

Economic Analysis of Technological Processes

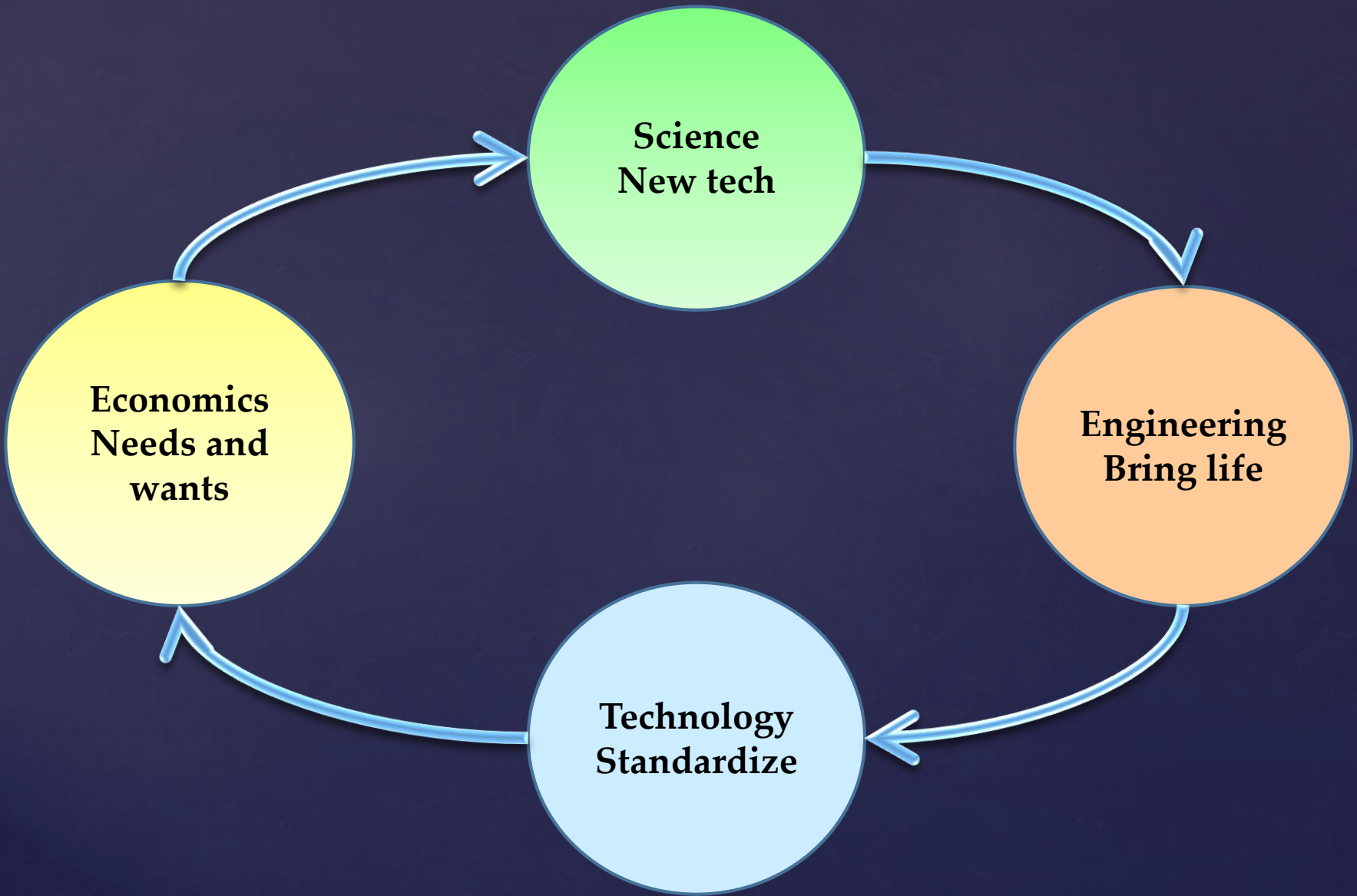
Lecture 1

Introduction. Engineering science and economics

The model of production in economics-functions and definitions

The market-general approach

Lecture 1: Introduction. Engineering science and economics



Lecture 1: Explain and apply the *Scarcity Principle*

Economics: making choices under scarcity and the results of them in a society

The Scarcity Principle: people have unlimited wants/needs and limited resources. More in one and less in another

= *No Free Lunch Principle*

Scarcity is involved in

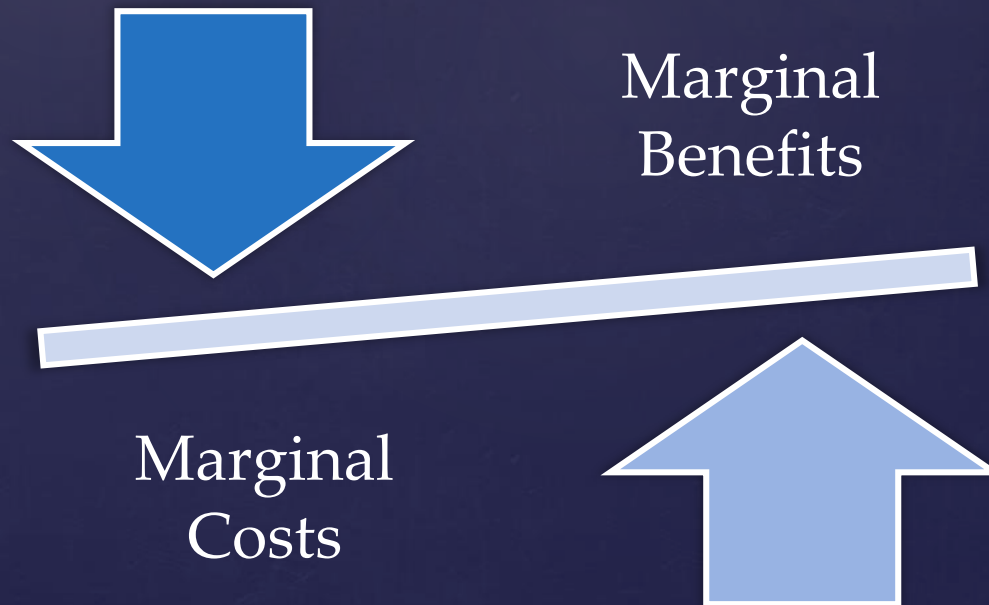
Global warming	Political elections	Career choices	Buying bottled water
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Lecture 1: Explain and apply the *Cost-Benefit Principle*

Take an action if and only if the *extra benefits are at least as great as the extra costs*

Costs and benefits are not just money

Being *rational*



Lecture 1: Explain and apply the *Cost-Benefit Principle*

Bring up examples: coupons, spread, medical check

Opportunity cost is the value of what must be foregone in order to undertake an activity, considers only your best alternative

Simplifying assumptions

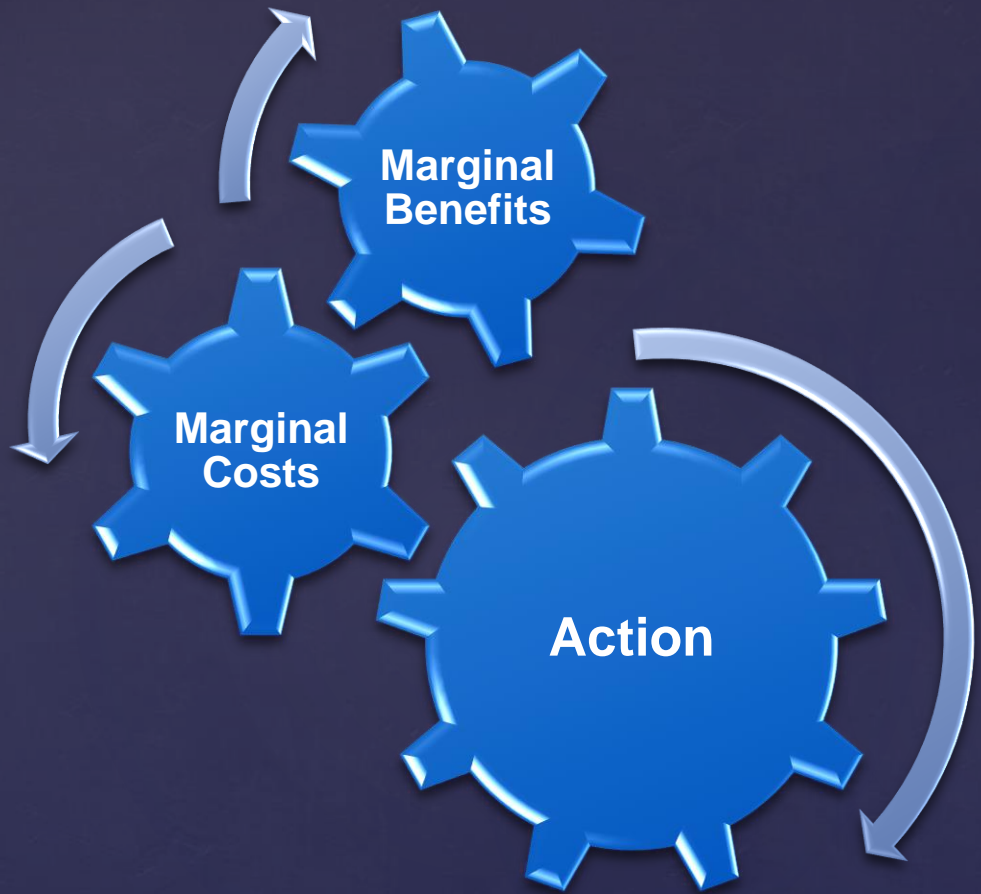
Abstract representation of key relationships

Lecture 1: Discuss three important pitfalls

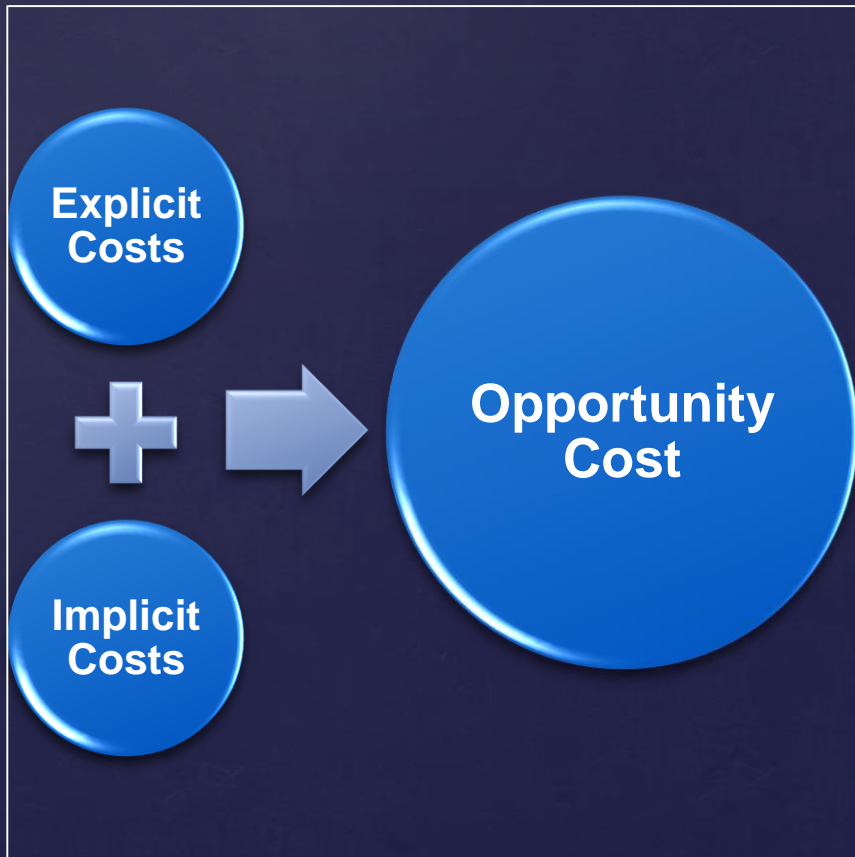
Economic analysis predicts likely behavior
Three general cases of mistakes

1. Measuring costs and benefits as proportions instead of absolute amounts
2. Ignoring implicit costs
3. Failure to think at the margin

Lecture 1: Discuss three important pitfalls



Sunk costs



Lecture 1: Marginal Analysis

Marginal cost is the increase in total cost from one additional unit of an activity

Average cost is total cost divided by the number of units

Marginal benefit is the increase in total benefit from one additional unit of an activity

Average benefit is total benefit divided by the number of units

Normative and Positive economics

Lecture 1: Incentive Principle

Explain and apply the *Incentive Principle*

Benefits

Actions are more likely
to be taken if their
benefits rise

Costs

Actions are less likely
to be taken if their
costs rise

Economics Is Choosing

Lecture 1: Economic models

Simplified description of real life

Consumers

Producers

Goods

and Principles

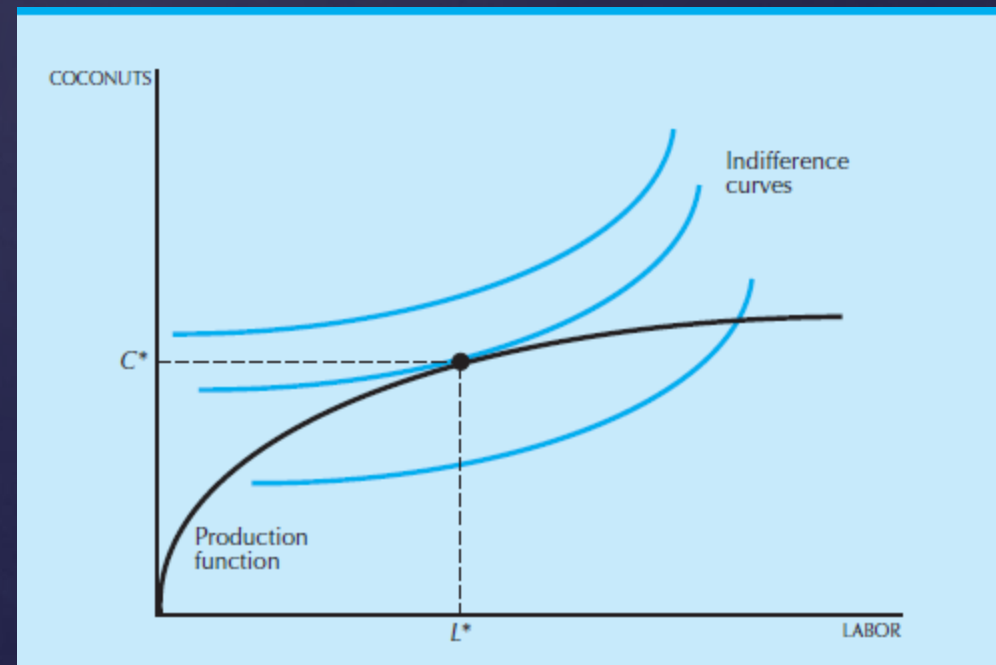
Tools: graphs, simple equations

Lecture 1: The model of production in economics-functions and definitions

Robinson Crusoe Economics: one consumer-one supplier-two goods

Leisure-coconut

Production function-
Indifference curve-
slope equation



Lecture 1: The model of production in economics-functions and definitions

Splitting activities and bringing in markets

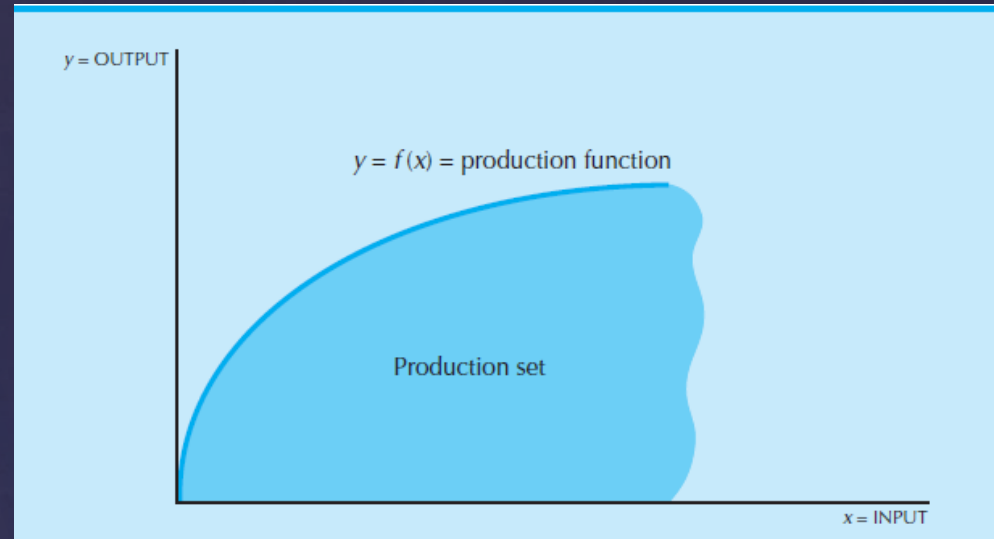
Profit, prices of labour and coconut

Currency and numeraire

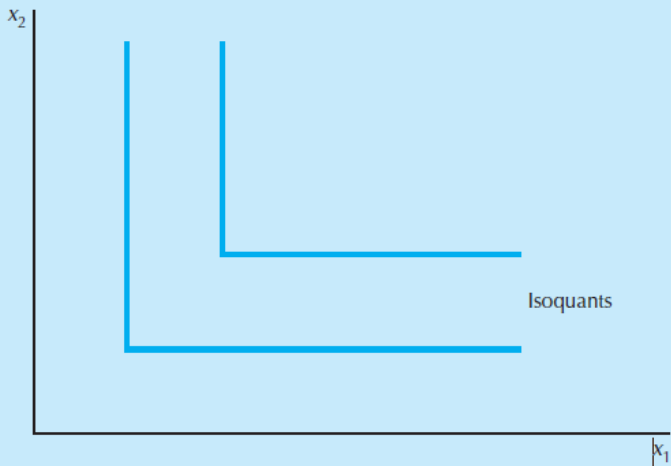
Equilibrium

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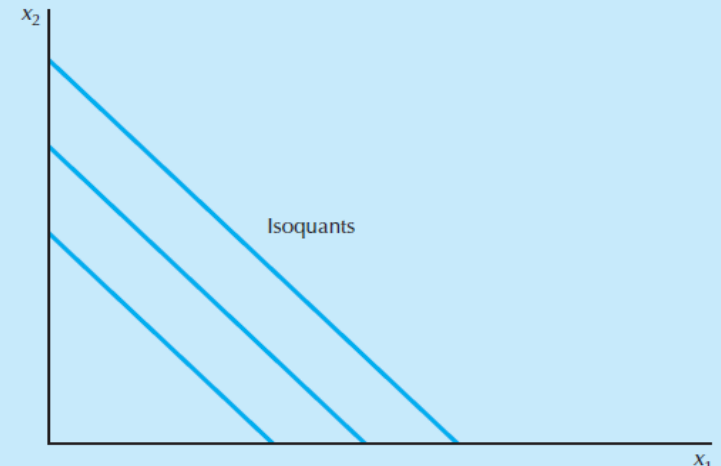
Technology



Fixed Proportion



Perfect substitutes



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Cobb-Douglas Function

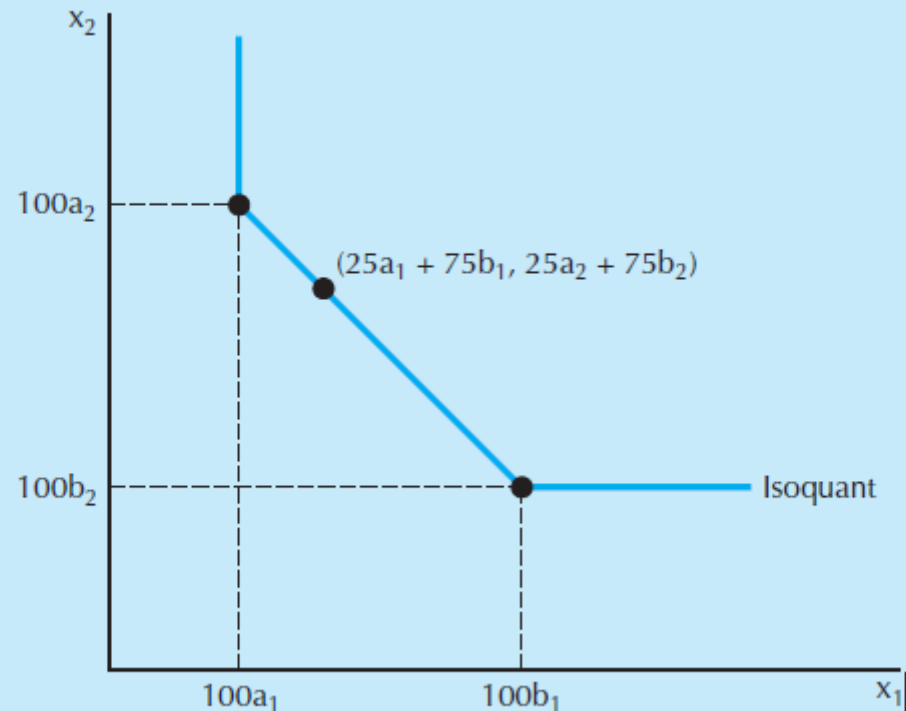
$$f(x_1, x_2) = Ax_1^a x_2^b$$

$$A = 1$$

$$a + b = 1$$

Marginal Product Factor

$$\frac{\Delta y}{\Delta x_1} = \frac{f(x_1 + \Delta x_1, x_2) - f(x_1, x_2)}{\Delta x_1}$$



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Technical Rate of Substitution

$$\Delta y = MP_1(x_1, x_2)\Delta x_1 + MP_2(x_1, x_2)\Delta x_2 = 0$$

$$\text{TRS}(x_1, x_2) = \frac{\Delta x_2}{\Delta x_1} = -\frac{MP_1(x_1, x_2)}{MP_2(x_1, x_2)}$$

Diminishing TRS: reduce the amount of the other factor so as to stay on the same isoquant

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Return to scale

Constant:

$$tf(x_1, x_2) = f(tx_1, tx_2)$$

Increasing:

$$f(tx_1, tx_2) > tf(x_1, x_2)$$

Decreasing:

$$f(tx_1, tx_2) < tf(x_1, x_2)$$

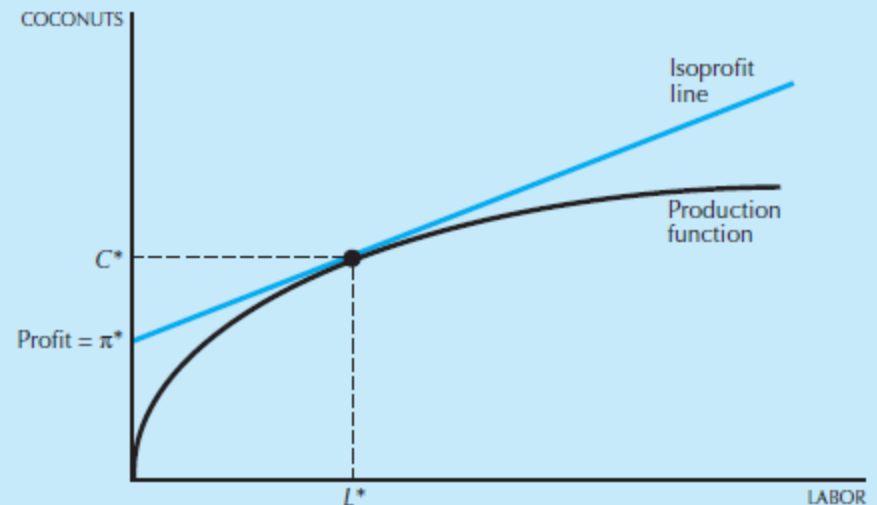
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The Firm

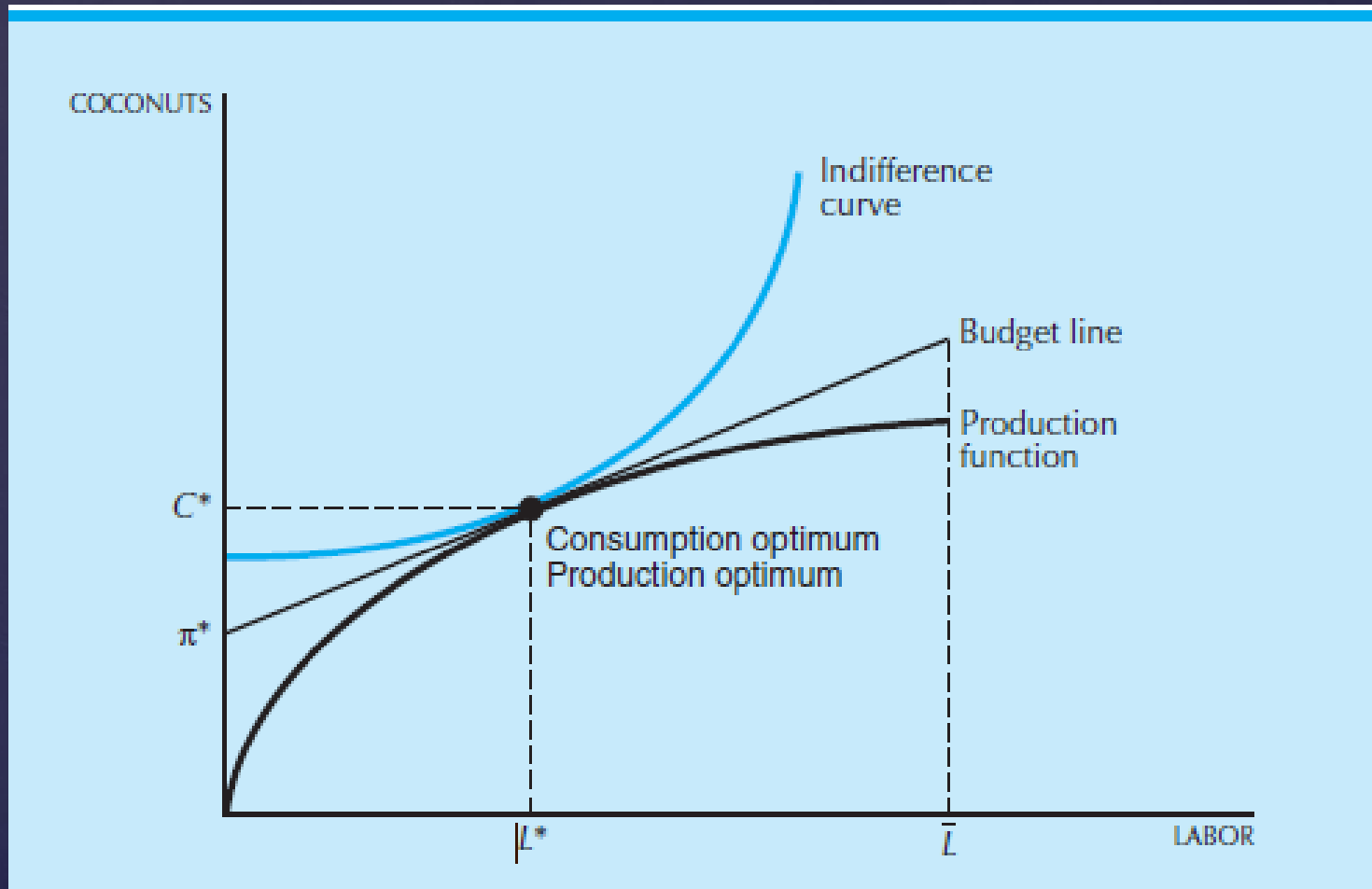
$\pi = C - wL$ the
Isoprofit Line

$$C = \pi + wL$$

Dividend



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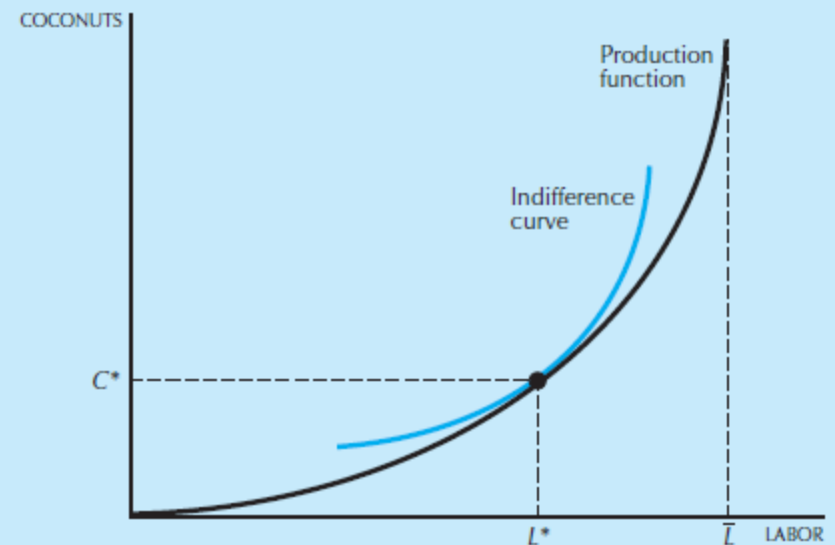
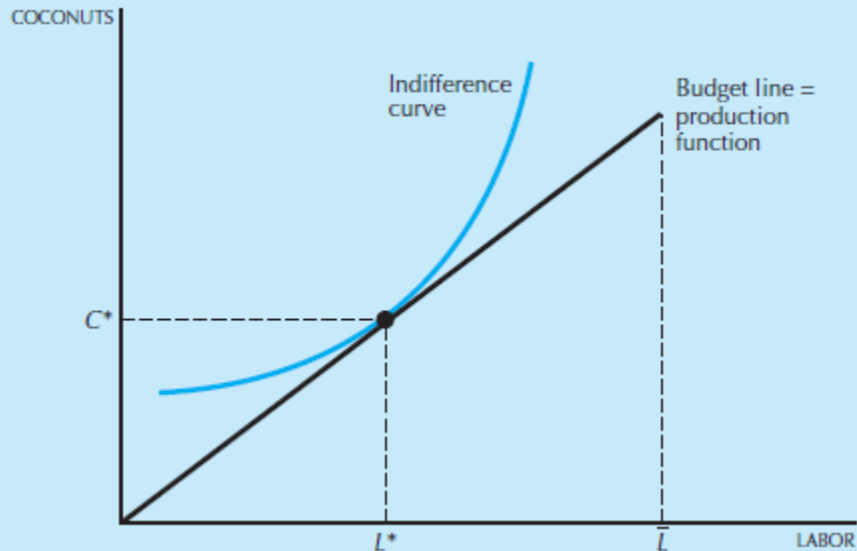


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Different Technologies

constant returns to scale-zero profit

increasing returns to scale-nonconvexity



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Welfare theorems

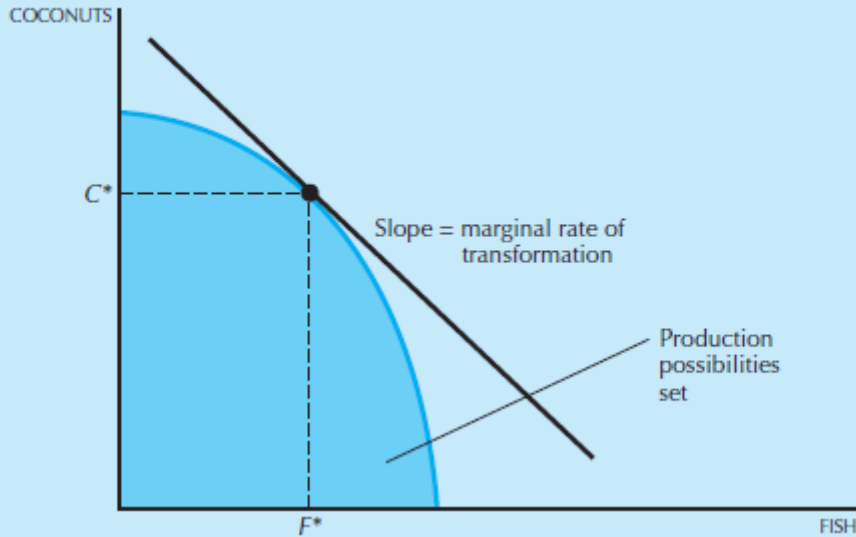
Pareto efficiency

First Theorem: no externalities

Second Theorem

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Generalized economics



$$F = 10L_f$$

$$C = 20L_c$$

$$L_c + L_f = 10.$$

$$L_f = F/10$$

$$L_c = C/20$$

$$L_f + L_c = 10$$

$$F/10 + C/20 = 10$$

marginal
rate of transformation

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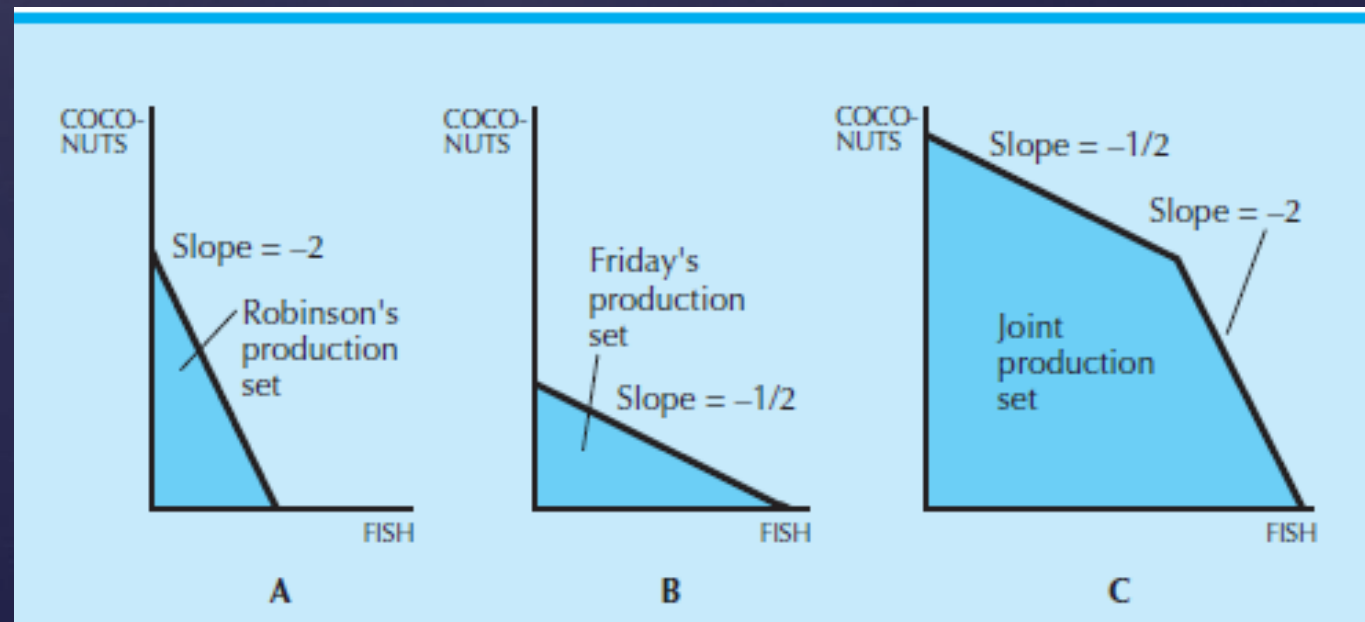
Comparative Advantages

$$F = 20L_f$$

$$F_{20} + C_{10} = 10$$

$$C = 10L_c$$

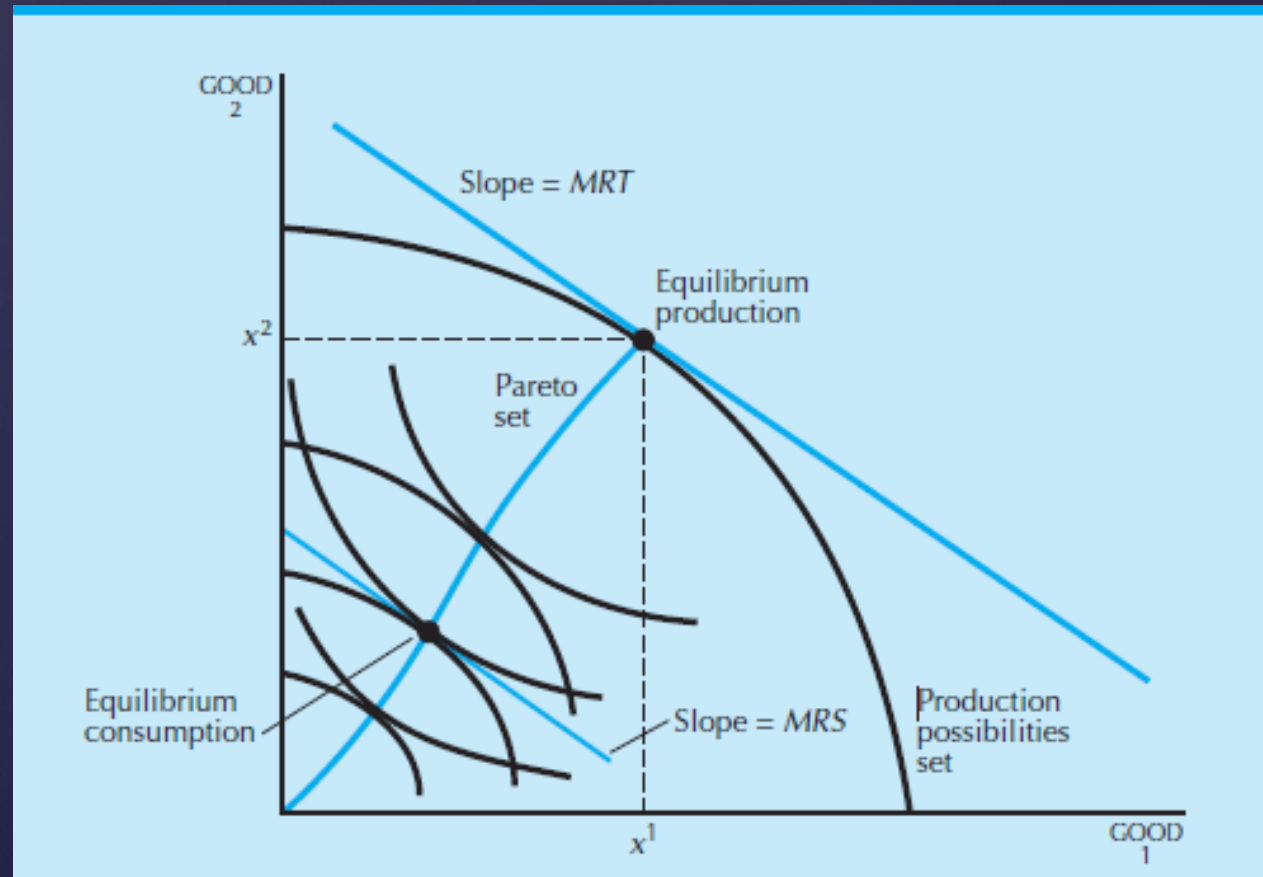
$$L_c + L_f = 10.$$



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Pareto Efficiency

Edgeworth box



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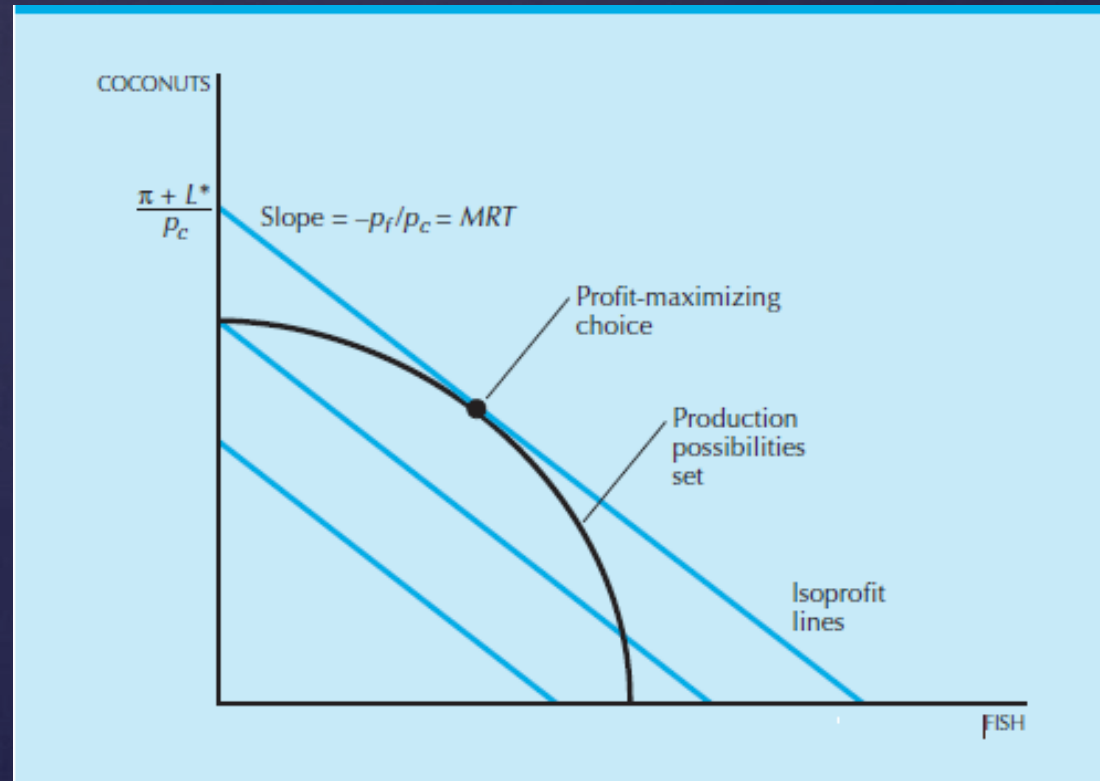
$$\text{Max}_{C,F,LF,LC} \quad p_C C + p_F F - w_C L_C - w_F L_F$$

$$L^* = w_C L_C^* + w_F L_F^*$$

$$\pi = p_C C + p_F F - L^*$$

$$C = (\pi + L^*)/p_C - p_F F/p_C$$

$$\text{MRT} = -p_F/p_C$$



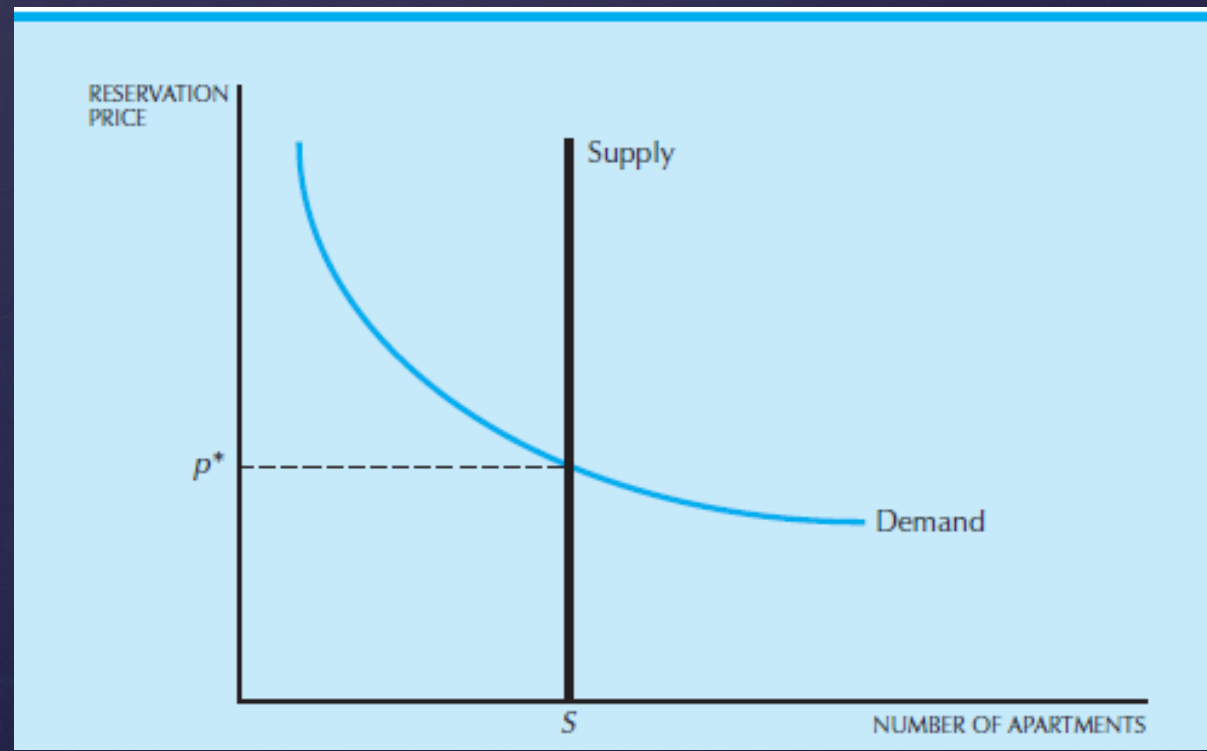
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Reservation Price

Demand

Supply

Comparative Statics



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Monopoly Discriminating monopolist-auction

Rent control

