Consumer Surplus and Producer Surplus

August 28, 2025

Introduction

- While we discussed the mechanism through which markets allocate resources, we did not comment on whether the market allocations are desirable
  - From positive to normative
- Welfare economics: the study of how the allocation of resources affects economic well-being
- What benefits do the buyers and sellers receive from taking part in a market
- How can a society make these benefits as large as possible?

Consumer surplus (1)

- Willingness to pay
  - Is the maximum amount that a buyer will pay for a good
- Consumer surplus
  - Is the difference between the amount a buyer is willing to pay and the amount s/he actually pays
- Demand curve and consumer surplus
  - Consumer surplus is the area below the demand curve and above the price
- Changes in the price and consumer surplus
  - What happens when the price falls

Consumer surplus and the demand curve

Willingness to Pay

Buyer	WTP
A	100
B	80
C	60
D	40

Demand curve

Price	Buyer(s)	Qty demanded
>100	None	0
(80-100]	A	1
(60-80]	A, B	2
(40-60]	A, B, C	3
<=40	A, B, C, D	4

Consumer surplus (2)

- Why do we care about consumer surplus
  - Consumer surplus is a measure of economic well-being of the consumers: it measures the benefit that the buyers receive from buying a good. The preferences of buyers, who are assumed to be rational, underlie the demand curve. Policy makers generally respect the buyers' preferences
  - Competing choices
  - In some circumstances, like the case of demand for drugs, consumer surplus may not be a good measure of society's willingness to pay

Producer surplus

- Cost and the willingness to sell
- Producer surplus is the difference between the cost of production and the amount that a seller receives
- Supply curve and producer surplus
  - Producer surplus is the area above the supply curve and below the price
- Relationship between the price and producer surplus

Market equilibrium (1)

- Consumer Surplus = value to buyers – amount paid by buyers
- Producer Surplus = amount received by sellers – cost to sellers
- Total surplus = consumer surplus + producer surplus
  - Total surplus is a measure of economic well-being of everyone in the society and social planners want to maximize the total surplus
  - What happens to total surplus in the equilibrium?

Market equilibrium (2)

- Efficiency: a resource allocation is said to be efficient if the total surplus is maximized
- Equilibrium (market) allocation is efficient
  - Free markets allocate the supply of goods to the buyers who value them most highly, measured by their willingness to pay
  - Free markets allocate the demand for goods to the sellers who can produce them at the lowest cost
  - In free markets, total surplus is maximized
  - Total surplus = *sum* (value to buyers – cost to sellers)
  - value to buyers and cost to sellers
- Social planners are interested in maximizing the efficiency. But are also concerned about equality

Production and Technology

The production function

- Specifies the maximum output that can be produced with a given quantity of inputs, given technology
  - The role of technology
  - Examples from goods and services sectors
- Total product: is the total amount of output produced
- Average product: is the total output divided by total units of input
- Marginal product *of an input* is the extra output produced by 1 additional unit of *that input*, ceteris paribus

(1) Units of labor input	(2) Total product	(3) Marginal product	(4) Average product
0	0		
		2,000	
1	2,000		2,000
		1,000	
2	3,000		1,500
		500	
3	3,500		1,167
		300	
4	3,800		950
		100	
5	3,900		780

TABLE 6-1. Total, Marginal, and Average Product

The law of diminishing returns

- *a la* the law of diminishing marginal utility
- A firm will get less and less extra output when it adds additional units of an input while holding the other inputs fixed
  - The marginal product of each unit of input will decline as the amount of that input increases, keeping the other inputs fixed
- "The law of diminishing returns is an empirical regularity rather than a universal truth like the law of gravity." It will prevail in **most situations**
- A key factor explaining the poverty of nations. Surplus labor in agriculture

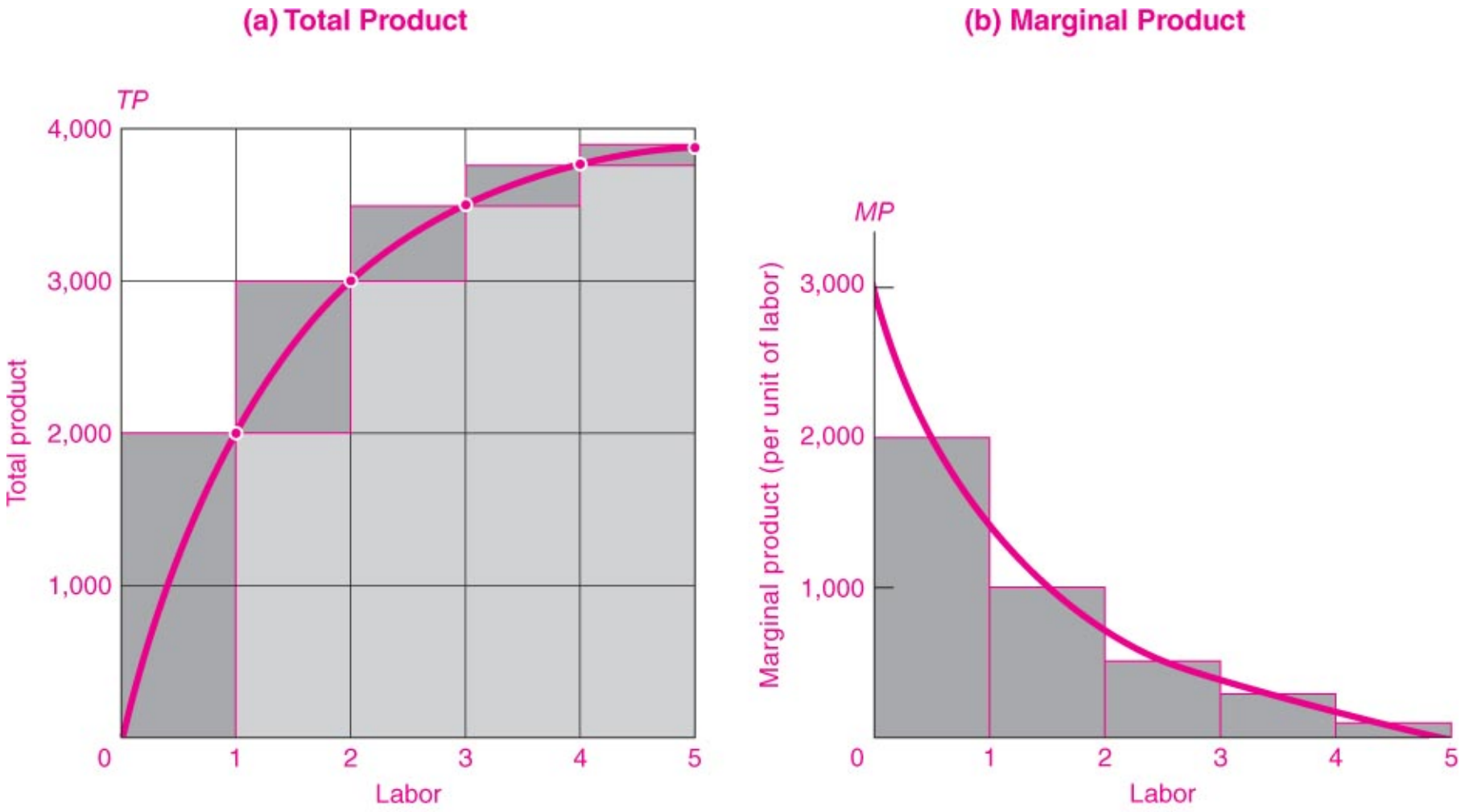


FIGURE 6-1. Marginal Product Is Derived from Total Product

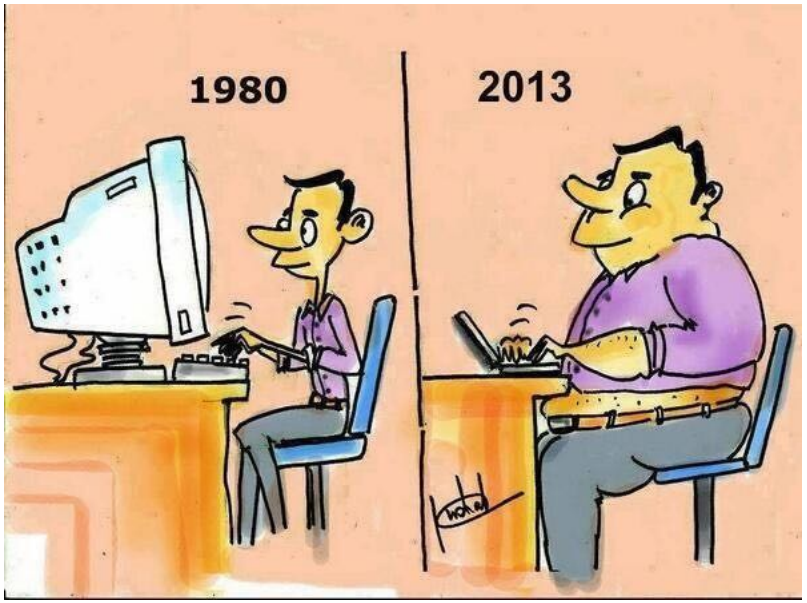
Returns to scale

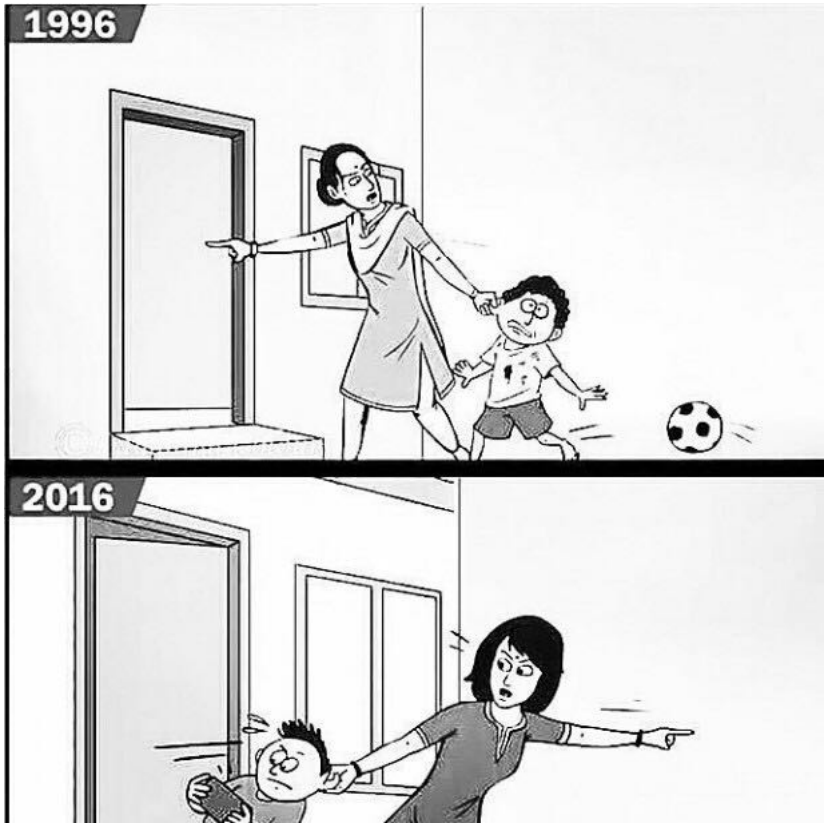
- Releasing the *ceteris paribus* assumption
  - What happens when all the inputs are increased?
  - What is the change in output when all the inputs are changed by the same proportion?
- Returns to scale: effects of scale increases of inputs on the quantity produced
  - *Constant return to scale*: a change in all inputs leads to equi-proportionate change in output, e.g., handicraft, haircutting
  - *Increasing return to scale*: a change in all inputs leads to more than proportionate change in output, e.g., most manufacturing plants
  - *Decreasing return to scale*: a change in all inputs leads to less than proportionate change in output, e.g., electricity generation-large plant size and high risk of plant failure
- Ahluwalia (1991): returns to scale in Indian manufacturing industry->1.072

Short and long run

- Importance of time
  - Production process requires not just labor and land but also time
  - Gestation period: plants
  - Farmers cannot switch crops in midseason
- Short run
  - A period in which firms can adjust production by changing variable factors but not fixed factors
  - Only some inputs, variable inputs, can be adjusted
- Long run
  - A period sufficiently long that all factors including capital can be adjusted

Technological change





Technological change

- Output growth can be achieved by
  - increasing inputs
  - technological improvements
  - much of the improvement in growth during the last century has come from the latter
- Process innovation
  - New knowledge improves production techniques for the existing products
  - Allows firm to produce more with same inputs; shifts in the production function
- Product innovation
  - New products are introduced in the market

Technological change

process innovation

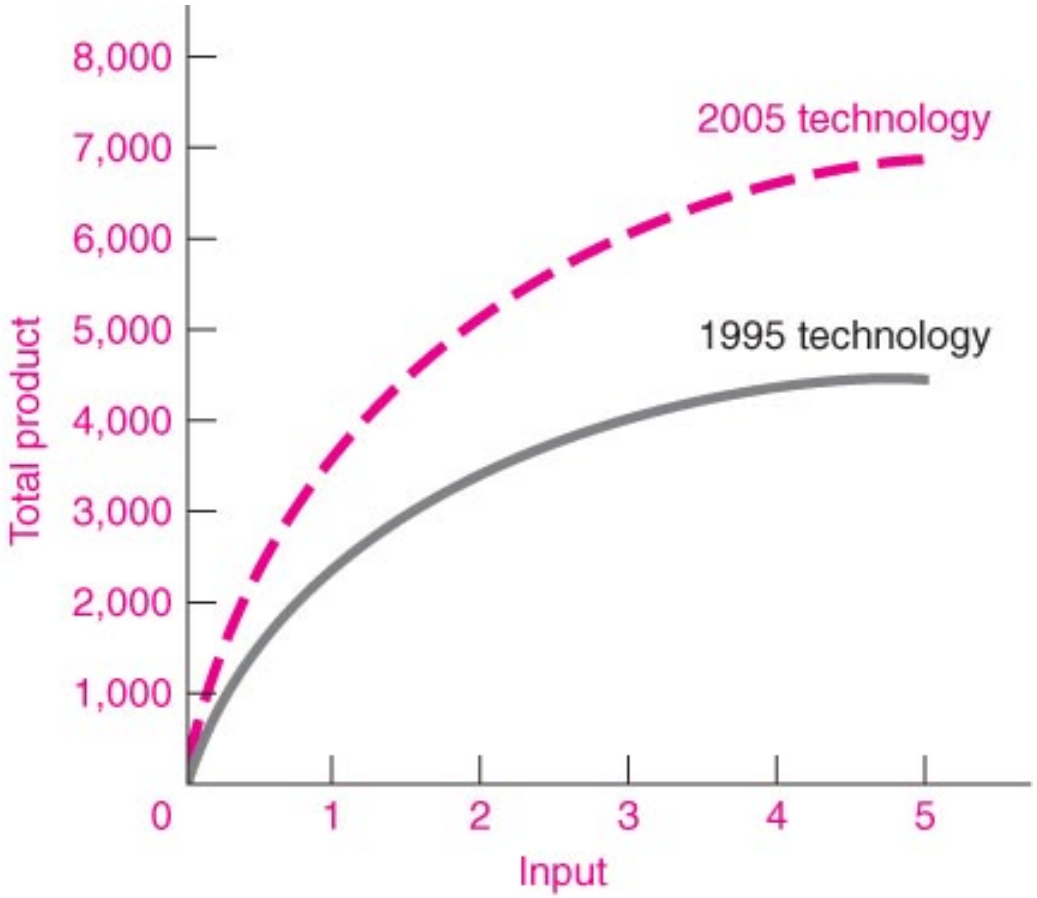
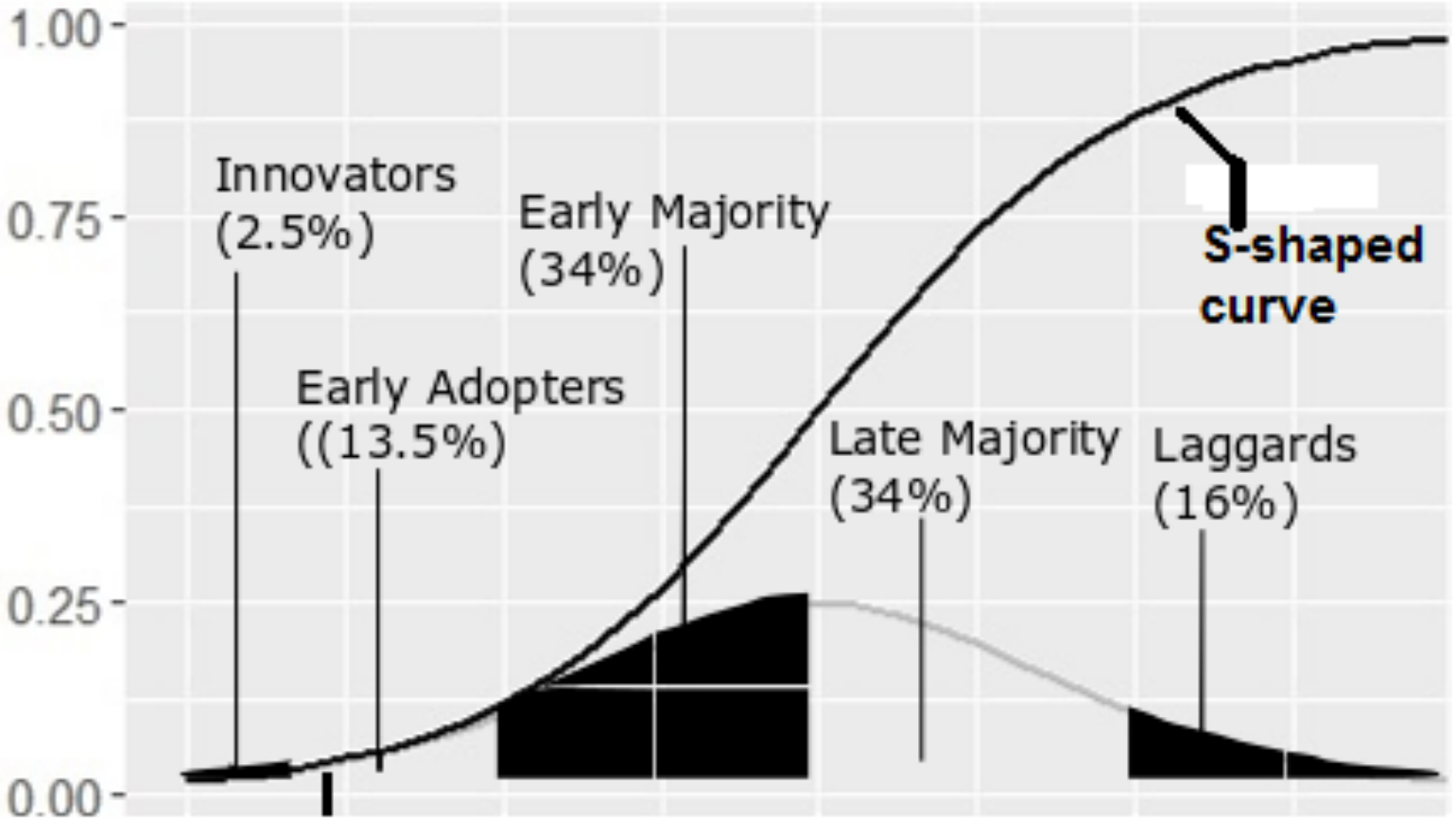


FIGURE 6-3. Technological Change Shifts Production Function Upward

Technological change

product innovation (based on Rogers 1983)



Technological change

product innovation

- adoption of innovation/ technology follows a sigmoid S-shaped curve depicting the life cycle of a product
- Adoption rate: slow (most technologies require a critical mass), increases (critical mass achieved) and accelerates, slow (saturation)
- ICT: various adopter categories and their social, economic, and demographic characteristics
  - Initial adopters usually male, but the gender gap declines with the level
  - Initial adopters: high social status (income, education, standard of living)
  - Role of income and education for mobile phones and personal computers
- Contributions of product innovations in raising the living standards is much more difficult to quantify, many of today's goods and services did not exist 30-40 years ago!
  - Name a few commodities (and processes) that have not changed since our grandfather's age

The Review of Economic Studies

Demographics and automation

Daron Acemoglu, MIT and Pascual Restrepo, Boston University

Posted on May 12, 2021

We argue theoretically and document empirically that aging leads to greater (industrial) automation, because it creates a shortage of middle-aged workers specializing in manual production tasks. We show that demographic change is associated with greater adoption of robots and other automation technologies across countries and with more robotics-related activities across US commuting zones. We also document more automation innovation in countries undergoing faster aging. Our directed technological change model predicts that the response of automation technologies to aging should be more pronounced in industries that rely more on middle-aged workers and those that present greater opportunities for automation and that productivity should improve and the labor share should decline relatively in industries that are more amenable to automation. The evidence supports all four of these predictions.

Productivity

- One of the ways to measure economic performance; two concepts
  - Labor productivity
    - Is the amount of output per unit of labor
  - Total factor productivity
    - Measures output per unit of total inputs (generally, some weighted average of inputs)
- Productivity growth
  - When output grows faster than the inputs, this represents growth in productivity

Productivity growth

- Occurs because of
  - Product innovation
  - Process innovation
  - Economies of scale and mass production
  - Economies of scope
    - a number of different products can be produced more efficiently *together*
    - Think of a multi-product firm; sharing of inputs and other expenses
- Growth in the Indian economy (Bosworth et al. 2006)

Period	Output per worker	Capital	Factor productivity	Output
1960-80	1.3	1.0	0.2	3.4
1980-2004	3.7	1.4	2.0	5.8
1960-2004	2.6	1.2	1.2	4.7

Costs: Basics

Introduction

- Costs play an important role in production, profit and investment decisions of a firm
  - Whether to hire a new worker or to pay overtime?
  - BPOs: Why do you think many firms in the advanced economies outsource various business activities to developing countries such as India?
    - Personal computers: “Designed by Apple in California Assembled in China”
  - KPOs
    - Banking and finance
  - Consider the household as an economy. Maids in households
  - What about course assignments?

Definitions (1)

- Fixed costs
  - Are expenses needed to be paid even if the firm produces zero output
  - Also called overhead or sunk costs
- Variable costs
  - Costs linked to the quantity produced, vary with the level of output
- Total cost
  - Equals sum of fixed and variable costs
  - Lowest total expense needed to produce an output, q
- Marginal cost
  - Is the additional cost incurred in producing an extra unit of output

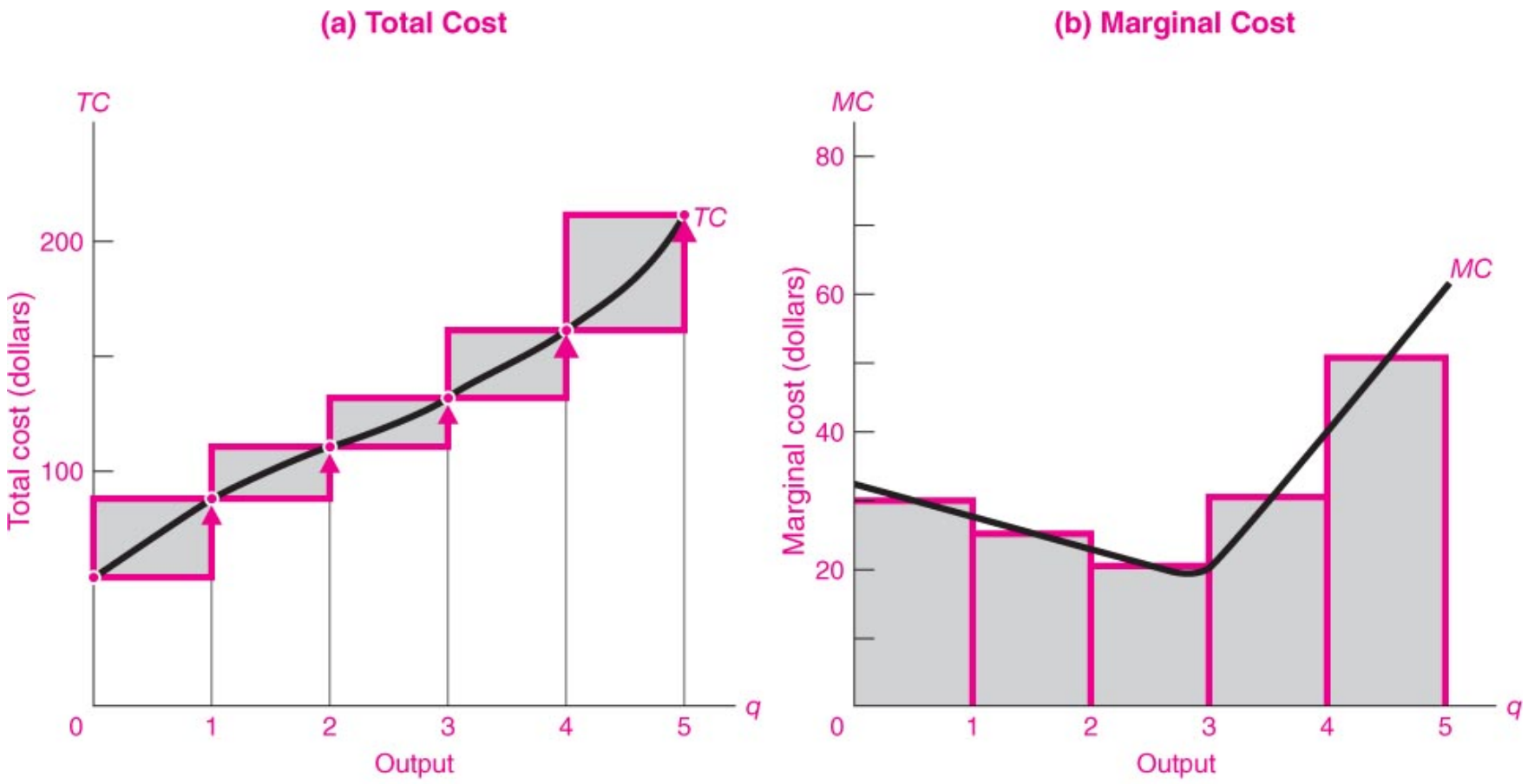


FIGURE 7-1. The Relationship between Total Cost and Marginal Cost

Definitions (2)

- Average cost
  - Is the total cost divided by the units of output produced; AFC; AVC
- Cost curves
- When MC is below (above) AC, it pulls AC down (up)
- When MC=AC, AC is constant. This usually happens at the bottom (i.e., the minimum level) of the AC curve
- Efficient scale
  - The quantity of output that minimizes AC

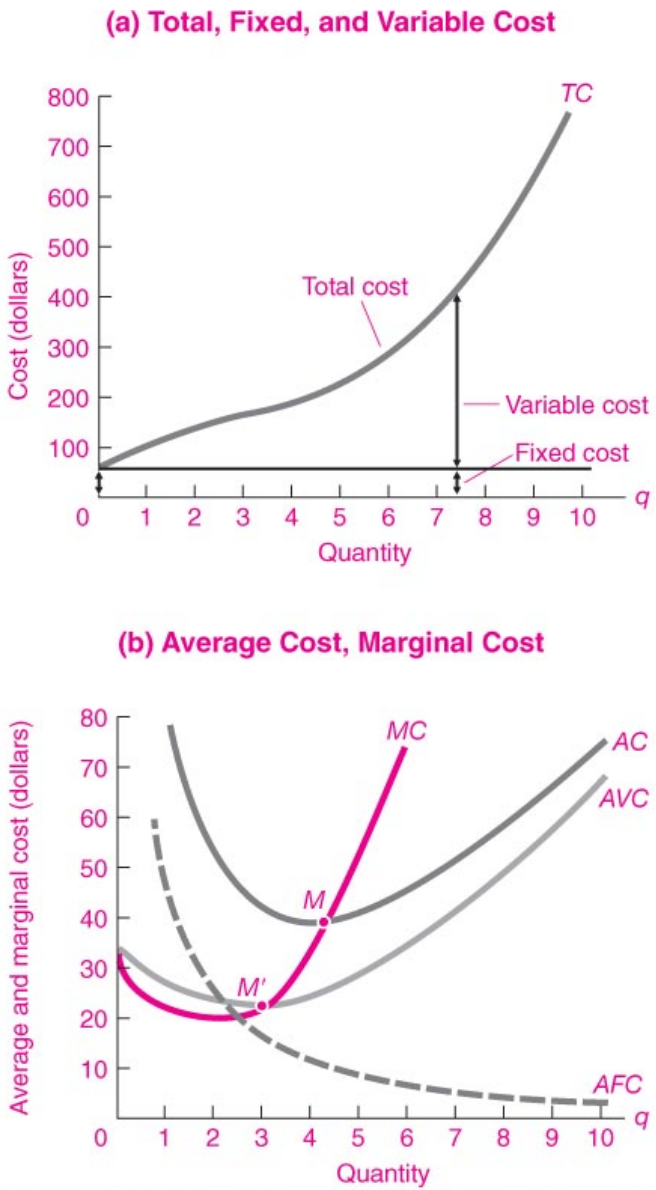


FIGURE 7-2. All Cost Curves Can Be Derived from the Total Cost Curve

An unusual cost

Streets of rage

Worst eight cities by average travel time, 2024

	Average travel time per 10km	Time lost per year in rush hour
Barranquilla (Colombia)	34m 51s	130hrs
Kolkata (India)	33m 21s	110hrs
Bangalore (India)	32m 59s	117hrs
Pune (India)	32m 13s	108hrs
London (Britain)	32m 08s	113hrs
Kyoto (Japan)	32m 07s	95hrs
Lima (Peru)	32m 03s	155hrs
Davao City (Philippines)	31m 50s	136hrs

Source: TomTom

- *Source*: "How to ease pollution, gridlock and honking on India's roads", The Economist, 10 July 2025

Economies and diseconomies

- Economies of scale
  - Long run average cost falls as the level of output rises
  - Specialization of workers
- Diseconomies of scale
  - Long run average cost rises as the level of output rises
  - Large firms - coordination and other problems