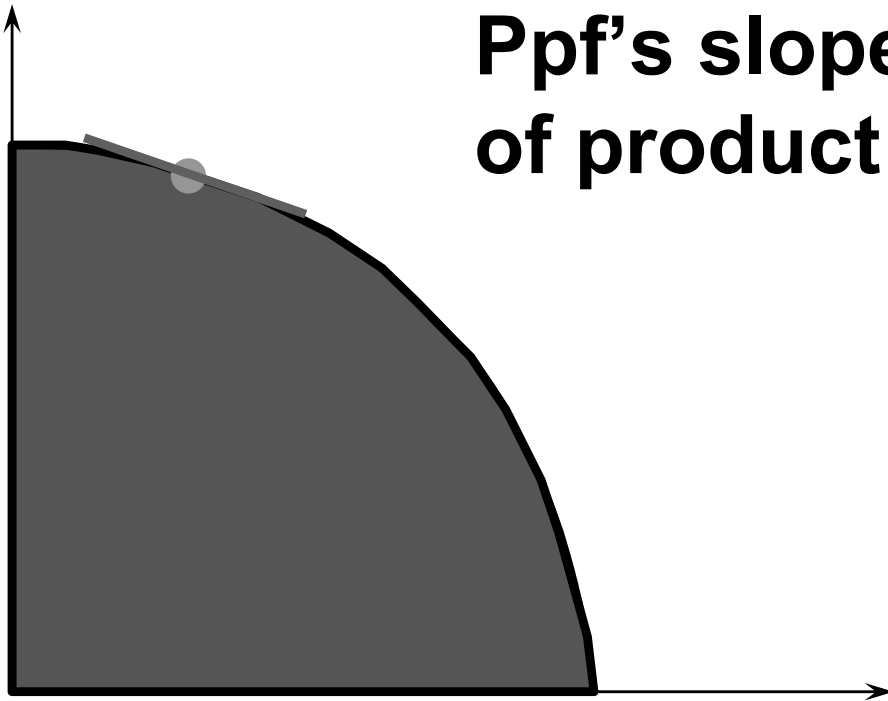
● Infeasible

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Production Possibilities

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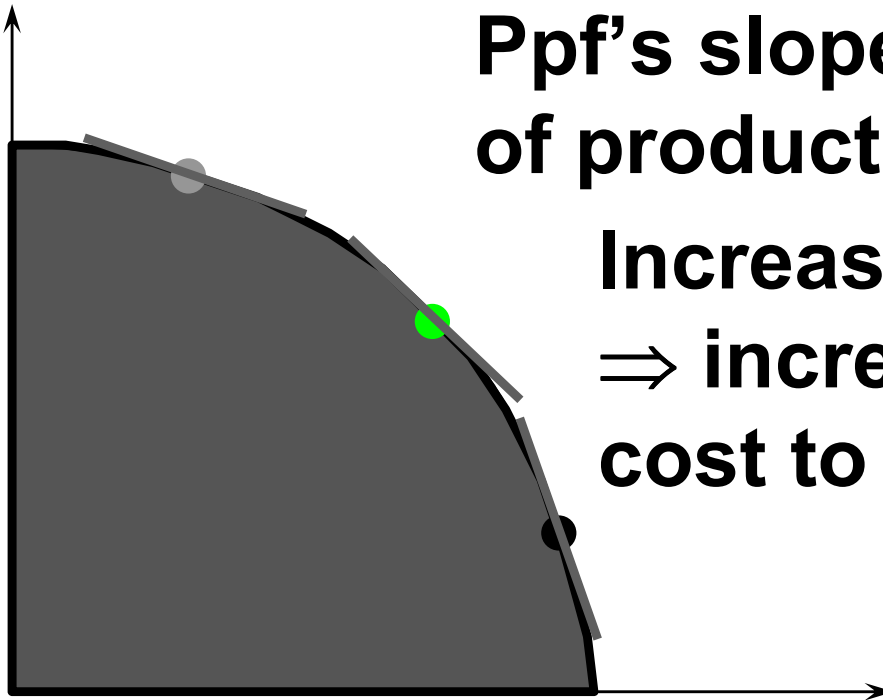


Ppf's slope is the marginal rate of product transformation.

Fish

Production Possibilities

Coconuts



Ppf's slope is the marginal rate of product transformation.

**Increasingly negative MRPT
⇒ increasing opportunity
cost to specialization.**

Fish

Production Possibilities

- ◆ **If there are no production externalities then a ppf will be concave w.r.t. the origin.**
- ◆ **Why?**

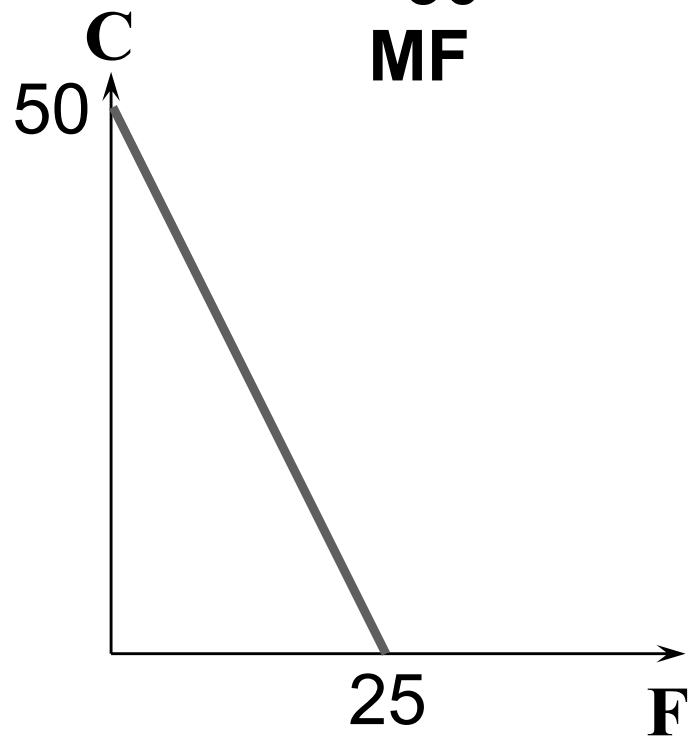
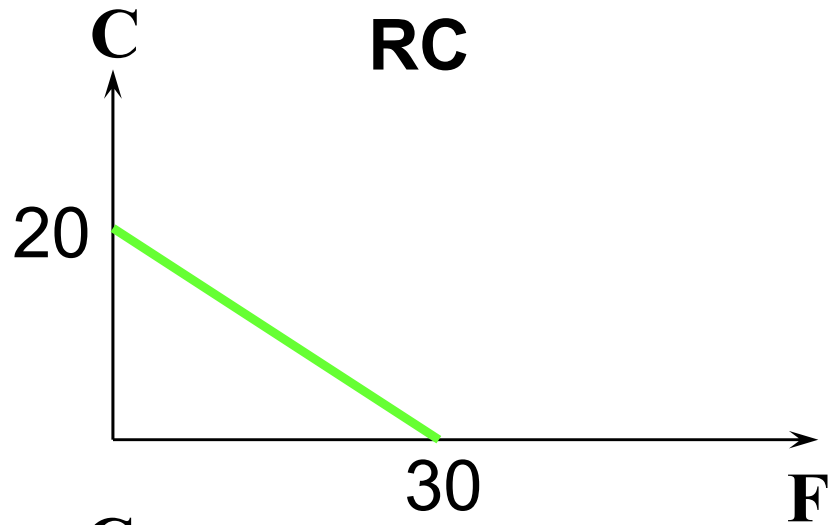
Production Possibilities

- ◆ **If there are no production externalities then a ppf will be concave w.r.t. the origin.**
- ◆ **Why?**
- ◆ **Because efficient production requires exploitation of comparative advantages.**

Comparative Advantage

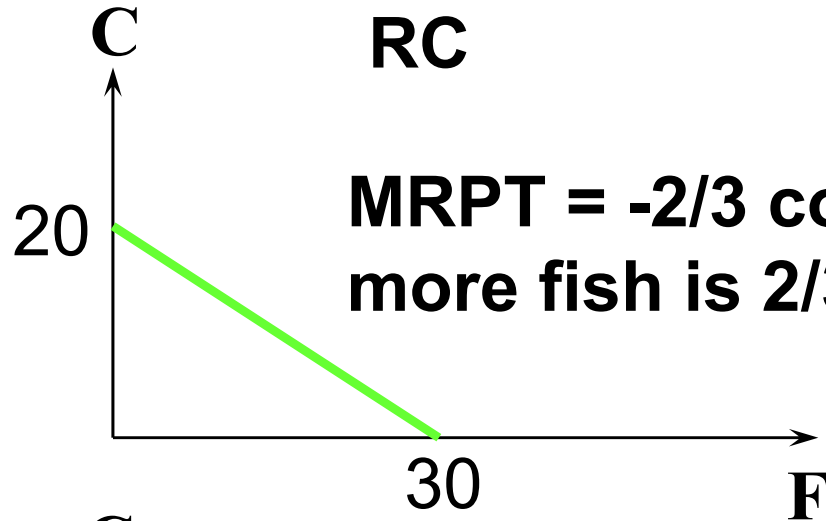
- ◆ **Two agents, RC and Man Friday (MF).**
- ◆ **RC can produce at most 20 coconuts or 30 fish.**
- ◆ **MF can produce at most 50 coconuts or 25 fish.**

Comparative Advantage

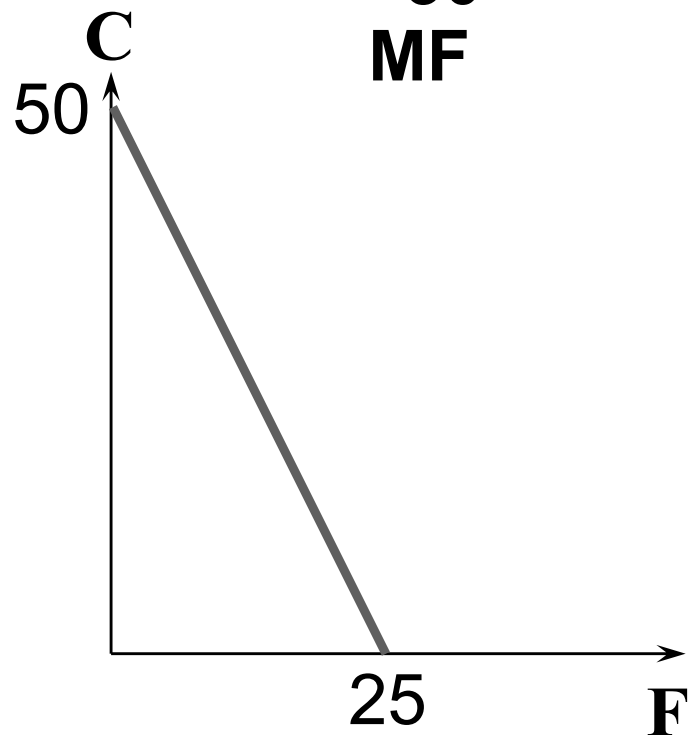


Comparative Advantage

RC

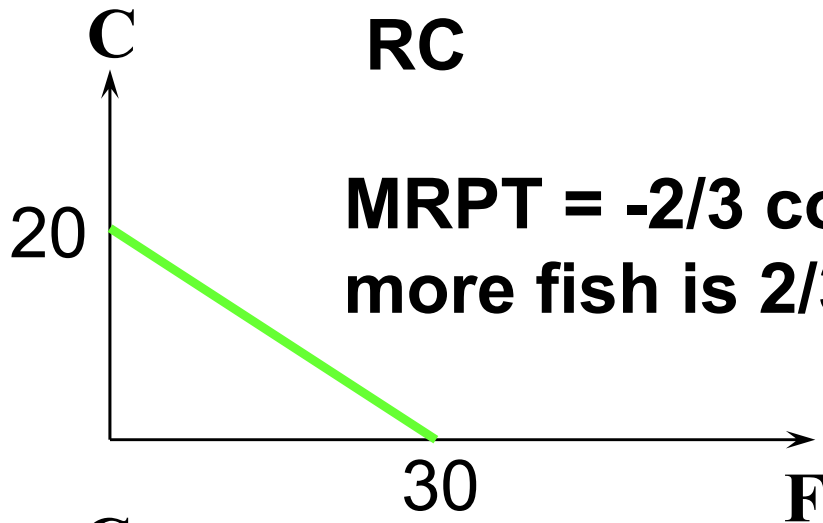


MRPT = $-\frac{2}{3}$ coconuts/fish so opp. cost of one more fish is $\frac{2}{3}$ foregone coconuts.



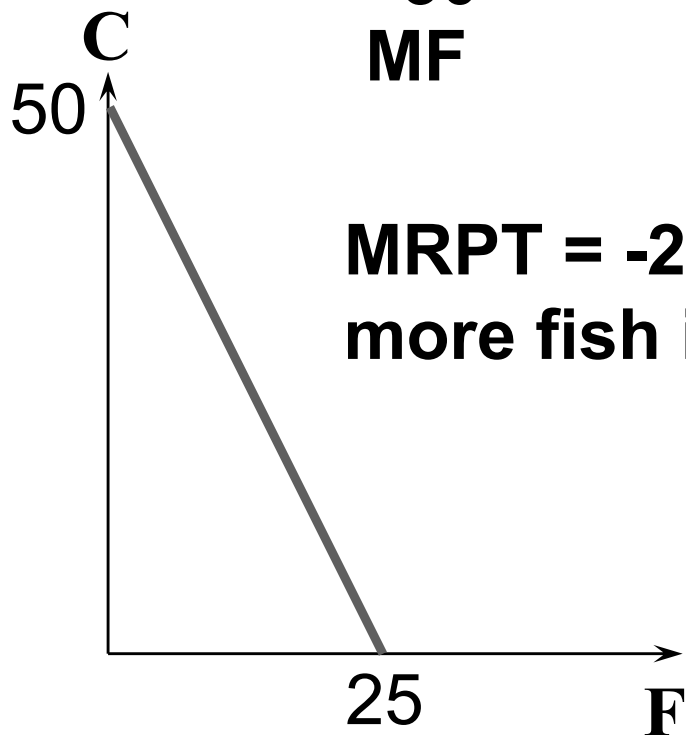
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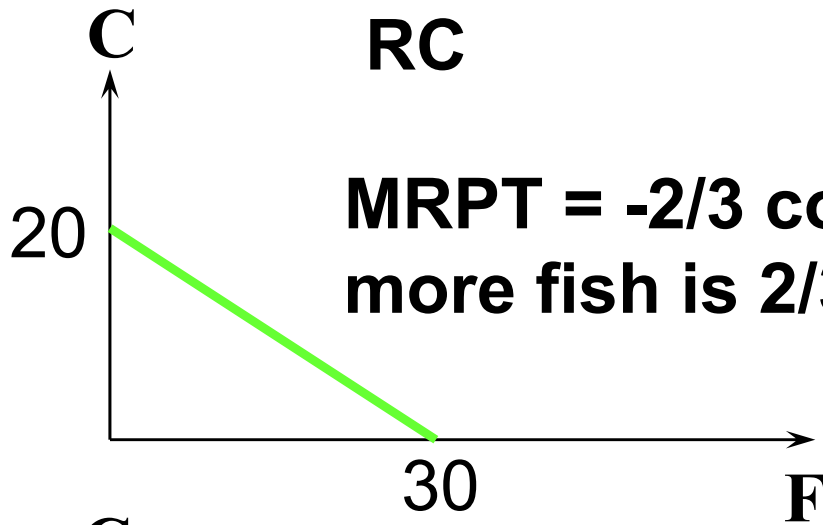
MF



MRPT = -2 coconuts/fish so opp. cost of one more fish is 2 foregone coconuts.

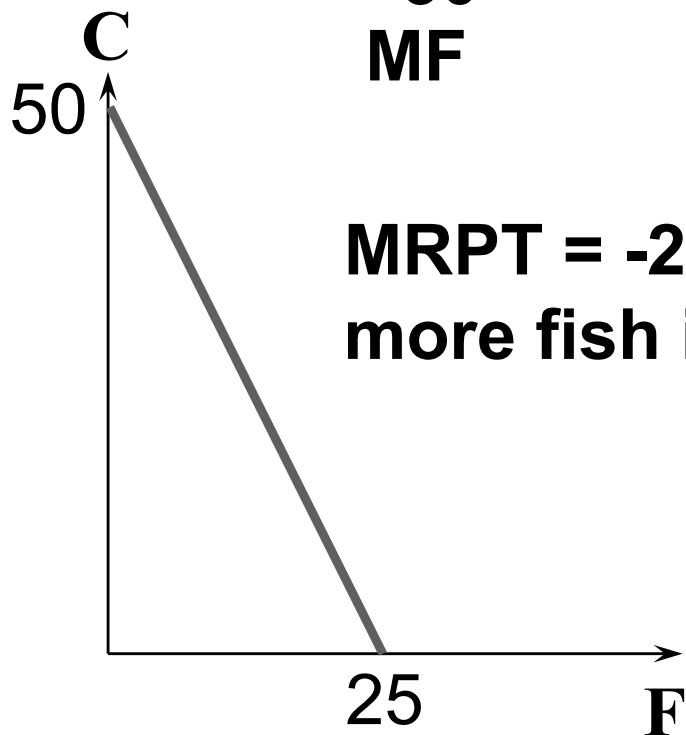
Comparative Advantage

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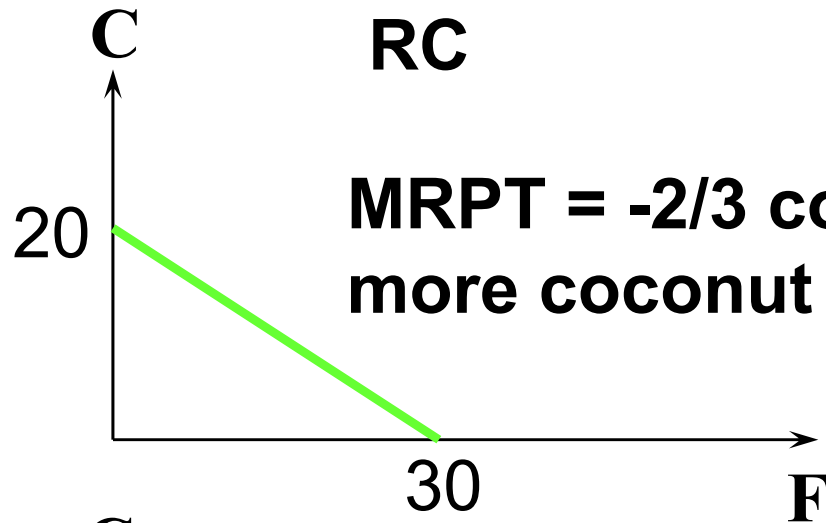
RC has the comparative opp. cost advantage in producing fish.



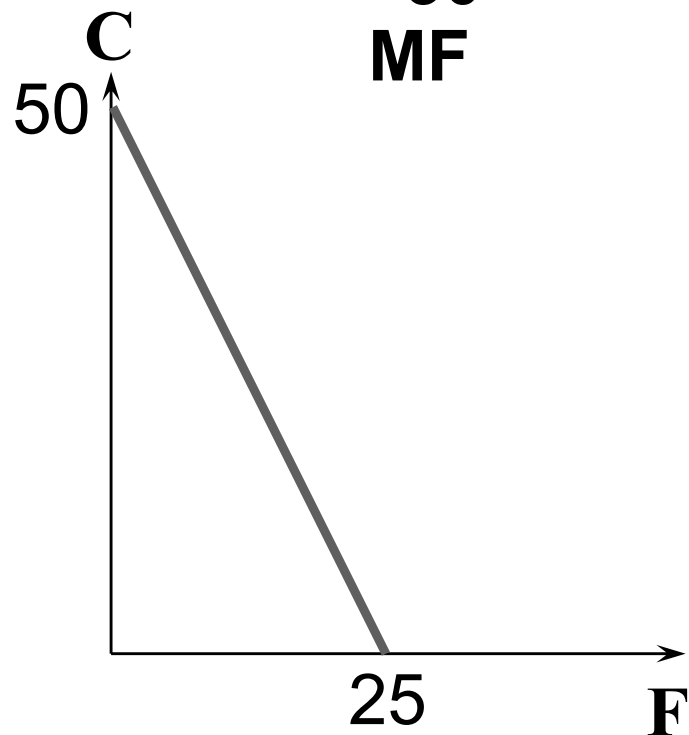
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Comparative Advantage

RC

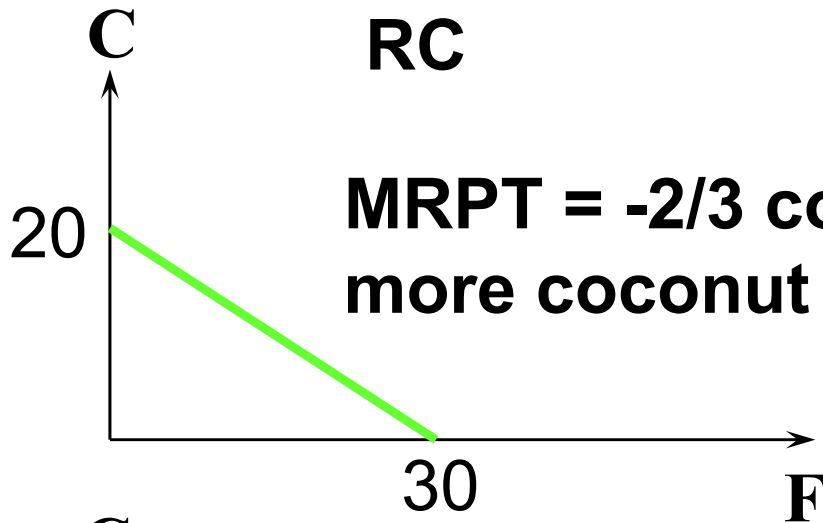


MRPT = $-\frac{2}{3}$ coconuts/fish so opp. cost of one more coconut is $\frac{3}{2}$ foregone fish.



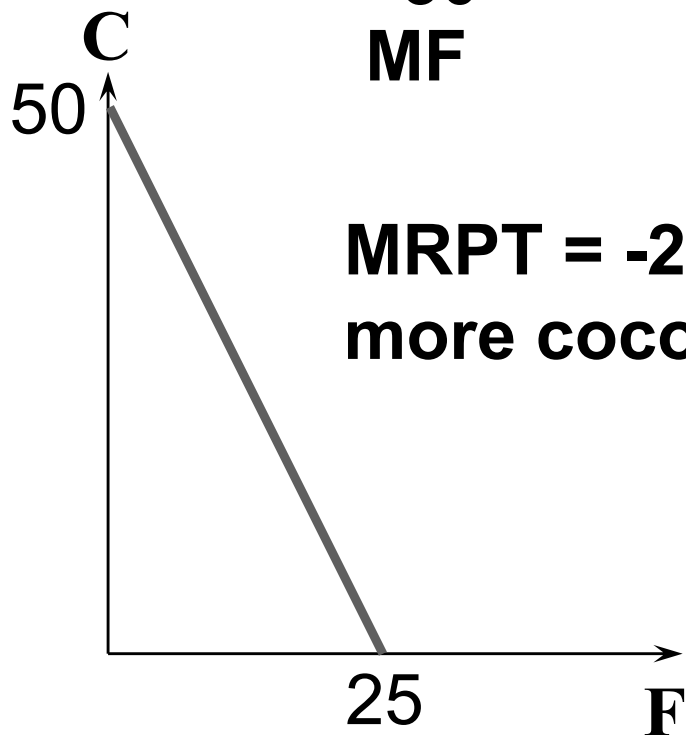
Comparative Advantage

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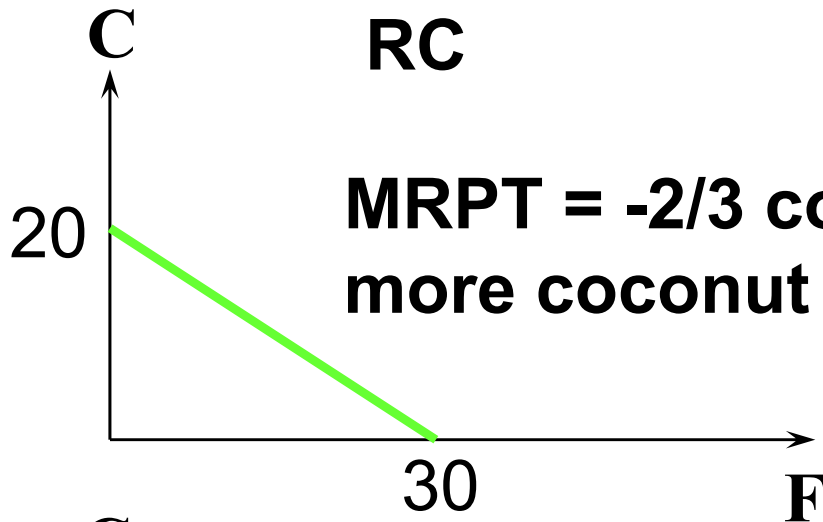
MF



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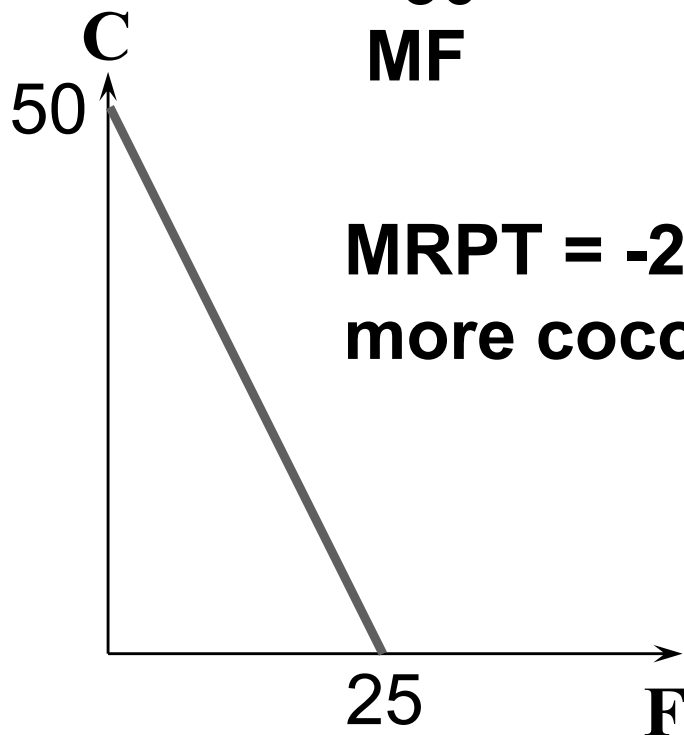
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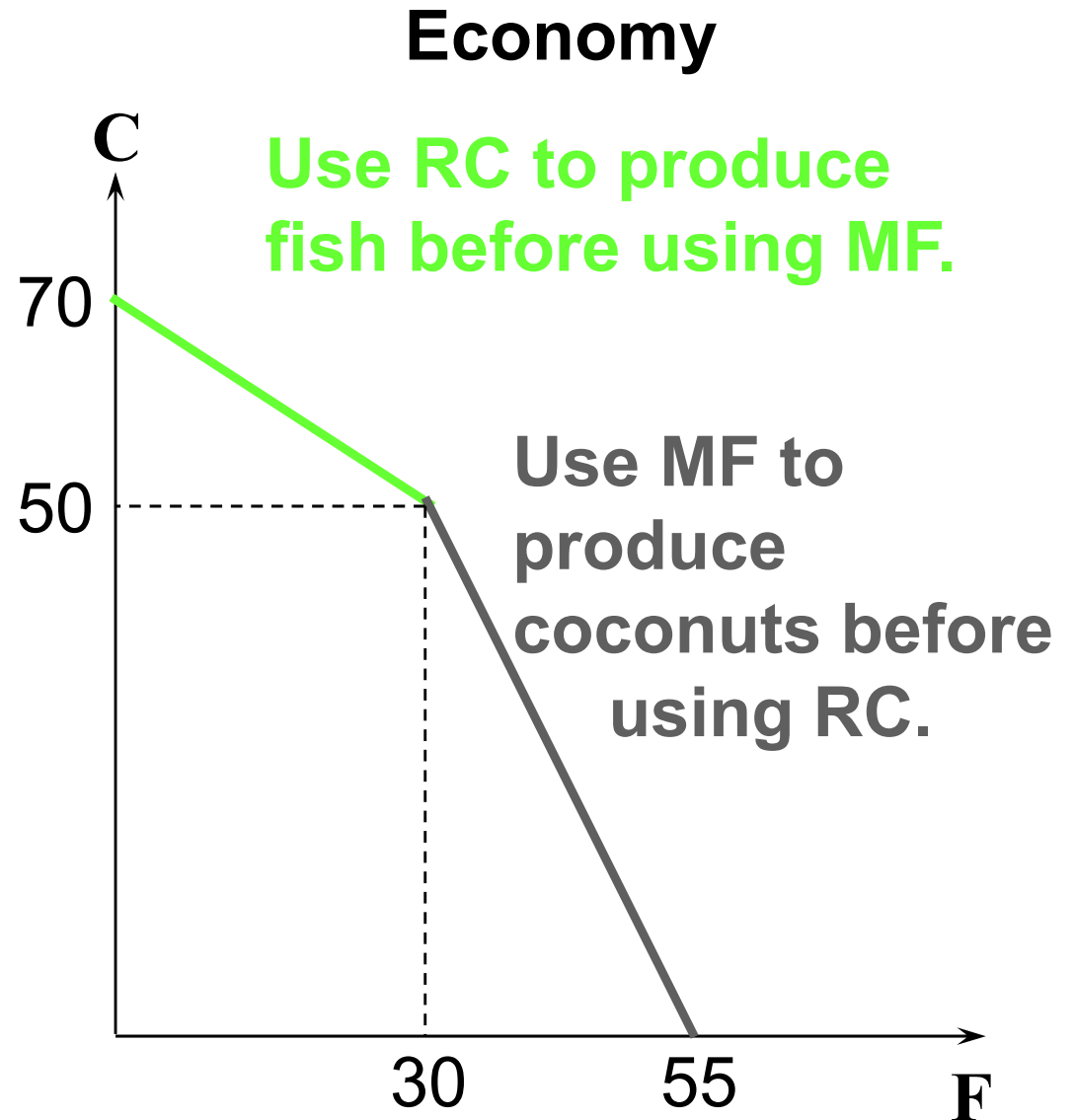
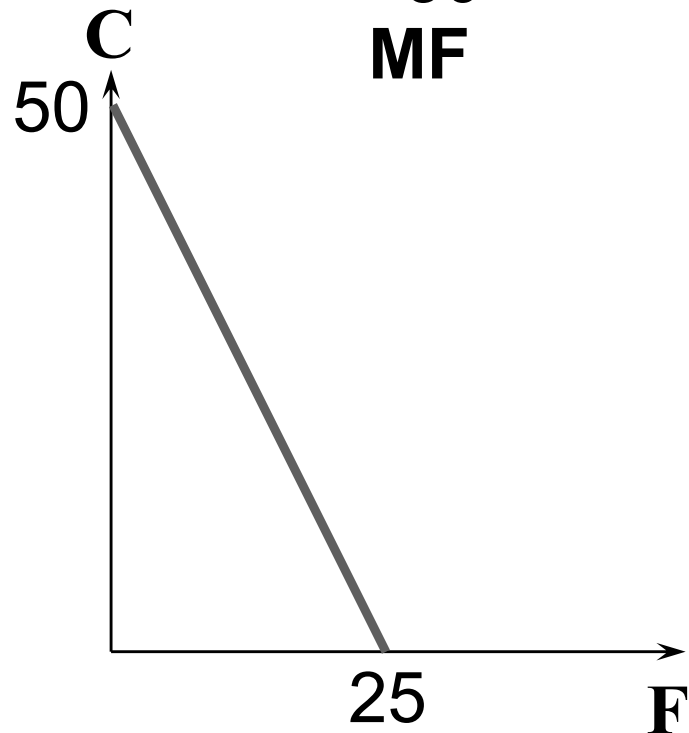
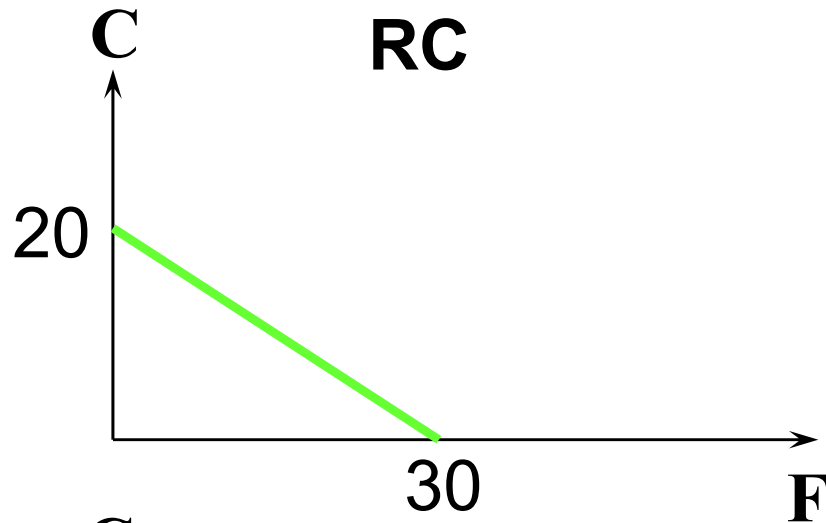
MF



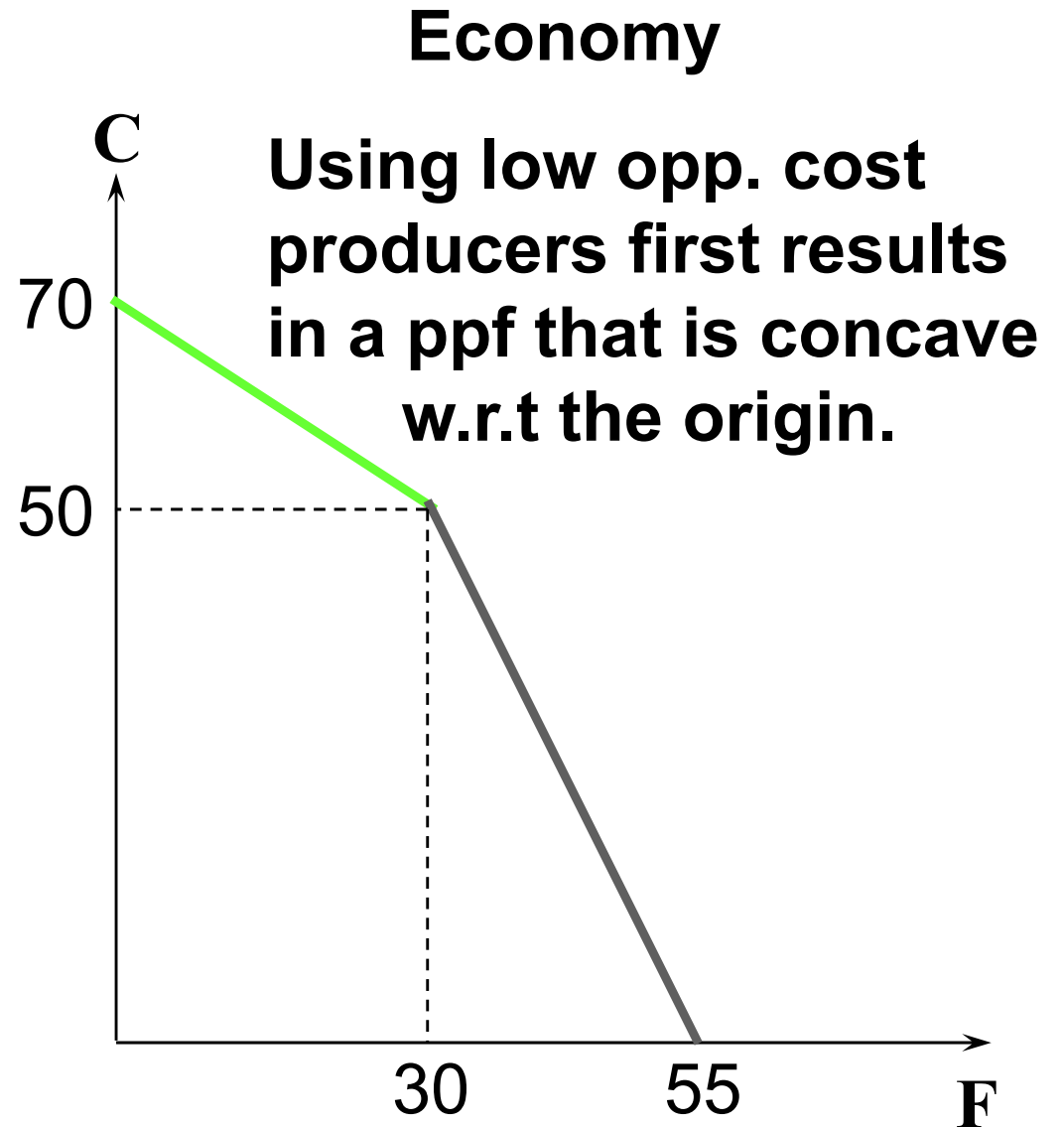
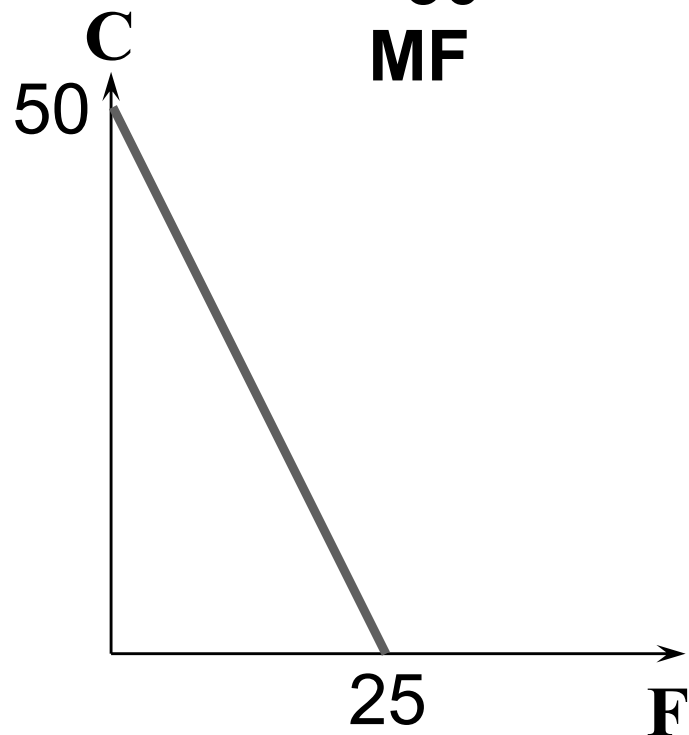
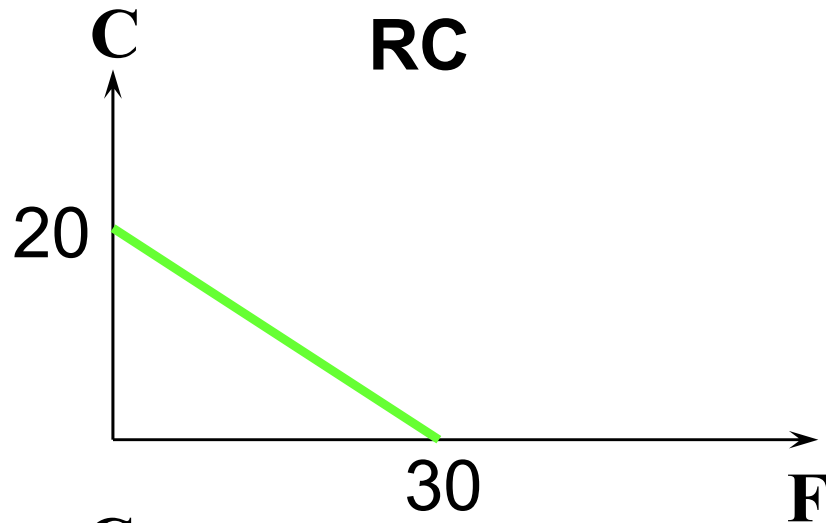
MRPT = -2 coconuts/fish so opp. cost of one more coconut is $\frac{1}{2}$ foregone fish.

MF has the comparative opp. cost advantage in producing coconuts.

Comparative Advantage



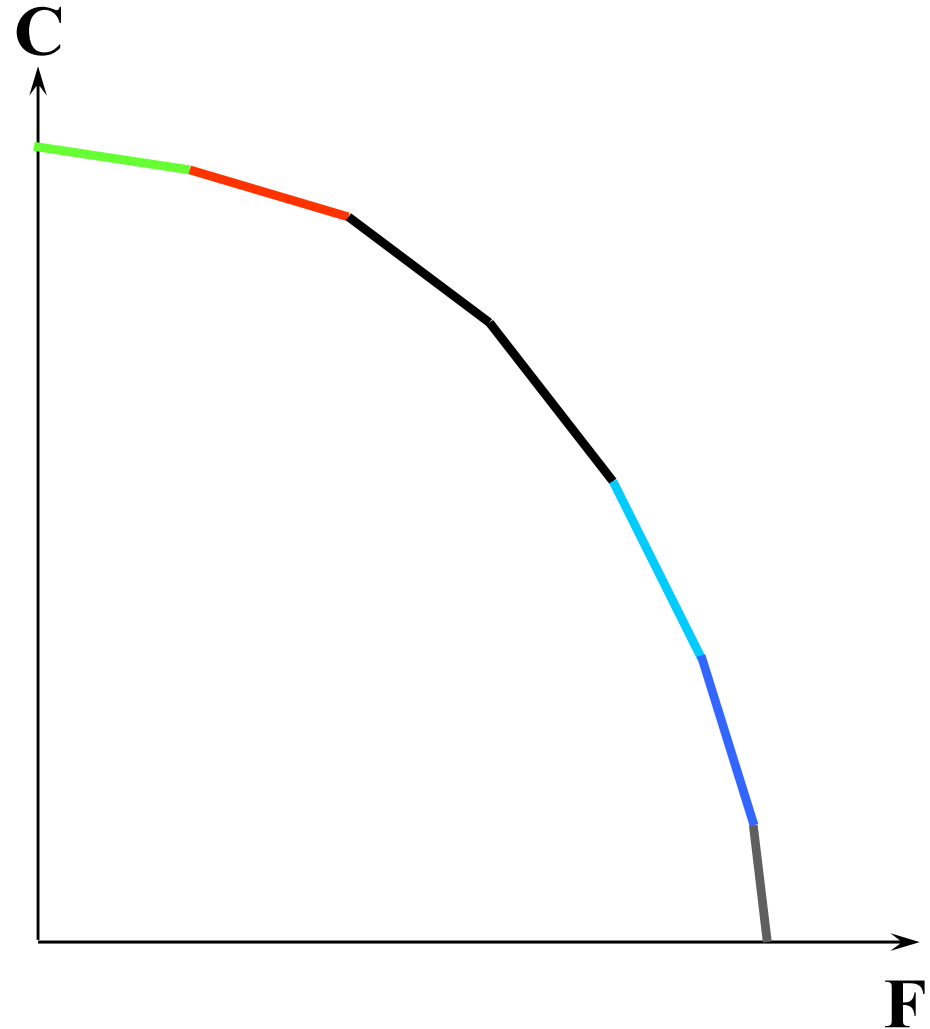
Comparative Advantage



Comparative Advantage

Economy

**More producers with
different opp. costs
“smooth out” the ppf.**



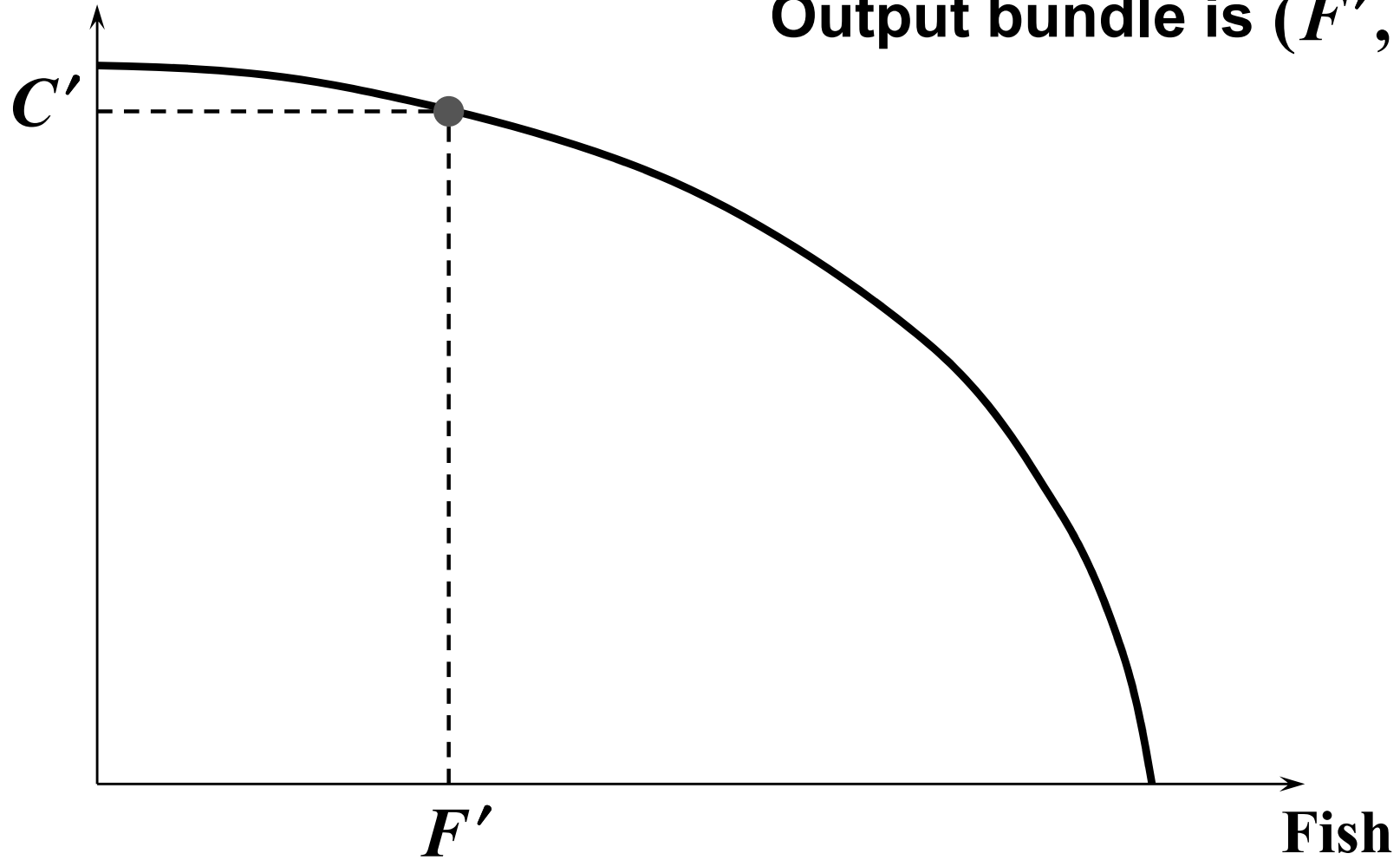
Coordinating Production & Consumption

- ◆ **The ppf contains many technically efficient output bundles.**
- ◆ **Which are Pareto efficient for consumers?**

Coordinating Production & Consumption

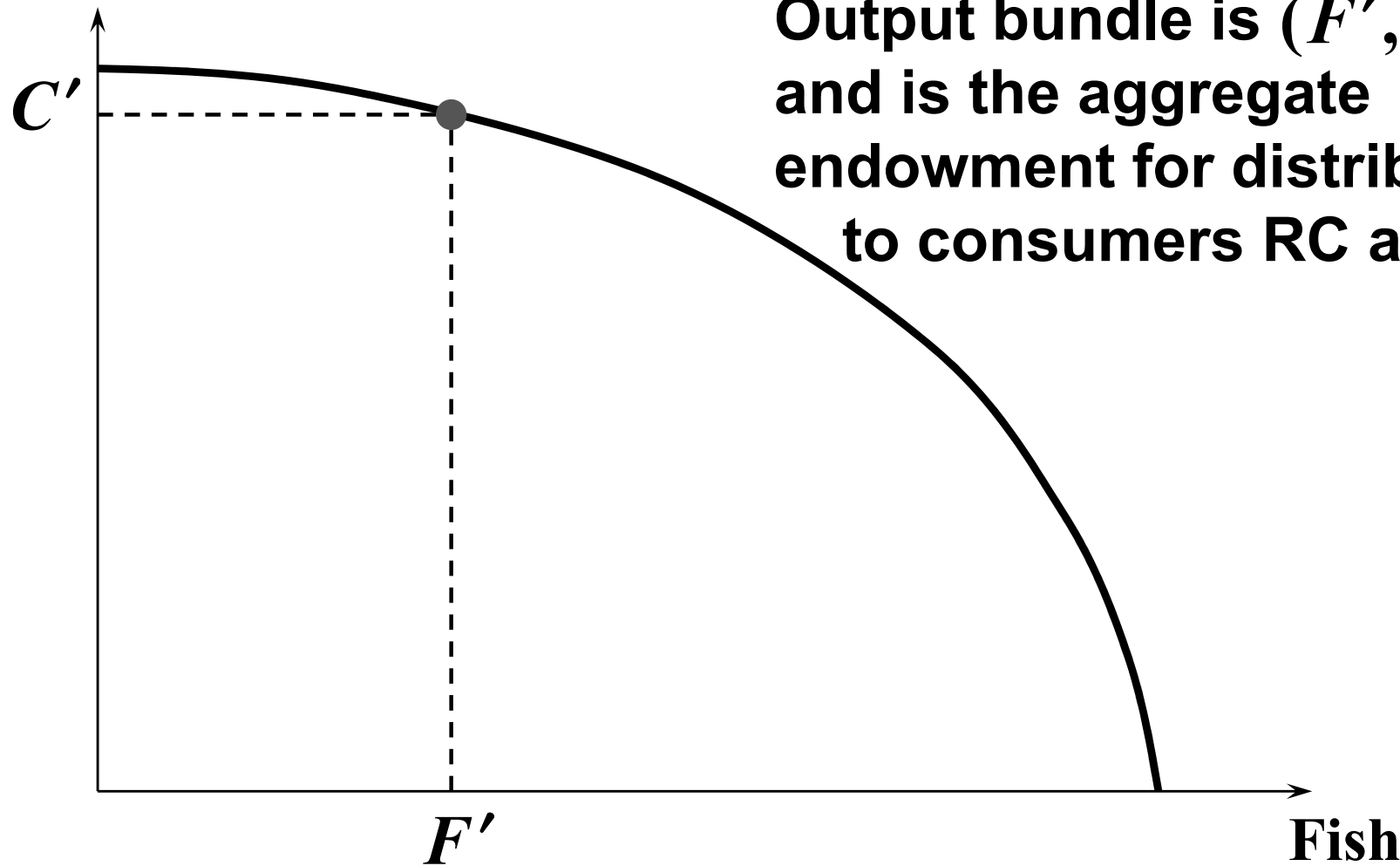
Coconuts

Output bundle is (F', C')



Coordinating Production & Consumption

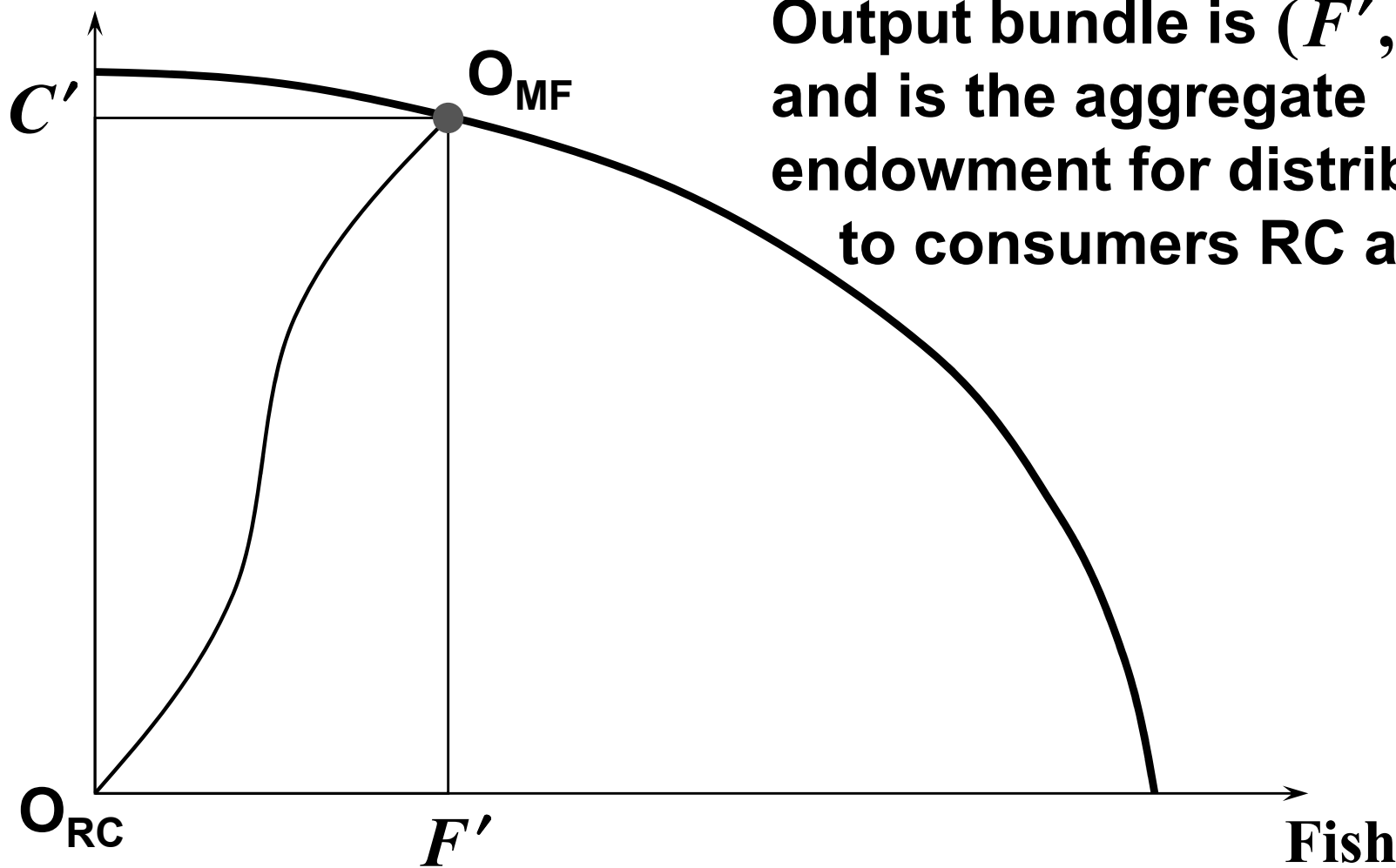
Coconuts



**Output bundle is (F', C')
and is the aggregate
endowment for distribution
to consumers RC and MF.**

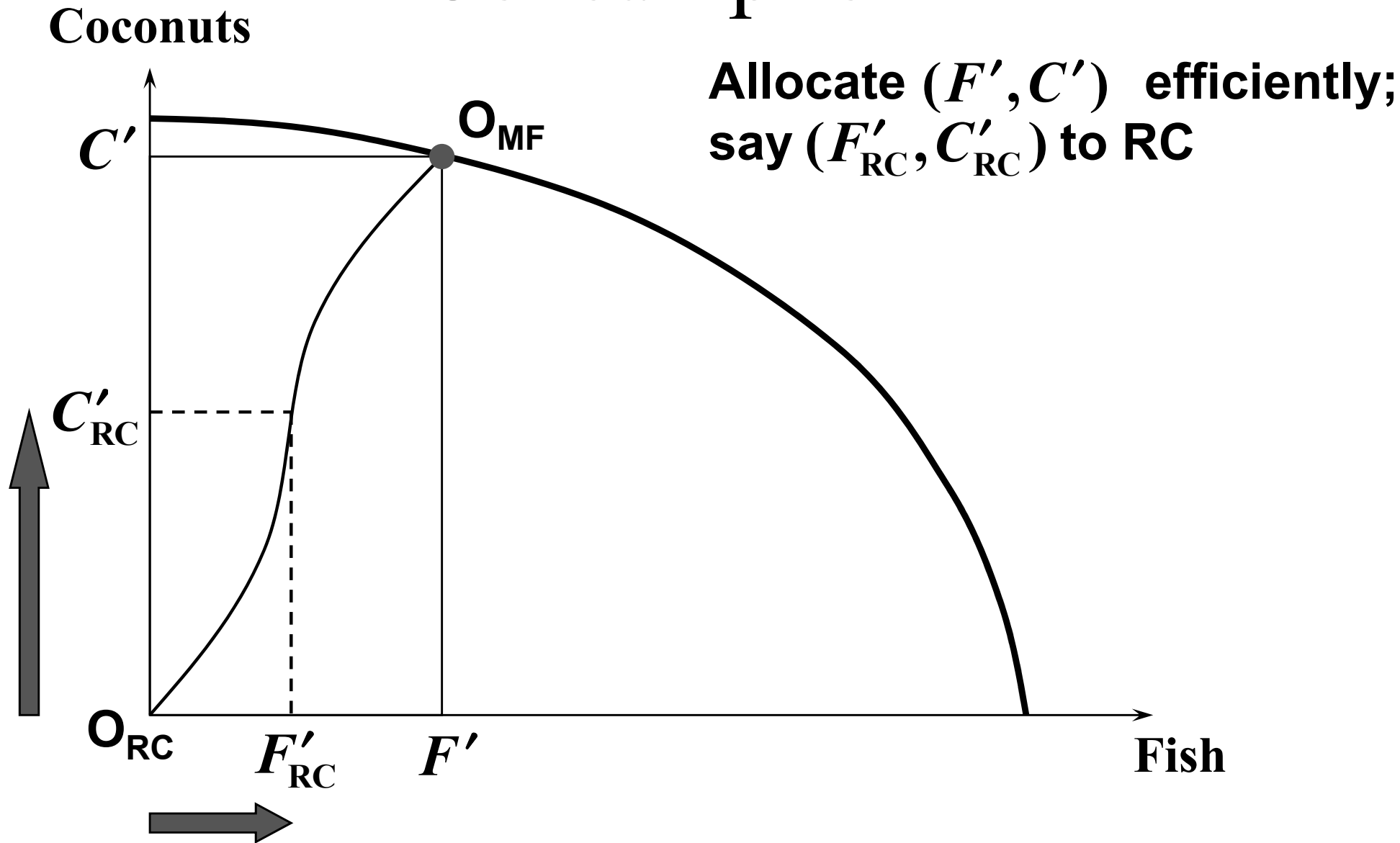
Coordinating Production & Consumption

Coconuts

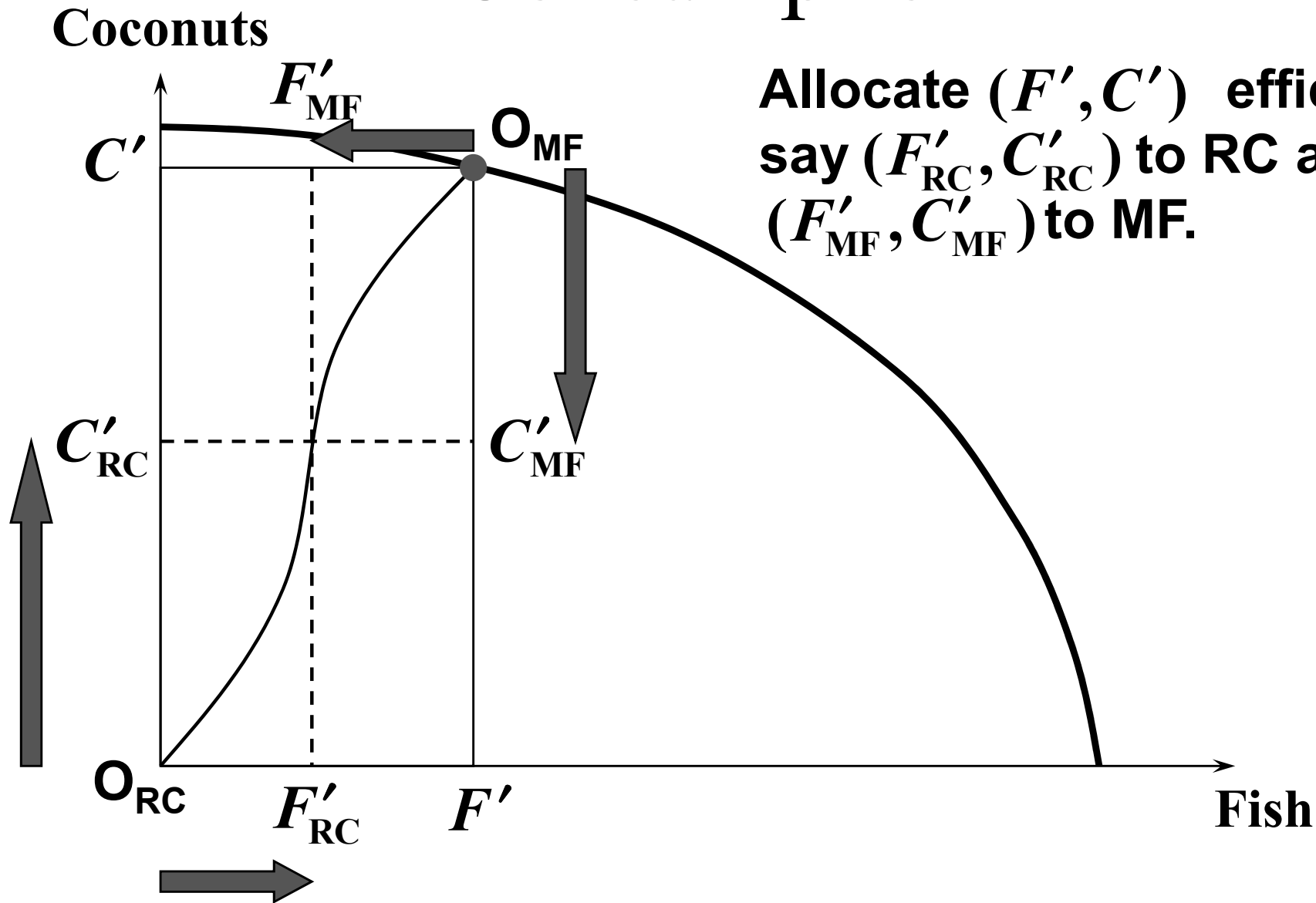


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Coordinating Production & Consumption



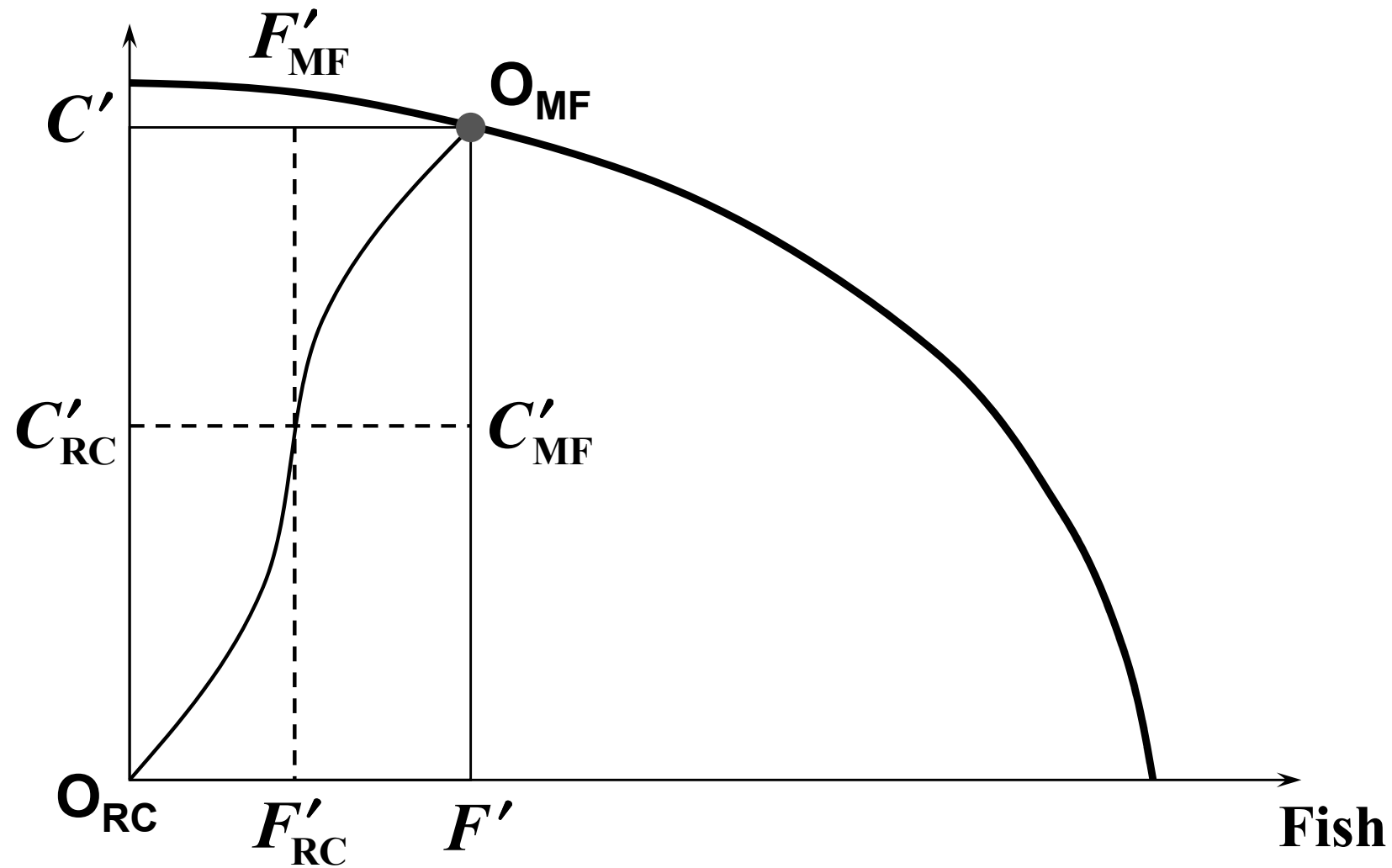
Coordinating Production & Consumption



**Allocate (F', C') efficiently;
say (F'_{RC}, C'_{RC}) to RC and
 (F'_{MF}, C'_{MF}) to MF.**

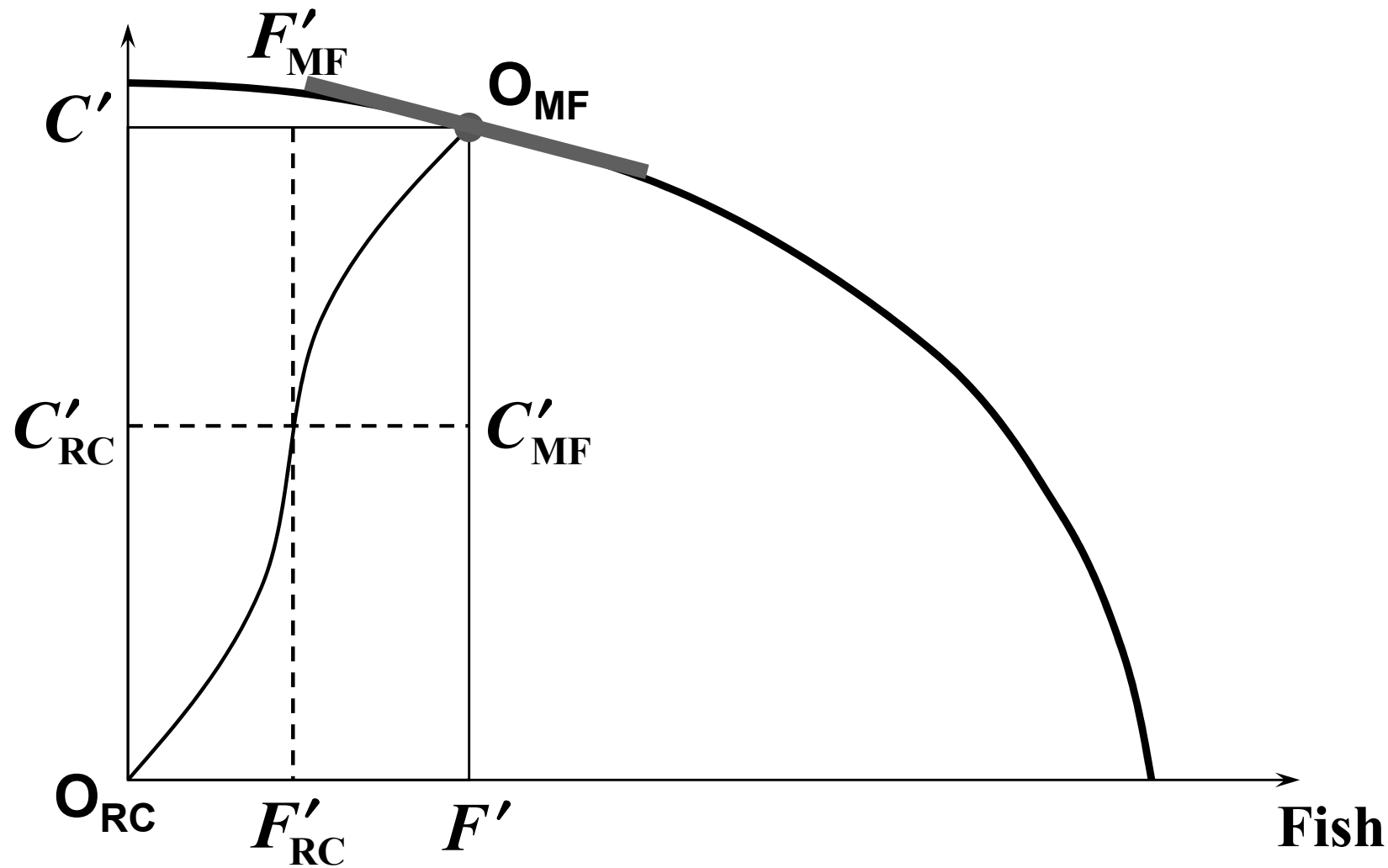
Coordinating Production & Consumption

Coconuts



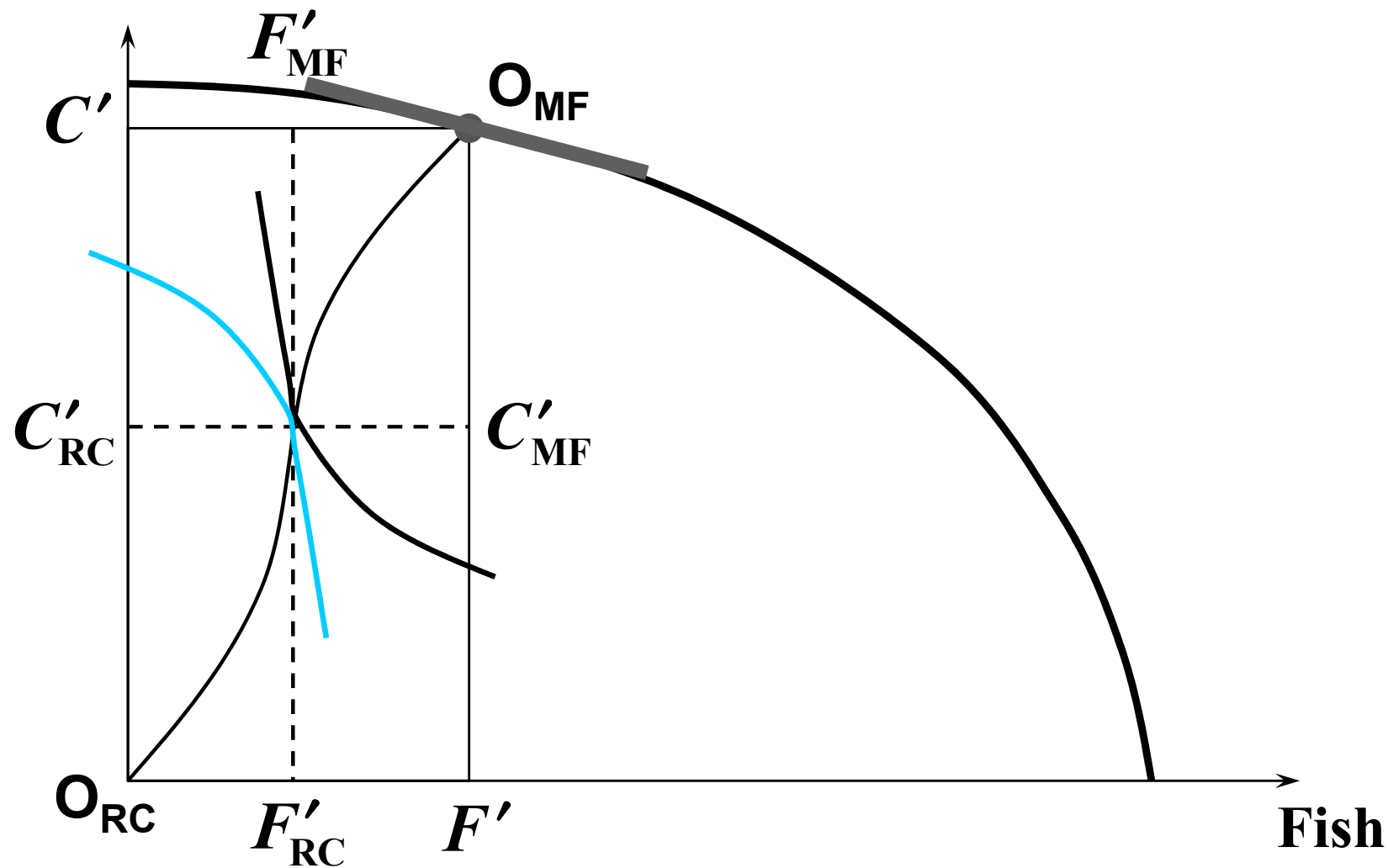
Coordinating Production & Consumption

Coconuts



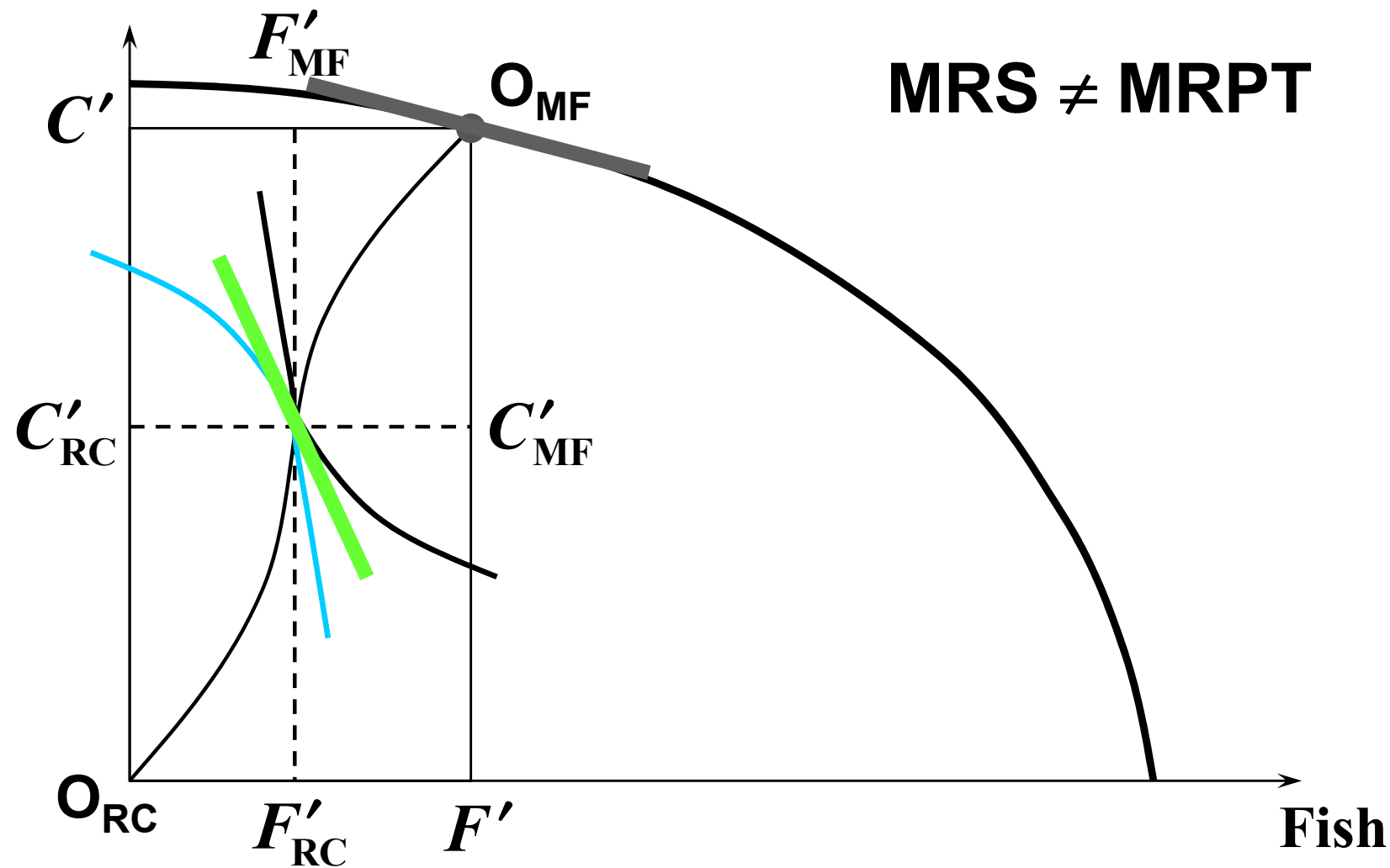
Coordinating Production & Consumption

Coconuts



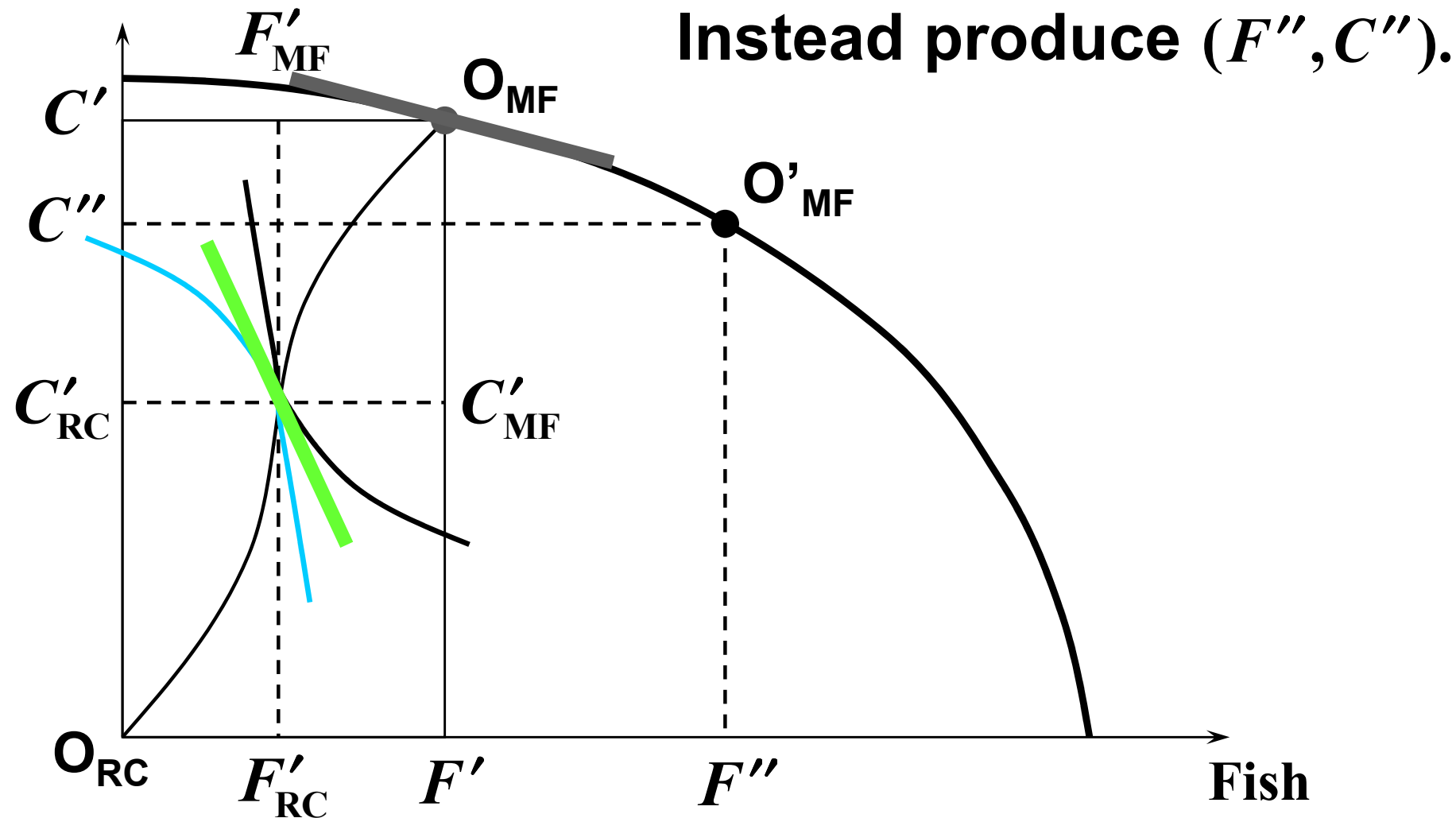
Coordinating Production & Consumption

Coconuts



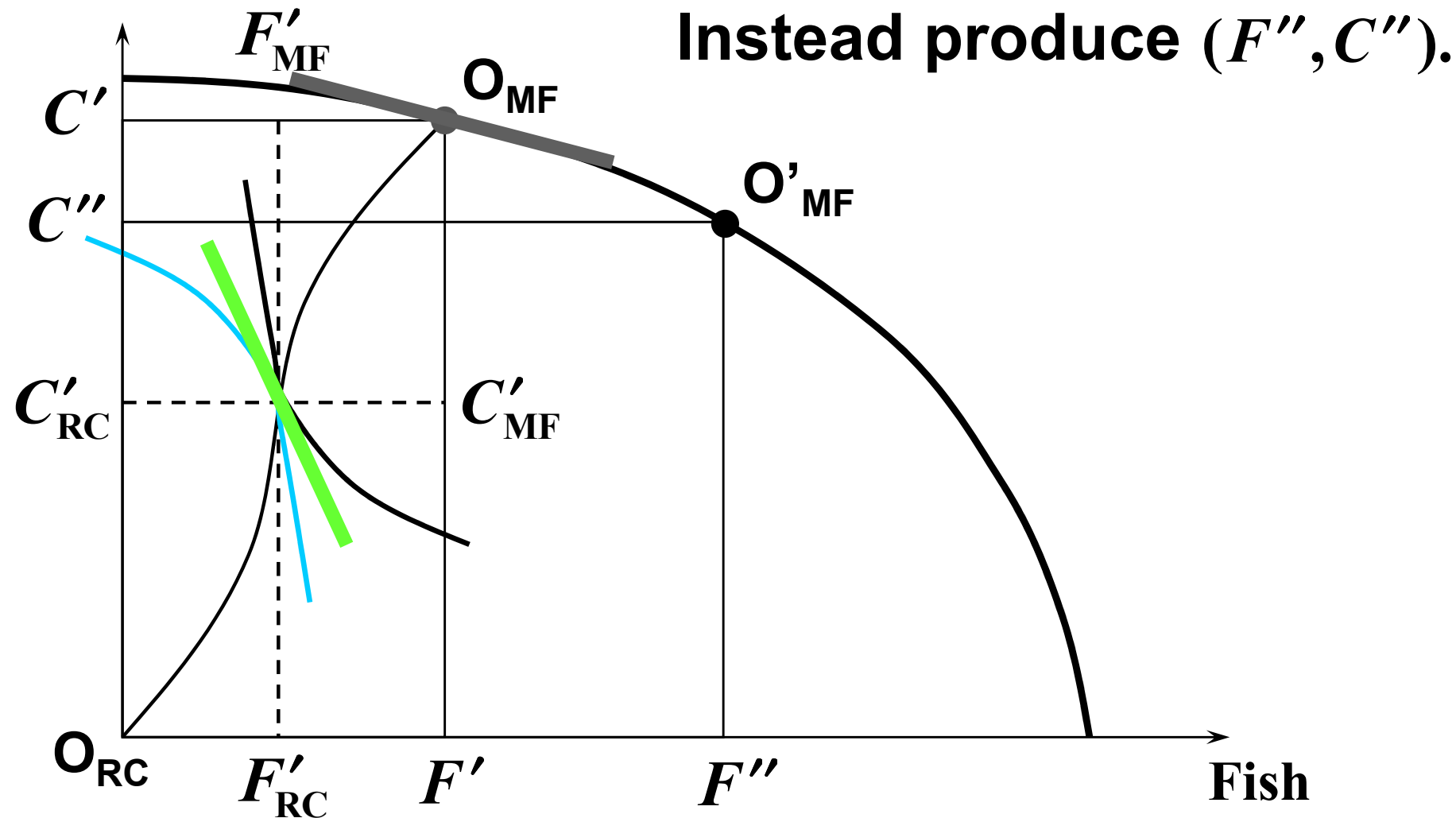
Coordinating Production & Consumption

Coconuts



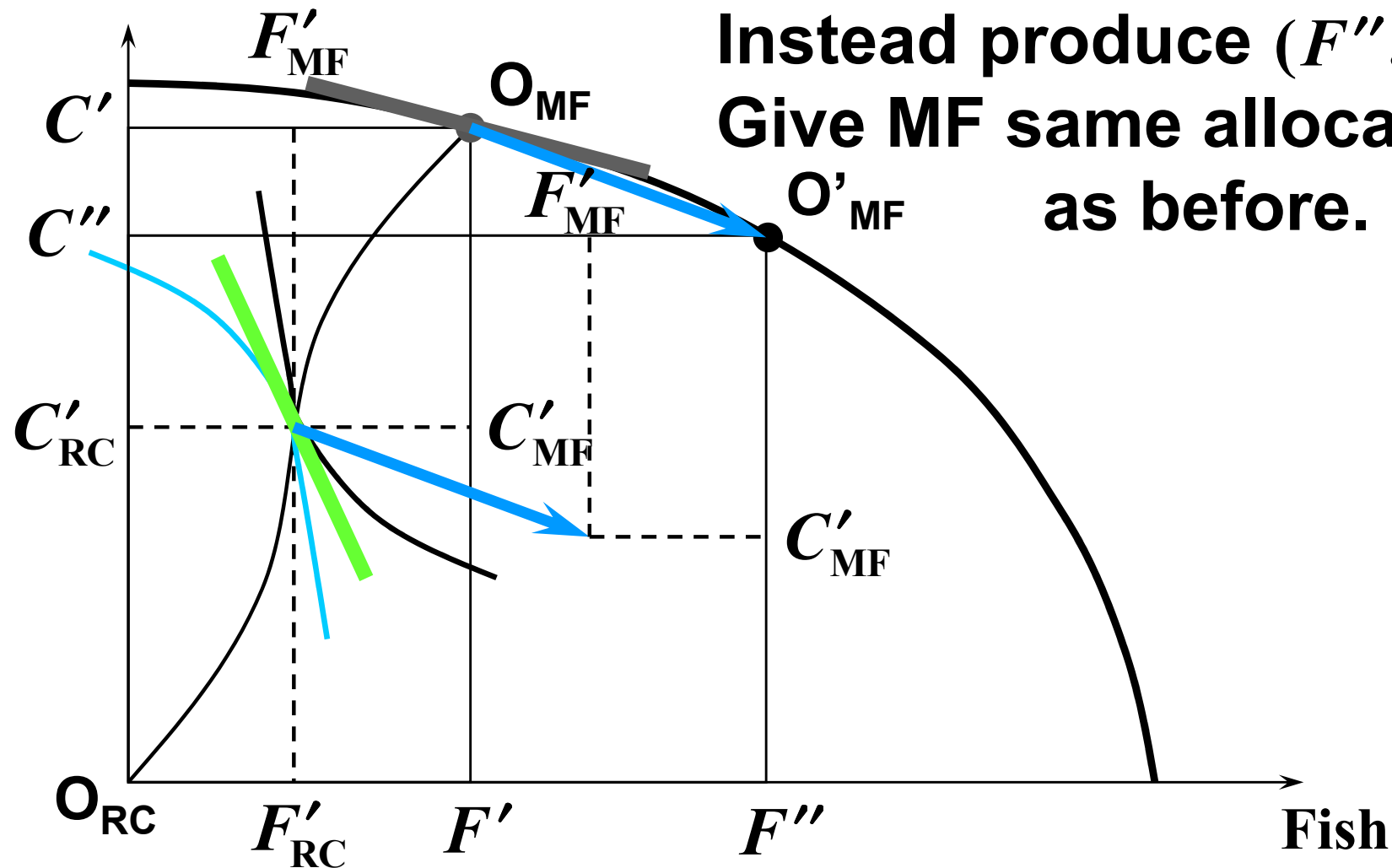
Coordinating Production & Consumption

Coconuts



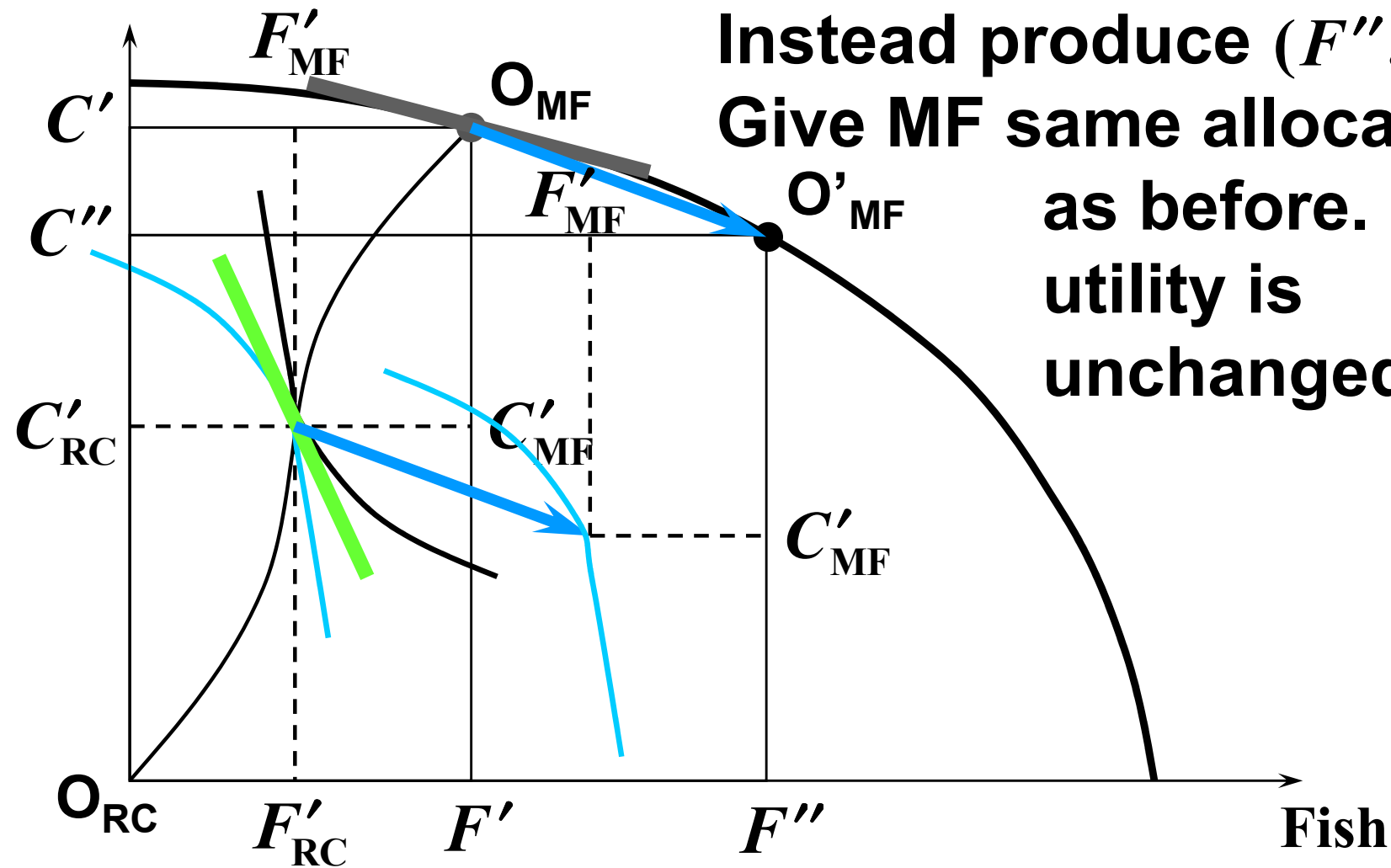
Coordinating Production & Consumption

Coconuts



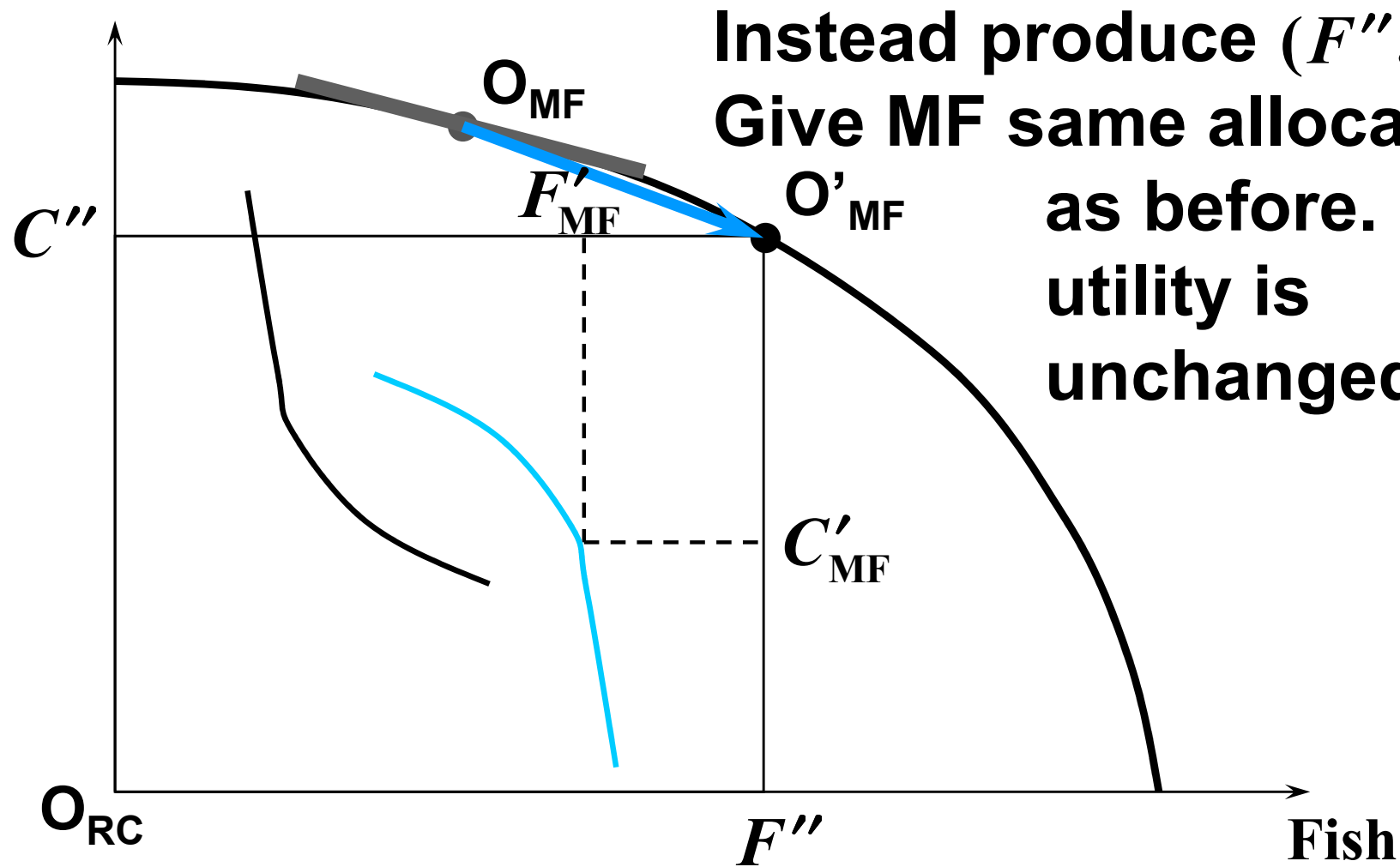
Coordinating Production & Consumption

Coconuts



Coordinating Production & Consumption

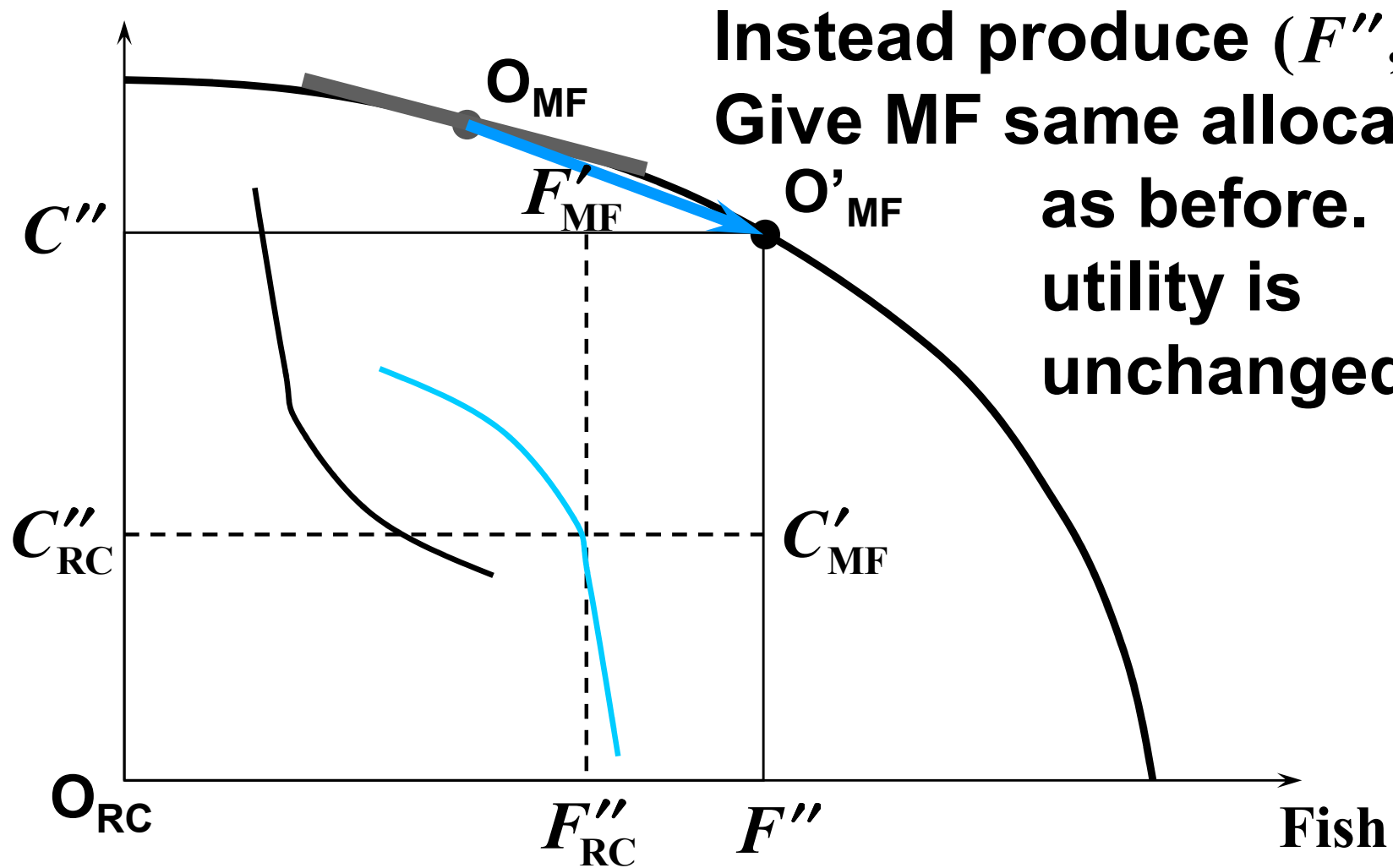
Coconuts



Instead produce (F'', C'') .
Give MF same allocation
as before. MF's
utility is
unchanged

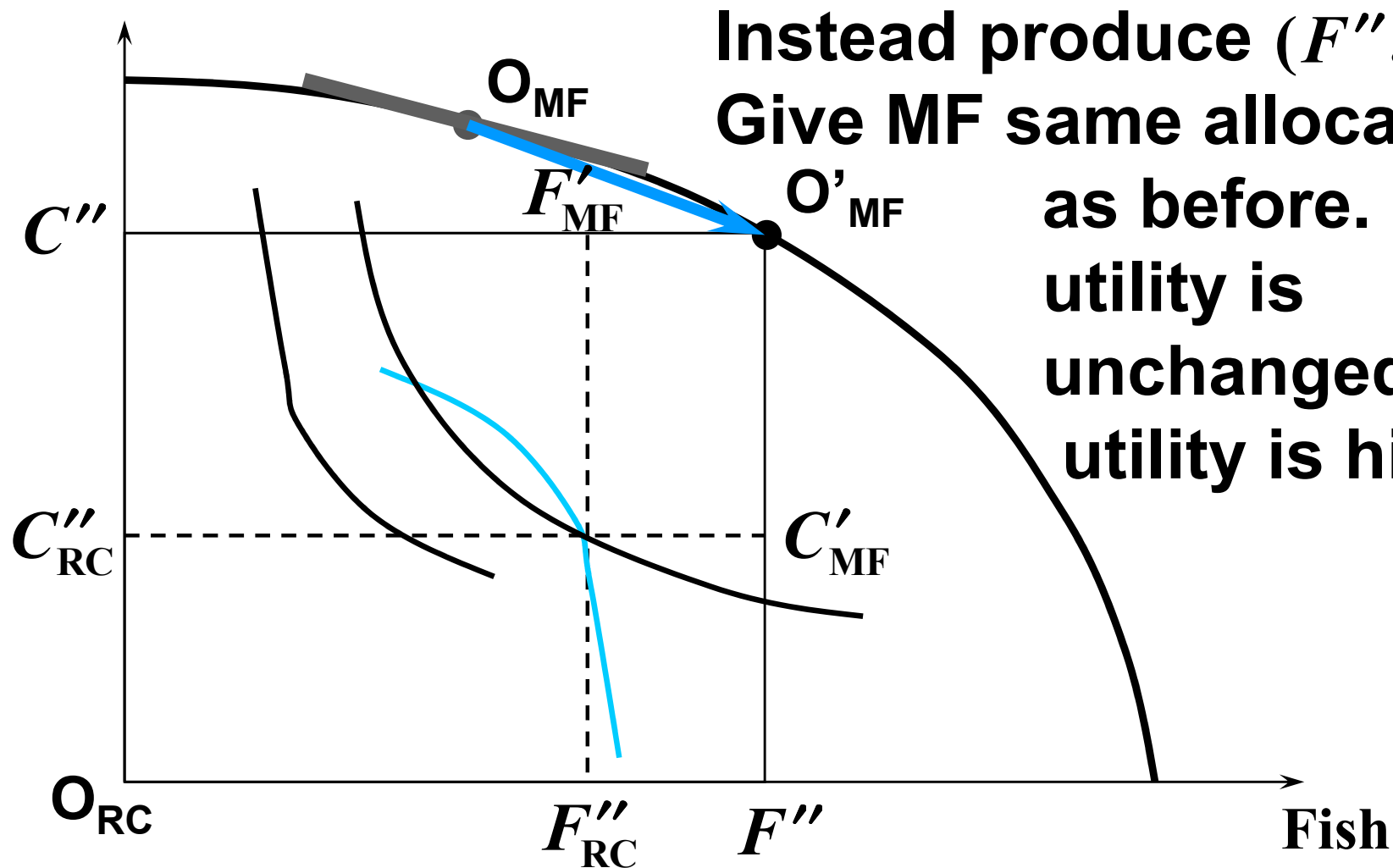
Coordinating Production & Consumption

Coconuts



Coordinating Production & Consumption

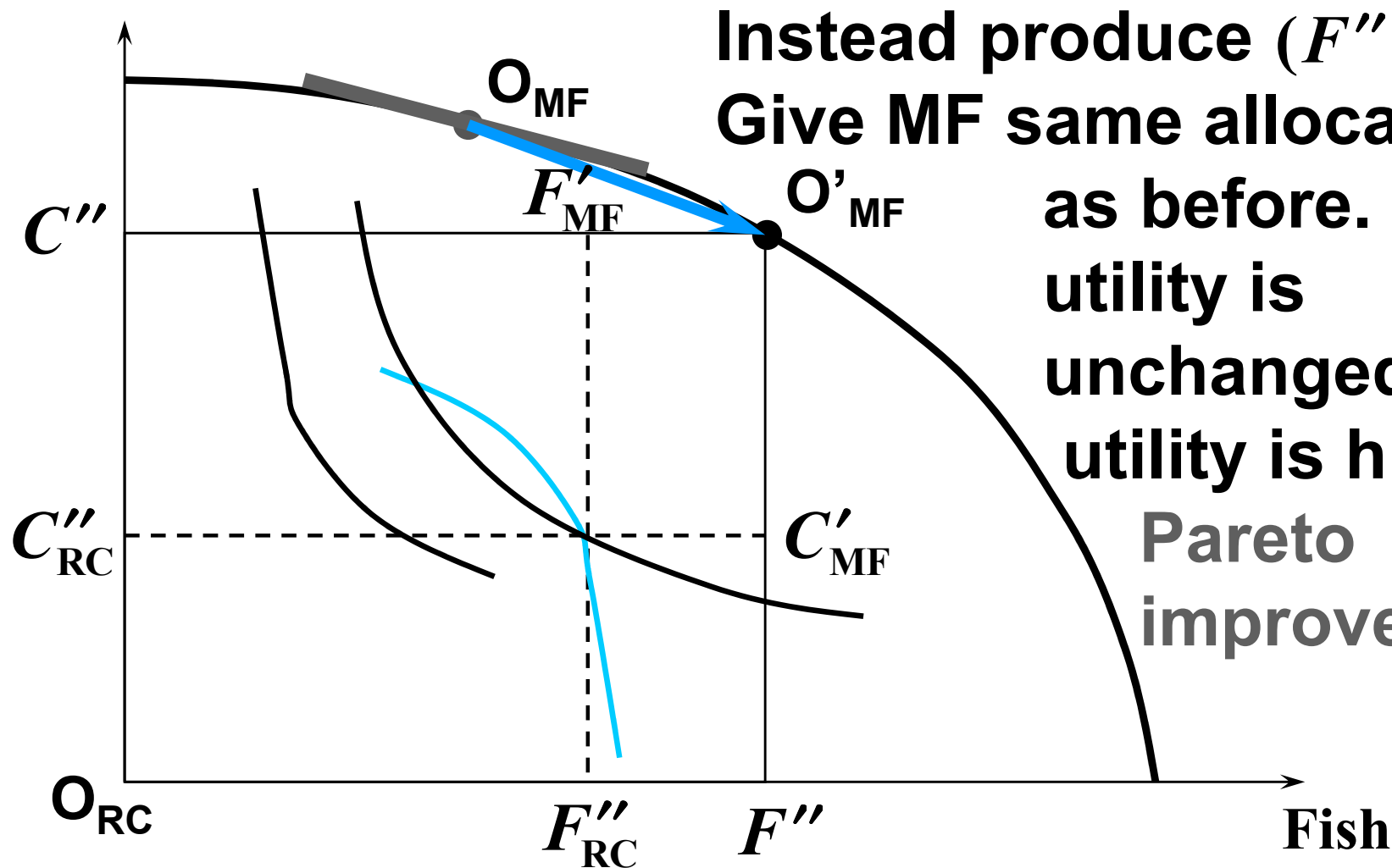
Coconuts



Instead produce (F'', C'') .
Give MF same allocation
as before. MF's
utility is
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Coordinating Production & Consumption

Coconuts



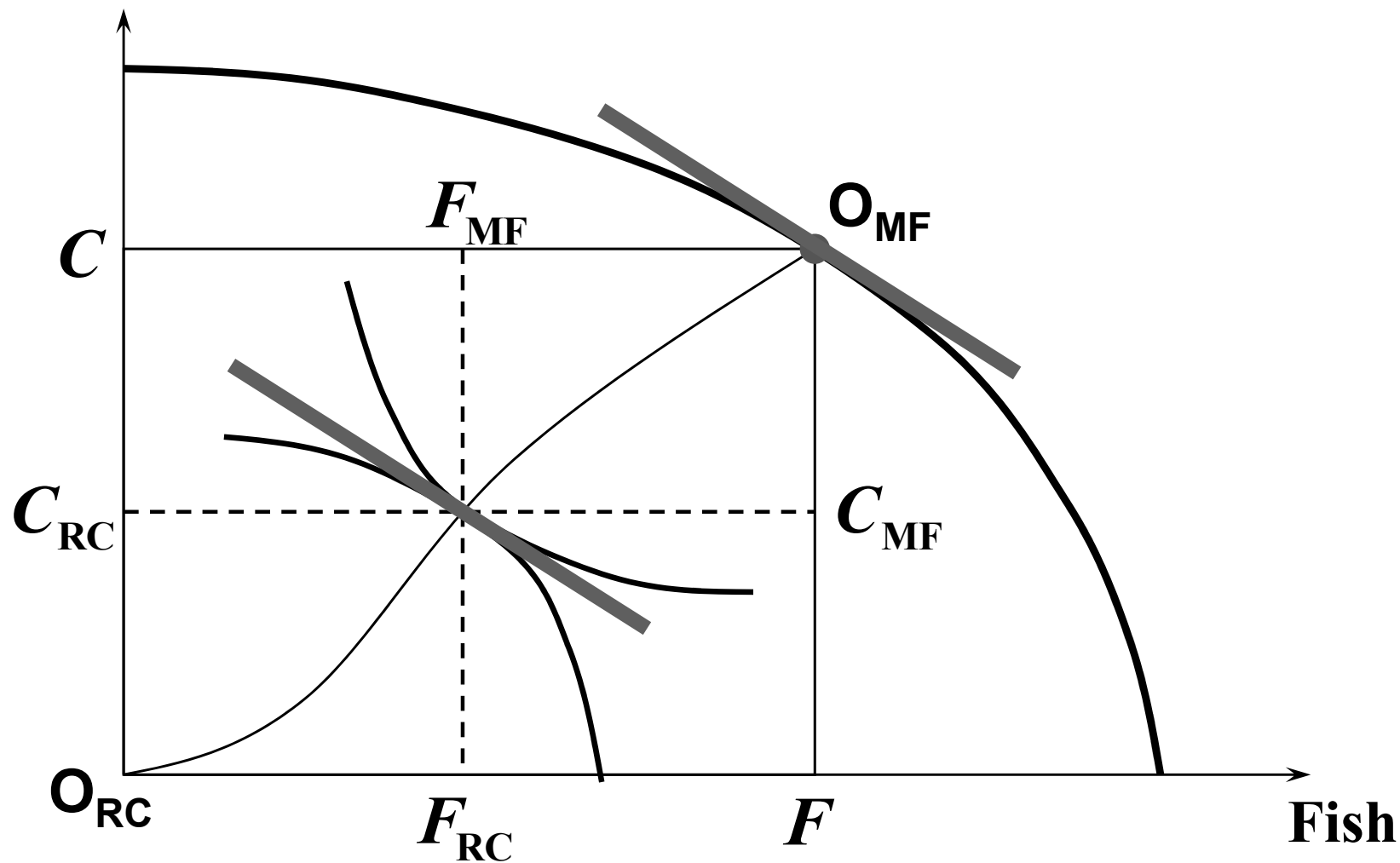
Instead produce (F'', C'') .
Give MF same allocation
as before. MF's
utility is
unchanged, RC's
utility is higher;
Pareto
improvement.

Coordinating Production & Consumption

- ◆ **MRS \neq MRPT \Rightarrow inefficient coordination of production and consumption.**
- ◆ **Hence, MRS = MRPT is necessary for a Pareto optimal economic state.**

Coordinating Production & Consumption

Coconuts



Decentralized Coordination of Production & Consumption

- ◆ RC and MF jointly run a firm producing coconuts and fish.
- ◆ RC and MF are also consumers who can sell labor.
- ◆ Price of coconut = p_C .
- ◆ Price of fish = p_F .
- ◆ RC's wage rate = w_{RC} .
- ◆ MF's wage rate = w_{MF} .

Decentralized Coordination of Production & Consumption

- ◆ L_{RC} , L_{MF} are amounts of labor purchased from RC and MF.
- ◆ Firm's profit-maximization problem is choose C , F , L_{RC} and L_{MF} to

$$\max \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}.$$

Decentralized Coordination of Production & Consumption

$$\max \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF} \cdot$$

Isoprofit line equation is

$$\text{constant } \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}$$

Decentralized Coordination of Production & Consumption

$$\max \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}.$$

Isoprofit line equation is

$$\text{constant } \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}$$

which rearranges to

$$C = \frac{\pi + w_{RC} L_{RC} + w_{MF} L_{MF}}{p_C} - \frac{p_F}{p_C} F.$$

Decentralized Coordination of Production & Consumption

$$\max \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}.$$

Isoprofit line equation is

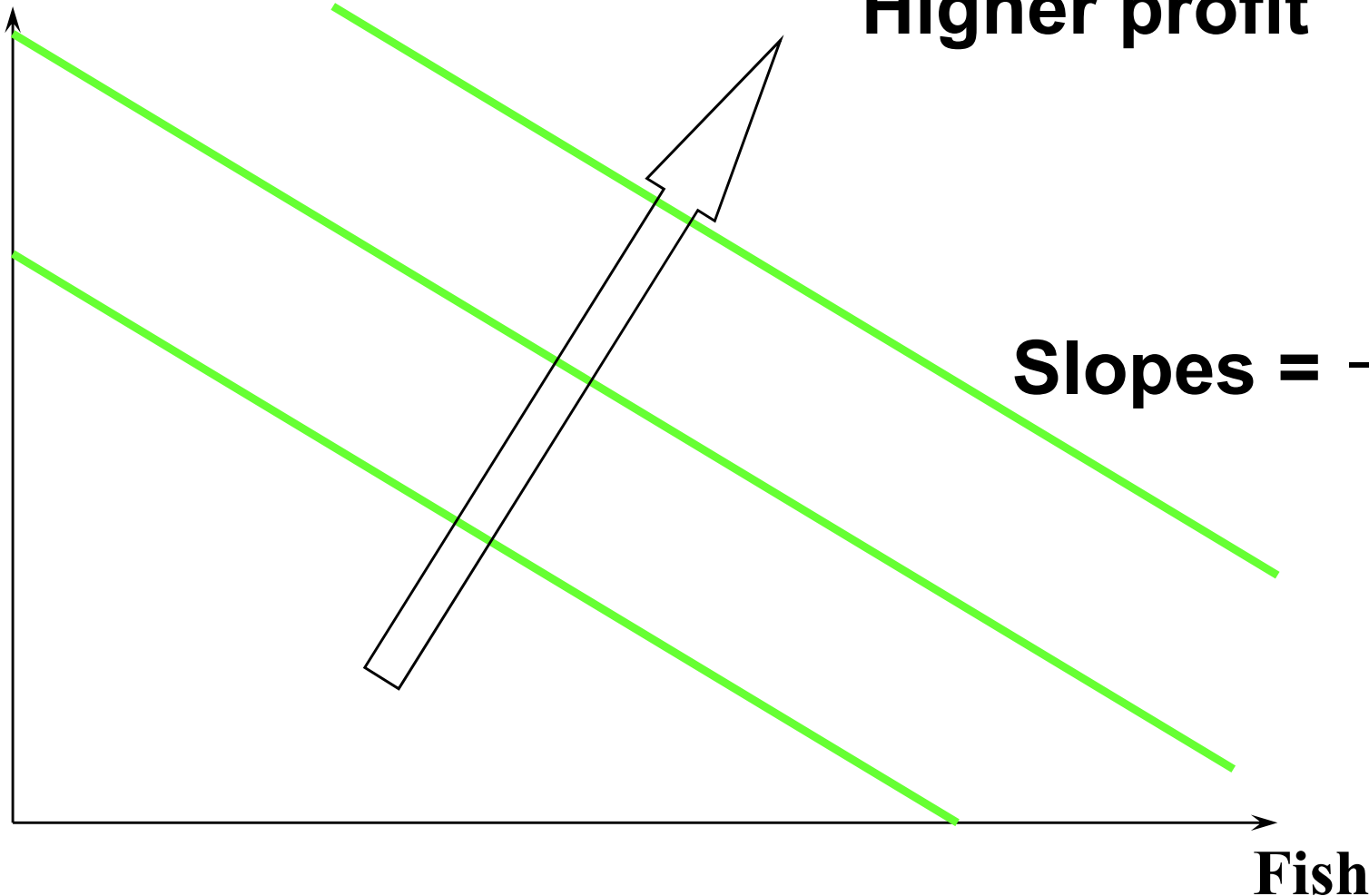
$$\text{constant } \pi = p_C C + p_F F - w_{RC} L_{RC} - w_{MF} L_{MF}$$

which rearranges to

$$C = \underbrace{\frac{\pi + w_{RC} L_{RC} + w_{MF} L_{MF}}{p_C}}_{\text{intercept}} - \underbrace{\frac{p_F}{p_C}}_{\text{slope}} F.$$

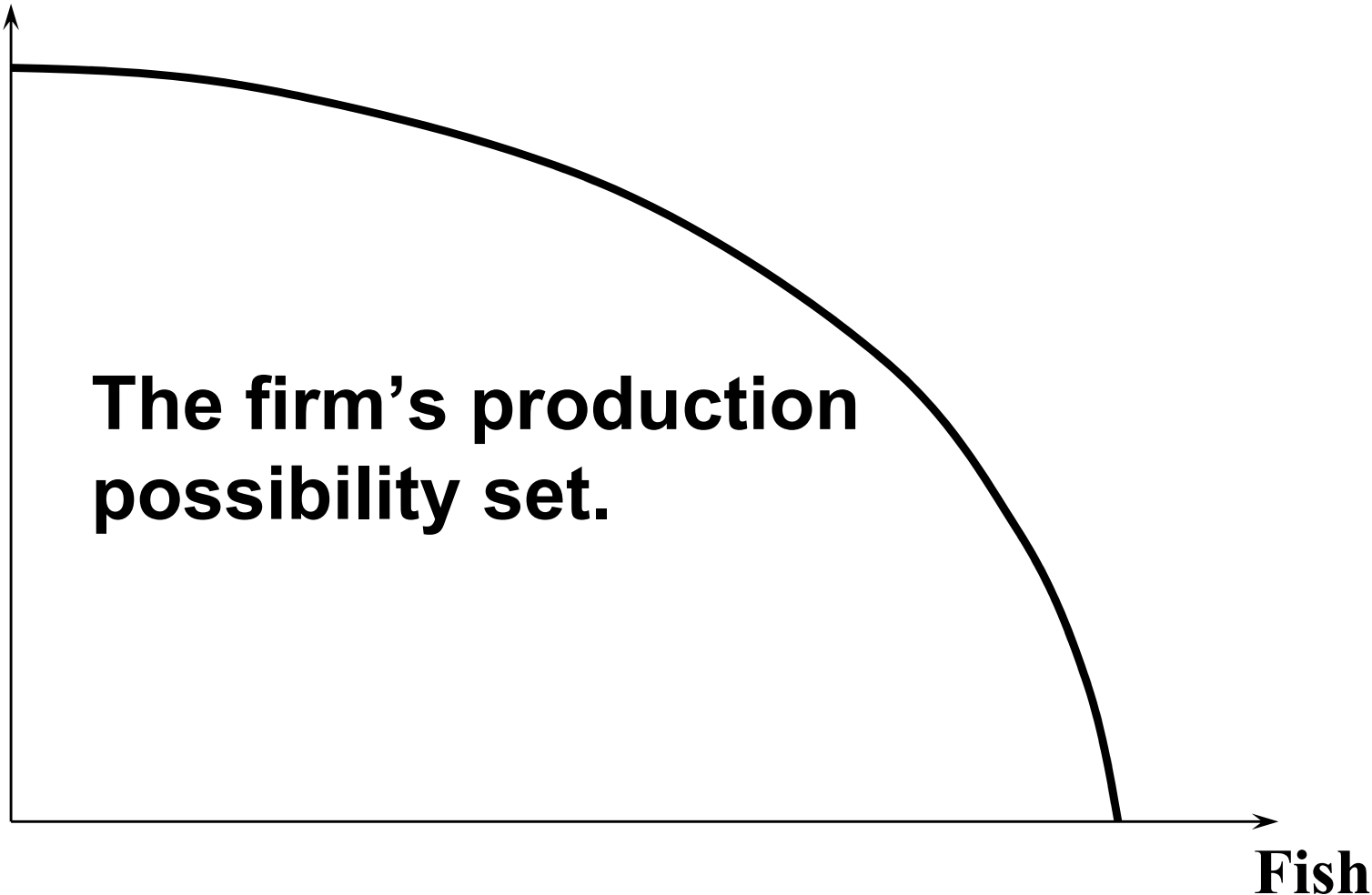
Decentralized Coordination of Production & Consumption

Coconuts



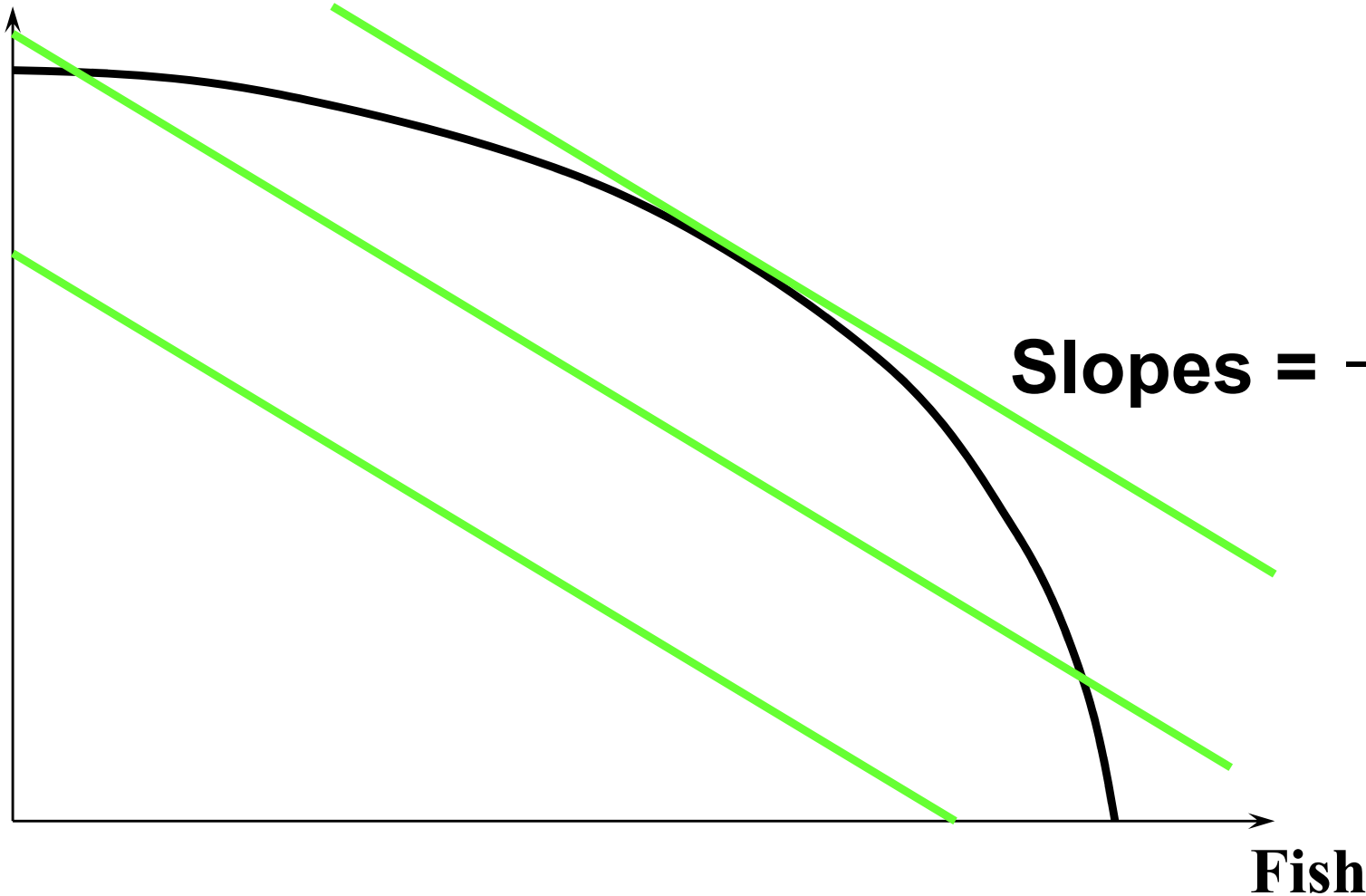
Decentralized Coordination of Production & Consumption

Coconuts



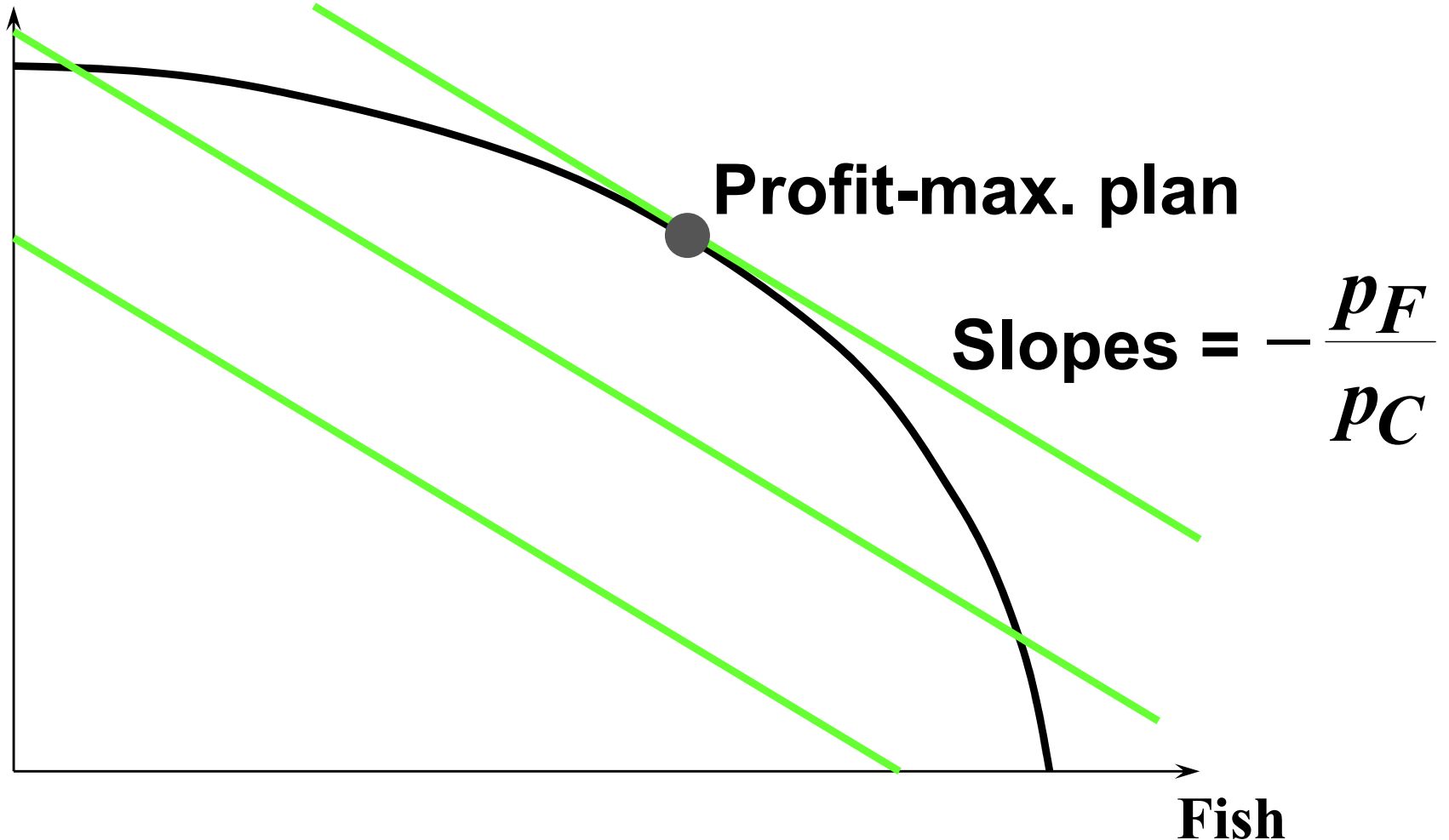
Decentralized Coordination of Production & Consumption

Coconuts

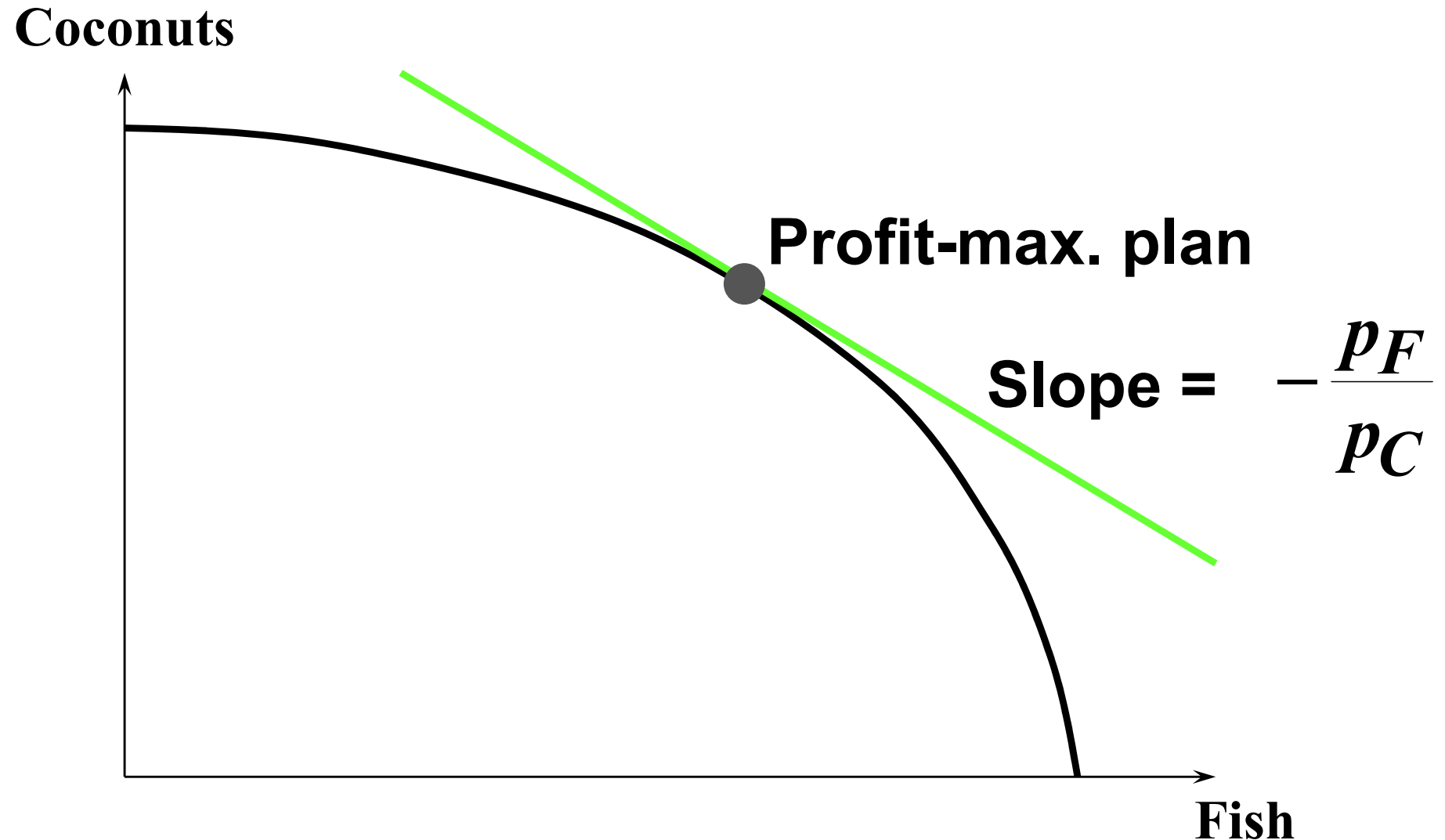


Decentralized Coordination of Production & Consumption

Coconuts

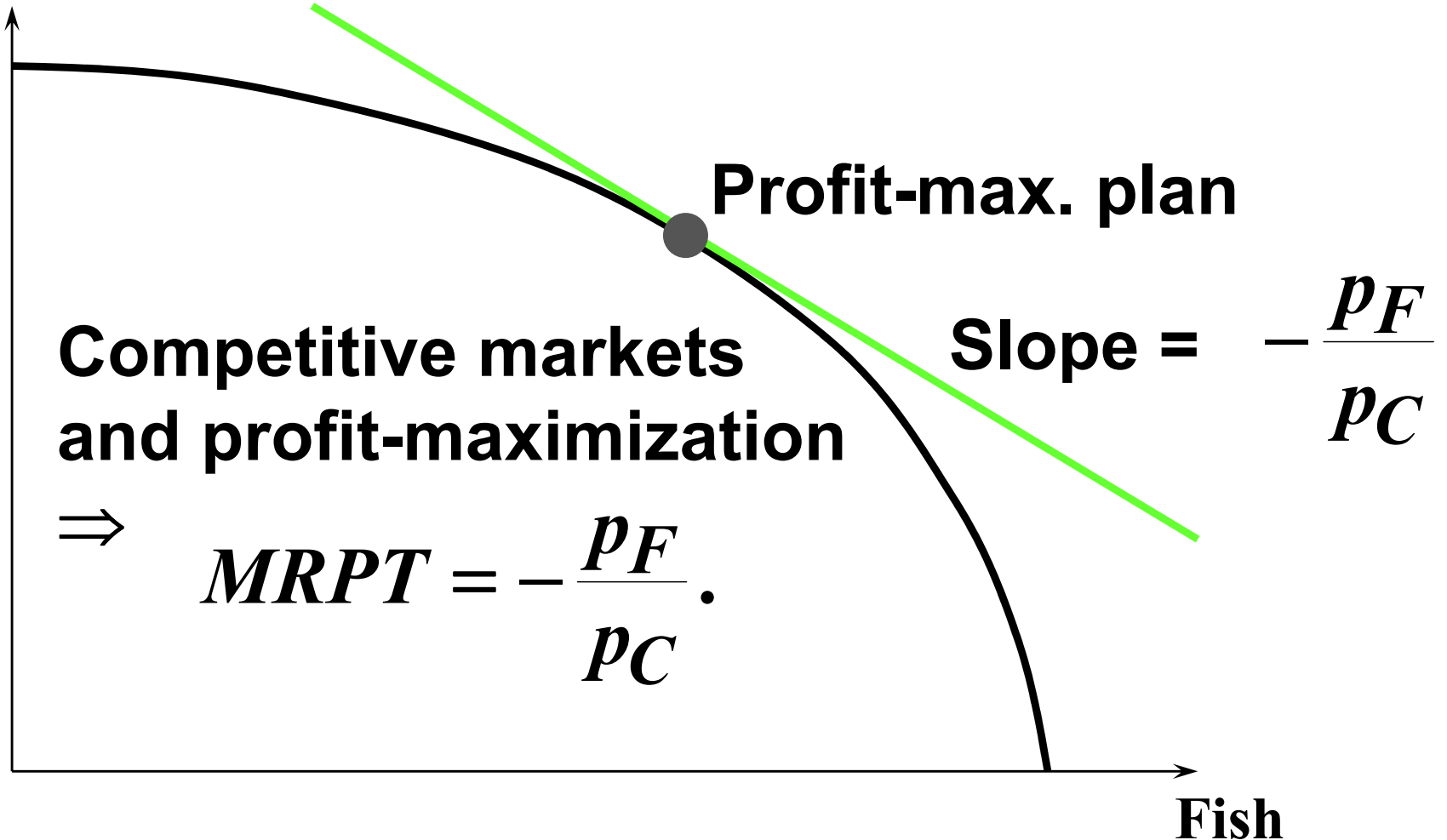


Decentralized Coordination of Production & Consumption



Decentralized Coordination of Production & Consumption

Coconuts



Decentralized Coordination of Production & Consumption

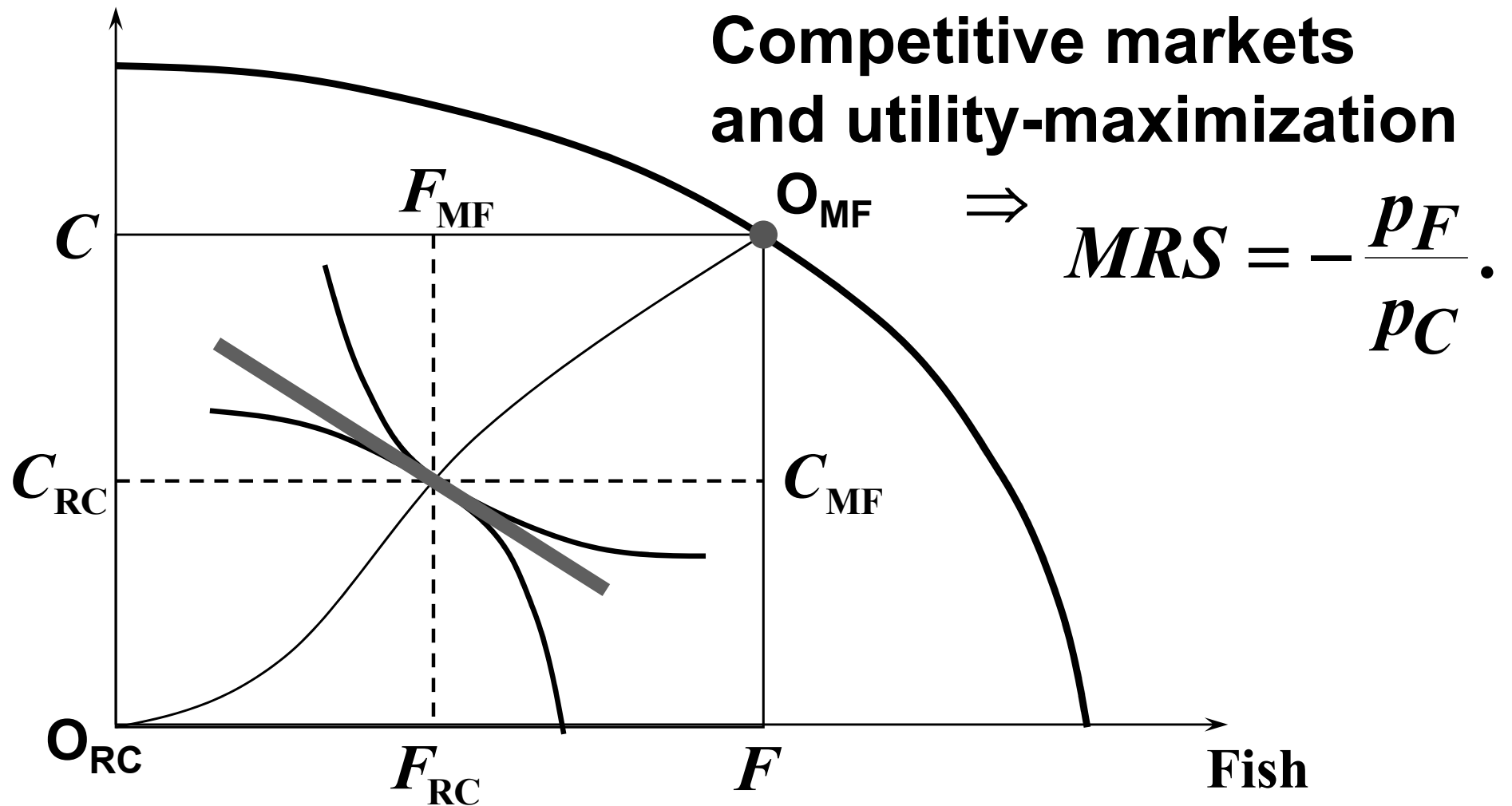
- ◆ **So competitive markets, profit-maximization, and utility maximization all together cause**

$$MRPT = -\frac{p_F}{p_C} = MRS,$$

the condition necessary for a Pareto optimal economic state.

Decentralized Coordination of Production & Consumption

Coconuts



Decentralized Coordination of Production & Consumption

